Keysight X-Series Signal Analyzer

This documentation is for the following X-Series Instruments:

- Multi-Touch Signal Analyzers (UXA, PXA, MXA, EXA, CXA, PXI)
- Multi-Touch PXI Vector Transceivers (VXT)
- Wireless Test Sets

WCDMA Mode User's & Programmer's Reference

KEYSIGHT TECHNOLOGIES

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Table Of Contents

1 Documentation Roadmap

This section describes the Keysight products covered by this document, and provides links to related documentation.

– "Products Covered by this Document" on page 80

– "Additional Documentation" on page 81

1.1 Products Covered by this Document

Product Family	Full Product Name	Model Numbers
Multi-Touch Signal Analyzers	UXA Signal Analyzer	N9042B
		N9041B
		N9040B
	PXA Signal Analyzer	N9032B
		N9030B
	MXA Signal Analyzer	N9021B
		N9020B
	EXA Signal Analyzer	N9010B
	CXA Signal Analyzer	N9000B
	PXIe Signal Analyzer	M9391A
Multi-Touch PXIe Vector Transceivers	VXT PXIe Vector Transceiver	M9421A
		M9420A
		M9415A
		M9411A
		M9410A
Wireless Test Sets		E6680A

1.2 Additional Documentation

If your instrument or computer has an internet connection, then you can access the latest editions of all relevant X-Series documentation via the links below.

This document is available in 3 formats:

- **Embedded Help**, in the instrument
- **Online Help**, at Keysight's web site

  For information on this Mode, browse to:

  http://rfmw.em.keysight.com/wireless/helpfiles/WCDMAMode/FlexUI.htm
- **Users & Programmers Reference**, in downloadable PDF format

  For information on this Mode, download from:

  http://literature.cdn.keysight.com/litweb/pdf/N9073-90002.pdf

The following documents are in downloadable PDF format:

Getting Started Guides, Instrument Messages & Security

- N90x0B Getting Started & Troubleshooting Guide
- N9041B Getting Started & Troubleshooting Guide
- X-Series Signal Analyzers Instrument Messages
- Security Features & Statement of Volatility

Specifications Guides

- N9000B CXA Specifications Guide
- N9010B EXA Specifications Guide
- N9020B MXA Specifications Guide
- N9030B PXA Specifications Guide
- N9040B UXA Specifications Guide
- N9041B UXA Specifications Guide

Measurement Guides

- Spectrum Analyzer Mode Measurement Guide
- Real-Time Spectrum Analyzer Measurement Guide
- Noise Figure Measurement Guide
- Analog Demod Measurement Application Measurement Guide
- Phase Noise Measurement Application Measurement Guide
- EMI Measurement Application Measurement Guide

Service Guides

- N9010B EXA Service Guide
- N9020B MXA Service Guide
- N9030B PXA Service Guide
- N9040B UXA Service Guide

2 User Interface

Here are the basic elements of the Multitouch User Interface. For more information, tap a topic.

Included in this section are also topics for several front panel keys not described in other topics. Tap one of these topics for more information.

"Cancel key" on page 165

"Onscreen Keyboard key" on page 166

"Touch On/Off Key" on page 167

"Tab key" on page 168

2.1 Screen Tabs

In the X-Series Multitouch User Interface (or Multitouch UI), you can run many different Measurement Applications, or “Modes”. Examples are Spectrum Analyzer Mode, LTE-A FDD Mode, IQ Analyzer Mode, and Real Time Spectrum Analyzer Mode. Each Mode has its own set of controls, windows and SCPI commands.

Each Mode runs within a “Screen”. The Multitouch UI supports multiple “Screens” (see "Multiscreen" on page 150 for more information). Each screen displays one Measurement in one Mode. The set of configured screens is shown across the top of the display as a set of Screen Tabs, with a + tab at the right for adding new Screens:

You can see up to six tabs at a time on the UXA, and 4 at a time on the CXA, EXA, MXA and PXA. If there are more Screens configured than this, arrows appear to the left and right of the Screen Tabs; pressing the arrows scrolls the Screen Tabs to the left or right. A scroll bar also appears at the bottom of the Screen Tabs, indicating that you can scroll the tabs by dragging them with your finger; you can also scroll them by dragging the scroll bar.

Pressing a Screen Tab selects that screen for operation. Pressing the blue (selected) Screen Tab is the same as pressing the Mode/Meas front panel key.

Both actions open the "Mode/Meas/View Dialog" on page 85. In addition, if you have a PC keyboard plugged in, the sequence CTL-SHIFT-M will open up this dialog.

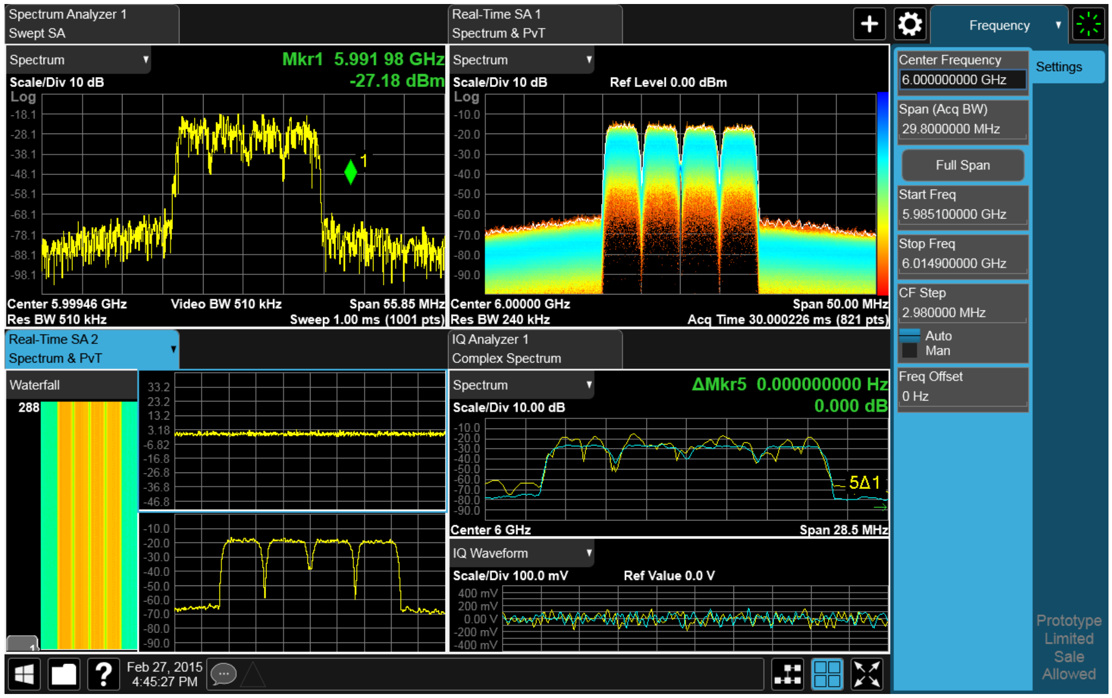
The + tab at the right of the Screen Tabs bar adds a new Screen by cloning the current screen. The new Screen has the identical setup and settings as the current Screen. You can then change the Mode, Measurement and/or settings of the new Screen.

You can define up to 16 screens at once.

Example Multiscreen View

The example below shows a four-screen display in Multiscreen view.

The Screen called “Real-Time SA 2” is selected, as indicated by its blue tab. Touching any other screen or tab selects the screen for that tab and brings it to the foreground.



The following topics provide more information:

– "Mode/Meas/View Dialog" on page 85

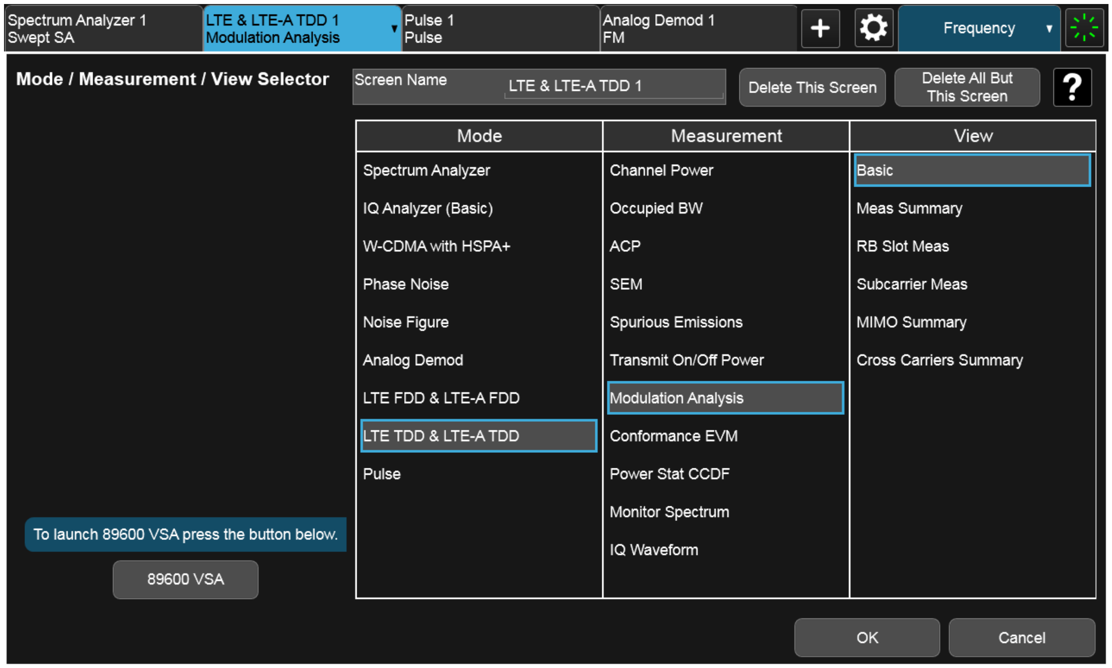
– "Add Screen" on page 101

– "Multiscreen" on page 150

2.1.1 Mode/Meas/View Dialog

The Mode/Meas/View dialog opens when you press the selected (blue) Screen tab (see "Screen Tabs" on page 84) or the **Mode/Meas** front panel key.

This dialog displays lists of available Modes, Measurements and Views, as well as the "Sequencer" on page 95 control for configuring Screens.



2.1.1.1 Mode

The first column in the Mode/Meas/View dialog allows you to select the desired Mode from those currently licensed in your instrument.

Modes, also known as “measurement applications”, are collections of measurement capabilities packaged together to provide you with an instrument personality specific to your measurement needs. Each Mode is ordered separately by Model Number and must be licensed in order for it to be available in the instrument.

You select the Mode you want to run using the Mode/Meas/View dialog. Once a Mode is selected, only the commands that are valid for that mode can be executed

For more information on Modes, preloading Modes, and memory requirements for Modes, see "More Information" on page 88

The `:INSTrument[:SELect]` command is used to remotely select a Mode by sending the instrument a parameter which represents the name of the desired Mode. The Mode Names may be found in the table under "Index to Modes" on page 88.

The `:INSTrument:NSELect` command is used to remotely select a Mode by sending the Mode Number of the desired Mode. See "Instrument Number Select" on page 87. The Mode Numbers may be found in the table under "Index to Modes" on page 88.

The `:INSTrument:CONFigure` command causes a Mode and Measurement switch at the same time. This generally results in faster overall switching than sending the `:INSTrument:SELect` and `CONFigure` commands separately. See "Mode and Measurement Select" on page 87.

Remote Command	`:INSTrument[:SELect] <mode_id>`

	where <mode_id> is one of the values listed in Index to Modes below. `:INSTrument[:SELect]?`
Example	`:INST SA`
Notes	A list of the valid mode choices is returned by the `:INST:CAT?` query
Preset	The default Mode is set to SA on **Restore System Defaults->All**, unless noted below: For N8973B, N8974B, N8975B, or N8976B: `NFIG` For E7760: `BASIC`
State Saved	Saved in instrument state
Annunciation	Application Title is in the Screen Tab

Instrument Number Select

Remote Command	`:INSTrument:NSELect <integer>` `:INSTrument:NSELect?`
Example	`:INST:NSEL 1`
Notes	The Mode Numbers may be found in the table under "Index to Modes" on page 88 SA mode is number 1 The command is sequential: that is, continued parsing of commands cannot proceed until the instrument select is complete and the resultant SCPI trees are available
Preset	The default Mode is set to `1` on **Restore System Defaults->All**, unless noted in the table above
State Saved	Saved in instrument state

Mode and Measurement Select

Remote Command	`:INSTrument:CONFigure:<mode>:<meas>` where `<mode>` is a valid parameter for the `:INST:SEL` command and `<meas>` is a valid parameter for the `:CONF` command in the Mode specified by `<mode>`

Example	`:INST:CONF:SA:SAN`
	selects the Spectrum Analyzer mode and the Swept SA measurement
	`:INST:CONF:WCDMA:RHO`
	selects the WCDMA mode and the Mod Accuracy measurement

Notes	The available parameters for `<mode>` are dependent upon installed and licensed applications resident in the instrument. The available parameters for `<meas>` are dependent on the `<mode>` parameter and the valid measurements available for that mode, which can depend on model numbers and installed options In general this command will execute more quickly than sending the equivalent separate `:INST:SEL` and `:CONF` commands

Index to Modes

The Mode Number in the table below is the parameter for use with the `:INSTrument:NSELect` command. The Mode Parameter is the parameter for use with the `:INSTrument[:SELect]` command. Your actual choices will depend upon which applications are installed in your instrument.

Mode	Mode Number	Mode Parameter <mode_id>
5G NR	109	NR5G
89601 VSA	101	VSA89601
Analog Demod	234	ADEMOD
Avionics	232	AVIONIC
Bluetooth	228	BTooth
Channel Quality / Group Delay	161	CQM
EMI Receiver	141	EMI
GSM/EDGE/EDGE Evo	13	EDGEGSM
I/Q Analyzer (Basic)	8	BASIC
LTE FDD & LTE-A FDD	107	LTEAFDD
LTE TDD & LTE-A TDD	108	LTEATDD
Measuring Receiver	233	MRECEIVE
MSR	106	MSR
Noise Figure	219	NFIGure
Phase Noise	14	PNOISE
Power Amplifier	81	PA
Pulse	151	PULSEX
Radio Test	300	RTS
Real Time Spectrum Analyzer	2	RTSA
Remote Language Compatibility	266	RLC
SCPI Language Compatibility	270	SCPILC
Sequence Analyzer	123	SEQAN
Short Range Comms	218	SRCOMMS
Spectrum Analyzer	1	SA
Vector Modulation Analyzer	200	VMA
WCDMA with HSPA+	9	WCDMA
WLAN	217	WLAN

More Information

The Mode name appears on the Screen Tab, followed by a number identifying which instance of the mode appears on that screen. Each Screen contains one Mode. For example, in the image below there is one Real-Time Spectrum Analyzer and two Spectrum Analyzer screens. The current Screen contains Real-Time SA 1.

It is possible to specify the order in which the Modes appear in the Mode menu, using the Configure Applications utility on the Desktop. It is also possible, using the same utility, to specify a subset of the available applications to load into memory at startup time, which can decrease the startup time of the instrument and the amount of memory consumed.

Each application (Mode) that runs in an X-Series instrument consumes virtual memory. The various applications consume varying amounts of virtual memory, and as more applications run, the memory consumption increases. Keysight characterizes each Mode and assigns a memory usage quantity based on a conservative estimate. The Configure Applications utility shows an estimate for how much memory each Mode will consume.

You can still run a Mode even if it is not preloaded into memory - during runtime, the first time an application that is not loaded into memory is selected (by either pressing that applications Mode key or sending that application's `:INST:SEL` command over SCPI), the Application will be loaded, but this takes a few seconds. The instrument will pause while loading the application while displaying a message box that says "Loading application, please wait..." Preloading the application eliminates this wait time but consumes additional memory.

2.1.1.2 Application Mode Remote Commands

This section contains a number of remote commands that are provided for programming convenience and remote compatibility.

Application Mode Catalog Query (Remote Command Only)

Returns a string containing a comma separated list of names of all the installed and licensed measurement modes (applications). These names can only be used with the :INSTrument[:SELect] command.

Remote Command	`:INSTrument:CATalog?`
Example	`:INST:CAT?`
Notes	Query returns a quoted string of the installed and licensed modes separated with a comma. Example: "SA,PNOISE,WCDMA"
Backwards Compatibility Notes	VSA (E4406A) :INSTrument:CATalog? returned a list of installed INSTrument:SELECT items as a comma separated list of string values, for example: "BASIC","GSM","EDGEGSM","CDMA","SERVICE" X-Series uses the ESA/PSA compatible query of a string contain comma separated values: "SA,PNOISE,NFIG,BASIC"

Current Application Model (Remote Command Only)

Returns a string that is the Model Number of the currently selected application (mode). This information is also displayed in the **Show System** screen.

Remote Command	`:SYSTem:APPLication[:CURRent][:NAME]?`
Example	`:SYST:APPL?`
Notes	Query returns a quoted string that is the Model Number of the currently selected application (Mode). Example: "N9060A" String length between 6 to 9 characters.
Preset	Not affected by Preset
State Saved	Not saved in state, the value will be the selected application when a Save is done.

Current Application Revision (Remote Command Only)

Returns a string that is the Revision of the currently selected application (mode). This information is also displayed in the Show System screen

Remote Command	`:SYSTem:APPLication[:CURRent]:REVision?`
Example	`:SYST:APPL:REV?`
Notes	Query returns a quoted string that is the Revision of the currently selected application (Mode). Example: "1.0.0.0" String length is a maximum of 23 characters. (each numeral can be an integer + 3 decimal points) The format is Major.Minor.Build.Compile, where Major must correspond to the Integer portion of the Version in the license file for the application.
Preset	Not affected by a Preset
State Saved	Not saved in state, the value will be the selected application when a Save is done.

Current Application Options (Remote Command Only)

Returns a string that is the Options list of the currently selected application (Mode). This information is also displayed in the Show System screen

Remote Command	`:SYSTem:APPLication[:CURRent]:OPTion?`
Example	`:SYST:APPL:OPT?`
Notes	Query returns a quoted string that is the Option list of the currently selected application (Mode). The format is the name as the *OPT? or SYSTem:OPTion command: a comma separated list of option identifiers. Example: "1FP,2FP"

	String length is a maximum of 255 characters.
Preset	Not affected by a Preset
State Saved	Not saved in state per se, the value will be the selected application when a Save is invoked.

Application Catalog Number of Entries (Remote Command Only)

Returns the number of installed and licensed applications (Modes).

Remote Command	`:SYSTem:APPLication:CATalog[:NAME]:COUNt?`
Example	`:SYST:APPL:CAT:COUN?`
Preset	Not affected by Preset
State Saved	Not saved in instrument state.

Application Catalog Model Numbers (Remote Command Only)

Returns a list of Model Numbers for the installed and licensed applications (Modes).

Remote Command	`:SYSTem:APPLication:CATalog[:NAME]?`
Example	`:SYST:APPL:CAT?`
Notes	Returned value is a quoted string of a comma separated list of Model Numbers. Example, if SAMS and Phase Noise are installed and licensed: "N9060A,N9068A" String length varies based on licenses. Licenses are between 6 and 9 characters. So the string length will be between COUNt * 7 – 1 and COUNt * 10 – 1. (7 & 10 = Model Number length + 1 for comma. -1 = no comma for the 1st entry.)
Preset	Not affected by a Preset
State Saved	Not saved in instrument state.

Application Catalog Revision (Remote Command Only)

Returns the Revision of the provided Model Number.

Remote Command	`:SYSTem:APPLication:CATalog:REVision? <model>`
Example	`:SYST:APPL:CAT:REV? ‘N9060A’`
Notes	Returned value is a quoted string of revision for the provided Model Number. The revision will be a null-string ("") if the provided Model Number is not installed, licensed, and loaded. Example, if SAMS is installed and licensed: "1.0.0.0" String length is a maximum of 23 characters. (each numeral can be an integer + 3 decimal points)

Preset	Not affected by a Preset.
State Saved	Not saved in instrument state.

Application Catalog Options (Remote Command Only)

Returns a list of Options for the provided Model Number

Remote Command	`:SYSTem:APPLication:CATalog:OPTion? <model>`
Example	`:SYST:APPL:CAT:OPT? 'N9060A'`
Notes	Returned value is a quoted string of a comma separated list of Options, in the same format as *OPT? or :SYSTem:OPTion?. If the provided Model Number is not installed and licensed a null-string ("") will be returned. Example, if SAMS is installed and licensed: "2FP" String length is a maximum of 255 characters.
Preset	Not affected by a Preset
State Saved	Not saved in instrument state.

ESA SA compatibility command (Remote Command only)

Provided for backwards compatibility with ESA. When this command is received, the analyzer aliases it to the appropriate Mode.

Remote Command	`:INSTrument[:SELect] 'SA' | 'PNOISE' | 'EDGE' | 'GSM' | 'BASIC'`
Example	`:INST 'SA'`
Notes	The query is not a quoted string. It is an enumeration as indicated in the Instrument Select table above

GSM Mode compatibility command (Remote Command only)

Provided for backwards compatibility. When this command is received, the analyzer aliases it to the following:

`:INST:SEL EDGEGSM`

Remote Command	`:INSTrument[:SELect] GSM`
Example	`:INST GSM`

SA compatibility command for EMC (Remote Command only)

Provided for ESU compatibility. When this command is received, the analyzer aliases it to the following:

`:INST:SEL SCPILC`

This results in the analyzer being placed in SCPI Language Compatibility Mode, in order to emulate the ESU Spectrum Analyzer Mode.

Remote Command	`:INSTrument[:SELect] SANalyzer`
Example	`:INST SAN`

Receiver compatibility command for EMC (Remote Command only)

Provided for ESU compatibility. When this command is received, the instrument aliases it to the following:

`:INST:SEL EMI`

`:CONF FSC`

This results in the instrument being placed in the EMI Receiver Mode, running the Frequency Scan measurement, in order to emulate the ESU Receiver Mode.

Remote Command	`:INSTrument[:SELect] RECeiver`
Example	`:INST REC`

APD compatibility command for EMC(Remote Command only)

Provided for ESU compatibility. When this command is received, the analyzer aliases it to the following:

`:INST:SEL EMI`

`:CONF APD`

This results in the analyzer being placed in the EMI Receiver Mode, running the APD measurement, in order to emulate the ESU APD Mode.

Remote Command	`:INSTrument[:SELect] APDistribution`
Example	`:INST APD`

IF Mode compatibility command for EMC (Remote Command only)

Provided for ESU compatibility. When this command is received, the analyzer aliases it to the following:

`:INST:SEL EMI`

`:CONF MON`

This results in the analyzer being placed in the EMI Receiver Mode, running the Monitor Spectrum measurement, in order to emulate the ESU IF Mode.

Remote Command	`:INSTrument[:SELect] IFANalyzer`
Example	`:INST IFAN`

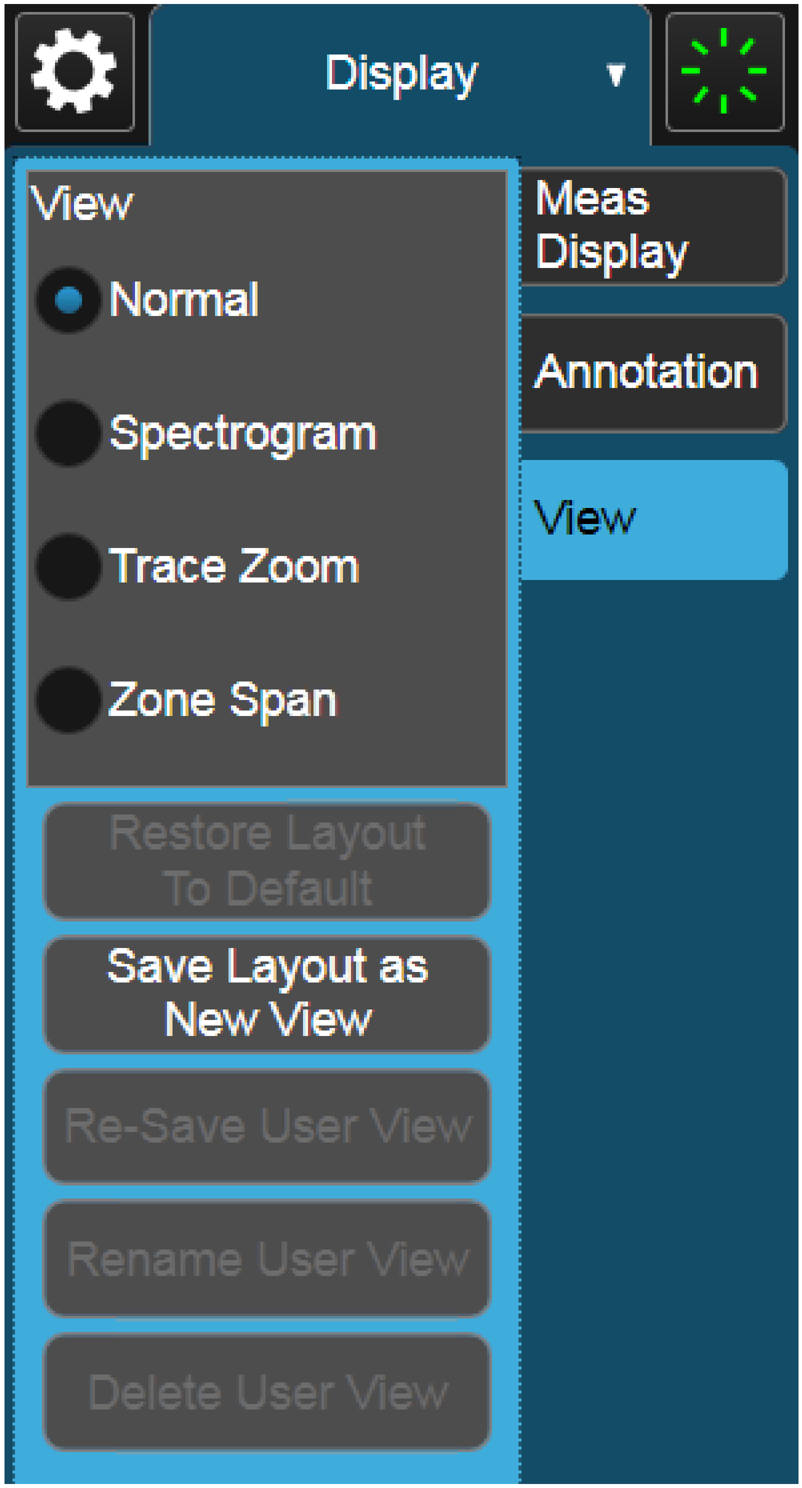
2.1.1.3 Measurement

The Measurement column of the Mode/Meas/View dialog shows all the Measurements available for the Mode which is selected in the first column. Select a Measurement in the second column and the View column will show all the Views available for that measurement. Once you have the Mode, Measurement and View selected, press OK to change the current Screen to that Mode, Measurement and View.

2.1.1.4 View

A View is a collection of Result Windows. The View column of the "Mode/Meas/View Dialog" on page 85 shows all the Views available for the Measurement which is selected in the second column. Once you have the Mode, Measurement and View selected, press OK to change the current Screen to that Mode, Measurement and View.

The View may also be set by using the View tab on the Display menu. The View tab is the last tab on the Display menu for every measurement. The Views are the same as those listed in the "Mode/Meas/View Dialog" on page 85.



2.1.1.5 Sequencer

Allows multiple Screens to update sequentially while in "Multiscreen" on page 150 display mode. Each Screen updates in sequence, and when all have updated, the sequence will start again.

To start the Sequencer, you must have more than one Screen defined, and you must have Multiscreen selected (see "Screen Tabs" on page 84).

If you want each Screen to use a different input, you must turn off **All Screens Use Same Input** under **Input/Output**, **Input**.

CAUTION

Differences in hardware settings between the Screens may cause switches and/or attenuators to cycle as you go from one Screen to another. This could potentially reduce the life of these components. To avoid this, make sure **Attenuation**, **µW Path Control** and other switch settings are the same in each Screen.

NOTE

When the Sequencer is running, the destination of remote commands is unpredictable, so you should stop the Sequencer before sending any measurement-related commands. Once the Sequencer has stopped, select a specific Screen using `:INSTrument:SCReen:SELect`, before sending any further commands. See "Select Screen" on page 152

NOTE

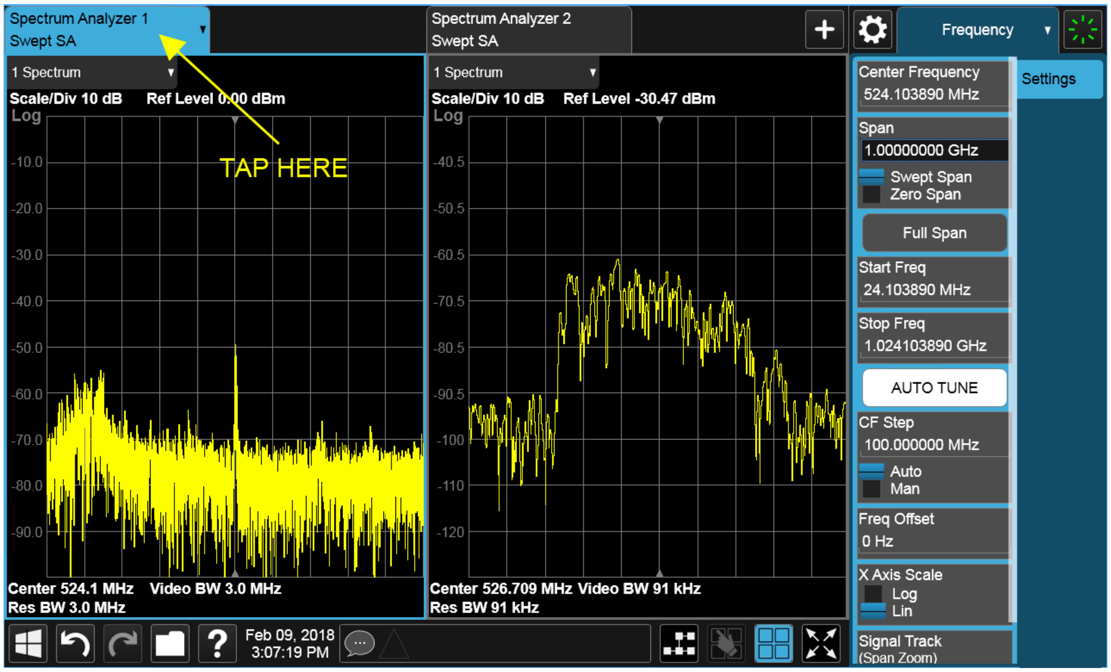
When the Sequencer is running, Auto alignment is temporarily disabled. A pending auto alignment might be executed when the sequencer is stopped.

See "More Information" on page 96

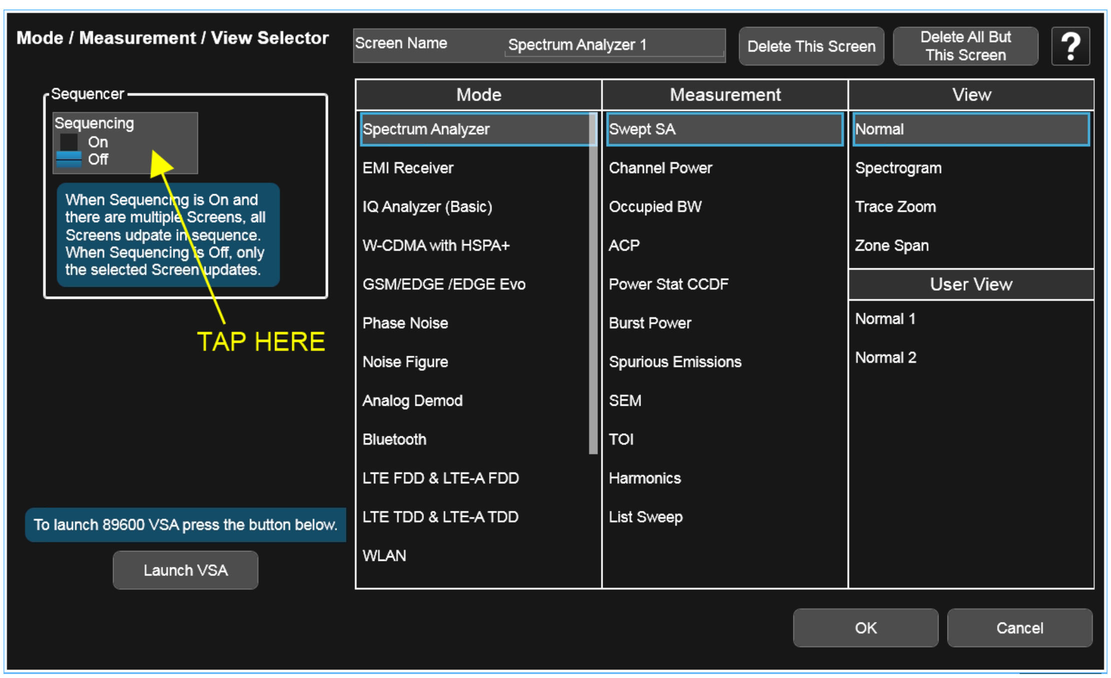
Remote Command	`:SYSTem:SEQuencer ON | OFF | 1 | 0` `:SYSTem:SEQuencer?`
Example	`:SYST:SEQ ON`
Notes	If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; Screen SCPI cannot be used when Display is disabled" is generated
Dependencies	To start the Sequencer, you must have more than one Screen defined and you must have Multiscreen selected
Preset	`OFF`

More Information

To start the Sequencer, tap the current (blue) Screen tab to go into the Mode/Meas/View Dialog:

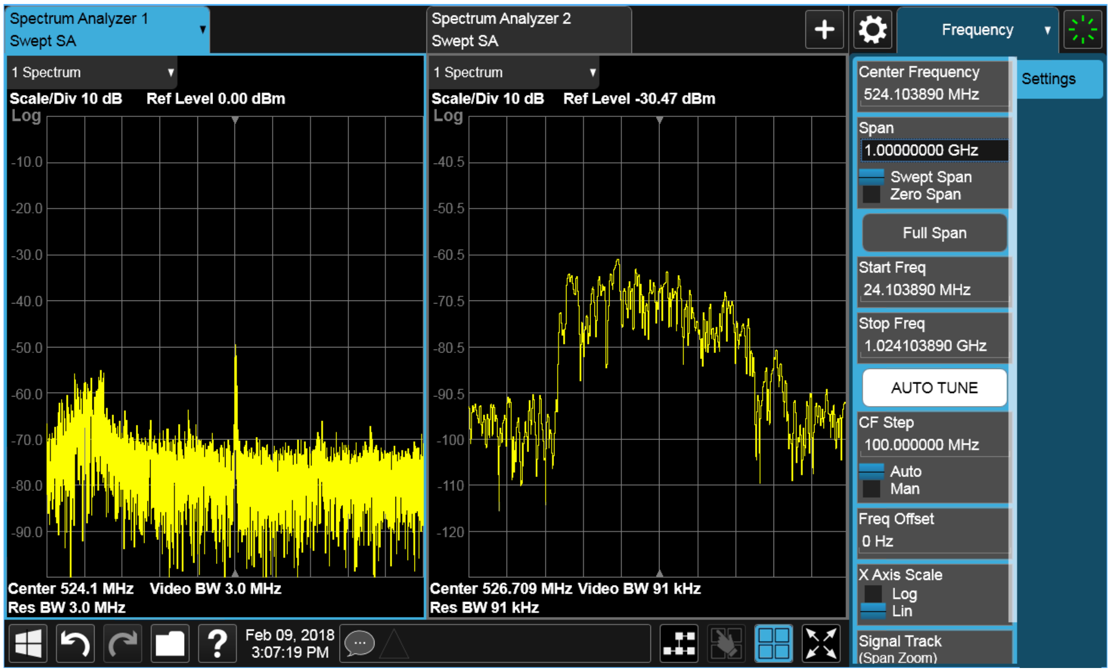


In the Sequencer block in the upper left hand corner, tap the Sequencing switch to turn it On:

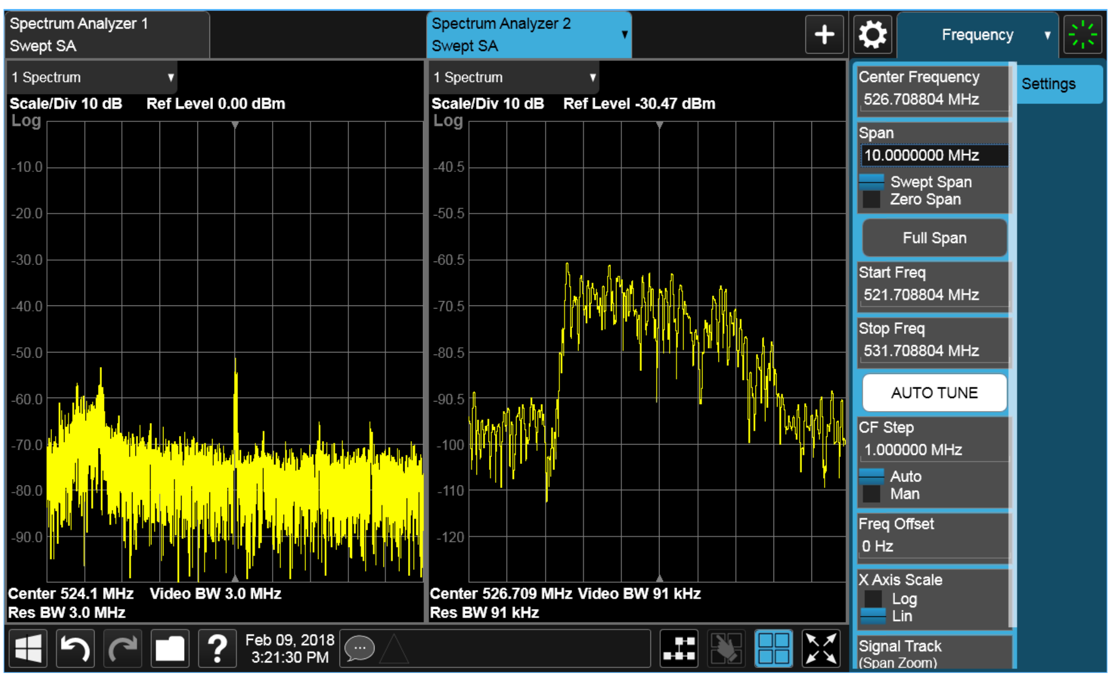


The instrument will immediately exit the Mode/Meas/View Dialog and begin making measurements in each of the screens, one after the other. When a measurement is being made in a particular Screen, that Screen's tab will be blue.

Measurement being made in Screen 1:



Measurement being made in Screen 2:



Touching any key or control on the display will cause the Sequencer to stop, so that you can make desired changes. When this happens, the message “Sequencer stopped” is displayed.

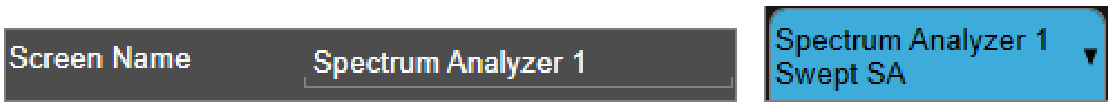
When the Sequencer is running, the screens update in the order in which they were created.

Each Screen takes one measurement then passes control to the next Screen. Each Screen updates as though it were in Single Sweep or Single Measurement mode. Thus, if Averaging is on, a Screen may take multiple sweeps before moving on to the next Screen.

2.1.1.6 Screen Name

By default, the screen name is the Mode (Application) name followed by a number indicating the instance of the application.

You may change the name displayed on the Screen Tab of any screen. The control to do this appears in the "Mode/Meas/View Dialog" on page 85:



When you touch this control an onscreen keyboard appears, allowing you to change the name. Whatever you change it to appears on the Tab, even if you subsequently change the screen to a different Mode.

To reset the name, delete the screen name entirely.

Each Screen Name must be unique; you cannot give the same name to more than one screen.

Remote Command	`:INSTrument:SCReen:REName <alphanumeric>`
Example	`:INST:SCR:REN “Baseband”`
Notes	The currently active screen is renamed. If the `<alphanumeric>` specifying the new name is already present in the list of screen names, the error message “-224, Illegal parameter value; New name <name> already exists” appears If the display is disabled (via `:DISP:ENAB OFF`) then the error message “-221, Settings conflict; Screen SCPI cannot be used when Display is disabled” appears

2.1.1.7 Delete This Screen

Pressing this button deletes the current Screen (the one with the blue tab). Deleting a screen removes it from view and selects the next lower screen in the list of screens. If only one screen is configured, it cannot be deleted.

If you press the **Delete This Screen** button, a prompt appears:

“This function will delete the current screen and its settings. This action cannot be undone. Do you want to proceed?”

Pressing **OK** or Enter deletes the screen, pressing **Cancel** or **ESC** does not.

Remote Command	`:INSTrument:SCReen:DELete`
Example	`:INST:SCR:DEL`
Notes	The currently active screen is deleted If the screen you are attempting to delete is the only configured screen, the error message "-221, Settings conflict; Last screen cannot be deleted" is displayed If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; Screen SCPI cannot be used when Display is disabled" is generated

2.1.1.8 Delete All But This Screen

Pressing this control deletes all the Screens except the current Screen (the one with the blue tab).

If you press the **Delete All But This Screen** button, a prompt appears:

"This function will delete all defined screens and their settings, except for the current screen. This action cannot be undone. Do you want to proceed?"

Pressing **OK** or Enter deletes the screen, pressing **Cancel** or ESC does not.

Remote Command	`:INSTrument:SCReen:DELete:ALL`
Example	`:INST:SCR:DEL:ALL`
Notes	You can reset the instrument to the power-on configuration by invoking `:INST:SCR:DEL:ALL` followed by `:SYSTem:DEFault ALL` If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; Screen SCPI cannot be used when Display is disabled" appears

2.1.1.9 89600 VSA

Pressing this button launches the 89600 VSA software. The 89600 VSA software is powerful, PC-based software, offering the industry's most sophisticated general purpose and standards specific signal evaluation and troubleshooting tools for R&D engineers. Even for proprietary and non-standard signals in SATCOM or MILCOM applications, you can make signal quality measurements with customized IQ constellation.

The 89600 VSA software offers the following features:

– Over 35 general-purpose analog and digital demodulators ranging from 2FSK to 4096QAM

– Flexible and custom IQ and OFDM signal analysis for single carrier

– Standards specific modulation analysis including:

- Cellular: GSM/EDGE, cdma2000, W-CDMA, TD-SCDMA, LTE(FDD/TDD),
- LTE-Advanced and more
- Wireless networking: 802.11a/b/g, 802.11n, 802.ac, 802.16 WiMAX (fixed/mobile), WiSUN (MR-FSK PHY)
- RFID
- Digital satellite video and other satellite signals, radar, LMDS
- Up to 400K bin FFT, for the highest resolution spectrum analysis
- A full suite of time domain analysis tools, including signal capture and playback, time gating, and CCDF measurements
- 20 simultaneous trace displays and the industry's most complete set of marker functions
- Easy-to-use Microsoft Windows graphical user interface

For more information see the Keysight 89600 Series VSA web site at www.keysight.com/find/89600vsa

To learn more about how to use the 89600 VSA in the instrument, start the 89600 VSA software, then open the 89600 VSA Help and navigate to the topic "About Keysight X-Series Signal Analyzer with 89600 VSA Software".

Example	`:INST:SEL VSA89601` `:INST:NSEL 101`

2.1.2 Add Screen

On X-Series analyzers you can configure up to 16 different Screens at one time. Each Screen contains one Mode, each Mode contains one Measurement, and each Measurement contains a number of Windows.

You can add screens by pressing the “+” icon in the "Screen Tabs" on page 84 panel. The icon is shown below:

Every time you add a Screen, the instrument “clones” or “copies” the current Screen into the new Screen. If desired, you can then use the "Mode/Meas/View Dialog" on page 85 to change the Mode, Measurement and/or View of the new Screen, or simply operate a second copy of your previous Screen, thus preserving the settings of your previous Screen.

When you have defined the maximum number of Screens (16), the “+” icon disappears.

For more information about operating the instrument with multiple screens configured, see "Multiscreen" on page 150.

Remote Command	`:INSTrument:SCReen:CREate`
Example	`:INST:SCR:CRE`
Notes	The maximum number of screens is 16. If an attempt to add a screen occurs when the maximum have been defined, the error message “-221, Settings conflict; Screen limit reached” appears When you create a new screen the Screen Name is the current Mode name followed by a number indicating the instance of the Mode. If the display is disabled (via `:DISP:ENAB OFF`) then the error message “-221, Settings conflict; Screen SCPI cannot be used when Display is disabled” appears

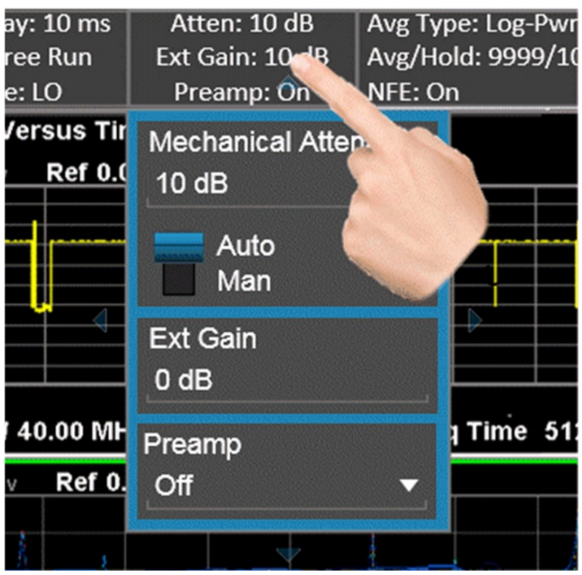
2.2 Meas Bar

The Meas Bar is used to display annotation for the current measurement. There are three primary uses for the Meas Bar:

1. To show annotation for the most important parameters in the measurement so you can see them at a glance
2. To show the annotation that you will most want to have recorded in a screen dump
3. To give you quick access to settings.

The Meas Bar is made up of a number of annotation panels, each of which, when pressed, opens up a dialog below it which contains controls for those settings.

For example, here is what the display looks like when you touch one of the regions of the Meas Bar:



Touching anywhere off the hotspot panel or pressing any hardkey except **Save** or **Quick Save** closes the hotspot panel.

In a hotspot panel, the control in black with the blue border is the active function. Each panel may have its own default active function.

Settings that are colored amber are those that you need to be particularly aware of; for example, if Alignments are off, this is shown in amber, so you will know that you may not be meeting spec. Similarly, if DC coupling is on, this is shown amber, to alert you to be careful what voltage you put on the input.

You can turn the Meas Bar on and off with a switch on the Annotation tab of the Display menu.

System Control Panel

The leftmost panel holds the GPIB/Remote annunciators, the Single/Continuous symbol/control, the LXI indicator and the PASS/FAIL indicator. Tapping this panel drops down controls for Single/Continuous, Pause/Resume and restart.

GPIB/Remote annunciators

The GPIB/Remote annunciators are shown as the letters `KRLTS`. Each letter is shown if the state is true and is not shown if the state is false, as follows:

K	Keylock indicator	This is shown when the instrument is in the Keylock state (turned on and off by the `SYST:KLOCk` command)
R	Remote annunciator	Shown when the instrument is in the remote state, as when being controlled via the IEEE-488 bus (GPIB) or TCP/IP connections
L	GPIB Listen annunciator	Shown when addressed to listen via GPIB orTCP/IP
T	GPIB Talk annunciator	Shown when addressed to talk via GPIB or TCP/IP
S	GPIB SRQ annunciator	Shown when the instrument is asserting SRQ on GPIB. This annunciator is an amber color

Single/Continuous symbol/control

This annunciator shows as an arrow on an oval line when in Continuous, or an arrow on a straight line when in Single.

LXI indicator

This indicator displays in green when LAN is connected, in white when LAN is not connected, and in red when LAN is connected but has a connection problem.

PASS/FAIL indicator

This annunciator displays when Limits are turned on. It is green if all Limits are passing, and a red FAIL if any limit is not passing.

The following command queries the status of the current measurement limit testing. It returns a 0 if the measured results pass when compared with the current limits. It returns a 1 if the measured results fail any limit tests.

Remote Command	`:CALCulate:CLIMits:FAIL?`
Example	`:CALC:CLIM:FAIL?` queries the current measurement to see if it fails the defined limits Returns a 0 or 1: 0 it passes, 1 it fails

Trace Detector Settings Panel

In the Swept SA and some other measurements, there is a special panel summarizing the settings for the traces in the measurement:

There is one column for each trace. The rows are as follows:

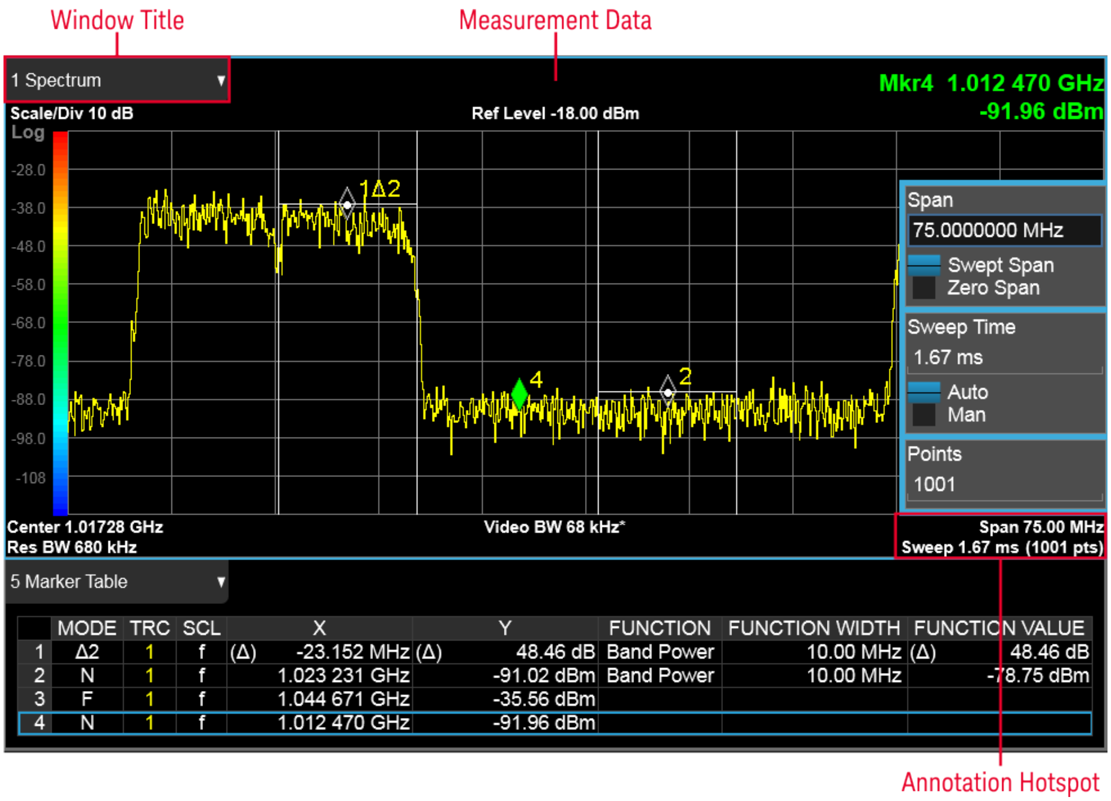
- The top row shows the Trace Number, in the trace color.
- The second row shows the Trace Type for each trace (W=Clear/Write, A=Trace Average, M=Max Hold, m=Min Hold); this letter is in white if the trace is Active, in gray if the trace is inactive; there is a bar through the letter if the trace is not being displayed
- The third row shows the detector for each trace (N=Normal, S=Sample, A=Average, P=peak, p=negative peak, Q=Quasi Peak, E=EMI Average, R=RMS Average, f=math function)

In the example above, trace 1 is active, visible, and in Average using the Sample detector, the other traces are inactive, blanked and in Clear/Write using the Normal detector.

Tapping this panel drops down controls for the Traces.

2.3 Measurement Display

The Measurement Display contains one or more data windows displaying the result of the current measurement. These may be graphical or textual windows.



	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	Δ2	1	f	(Δ) -23.152 MHz	(Δ) 48.46 dB	Band Power	10.00 MHz	(Δ) 48.46 dB
2	N	1	f	1.023 231 GHz	-91.02 dBm	Band Power	10.00 MHz	-78.75 dBm
3	F	1	f	1.044 671 GHz	-35.56 dBm			
4	N	1	f	1.012 470 GHz	-91.96 dBm			

Each window in the Measurement display contains a "Window Title" on page 106, "Measurement Data" on page 110, and graphical windows also may contain "Annotation Hotspot" on page 113s.

The selected window in the Measurement Display is indicated by a blue border. Window-dependent controls in the menu panel always refer to the selected window.

2.3.1 Window Title

The Window Title appears in the upper left hand corner of the window, and includes a title describing the measurement data currently being displayed in the window. The title may also contain additional information about the data in the window, for example in the LTE measurement supplication, the component carrier being displayed in the window will be indicated (e.g., “CC0”).

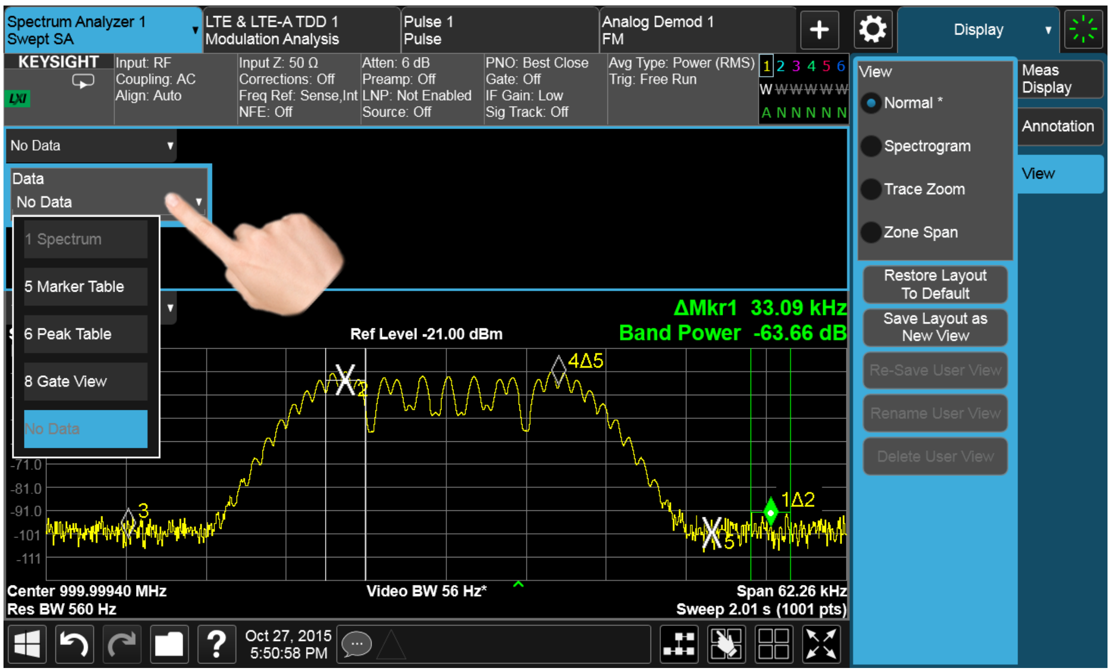
Measurements that support User Views (see "View Editor" on page 128) also display the Window Number in the Window Title, to enable window addressing from SCPI. The number is the number that will be used in the SCPI command to address that window, for example, in the WCDMA Mod Accuracy measurement, Code Domain

Power is assigned window number 6, so you address it with the following SCPI command:

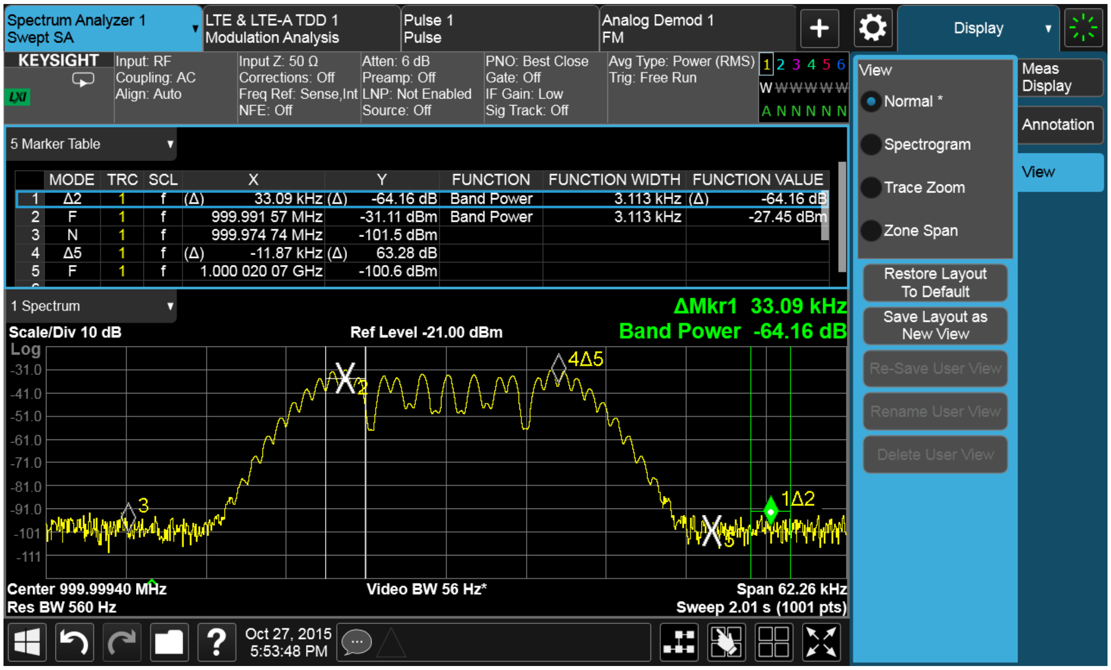
```
:DISP:RHO:WIND6:TRAC:Y:RLEV 0.0
```

Note the arrow pointing down on the right side of the Window Title. This indicates that touching the Window Title will display a dropdown, which enables you to select the Measurement Data to be displayed in the window.

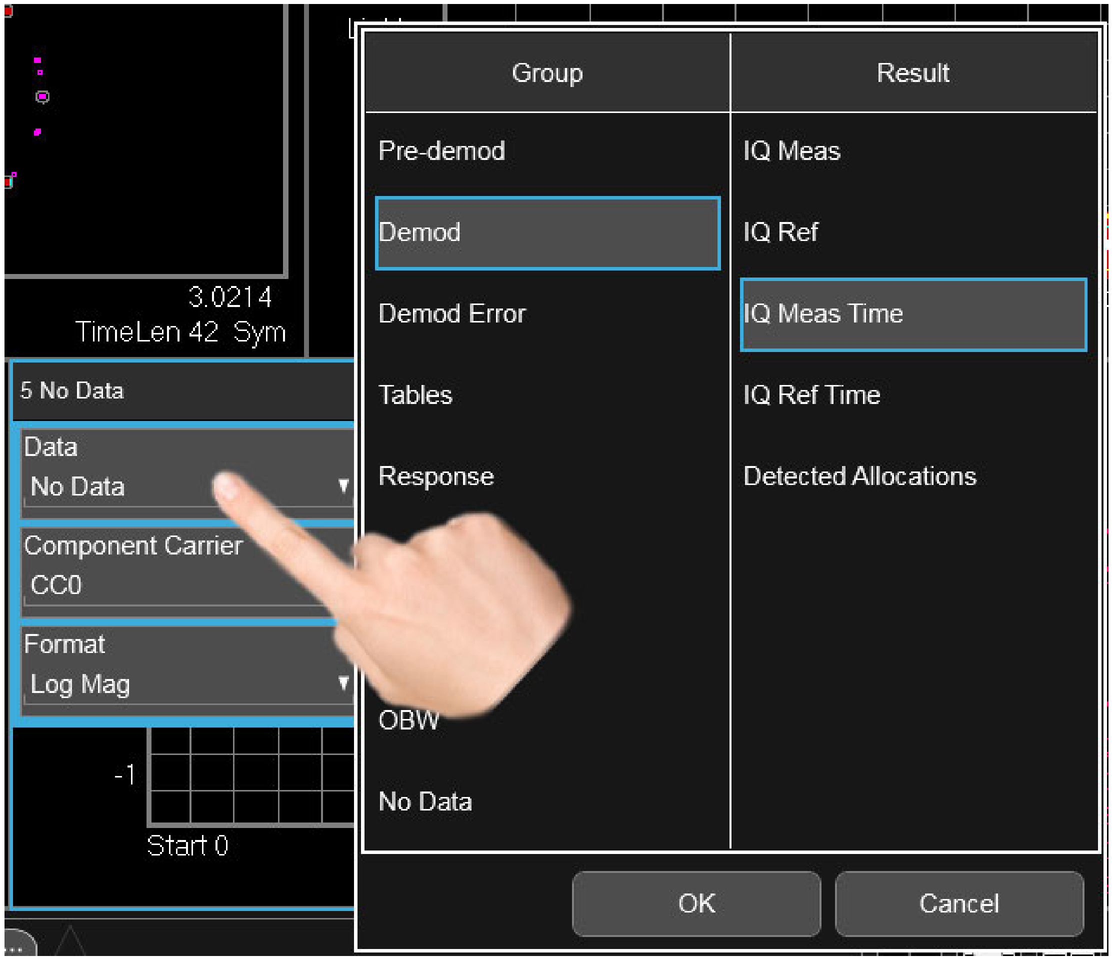
For example, if we wish to assign the results of the upper window in the display below to the Marker Table, we would touch the window title and then the "Data" control that is revealed, as shown:



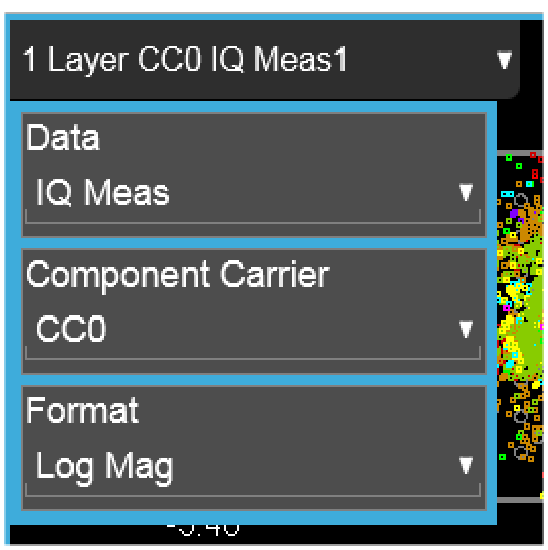
And then select Marker Table, yielding the result below:



Note also that the Window Data dropdown can be a cascaded list, if the number of available results requires categorization to hold them all:



Note also that the Window Data dropdown sometimes includes controls for further configuring the window, for example, in LTE choosing the desired Component Carrier and Data format.



Touching a window's title dropdown also selects the window.

2.3.2 Measurement Data

The Measurement Data region shows graphical or textual data for the Data selected in the Window Title Data control. Below you can see examples of both graphical and textual windows in a four-window display.

There are many gestures which you can use to interact with a measurement display window. They are detailed below.

Swipe

There are several swipe actions, as listed below. One of the most important actions is swiping a spectrum window to the left or right, or up or down, to adjust the frequency and level of the spectrum, as shown below.

Swipe actions are summarized in the table below. Not all of these may be available, depending on the measurement.

Object	Action
Spectrum Trace Left/Right	Drag trace (change Center Frequency)
Spectrum Trace up/down	Drag trace (change Ref Level)
Marker Left/Right	Drag marker along trace
Fixed Marker Left/Right/Up/Down	Drag marker in space
Scrollable area	Scroll vertically or horizontally. Scrollable areas include the Menu Panel (if overfull), tables and lists. A scrollable area is indicated by a vertical or horizontal translucent white bar which can also be dragged by a mouse When scrolling a table: – Row headers remain in place when the table is scrolled horizontally, and scroll with the table when the table is scrolled vertically – Column headers remain in place when the table is scrolled vertically, and scroll with the table when the table is scrolled horizontally
Toggle control	Toggle in that direction

Pinch

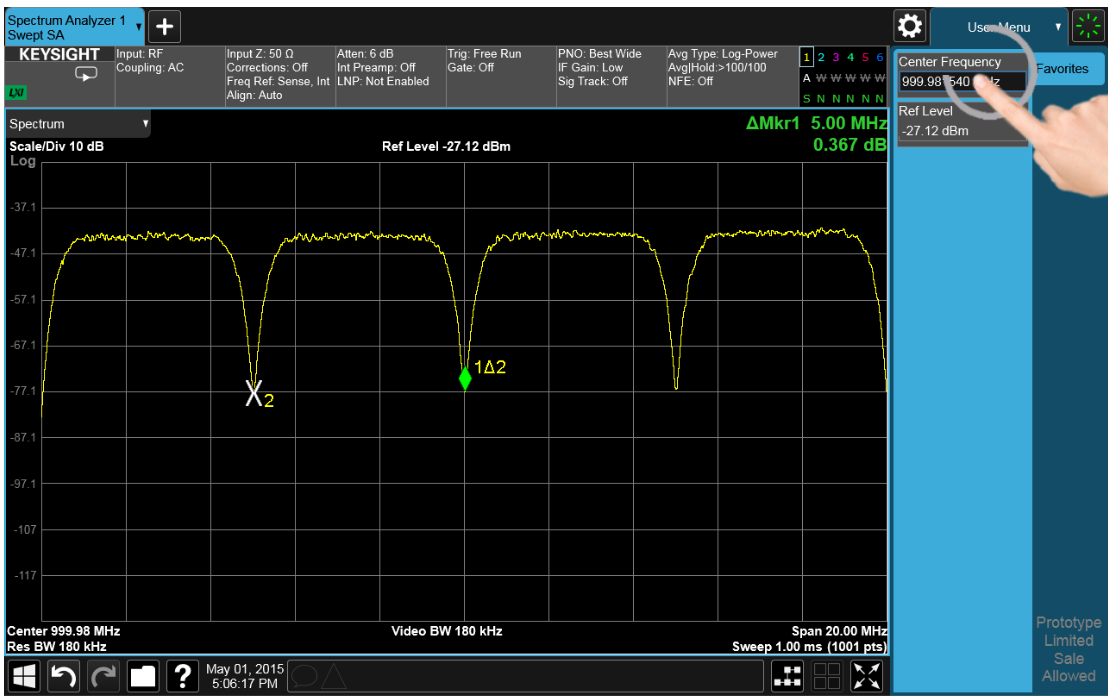
You can also pinch in or out either horizontally or vertically to zoom in the x-axis or y-axis dimension. For example, a pinch horizontally lets you adjust the Span of the

Spectrum window. Also, pinching on the wings of a Band Power or other Band Function allows you to widen or narrow that Band Function.

Pinching may sometimes be easier if you use the index finger of each hand, rather than pinching with one hand.

Touch-and-Hold

You can also touch-and-hold the display, that is, touch it and hold your finger on the display. A circle is drawn, and when the drawing completes, a right-click gesture is performed that depends on the screen feature touched, as listed in the table below.



Right Click on a Trace	Peak Search, Trace Type (Clear/Write, Trace Average, Max Hold, Min Hold), Trace View/Blank (Active, View, Blank, Background). Not all of these may be available, depending on the measurement
Right Click on a Marker	Marker Mode (Normal. Delta, Fixed, Off), Peak Search, Next Peak, Next Pk Right, Next Pk Left). Not all of these may be available, depending on the measurement
Right Click on the Background	Lets you select Help
Right Click on a Menu Panel control	Lets you add or remove that control from the User Menu or get Help on that control

Tap

Tapping an object causes the actions defined in the table below:

Object	Action
Marker	Select
Marker (repeated taps on stacked)	Cycle through stacked markers
Trace	Select. In addition if Marker is the active function, move the selected marker to the point where you tapped
Trace (repeated taps on stacked)	Cycle through stacked traces
Window	Select if unselected
Screen	Select if unselected

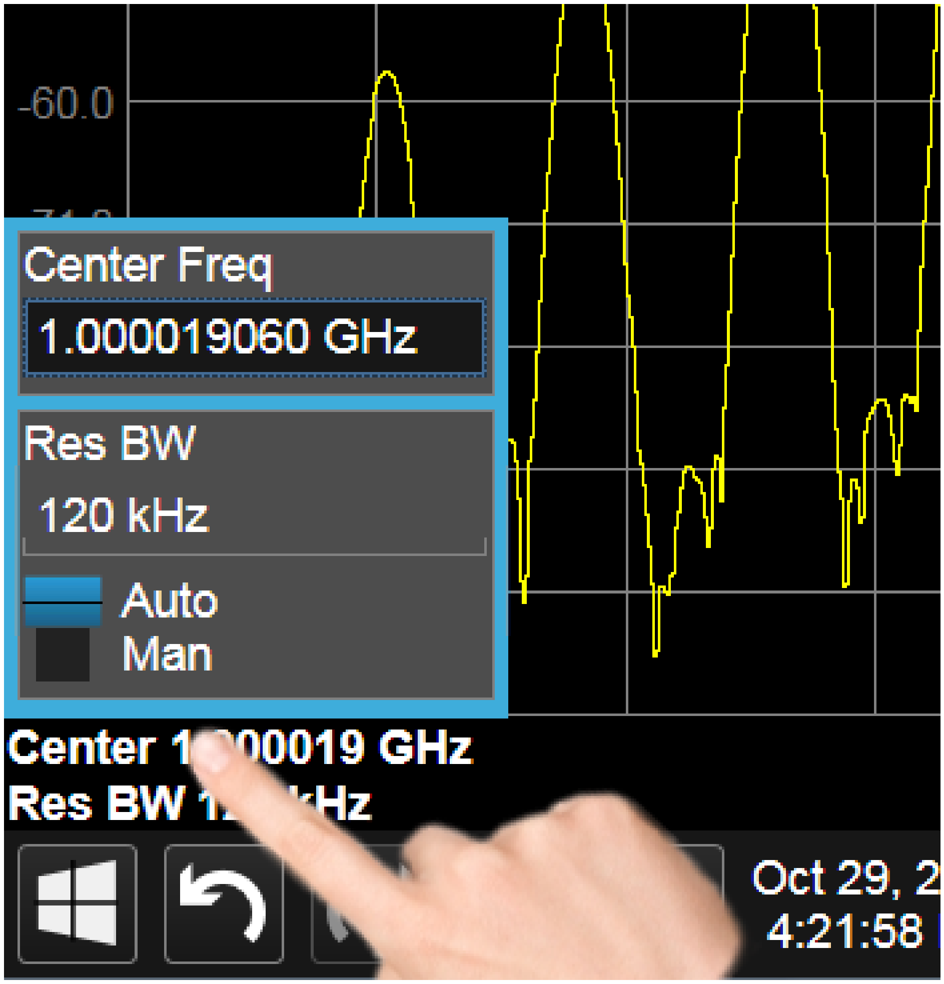
Double Tap

Double-tapping an object causes the actions defined in the table below:

Object	Action
Window	Zoom/Unzoom

2.3.3 Annotation Hotspot

You can tap on a graticule annotation to modify one of the fields in that annotation. For example if you tap on the region with Center Freq and Res BW in it, a menu panel pops up with just those settings on it.



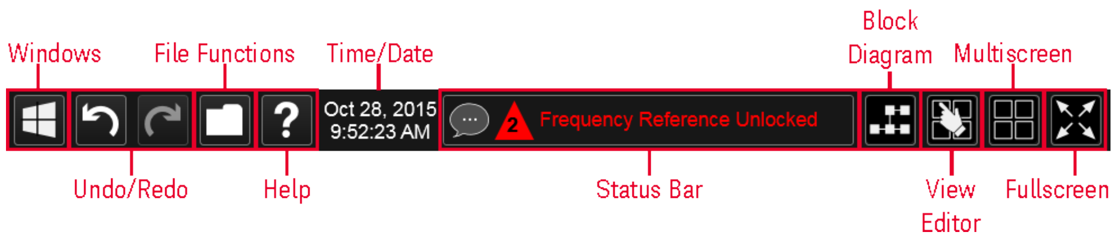
Touching anywhere off the hotspot panel or pressing any hardkey except **Save** or **Quick Save** closes the hotspot panel.

Annotation which is not currently able to be adjusted is not grayed out on the display, but the control in the hotspot that drops down or pops up is grayed out.

In a hotspot panel, the control in black with the blue border is the active function. Each panel may have its own default active function

2.4 Control Bar

The Control Bar contains controls and readouts that let you control instrument functions independent of the current measurement.



2.4.1 Windows

Pressing the Windows icon on the "Control Bar" on page 115 has the same effect as pressing the Windows icon on the Windows taskbar. It displays the Windows taskbar and Start Menu, which allows you to launch Windows programs and access features such as the Control Panel.

2.4.2 Undo/Redo

The Undo button in the "Control Bar" on page 115,

and the Undo front panel key,

are used to undo the most recently executed function.

If you Undo a function, and then decide you should not have done so, you can use the **Redo** button in the "Control Bar" on page 115 to put it back the way it was. The Redo function may also be executed by pressing **Ctrl+Undo** (holding the **Ctrl** key down while pressing the **Undo** font panel key).

Undo allows you to restore a setting, which you had previously set, back to its value before you changed it. When you press the Undo button or front panel key, the last setting you changed is “undone”, that is, its previous setting is restored. You are notified of this fact with an advisory pop up message; for example, if the Center

Frequency had been 300 MHz, and you changed it to 1 GHz and then pressed **Undo**, the message would show:

```
UNDO: Center Freq 1 GHz -> 300 MHz
```

The instrument can store 5 levels of action for Undo.

To truly understand Undo and Redo, it helps to think of two “stacks”, an Undo stack and a Redo stack,

UNDO stack	REDO stack

Whenever you perform an action, it is placed on the Undo stack. So for example, if you set the Center Frequency to 1 GHz, then set the RBW to 1 MHz, then set the Detector to Peak, each of these actions gets “pushed” onto the Undo stack:

UNDO stack	REDO stack
Det = Peak	
RBW = 1MHz	
CF = 1 GHz	

When you press **Undo**, the top item on the Undo stack is removed, the action represented by that item is undone, and the item is placed on the Redo stack. So pressing **Undo** once in the above case would undo the setting of the peak detector, and the stacks would look like this:

UNDO stack	REDO stack
RBW = 1MHz	Det = Peak
CF = 1 GHz	

Now pressing **Undo** again would undo the RBW = 1 MHz action, and the stacks would look like this:

UNDO stack	REDO stack
CF = 1 GHz	RBW = 1MHz
	Det = Peak

Now pressing Redo would Redo the RBW = 1 MHz action, and the stacks would again look like this:

UNDO stack	REDO stack
RBW = 1MHz	Det = Peak
CF = 1 GHz	

Also, whenever you set a value, the Redo stack is cleared; you can't redo an action once you have interrupted the original flow of actions. Think of the Undo stack as the past, and the Redo stack as the future; if you have items in both stacks it means you have gone back to a time in the past; if you then *do* something you have changed the future, so the old future (the Redo stack) gets cleared.

For example, in the example above, if you now were to change another setting, such as VBW = 1 kHz, the Redo stack gets cleared, and the stacks would look like this:

UNDO stack	REDO stack
VBW = 1 kHz	
RBW = 1MHz	
CF = 1 GHz	

Undo can undo changes you make with the knob or step keys, however all contiguous events that affect the same parameter are aggregated into one event for the sake of Undo. For example, if CF is the active function and is 1 GHz, and you turn the knob back and forth, then enter a value, then use the step keys, when you press Undo, the instrument returns to CF = 1 GHz.

Actions that Cannot be Undone

There are some actions that cannot be undone, because these clear the Undo/Redo stack:

- Restore Mode Defaults clears the stack for that Mode in that Screen
- Sending SCPI commands clears the stack for that Mode in that Screen
- Loading a state file (including User Preset) clears the stack for that Mode in that Screen
- Deleting a Screen clears all the stacks in that screen
- Changing Views

Undo/Redo works within the context of a Mode. Each Mode in each Screen keeps its own record. Settings in the Control Panel or System Settings menus are not undoable.

There are several actions that may change many parameters. Among these are Auto Tune, and Adjust Atten for Min Clipping. After executing such a function, Undo sets all parameters back to their value before the function was selected. Auto Tune appears to be a single action, even though the instrument executes it in several steps.

Redo reverses the effect of the last Undo action, assuming that no other settings have been changed since the last Undo. Changing a setting after an Undo clears memory of all settings after that Undo, that is, it clears the Redo stack, as explained above.

When you press the **Redo** icon or **Ctl** and the **Undo** hardkey, you are notified with an advisory popup message; for example, if the Center Frequency had been 300 MHz, and you changed it to 1 GHz and then pressed **Undo**, the message would say:

```
UNDO: Center Freq 1 GHz -> 300 MHz
```

If you then press **Redo**, the message will say:

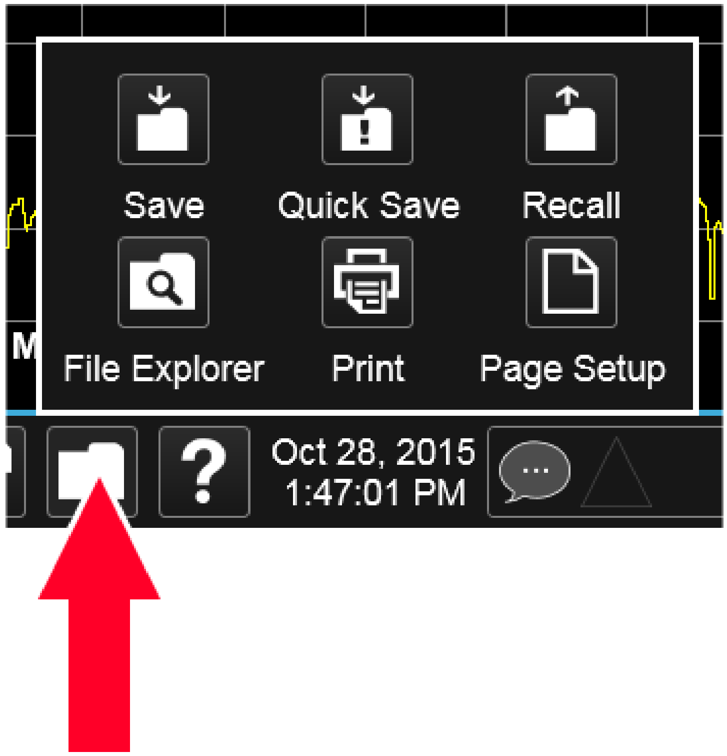
```
REDO: Center Freq 300 MHz -> 1 GHz
```

Neither **Undo** nor **Redo** perform any navigation, and have no effect on which menu panel is displayed nor which function is active.

2.4.3 File Functions

The File Functions popup contains controls for executing Save, Recall, File and Print operations. You display the File Functions popup by tapping the File Functions icon in the "Control Bar" on page 115.

For more information on a control, tap an icon in the image below.



Tapping this folder icon displays the File Functions popup

2.4.3.1 File Explorer

Pressing the File Explorer button in the "File Functions" on page 118 dialog opens the Windows File Explorer, which allows you to perform operating system file functions such as Move, Copy and Delete.

File Explorer also allows you to map network drives to drive letters on your PC or intranet, in order to more easily save screen images, states and other data, and load them back into the instrument.

2.4.4 Help

Pressing the Help button in the "Control Bar" on page 115, the **Help** front panel key, or **F1** if you have a PC keyboard connected, opens the context-sensitive Help system and allows you to get Help on the current menu panel. The Help button appears in the "Control Bar" on page 115 and also in the banner of full-screen dialogs.

You can also use the Help window's Contents pane to navigate to Help for any function in the instrument.

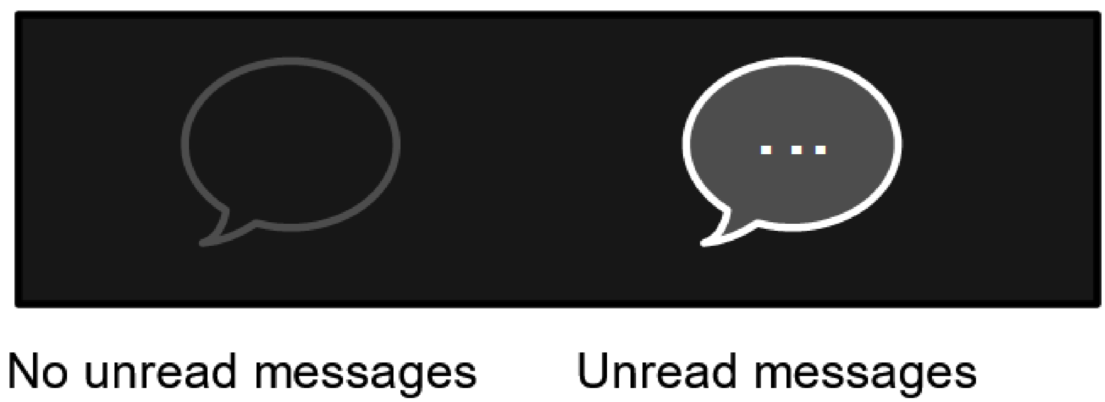
In addition, if you touch and hold a specific control, one of the choices is **Help on this setting**.

The Help window appears in full screen mode, with the Contents pane on the left and the User Documentation pane on the right. The small pullout tab between the Contents pane and the User Documentation pane enables you to hide or view the Contents pane.

2.4.5 Status Bar

The Status Panel (or Status Bar) appears at the bottom of the display and contains three fields:

The Message Balloon appears on the left side of the Status Panel and lets you know when there is an unread message in the queue.



The Message Balloon has a gray outline and no fill if there are no unread messages; it has a gray fill and a white outline and displays a white ellipsis in the middle if there are unread messages.

The Condition Indicator appears to the right of the Message Balloon and shows the current number of open conditions. Below are some examples of what the Condition Indicator can look like:

The triangle is unfilled if no there are no open conditions, filled with yellow if all open conditions are warnings, and filled with red if at least one open condition is an error. The number displayed is the total number of open conditions.

Touching the Condition Indicator opens up the Show Status dialog (see below) with the Current Conditions tab selected. Touching anywhere else on the Status Bar opens up the Show Status dialog with the History tab selected.

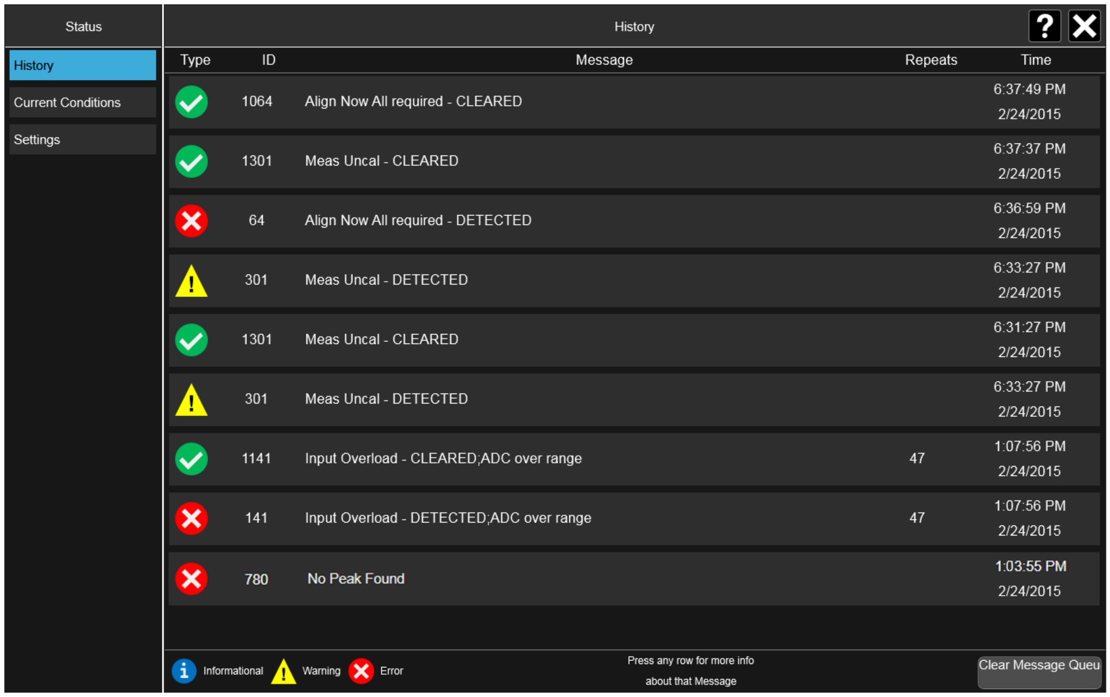
The Condition Message appears to the right of the Condition Indicator. In the example below, the cCondition Message is “Align All, Now required”:

Warning condition messages display in yellow, error condition messages display in red.

If there is more than 1 open condition, the Condition Message cycles through the display of all of the open conditions, one at a time. Each message is displayed for 2 seconds, then the next for 2 seconds, and so on.

Show Status Dialog

The Show Status dialog appears if you tap anywhere in the Status Bar. Touching the Condition Indicator (the triangle in the Status Bar) opens up the Show Status dialog with the Current Conditions tab selected. Touching anywhere else on the Status Bar opens up the Show Status dialog with the History tab selected.



If the display fills up, scrolling is enabled just as in other X-Series Multi-touch UI displays.

The Status dialog automatically refreshes as new messages and conditions occur.

At the bottom of the screen is a Clear Message Queue button. This button clears all errors in all error queues.

Note the following:

- Clear Message Queue does not affect the current status conditions
- Mode Preset does not clear the message queue
- Restore System Defaults (Super Preset) will clear all message queues
- *CLS only clears the queue if it is sent remotely and *RST does not affect any error queue
- Switching Modes does not affect any error queues

See "More Information" on page 123

Remote Command	`:SYSTem:ERRor[:NEXT]?`
Example	`:SYST:ERR?`
Notes	The return string has the format: `<Error Number>,<Error>` Where `<Error Number>` and `<Error>` are those shown on the Show Errors screen

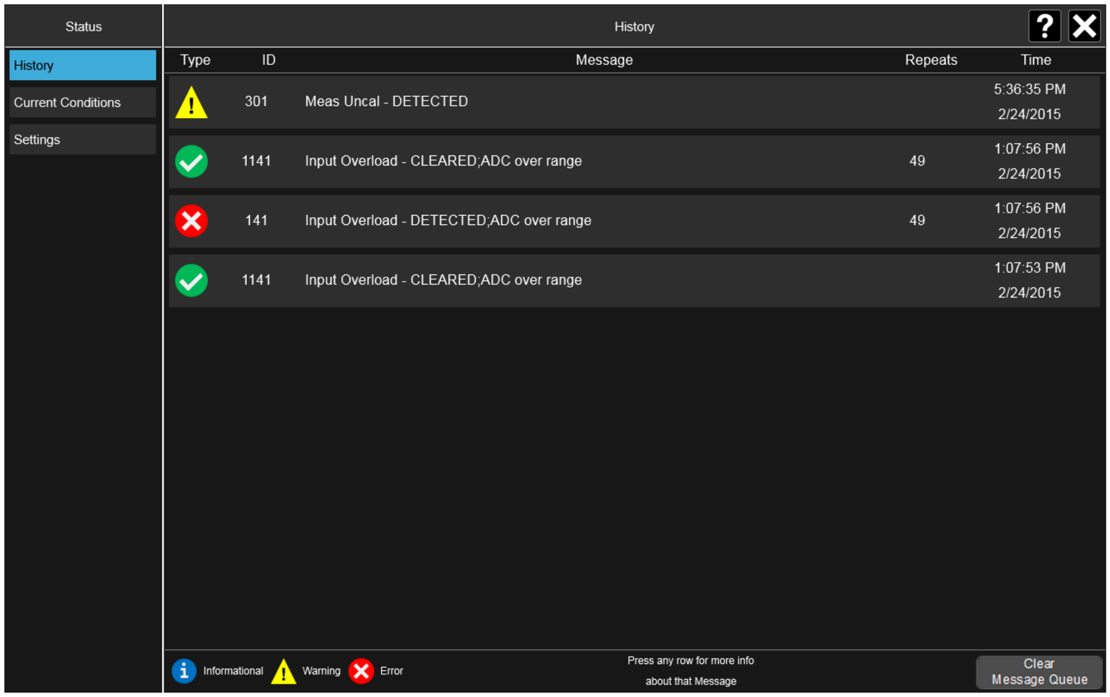
Backwards Compatibility Notes	In some legacy analyzers, the Repeat field shows the number of times the message has repeated since the last time the error queue was cleared. In the X-Series, the Repeat field shows the number of times the error has repeated since the last intervening error. So the count may very well be different than in the past even for identical signal conditions Unlike previous analyzers, in the X-Series all errors are reported through the Message or Status lines and are logged to the event queue. They never appear as text in the graticule area (as they sometimes do in previous analyzers) and they are never displayed in the settings panel at the top of the screen (as they sometimes do, by changing color, in previous analyzers) As a consequence of the above, the user can only see one status condition (the most recently generated) without looking at the queue. In the past, at least in the Spectrum Analyzer, multiple status conditions might display on the right side of the graticule In general, there is no backwards compatibility specified or guaranteed between the error numbers in the X-Series and those of earlier products. Error, event, and status processing code in customers' software will probably need to be rewritten to work with X-Series In the legacy analyzers, some conditions report as errors and others simply turn on status bits. Conditions that report as errors often report over and over as long as the condition exists. In the X-series, all conditions report as start and stop events. Consequently, software that repeatedly queries for a condition error until it stops reporting will have to be rewritten for the X-series

More Information

The Status Dialog has two screens, selectable by the tabs on the right: History and Current Conditions:

History

History brings up a screen displaying the front panel message queue in chronological order, with the newest event at the top. Remember that the front panel queue contains all of the events generated by front panel actions as well as error events from all of the SCPI queues. A typical History display appears below:



The fields on the History display are:

Type Displays the icon identifying the event or condition as an error or warning

ID Displays the error number

Message Displays the message text

Repeat (RPT) This field shows the number of consecutive instances of the event, uninterrupted by other events. In other words, if an event occurs 5 times with no other intervening event, the value of repeat will be 5

If the value of Repeat is 1 the field does not display. If the value of Repeat is >1, the time and date shown are those of the most recent occurrence. If the value of repeat reaches 999,999 it stops there. The Repeat field can run into some pretty large numbers when apps (like the GSM app) report things like “GSM sync burst not found” as events rather than conditions, which is actually fairly common

Note that the repeat count is unavailable over SCPI

Time Shows the most recent time (including the date) at which the event occurred. Time is displayed to the second

To understand the History dialog, and to properly program the instrument’s messaging system, remember that there are two types of occurrences, events and conditions:

– An event is an occurrence of zero duration. Events generate messages which are displayed in the center of the display for a period of time and then fade away. These may be of an advisory nature or may represent errors, for example “No peak found”

– A condition is an occurrence of finite duration, that is, it has a start and an end. Conditions are states of the analyzer characterized by some combination of settings or some kind of failure that the user needs to be told about while it is happening, but then can stop being told once it goes away; for example “Input overload; ADC over range”

The error queue contains error events as well as the DETECTED and CLEARED events for condition errors, as seen in the figure above.

DETECTED events have numbers less than 1000 and CLEARED events have the same number plus 1000. For example,

301, Meas Uncal – DETECTED

and later

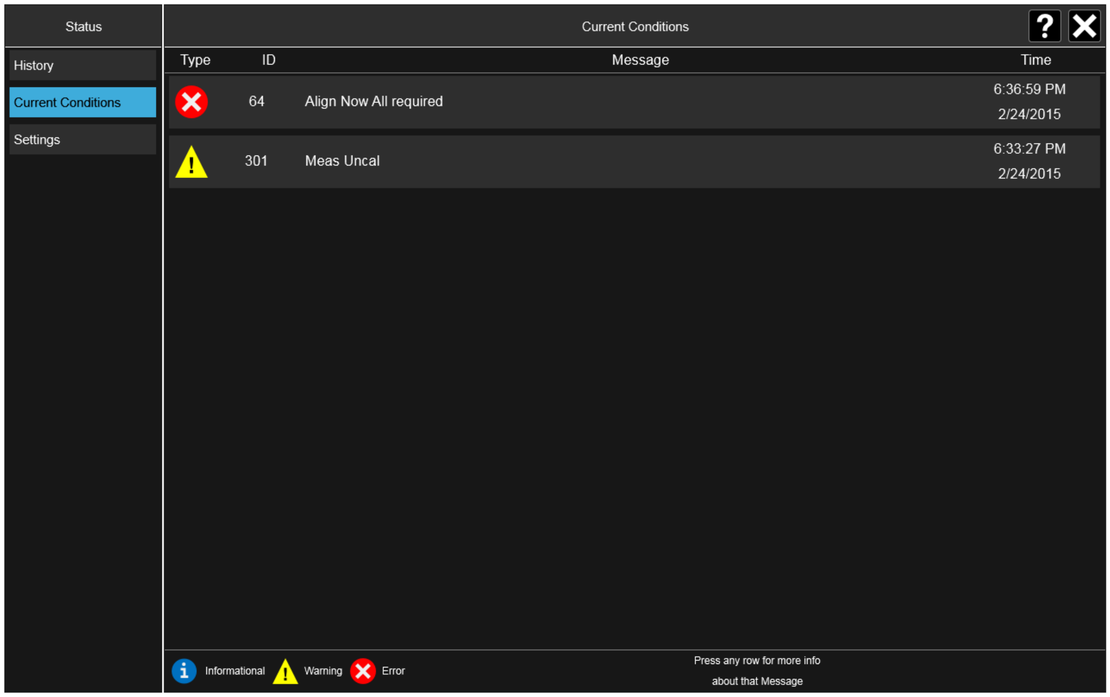
1301, Meas Uncal – CLEARED

To detect a condition error over SCPI, you should read the error queue and note any DETECTED error which is not followed eventually by an associated CLEARED error. This means the condition is still in effect. It is not sufficient to simply read the error queue until you get “No Errors” back. You may still have the condition error; the condition may still be in effect, and if that is the case, all you have done by clearing the error queue is to remove the first event (the DETECTED event) from the queue. For a condition error, you have to read the error queue until you see the CLEARED event for that condition. THEN you know that the condition is gone.

Current Conditions

The **Current Conditions** display shows all of the open conditions in the instrument. An open condition is a condition error or warning for which a start (detected) event has occurred but for which no corresponding stop (cleared) event has occurred.

An example of the Current Conditions screen appears below:

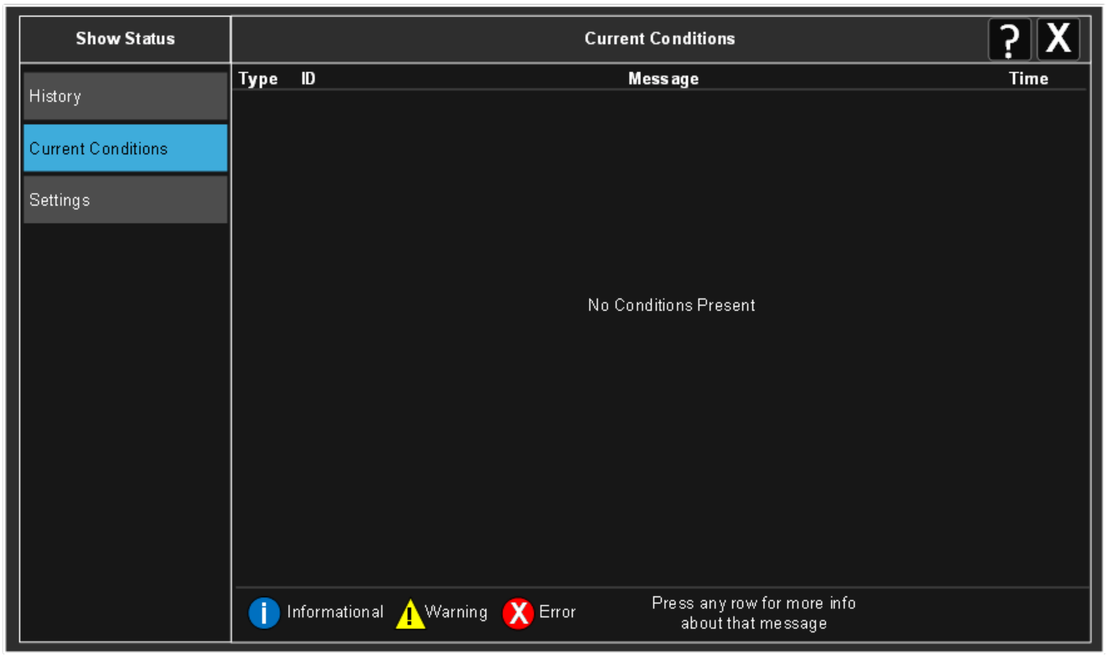


The fields on the Current Conditions display are:

Type	Displays the icon identifying the event or condition as an error or warning or informational
ID	Displays the error number
Message	Displays the message text
Time	Shows the most recent time (including the date) at which the event occurred. Time is displayed to the second

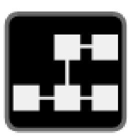
Touching a condition message expands the display of that message. Touching again collapses it. The description is the same as the one that appears on the message dialog. An example of this is shown in the History section, below.

When there are no open conditions, the display is as shown below:



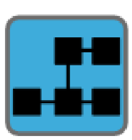
2.4.6 Block Diagram

When you press the Block Diagram button in the "Control Bar" on page 115, the display changes to a stylized pictorial representation of the current internal hardware setup and signal processing path. When you touch one of the blocks on the Block Diagram, the corresponding menu panel opens.



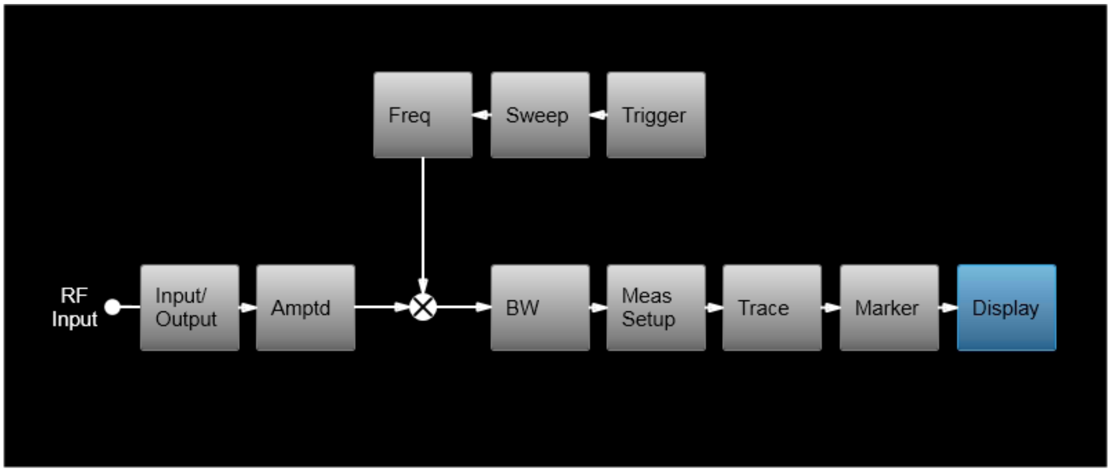
When you press the Block Diagram button, the display changes to a stylized pictorial representation of the current internal hardware setup and signal processing path. When you touch one of the blocks on the Block Diagram, the corresponding menu panel opens.

While in the Block Diagram display, the button is blue colored, as:

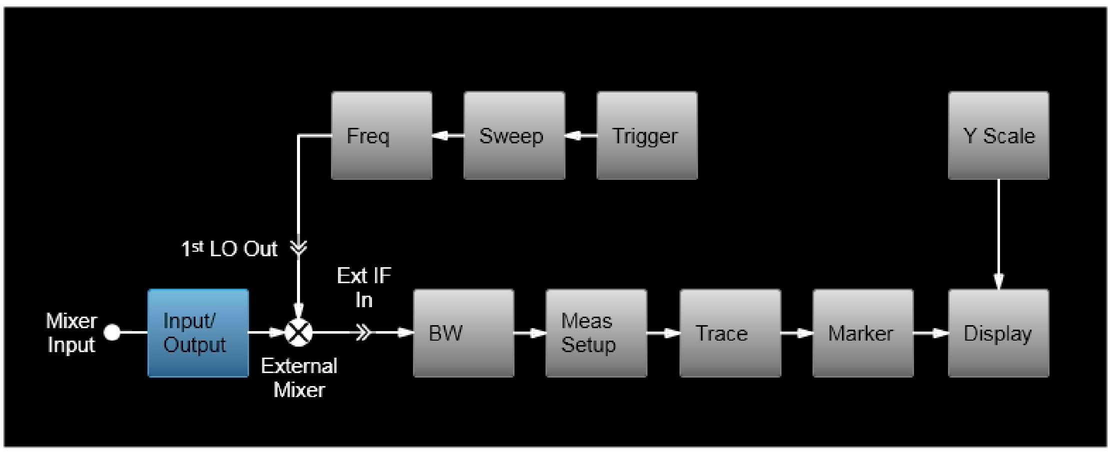


To exit the Block Diagram display, tap the button again.

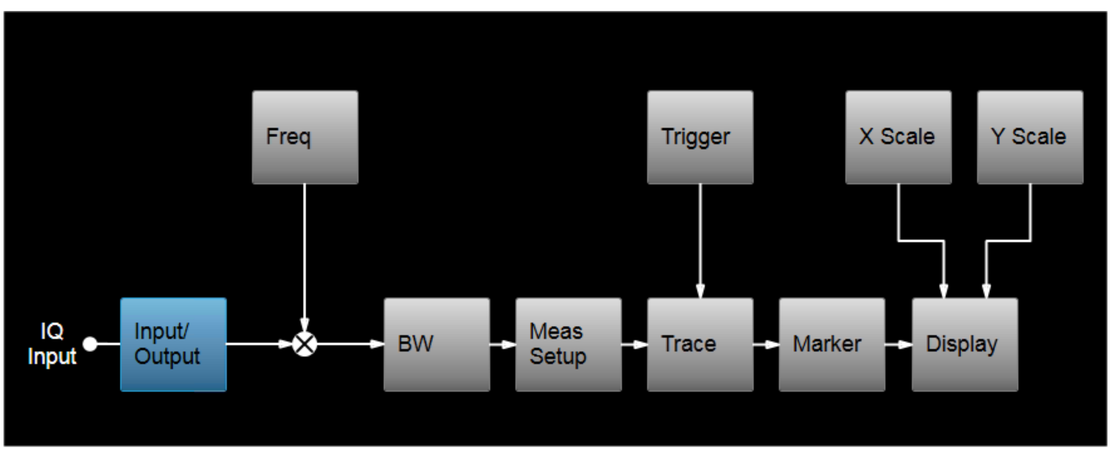
The Block Diagram display is not meant to be a completely accurate representation, but one which can show differences as you change the hardware setup. For example, here is the basic RF Block Diagram:



And here is the Block Diagram when External Mixing is selected:



And here is the Block Diagram when the I/Q inputs are selected:

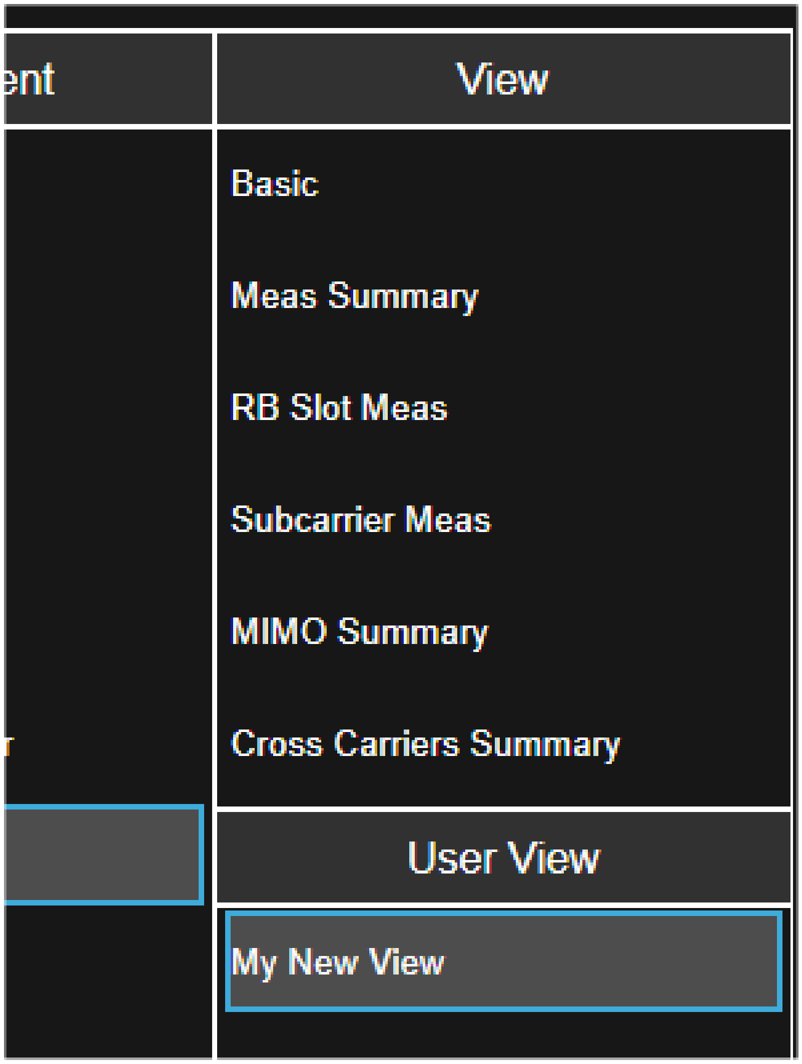


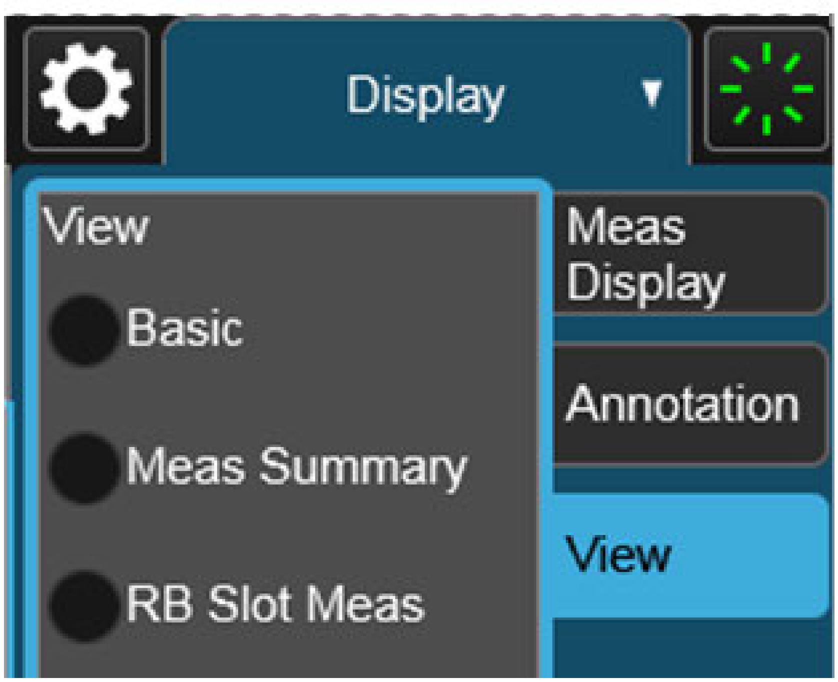
2.4.7 View Editor

This section describes the use of the View Editor, which allows you to:

- Add windows to and delete windows from the current measurement
- Resize and rearrange windows
- Create User Views

User Views are custom Views that you create by adding, deleting, rearranging, resizing, or changing the contents of the windows in an existing View, and then saving the edited View as a new View. The instrument lists the current User Views for a measurement after the Predefined Views, in the Mode/Meas dialog and on the View menu panel under Display:


ent
View
Basic
Meas Summary
RB Slot Meas
Subcarrier Meas
MIMO Summary
Cross Carriers Summary
User View
My New View

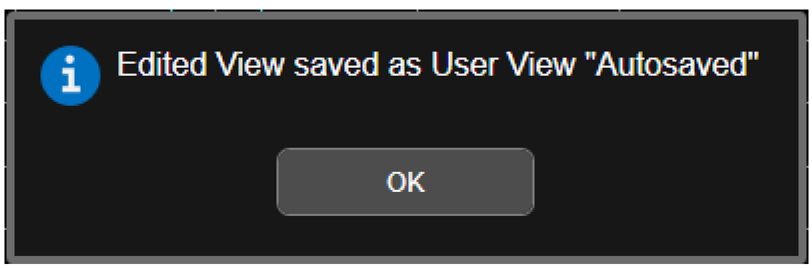

Display
View
Basic
Meas Summary
RB Slot Meas
Meas Display
Annotation
View

You can save an edited View using the **Save Layout as New View** control in the View menu (see "To Save a User View" on page 144).

On occasion, the instrument may automatically save an edited View for you. If you have edited a View, so that the * is displaying next to the View name, you must save that View as a User View before you save State or switch measurements. If you forget that you have made changes to a View, then to keep from losing your edited View when you switch measurements, the instrument will save it for you. If you have an edited View that has not been saved and you try to do any of the following:

- Enter the “Save” menu
- Switch Measurements
- Switch Modes
- Switch Screens

the edited view will be saved for you with the name “Autosaved”. When this happens, you will receive the following message:



If an Autosaved User View already exists, the User View called “Autosaved” will be overwritten with the currently edited view. If you have multiple edited views, the selected edited view will be Autosaved. If there is not an edited view selected the last selected edited view will be Autosaved.

To Open the View Editor

Pressing the View Editor button (shown above) in the "Control Bar" on page 115, at the bottom right of the screen, opens the View Editor.

While in the View Editor, the icon is blue colored, as:

Pressing the View Editor button again exits the View Editor.

To Close the View Editor

Tap the View Editor button again.

The user chooses the desired View through the use of the Mode/Meas/View dialog (see "Mode/Meas/View Dialog" on page 85) or the View menu (a tab under the **Display** key). The View menu allows the user to browse the views in the current measurement. The View menu contains a list of Predefined Views for you to use. If you wish to modify a Predefined View or create your own, new View, you use the View Editor.

User Views & Predefined Views

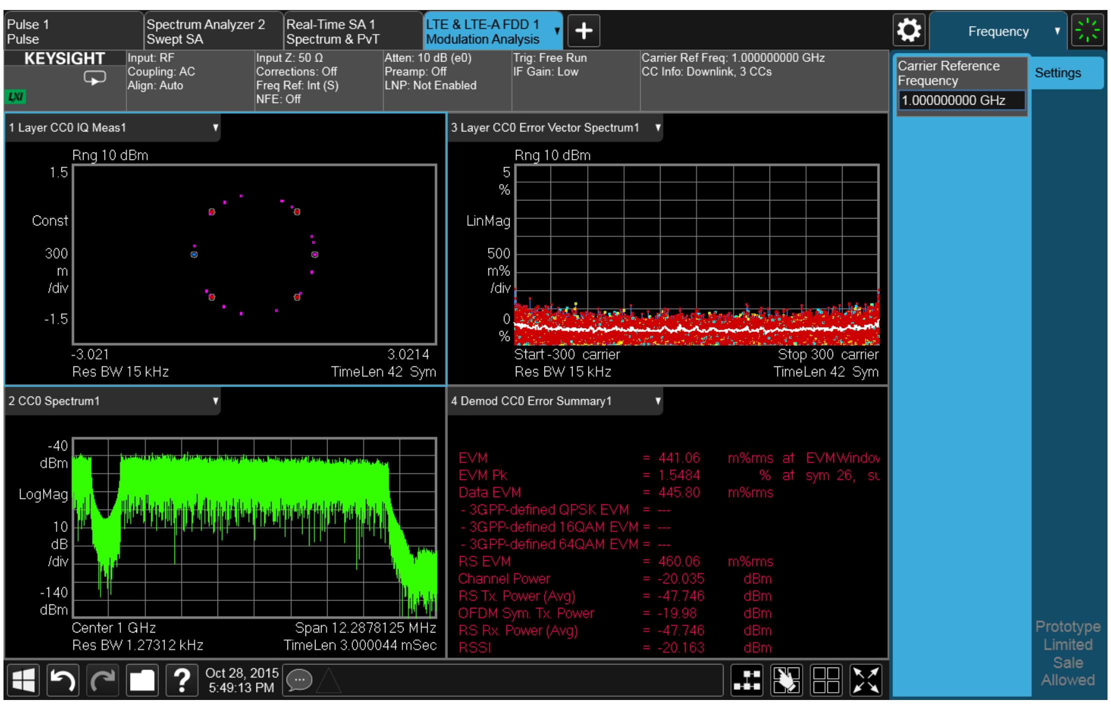
A User View is any View that is not in the list of predefined Views for the current measurement. For example, the Swept SA measurement has four predefined Views: Normal, Spectrogram, Zone Span, and Trace Zoom.

User Views allow you to add, delete, change and rearrange the windows of a predefined View, creating a new custom view.

2.4.7.1 To Create a User View

Whenever you add or delete a window to/from a predefined View, or change what is being displayed in a Predefined View's window, the Predefined View is marked with an asterisk (*), to show that it has been modified.

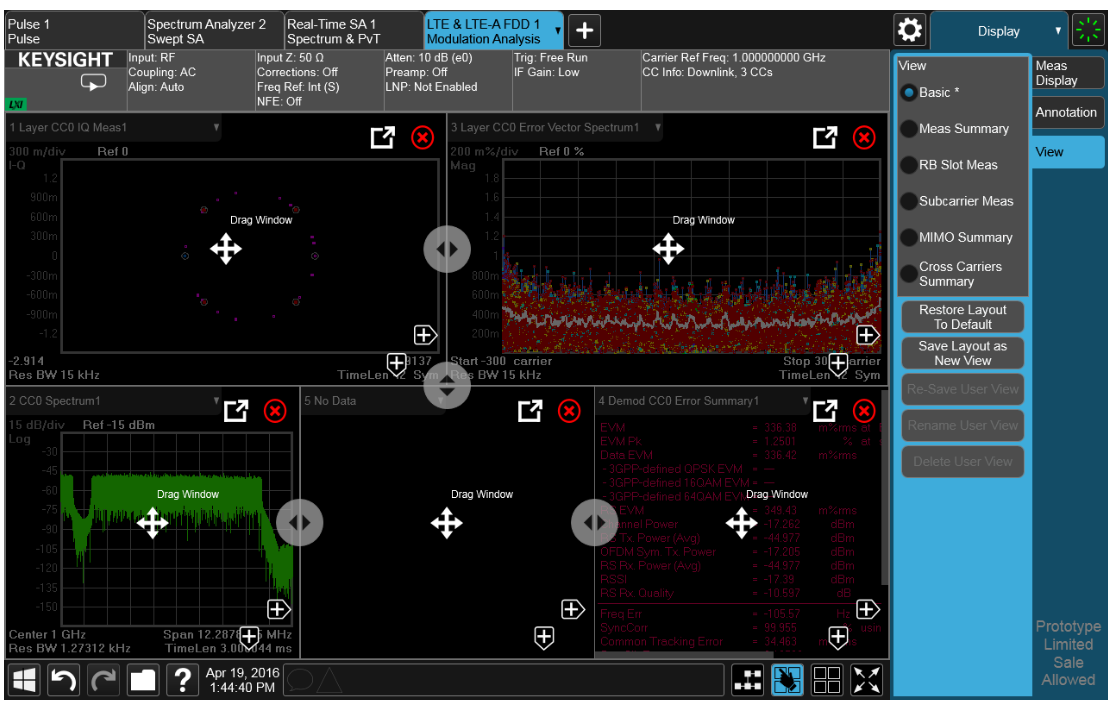
For example, to edit the View shown below, you press the Edit View icon.



When you do this, you get the View Editor screen, which appears as below. The menu panel switches to the View menu. Here we see that we are in the Predefined View called "Basic".

Each window has two arrows containing + signs. Pressing either of the "+" symbols adds a new window on that side. For example, let's say you press the + symbol on the right of the lower left window:

You would then see this:



A fifth window has been added, and is automatically assigned the number 5. (The window number, which is displayed in the Window Title region, is used when sending SCPI commands to that window).

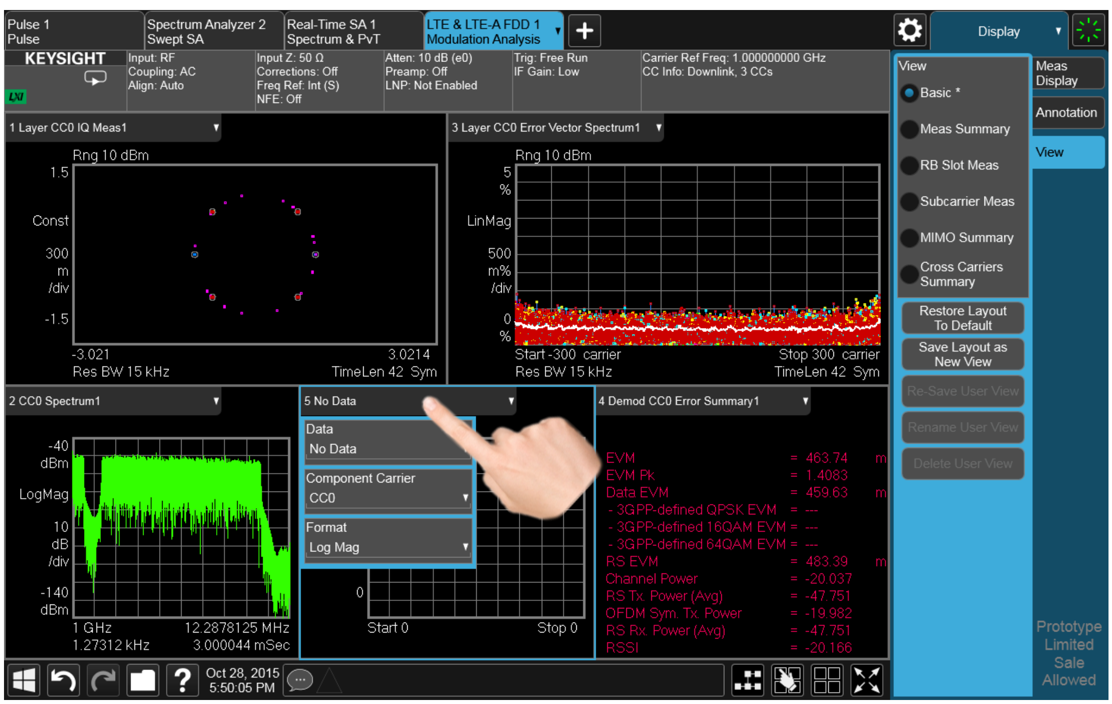
Note the * that now appears next to Basic in the View menu, indicating that you are now in the **modified** Basic View. You see the * if you add, delete or rearrange windows, but simply resizing windows does not display the *. The * means you are in a modified View, which must be saved as a User View before you leave the measurement (if you don't save it, the instrument will save it for you).

Note also that the Restore Layout to Default control is no longer grayed out. If you press this control it restores the Basic View to its default state. Restore Layout to Default becomes available when you add, delete or rearrange windows **and** when you resize them; otherwise it is grayed out.

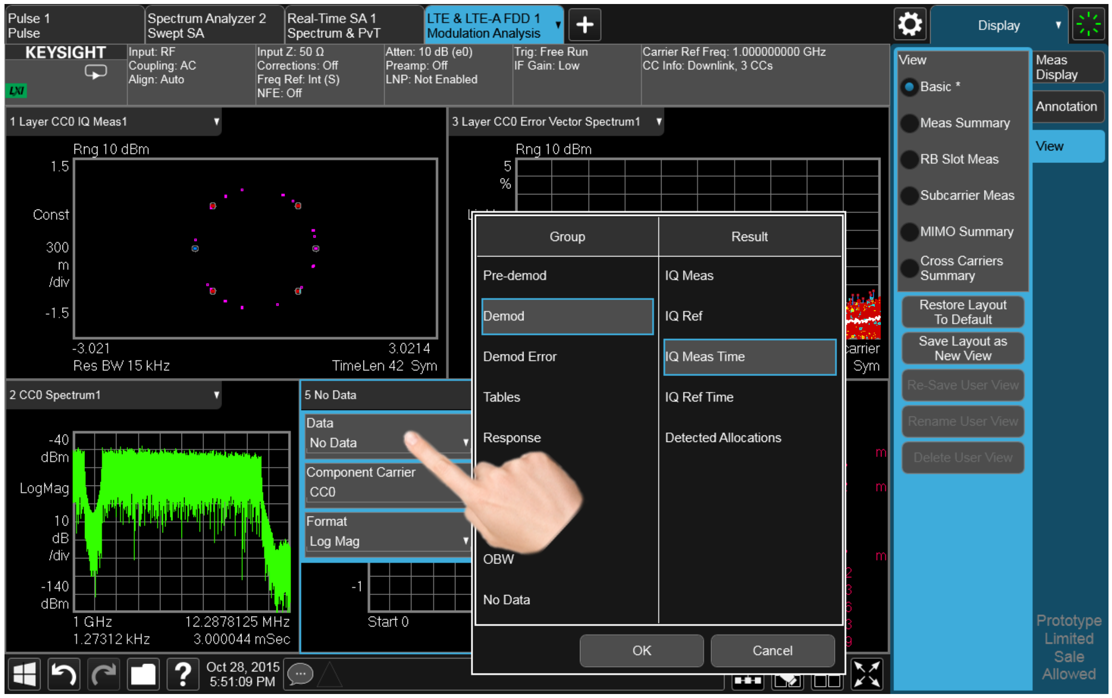
You can add more windows with the "+" arrow symbols. Note that the "+" arrow symbols only appear if the current measurement has more windows available to display. If you are already displaying all the measurement's windows, the "+" symbols disappear.

You can exit the View Editor by again tapping the Edit View icon.

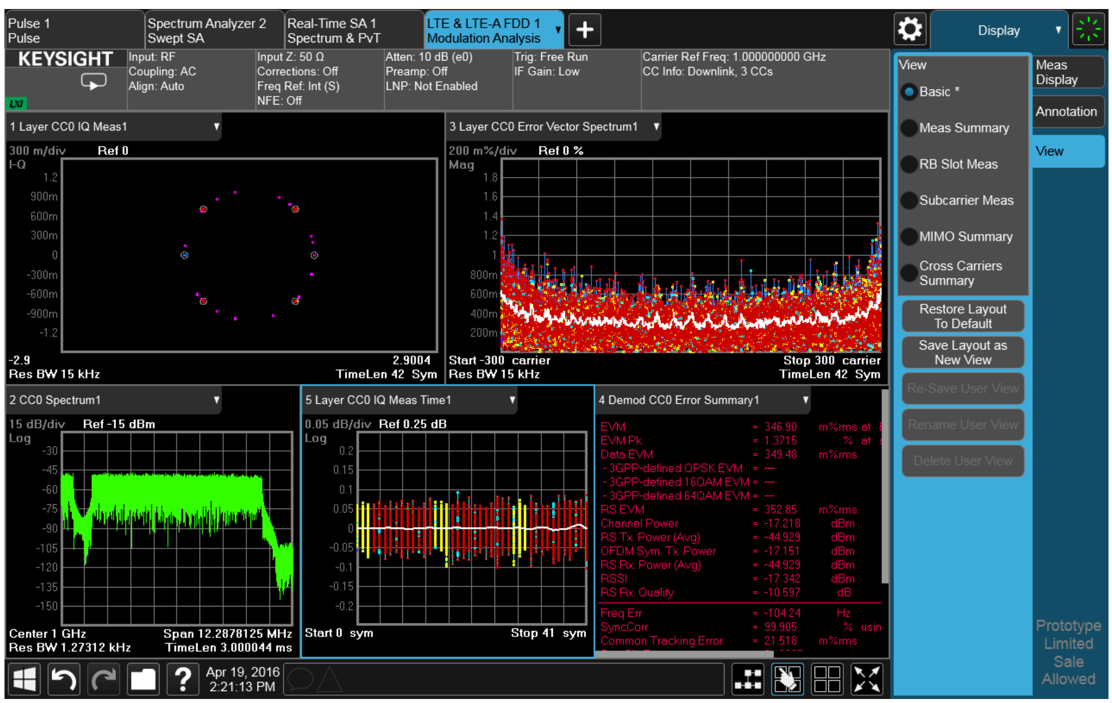
You can specify which result you want to see in the new window by tapping its title region.



A panel drops down, containing a Data control for specifying window results. Some measurements, such as LTE-A in this example, also provide controls on this dropdown for specifying other window parameters, such as the Component Carrier and Data Format, Tap the Data control and you will see a list of available results for the window. In some cases, as in LTE-A, this will be a cascading list, due to the number of results available:



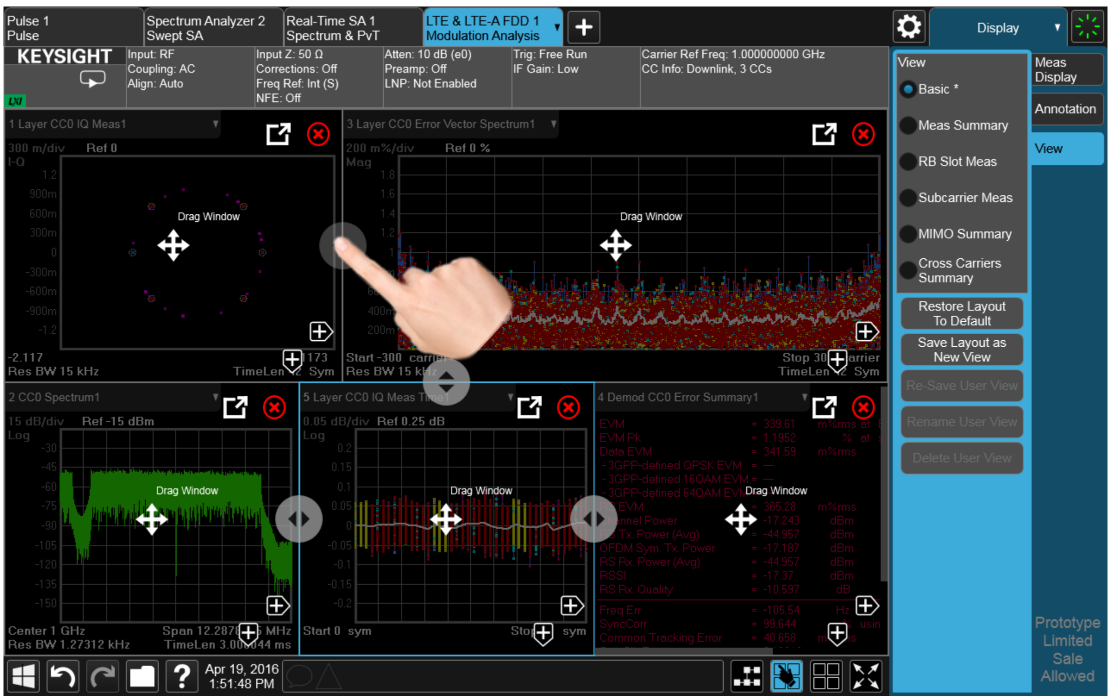
Choose the result you want and tap OK. Here we have chosen IQ Meas Time from the Demod group:



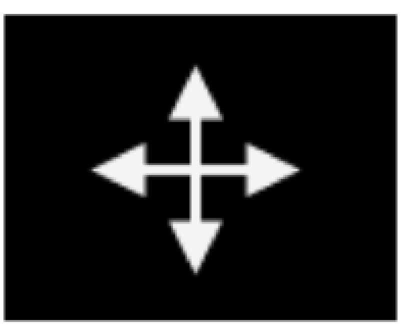
Your new, edited User View is now ready to use.

2.4.7.2 To Resize or Rearrange Windows in a View

Sometimes you may wish to resize a window. To do this go back into the View Editor and note the large, translucent white circles along the edges of the draggable borders. These are the “resize handles”. You can resize the windows by dragging these handles. Note that in their quiescent state they are slightly translucent; when you touch one it turns solid white, indicating that it is draggable. If you touch and drag one of them it moves the axis to which it is attached.

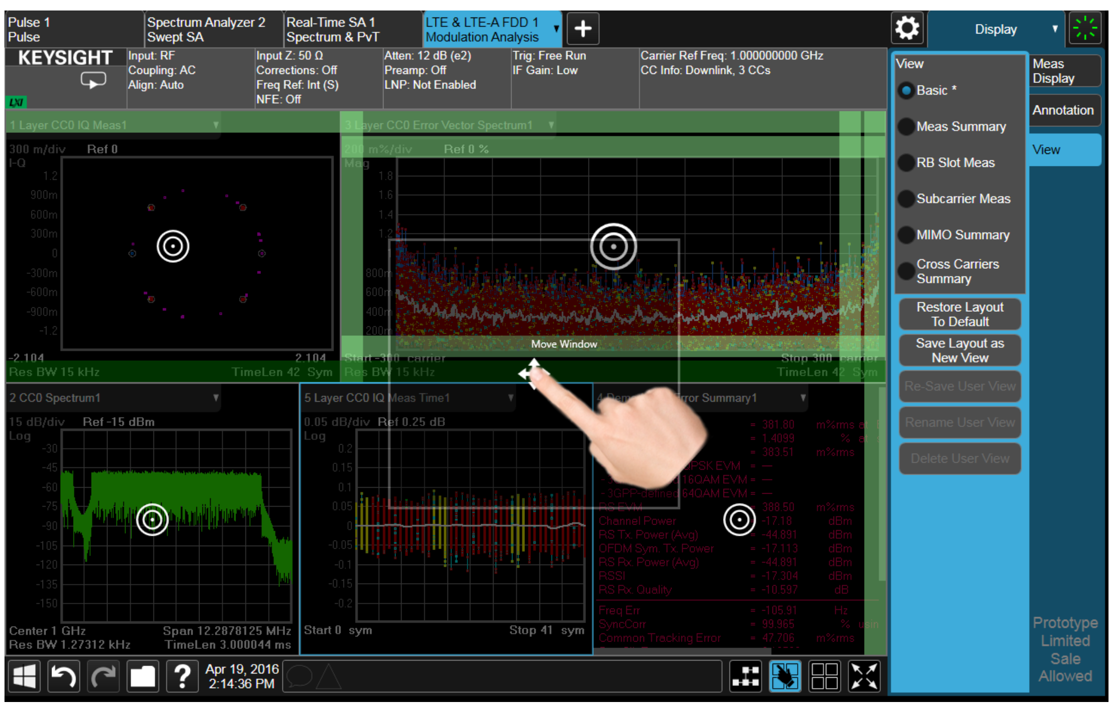


Another feature that comes with the View Editor is the ability to move windows around. You do this by dragging the four-arrow objects in the center of the window; the whole window goes along. Actually you can touch and drag anywhere in the window (except on one of the arrows or the delete circle) and it will drag, but the four-arrow objects give you an indication and a convenient finger target.

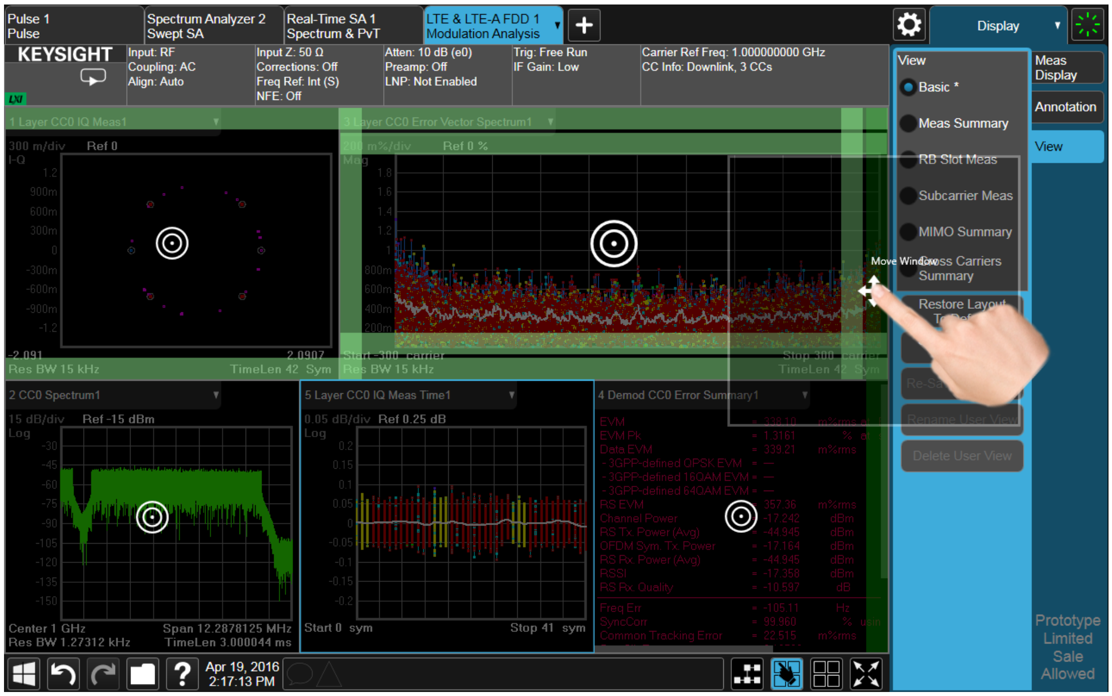


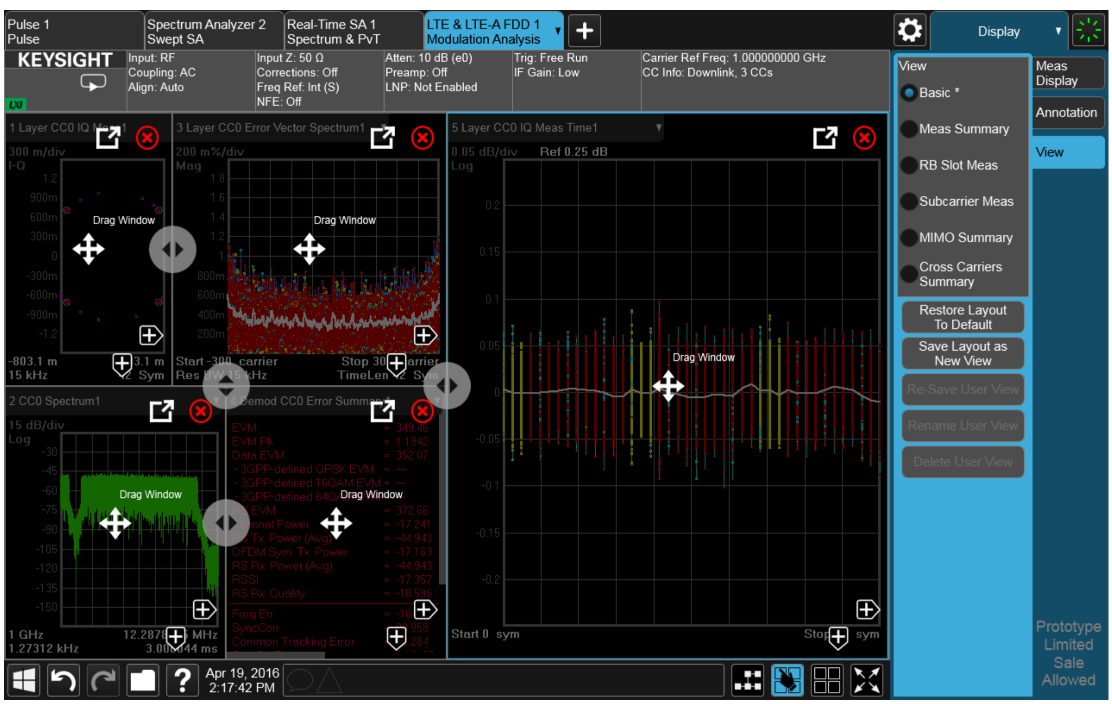
The outline of the window appears as it is being dragged. When you start to drag a window, target symbols appear in the other windows:

If you drop a window on one of the targets, it swaps positions with the target window. If you drag a window's center into another window, green stripes appear on the edges to show you where the window will go when you release it:



When you hover over one of the stripes it gets dimmer, to show the position the window being dragged will take on. If you release a window over an inner stripe, the window you are dragging and the window over which you were hovering resize to share the space the target window originally occupied. If you release a window over an outer stripe, as shown below, the window you are dragging takes on a new position outside the array of other windows:





In either case, one or more of the remaining windows resize to occupy the space formerly occupied by the window you were dragging.

2.4.7.3 To Undock and Redock Windows

You can undock a window from the analyzer's display frame so that it becomes a separate, floating window with its own Windows banner and title. There are two different ways to do this:

1. Drag the window to a spot on the display where its center is not on top of any targets or green stripes. When you do this the note on the window will change to "Undock Window":

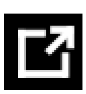
Now release the window and it will undock in place without changing size:

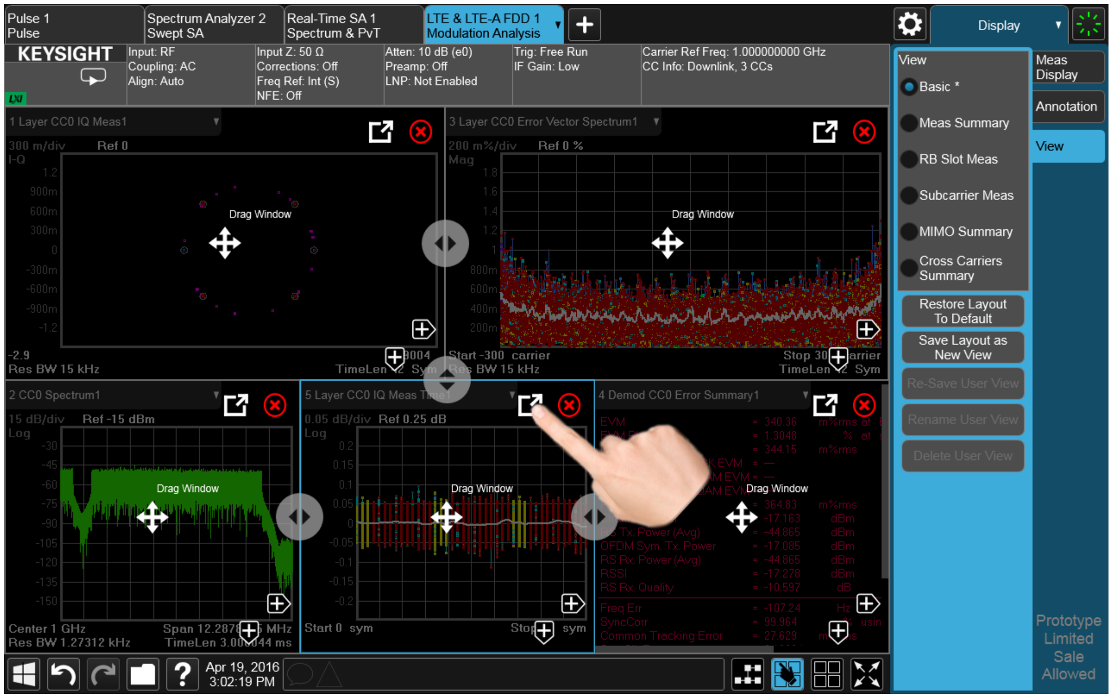
Notice that it now has a banner and a title of its own. The first line of the banner is the Mode name and the second is the Measurement name. If the window is too small, these will be shortened with an ellipsis. The window name and number themselves appear in the upper left corner of the window, as usual.

Note that we are still in Edit View mode so the main window stills display the shaded overlay and, if there is more than one window left on the main display, the "move" arrows and delete and undock controls.

There are no "add" arrows or "drag cross" or "delete X" on the undocked window, because now it is a normal Windows window; so you can minimize it, maximize it, delete it, and resize it in the normal Windows way, whether the main window is in Edit View or not. You can also drag it around or to any monitor, and it will snap to full screen when dragged to an edge like any other Windows window.

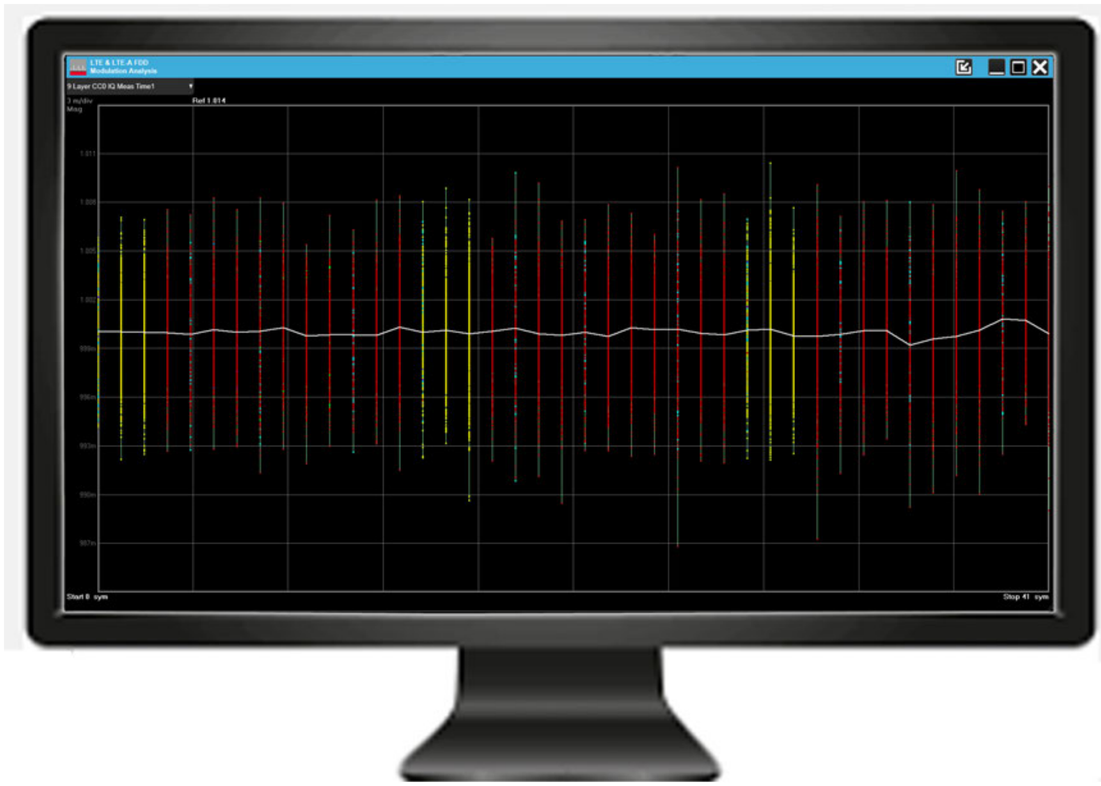
2. Tap the "undock" icon in the corner of the window:





A prompt will appear with a picture which allows you to specify which monitor to which you wish to undock the window:

Tap one of the monitors and you will see the window undock to that monitor, which may be a different monitor than the analyzer:



You can now treat this window like any other in Windows; you can resize it, drag it around and/or to a different monitor, etc.

The undocked windows represent a modified (starred) View and can be saved to a User View. They disappear if you change measurements or Views and return if you change back. If the external monitor is unplugged, the undocked windows land back on the main analyzer window and remain there, undocked, even if the monitor is plugged back in. The same is true if a User View is selected which had windows on a monitor that is not connected.

Note that even with a window undocked, there is still only one selected window in xSA, indicated by a blue window border (for a docked window) or a blue window banner (for an undocked window). Also, all popup messages still appear only on the main analyzer screen.

In multiscreen display mode, all windows for each Screen's current View (docked and undocked) are displayed. In single screen display mode, only the windows associated with the current Screen's current View (docked and undocked) are displayed.

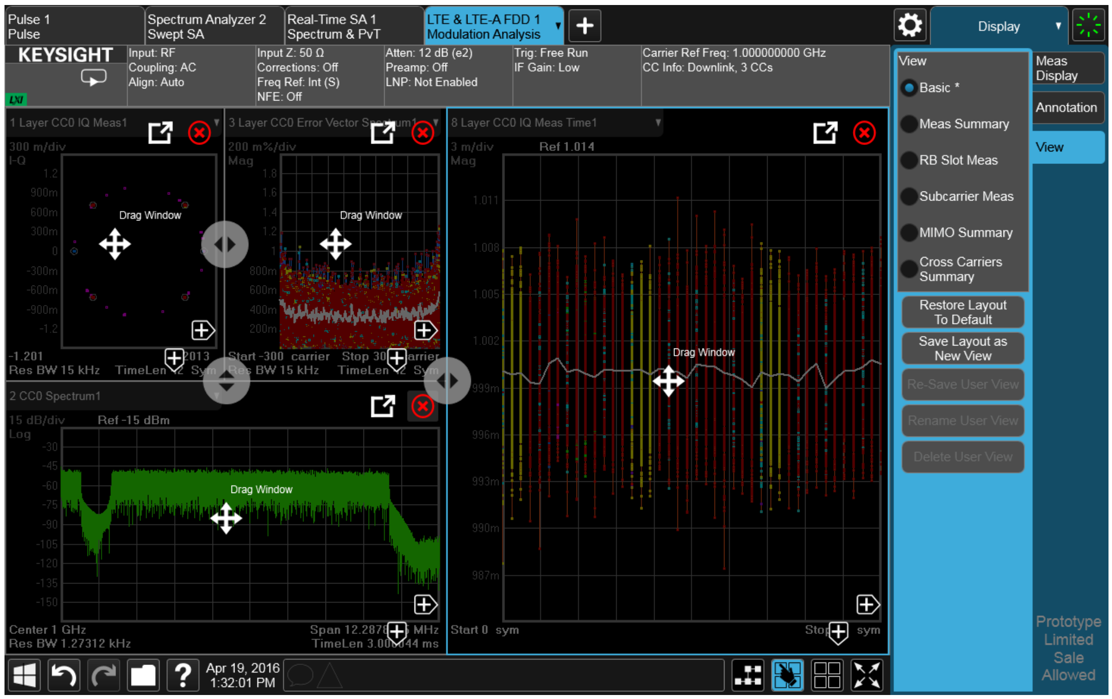
With undocked windows, when you save a Screen Image, the undocked windows are not included in the png.

To redock an undocked window to its original location, tap the "redock" icon in the window's banner:  The window will return to its original location.

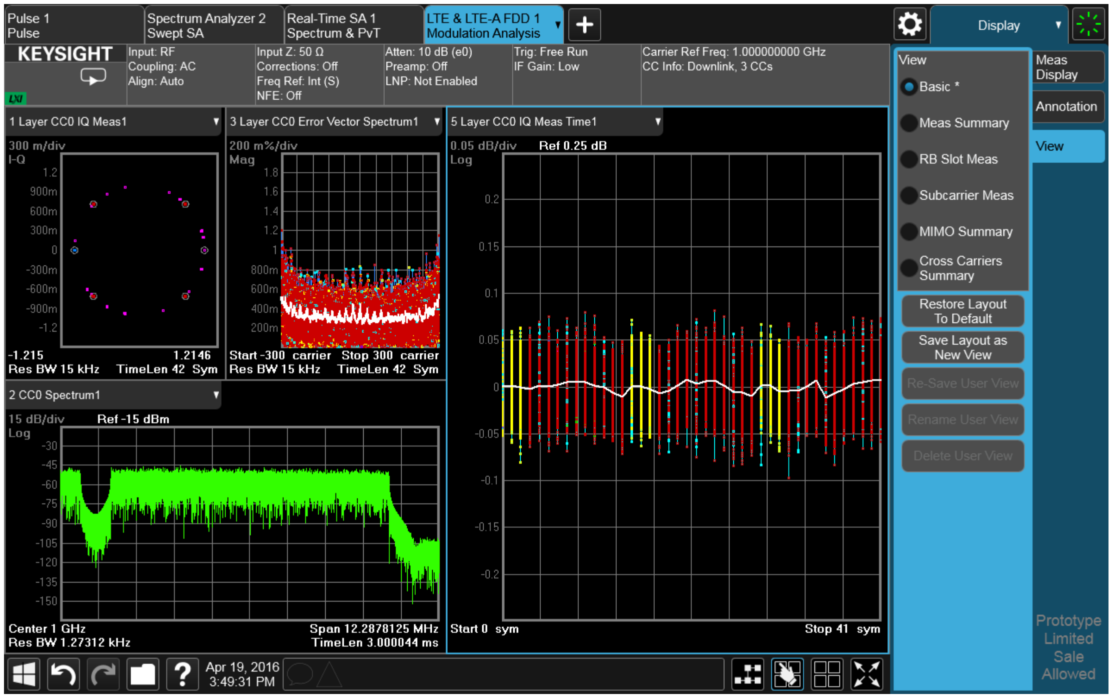
2.4.7.4 To Delete a Window from a View

The View Editor also lets you delete a window. To do this, tap one of the circled red X's, as shown below.

There has to be more than one window for you to see the circled red Xs.



Now press the View Editor button (the blue hand) to exit the View Editor. At this point, you have an edited Predefined View, as shown by the * next to Basic:



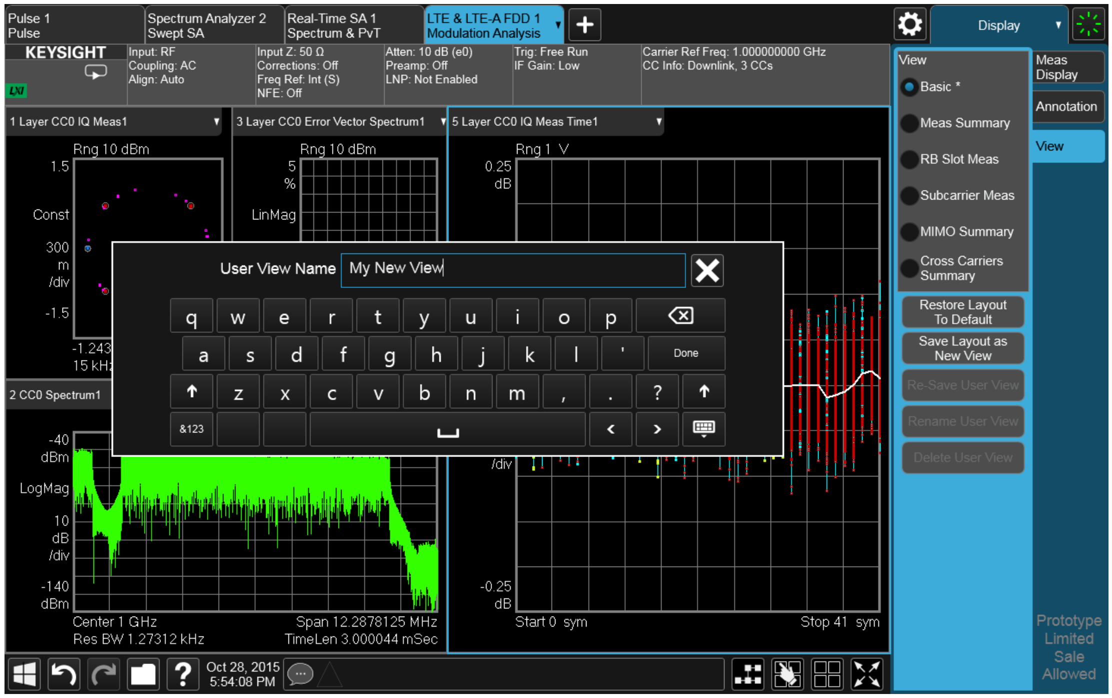
When you are finished with it, you can restore the Layout to the default for Basic by pressing “Restore Layout to Default”. Or you can save your edited View as a “User View” (if you exit the measurement without saving the edited View, the instrument will save it for you as a User View called “Autosaved”).

If you clone the current Screen by pressing the “+” tab, the modified Predefined View will be saved as a User View called “Autosaved”, and it will be available in the new Screen.

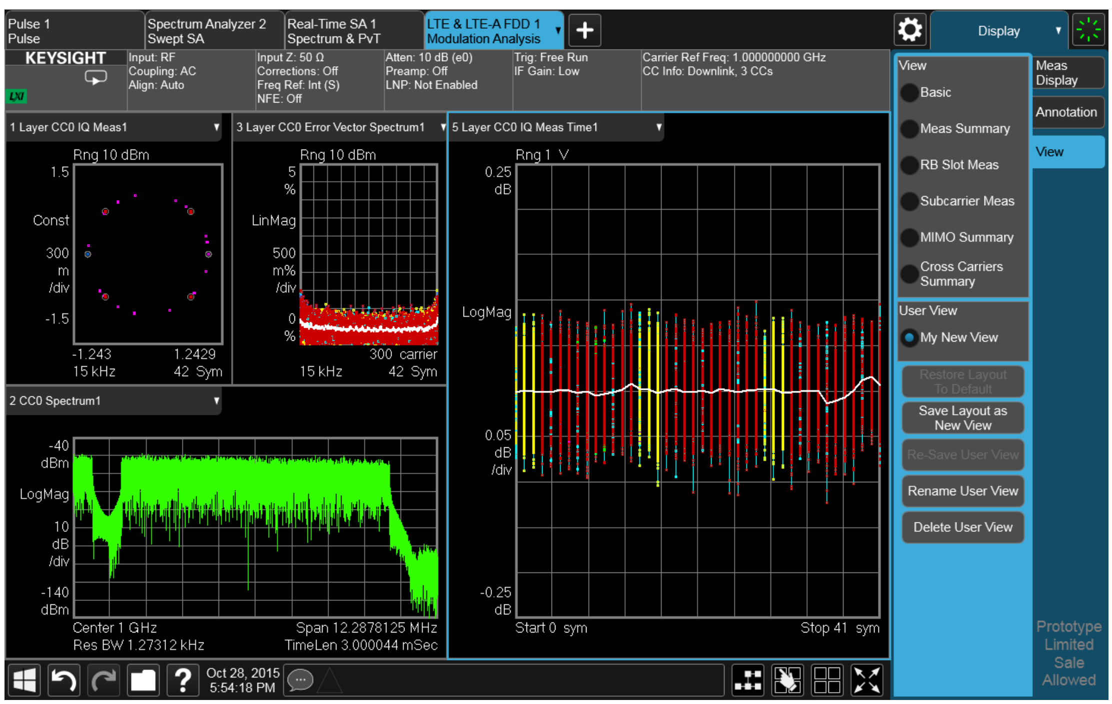
2.4.7.5 To Save a User View

See also "Transferring User Views Between Instruments" on page 146

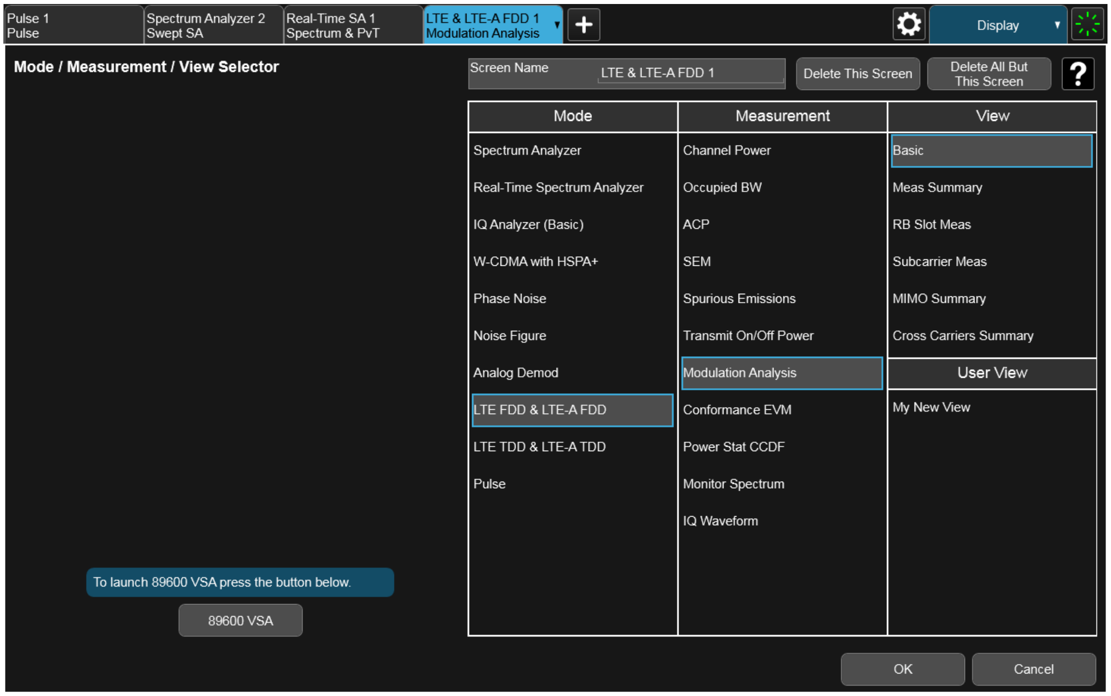
To save your new View as a User View, tap the “Save Layout as New View” control. You will get an alpha keyboard that lets you name your new View; the default is the old View name with a number. Below, we have typed in “My New View”:



When you tap "Done", the View is saved:



Notice the User View region which has appeared on the menu panel above, with the new User View called "My New View. Notice also that "Basic" has returned to its original, unedited state and the * is gone from its name. Note also that "Restore Layout to Default" is grayed out. Note also that if you go to the Mode/Meas dialog, you will see the User View there as well:



When naming a new View, you must choose a name that is not already in use for any User View in any measurement; this is because User Views get written to permanent memory and are available to all instances of the Measurement in any screen. They survive a Mode Preset and also survive shutdown and restart of the application.

Transferring User Views Between Instruments

To transfer a User View to another instrument, you must copy the desired file to a portable drive or to your network and then copy it to the target instrument.

When you save a User View, a file is created (or updated if it already exists) containing all the User Views for the current measurement. All of these files are saved on the D: drive in the instrument, in the folder:

`D:\Users\Instrument\My Documents\UserViews`

(assuming you are logged in as Instrument, which is the default).

Look for the file for your measurement. The file naming convention is:

`ModeName.MeasName.layout`

Where `ModeName` is the long-form SCPI parameter for the `:INST:SEL` command for your Mode, and `MeasName` is the long-form SCPI parameter for the `:CONF` command for your Measurement.

For a full list of all `ModeName` parameters, see **Index to Modes** in "Mode" on page 86.

The following is a full list of all `MeasName` parameters.

Measurement Name	SCPI ID
ACP, Adjacent Channel Power	`ACPower`

Measurement Name	SCPI ID
AM	AM
APD	APD
Burst Power	BPOWer
Channel Power	CHPower
Code Domain	CDPower
Combined GSM	CGSM
Combined WCDMA	CWCDma
Complex Spectrum	SPECtrum
Conformance EVM	CEVM
Digital Demod	DDEMod
Disturbance Analyzer	DANalyzer
EDR In-band Spurious Emissions	IBSPurious
EVM	EEVM
FM	FM
FM Stereo	FMStereo
Frequency Scan	FSCan
GMSK Phase & Freq Error	PFERror
Harmonics	HARMonics
IQ Waveform	WAVeform
LE In-band Emissions	IBEMissions
List Power Step	LPSTep
List Sweep	LIST
Log Plot	LPLot
Mod Accuracy	RHO
Modulation Analysis	EVM
Monitor Spectrum	MONitor
Noise Figure	NFIGure
Occupied BW	OBWidth
Output RF Spectrum	EORFspectr
Output Spectrum BW	OBWidth
PM	PM
Power Amplifier	PAMPlifier
Power Control	PCONtrol
Power Stat CCDF	PSTatistic
Power vs Time	EPVTime
Pulse	PULSe
QPSK EVM	EVMQpsk

Measurement Name	SCPI ID
SEM	SEMask
Spectral Flatness	FLATness
Spectrum & PvT	RTSA
Spot Frequency	SFRequency
Spurious Emission	SPURious
Strip Chart	SCHart
Swept SA	SANalyzer
TOI	TOI
Transmit Analysis	TX
Transmit On/Off Power	PVTime
Transmit Power	TXPower
Tx Band Spur	ETSPur

Examples:

– The User View file for the Swept SA measurement is `SA.SANalyzer.layout`.

– The User View file for the ACP measurement in the WCDMA mode is `WCDMA.ACPower.layout`.

Copy the desired file to a thumb drive or to your network. Then go to the target instrument and copy the file into the D:\Users\Instrument\My Documents\UserViews directory on that instrument (again, assuming you are logged in as Instrument).

NOTE: copying this file to another instrument will overwrite the file already in that instrument, if any, and will destroy any User Views that might have been created on that instrument.

NOTE: When you delete the last User View for a measurement, the file is removed.

2.4.7.6 To Rename a User View

You can rename a User View by selecting that View and tapping “Rename User View.” You can also re-edit a User View; if you do this, an asterisk will appear next to the User View’s name. You can then tap “Re-Save User View to save it back to its existing name, or “Save Layout as New View” to add another, new User View.

2.4.7.7 To Delete a User View

You can delete a User View by doing the following:

1. From the "Mode/Meas/View Dialog" on page 85, *or* from the **View** menu, select the User View that you want to delete
2. Switch to the **Display** menu

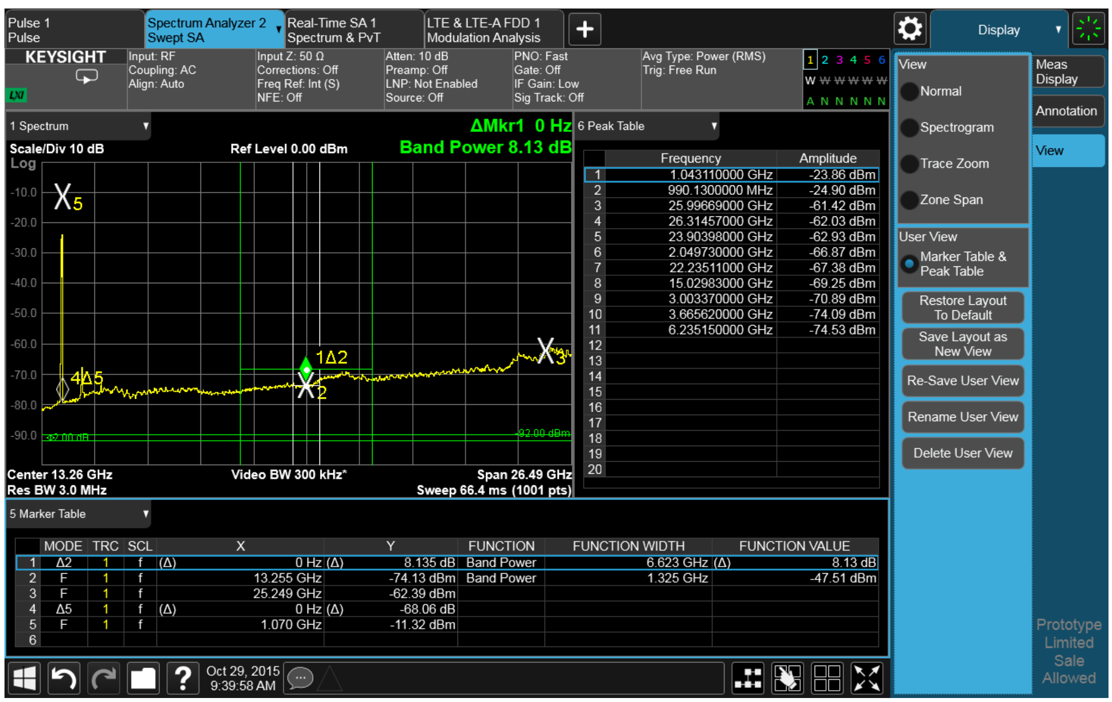
3. Select the **View** tab
4. Tap **Delete User View**

2.4.7.8 To Delete All User Views

You can delete all User Views by tapping “Delete All User Views.” The default view becomes the current view for the Measurement if a User View was the current view when this control was pressed.

2.4.7.9 Use Case: Displaying Marker and Peak Tables

One common application for User Views is to create a View that allows the Spectrum Analyzer to display both a Marker Table and a Peak Table at the same time. To do this, simply add a Marker Table Window and a Peak Table window to the Spectrum window of the Swept SA measurement. The result is shown below; note that the new View has been named “Marker Table & Peak Table”:



NOTE: There are legacy displays like Marker Table, Peak Table, Measure at Marker and Gate View, which are not Views but special display modes. These are retained for backwards compatibility, however they are turned on and off with switches and do not use the View system. Turning on one of these switches does not create a modified View, it merely adds the specified window to the current View; turning the switch back off removes the window. While the switch is on, NO View shows as selected in the View menu. These switches are grayed out if you are in a modified View or a User View. Since only one of these switches can be on at a time, and because these switches turn off on a Preset, User Views offer a superior way of adding windows than using the switches.

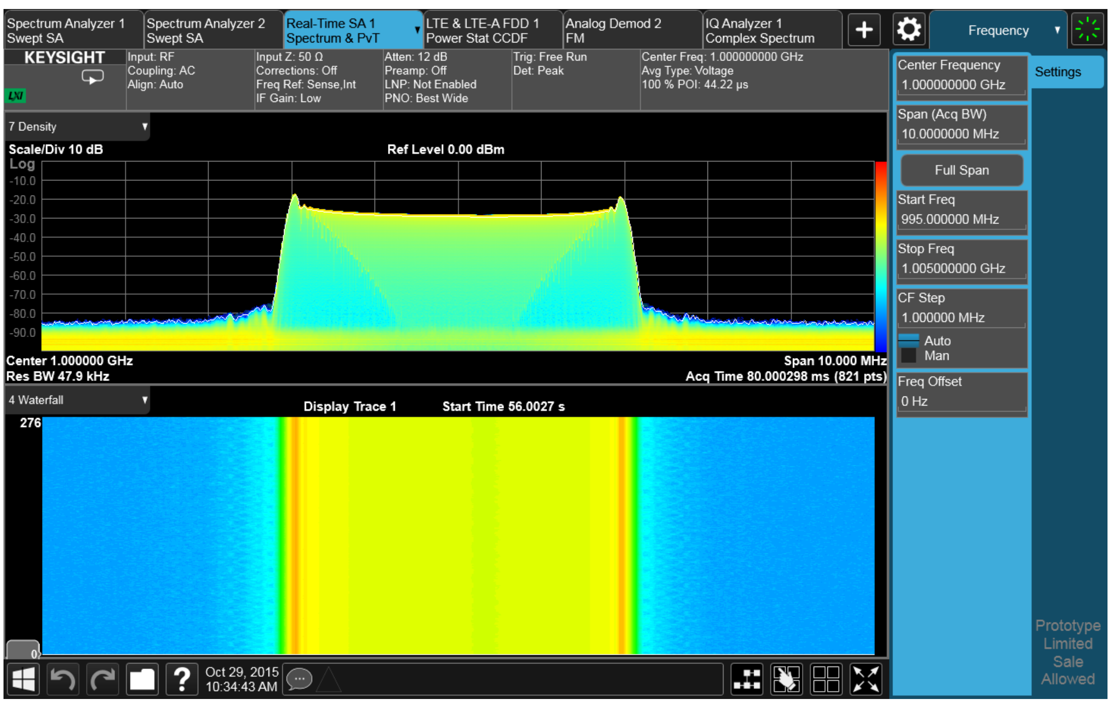
Some measurements do not support User Views; these do not allow adding, deleting or rearranging windows, however they do allow resizing windows. In these measurements you can get into the View Editor but the Add icons, Delete icons and Move icons will not appear. You can still resize the windows and in some cases (e.g. Noise Figure) you can still change window contents.

2.4.7.10 View Editor Remote Commands

Remote Commands for User Views can be found in the documentation for the **Display, View** tab.

2.4.8 Multiscreen

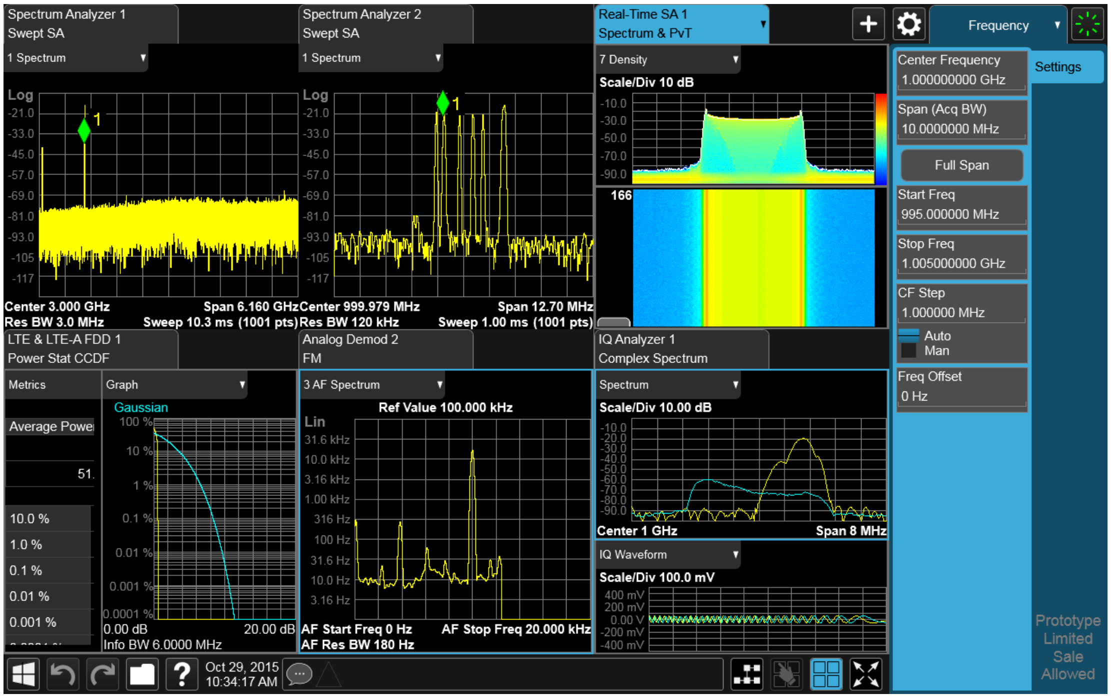
You can configure up to 16 different Screens at a time. Normally, you only see one Screen, and the set of configured screens is shown across the top of the display in a series of "Screen Tabs" on page 84. Touching any screen’s tab brings it to the foreground, makes it the current Screen and starts it updating.



Multiscreen view lets you display all of the configured Screens at once.

You can switch to Multiscreen View by pressing this button in the "Control Bar" on page 115 at the bottom right of the screen:

Multiscreen View looks like this:



While in Multiscreen View, the button changes from a black background to a blue background:

To exit Multiscreen view, tap the button again.

Multiscreen View cannot be activated if only one screen is configured.

Each Screen contains one Mode, each Mode contains one Measurement, and each Measurement contains a number of Windows arranged in Views. You can configure multiple instances of the same Mode along with any combination of other Modes.

In Multiscreen View, just as in Single Screen View, only one screen is active.

You switch Screens by tapping the Screen Tab you want, or when in Multiscreen View, you can tap the Screen itself. When you switch Screens, the current Screen's state and measurement results are preserved, the new Screen's previous state and data are loaded, and the new Screen starts running its Mode.

In Multiscreen View:

– The Meas Bar does not display

– The Screens are presented in an array of equal size boxes, except where the number of Screens means some have to be different sizes (as when you have 3 Screens, 5 Screens, etc.).

– Each Screen has a tab that contains the name of the Mode and Measurement in the box and a number associated with the instance of that Mode. You can enter a custom Screen name that replaces the Mode name, by going into the Mode/Meas dialog

– There is always one and only one selected Screen. It is indicated by a blue tab. Only the selected Screen is actually running a measurement and updating its display

– The selected window in the selected screen is the context for the current menus. It is the only window on the display with a blue border

– As you go from screen to screen, each screen remembers the last menu that was active in that screen and restores it as the active menu

In Multiscreen View, as in Single Screen View, tapping the blue tab or pressing the Mode/Meas front panel key opens the "Mode/Meas/View Dialog" on page 85 which allows you to change the Mode (or Measurement or View) being displayed in that Screen.

Remote Command	`:INSTrument:SCReen:MULTiple[:STATe] OFF | ON | 0 | 1` `:INSTrument:SCReen:MULTiple?`
Example	`:INST:SCR:MULT ON`
Notes	If only one screen is configured, attempting to set Multi-Screen ON generates the error "-221, Settings conflict; Multi-Screen requires >1 screen"
Preset	OFF

For more information, see the following:

– "Select Screen" on page 152

– "Screen List (Remote only command)" on page 153

2.4.8.1 Select Screen

You can select a screen by touching its tab or, in "Multiscreen" on page 150 mode, touching the screen itself. Selecting the Screen activates the screen and suspends the previously selected screen (if any).

Remote Command	`:INSTrument:SCReen:SELect <screen name>` `:INSTrument:SCReen:SELect?`
Example	`:INST:SCR:SEL "Baseband"`
Notes	If the <screen name> is specified but not found in the list of Screens, the error message "-224, Illegal parameter value; Screen Name not found" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; Screen SCPI cannot be used when Display is disabled" is generated
Preset	Returns the name of the active screen

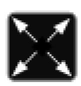
2.4.8.2 Screen List (Remote only command)

You can obtain a list of currently configured Screens. This permits your remote program to manage screens for selection, renaming, or deletion.

Remote Command	`:INSTrument:SCReen:CATalog?`
Example	`:INST:SCR:CAT?`
Notes	The query response is a comma separated list of Screen Names. If only 1 Screen is configured, there is no trailing comma For R&S compatibility, the following query is also available: `:INSTrument:SCReen:LIST?`
Preset	Returns list of currently configured Screens

2.4.9 Fullscreen

The Fullscreen button is in the "Control Bar" on page 115, at the lower right corner of the display.



When **Full Screen** is pressed the measurement window expands horizontally over the entire instrument display. The screen graticule area expands to fill the available display area.

It turns off the display of the menu panel, however the controls that drop down from the Meas Bar and on-screen annotation are still available, and you can still drag the trace and markers and perform a pinch zoom, so you can still operate the instrument.

Pressing **Full Screen** again while Full Screen is in effect cancels Full Screen.

You can get even more screen area for your data display by turning off the Meas Bar using the Annotation tab of the Display menu)

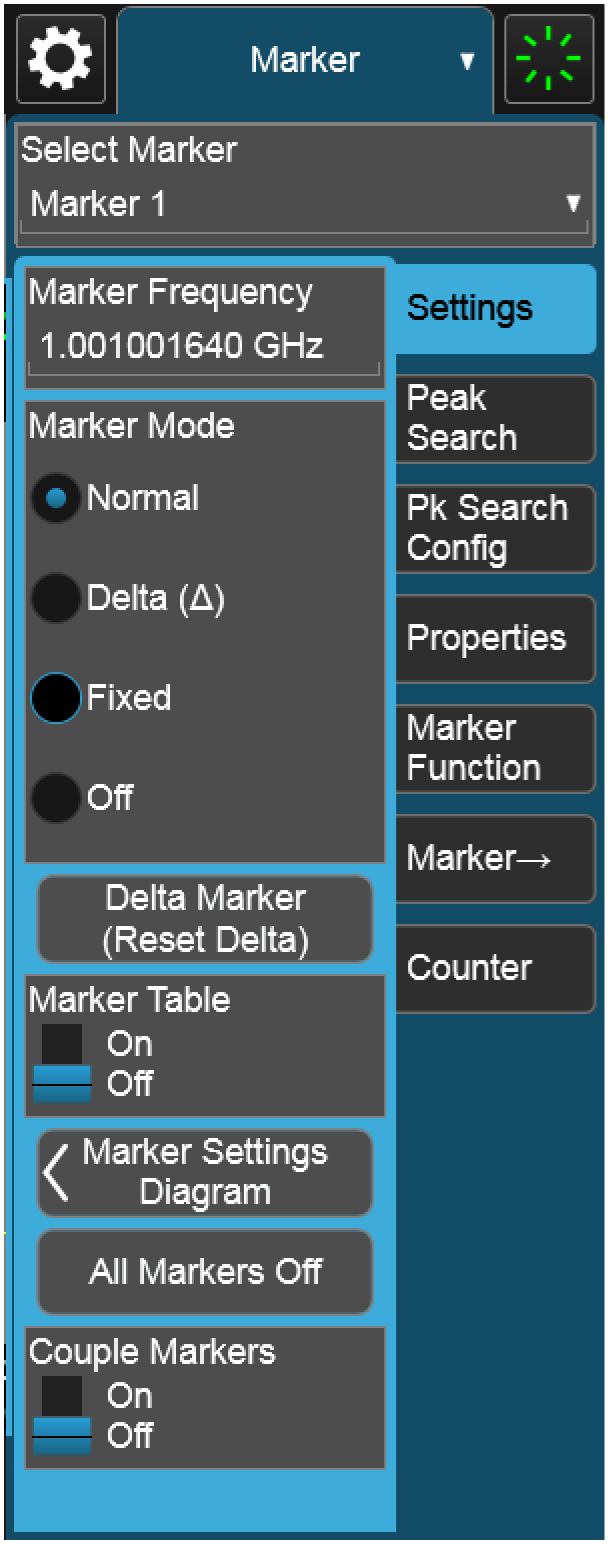
Full Screen is canceled by the **Preset** key.

Remote Command	`:DISPlay:FSCReen[:STATe] OFF | ON | 0 | 1` `:DISPlay:FSCReen[:STATe]?`
Notes	This was set to Off by :SYST:DEF MISC in MXA1, but not by Preset. It is no longer set Off by :SYST:DEF MISC, since it is now meas global instead of mode global
Preset	Unaffected by Preset but set to Off by Restore Misc Defaults or shutdown and restart
State Saved	Not saved in instrument state
Backwards Compatibility SCPI	`:DISPlay:MENU[:STATe] OFF | ON | 0 | 1` This emulates ESA full screen functionality, which is the same as the FSCReen command in PSA except

	that the sense of on/off is reversed (that is, OFF means the menus are OFF, so Fullscreen is ON) and the default is ON (meaning Fullscreen is OFF)
Backwards Compatibility Notes	In ESA/PSA, Full Screen was turned on with a softkey, so pressing any other key turned Full Screen off. In the X-Series, because a hardkey is provided to turn this function on and off, pressing any other key no longer turns off Full Screen

2.5 Menu Panel

The menu panel is the main focus of the X-Series Multitouch user interface. The controls include active functions, dropdowns, action buttons, radio buttons and toggles.

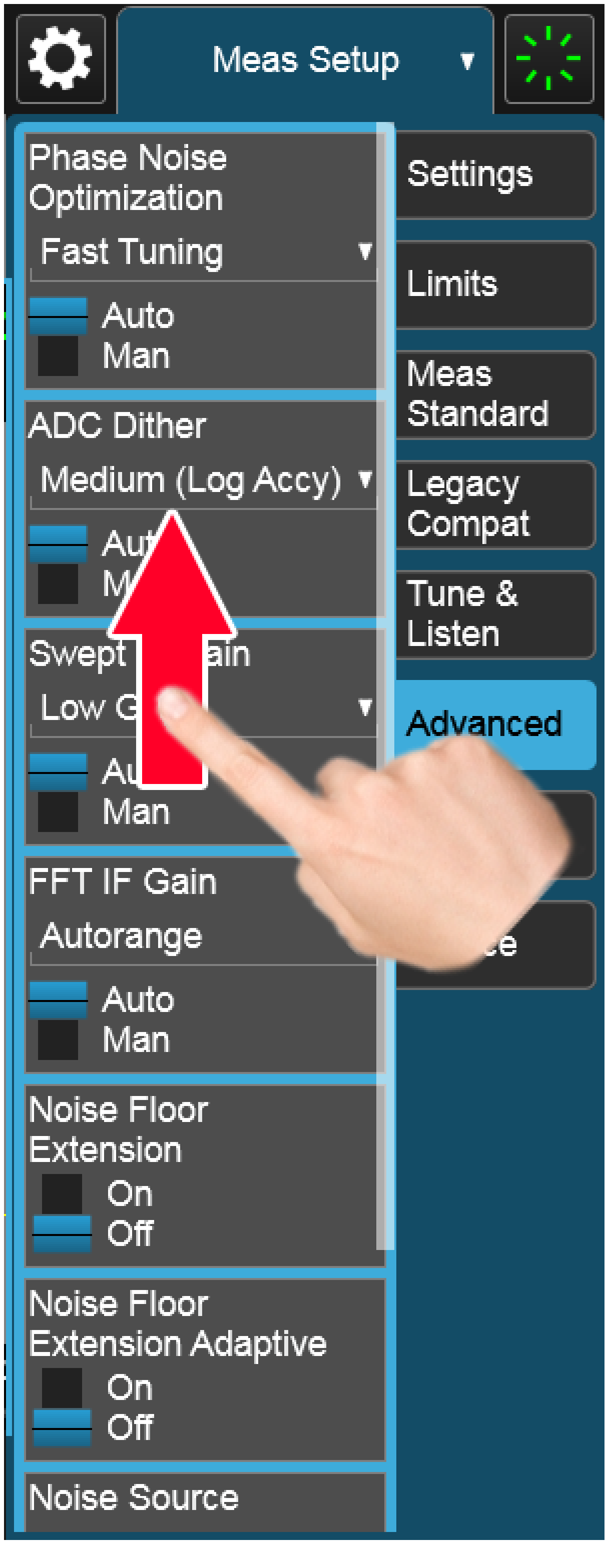


The menu panel normally appears on the right side of the display and consists of a rectangular panel with multiple “sub-panels” lying on top of each other, each sub-panel being accessed by a tab on the right.

You press a front panel key (or “hardkey”) to access a particular menu. On the front panel there are twelve “measurement hardkeys” (the ones in the shaded region in the figures below) – these are the hardkeys that open up menus in the menu panel.

With a menu open, tap a tab to access the controls on its sub-panel. Whenever you press the front panel key associated with a menu, the default (top) tab is selected.

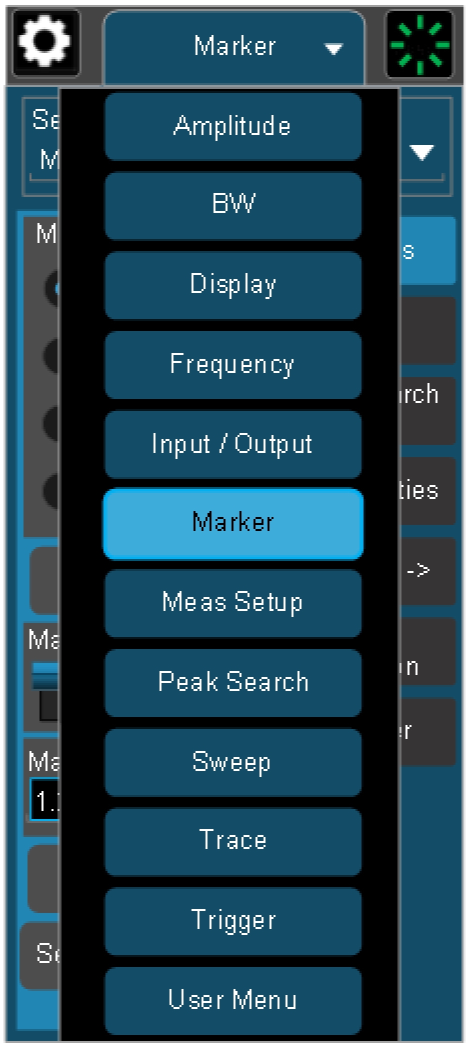
If the number of controls on a panel exceeds the height of the panel, scrolling is enabled, which is indicated by a white bar on the left that fades away after a few seconds. You swipe up or down with your finger to scroll the panel, or you can grab the white bar with a mouse.



If you move to a different menu panel or sub-panel and then come back to a previous panel, the previous panel is always reset to be scrolled all the way back to the top.

Accessing Menus Without Using Front-Panel Keys

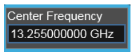
You can access the menu panels without using the front panel keys, as you would need to do if you were operating the instrument using Remote Desktop. Touch or click on the menu title, as shown below. A dropdown containing the twelve measurement hardkeys appears. Selecting a hardkey from the dropdown displays the corresponding menu, and the dropdown disappears.



Entering Numeric Values

Many controls on the menu panel allow you to enter numeric values. These are called “active functions.” An active function control displays a number and a suffix, for example 13.255 GHz, as in the example below:

An active function is "active" if the numeric value is surrounded by a black background with a blue border, as below. In this state, it is ready to receive numeric input from the number pad on the front panel, the knob, or the step keys.



When an active function is in the active state, you can start typing or pressing the number keys on the front panel, which causes the Numeric Entry Panel to appear, as shown below. The Numeric Entry Panel displays the typed value, and the terminators to complete the entry.

Here we see a UXA with an active function control in the active state. Although no Numeric Entry Panel is displayed, you can just touch the "2" key:

This causes the Numeric Entry Panel to pop up to receive the numbers you are typing:

Type in as many digits as required, then touch one of the unit terminator buttons in the Numeric Entry Panel to complete the entry. In this case, 2 GHz was the desired entry, so you just touch the “GHz” terminator:

The Numeric Entry Panel disappears and, in the example, the active function value becomes 2 GHz.

It is important to note that you can always pop up the Numeric Entry Panel by touching an active function control while it is active; for example, if you were to touch it in the figure above, the Numeric Entry Panel would pop up right next to the control:

You can display the Numeric Entry Panel by touching any active function control while it is active, but you don’t have to pop up the Numeric Entry Panel first, you can just start typing and it will pop up on its own, thus saving you a keystroke.

You can also adjust a value without displaying the Numeric Entry panel by turning the knob or using the step keys while an active function is active. If you turn the knob or use the step keys while the Numeric Entry Panel is displayed, it disappears, allowing you to see the entire screen while you are making the adjustment.

You can also drag the Numeric Entry Panel to another part of the display if it is covering something that you wish to see while it is on the screen.

2.6 Cancel key

This front-panel key has the same functions as the Windows **Esc** (Escape) key. It does the following:

– Cancels dialogs

– Cancels active functions (unless there is an entry in progress, in which case it cancels that, and reverts to the previous value)

– Resets input overloads

– Aborts print operations

– Cancels certain other operations (such as alignments)

– Returns you to Local Control (if in Remote)

– If the backlight is off, turns on the backlight, and does nothing else

Most of this functionality is the same as earlier X-Series models and similar to ESA and PSA operation.

When the instrument is in Remote, any hardkey that is pressed on the front panel displays this message:

`Analyzer is in Remote. Press ESC to return to Local`

The exception is the **Cancel (ESC)** key, which takes the instrument out of Remote.

When the instrument is also in the LLO (local lockout state), the **Local** key is locked out as well. When this is the case, and the **Local** key is pressed, this message is displayed:

`Local key is locked out by remote computer. Cancel Local Lockout on computer or release remote control`

When you see this message, you should disconnect the remote computer, or use it to take the instrument out of the Local Lockout state.

2.7 Onscreen Keyboard key

This key turns the onscreen alpha keyboard (OSK) on and off.

There are two onscreen keyboards:

– The Multitouch OSK, which pops up automatically if, while using the analyzer application, a text field becomes the active function

– The Windows OSK, which you must open manually when a text field must be entered while interacting with Windows or other apps

2.8 Touch On/Off Key

This front-panel key turns the display touch functionality on and off. If off, you can turn it back on using the front panel **Touch On/Off** key. When the touch functionality is off, you can still use a mouse as a pointer.

When toggled, a dialog box appears midscreen that confirms “Touchscreen On” or “Touchscreen Off”.

This function remains in effect until it is turned off or until the app shuts down. The app always starts up with Touch enabled.

2.9 Tab key

This key has the same function as the **Tab** key on a PC keyboard.

You can use this key to display the Windows Taskbar, as follows.

- Alt-Tab to the Desktop
- Touch the desktop
- Touch **TAB**
- The Taskbar appears

2.10 Local Button

Appears in the Menu Panel when the instrument is in remote, and can be brought back to local via the **Local (ESC)** Key. See also "Cancel key" on page 165.

3 W-CDMA Mode

The W-CDMA with HSPA+ mode can be used for testing a W-CDMA transmitter, including measuring HSDPA/HSUPA signals, manufactured according to the following standards documents:

- 3GPP TS 25.141 Base Station (BS) conformance testing (FDD) V6.10.0 (2005-06)
- 3GPP TS 25.211 Physical channels and mapping of transport channels onto physical channels (FDD) V6.5.0 (2005-06)
- 3GPP TS 25.212 Multiplexing and channel coding (FDD) V6.5.0 (2005-06)
- 3GPP TS 25.213 Spreading and modulation (FDD) V6.3.0 (2005-06)
- 3GPP TS 25.214 Physical layer procedure (FDD) V6.6.0 (2005-06)
- 3GPP TS 34.121 Terminal conformance specification; Radio transmission and reception (FDD) V6.1.0 (2005-06)

These documents define complex, multipart measurements used to create and maintain an interference-free environment. For example, the documents include standardized test methods for the measurement of power in a carrier, a spectrum emission mask, and other critical measurements.

The instrument automatically makes these measurements using the measurement methods and limits defined in the documents. The detailed results displayed by the measurements enable you to analyze W-CDMA system performance. You may alter the measurement parameters for specialized analysis. For infrastructure test, the analyzer will test transmitters of base stations in a non-interfering manner using a coupler or power splitter.

Example	`:INST:SEL WCDMA` `:INST:NSEL 9`
Dependencies	The mode must be installed and licensed in your instrument before it is available for use
Status Bits/OPC dependencies	Changing modes resets all SCPI status registers and mask registers to their power-on defaults. Therefore, event or condition register masks must be re-established after a mode change

3.1 Measurement Commands

The commands for selecting each measurement are shown below. The commands relating to the Views and Windows for each measurement are described in the documentation for each measurement.

Example

Measurement	Command
Channel Power	:CONFigure:CHPower
Adjacent Channel Power	:CONFigure:ACPower
Spectrum Emissions Mask	:CONFigure:SEMask
Spurious Emissions	:CONFigure:SPURious
Occupied Bandwidth	:CONFigure:OBWidth
Power Stat CCDF	:CONFigure:PSTatistic
Code Domain Power	:CONFigure:CDPower
Modulation Accuracy	:CONFigure:RHO
Power Control	:CONFigure:PCONtrol
QPSK EVM	:CONFigure:EVMQpsk
Monitor Spectrum	:CONFigure:MONitor
IQ Waveform	:CONFigure:WAVeform
Combined WCDMA	:CONFigure:CWCDma
List Power Step	:CONFigure:LIST

Preset	MONitor
State Saved	Instrument State

3.2 Monitor Spectrum Measurement

The Monitor Spectrum measurement provides a quick, convenient means of looking at the entire spectrum. While the look and feel are similar to Spectrum Analyzer Mode, the functionality is greatly reduced for easy operation. The main purpose of this measurement is to show the spectrum. The default span should cover an appropriate frequency range of the application.

Monitor Spectrum Measurement Commands

The following commands can be used to retrieve the measurement results:

`:CONFigure:MONitor`

`:CONFigure:MONitor:NDEFault`

`:INITiate:MONitor`

`:FETCh:MONitor[n]?`

`:READ:MONitor[n]?`

`:MEASure:MONitor[n]?`

Remote Command Results for Monitor Spectrum Measurement

The following table describes the results returned by the queries listed above, according to the index value `n`.

n	Results Returned
1 (or not specified)	Returns trace1 data with comma separated floating numbers
2	Returns trace2 data with comma separated floating numbers
3	Returns trace3 data with comma separated floating numbers

3.2.1 Views

For modes other than MSR, LTEAFDD/LTEATDD and 5GNR, there is a single view, **Normal**.

For the MSR, LTEAFDD/LTEATDD and 5GNR modes, there are two views, **Normal** and **Carrier Info**, as described in the table below. The **Normal** view is the same as the common Monitor Spectrum view in other Modes. Carrier Info is available on the spectrum trace.

"Normal" on page 216	This is a single window view of the spectrum In MSR, LTEAFDD/LTEATDD and 5GNR modes you can turn on attributes that show

	the defined carriers and the sub-blocks also
Carrier Info	This view shows the spectrum in the top window and a carrier configuration summary in the bottom window Carrier center frequency can be displayed in either offset or absolute frequency depending on Carrier Freq

View Selection by Name (MSR, LTEAFDD/LTEATDD and 5GNR only)

Remote Command	`:DISPlay:MONitor:VIEW[:SELect] RTRace | CINFormation` `:DISPlay:MONitor:VIEW[:SELect]?`
Example	`:DISP:MON:VIEW RTR` `:DISP:MON:VIEW?`
Preset	`RTRace`
State Saved	Saved in instrument state
Range	Power Results|Carrier Info

View Selection by Number (MSR, LTE-A FDD/TDD and 5G NR only)

Remote Command	`:DISPlay:MONitor:VIEW:NSELect <integer>` `:DISPlay:MONitor:VIEW:NSELect?`
Example	`:DISP:MON:VIEW:NSEL 1` `:DISP:MON:VIEW:NSEL?`
Preset	1
State Saved	Saved in instrument state
Min/Max	1/2

3.2.1.1 Normal

Windows: "Spectrum" on page 174

Single window view of the graph.

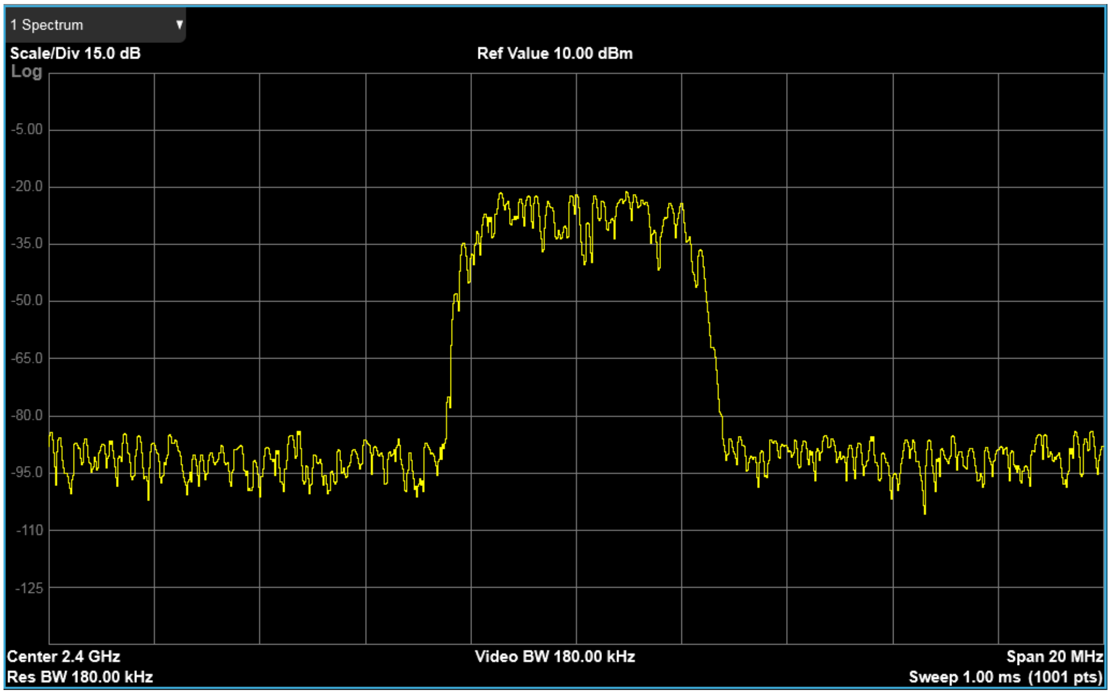
Example	`:DISP:MON:VIEW RTR`
Dependencies	This command is only available in the MSR, LTE-A FDD/TDD and 5G NR modes. In other Modes this is the only View

3.2.2 Windows

This section describes the windows used in the Monitor Spectrum measurement.

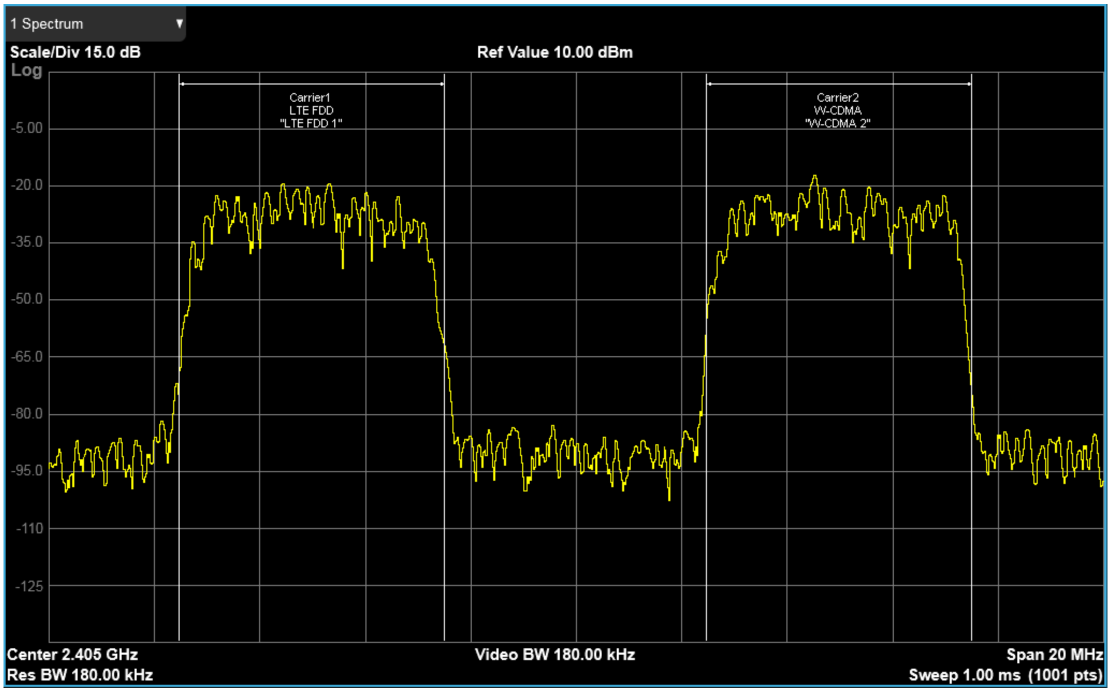
3.2.2.1 Spectrum

In all modes except **MSR, LTEAFDD/LTEATDD, and 5GNR,** this is a single trace window showing the spectrum.

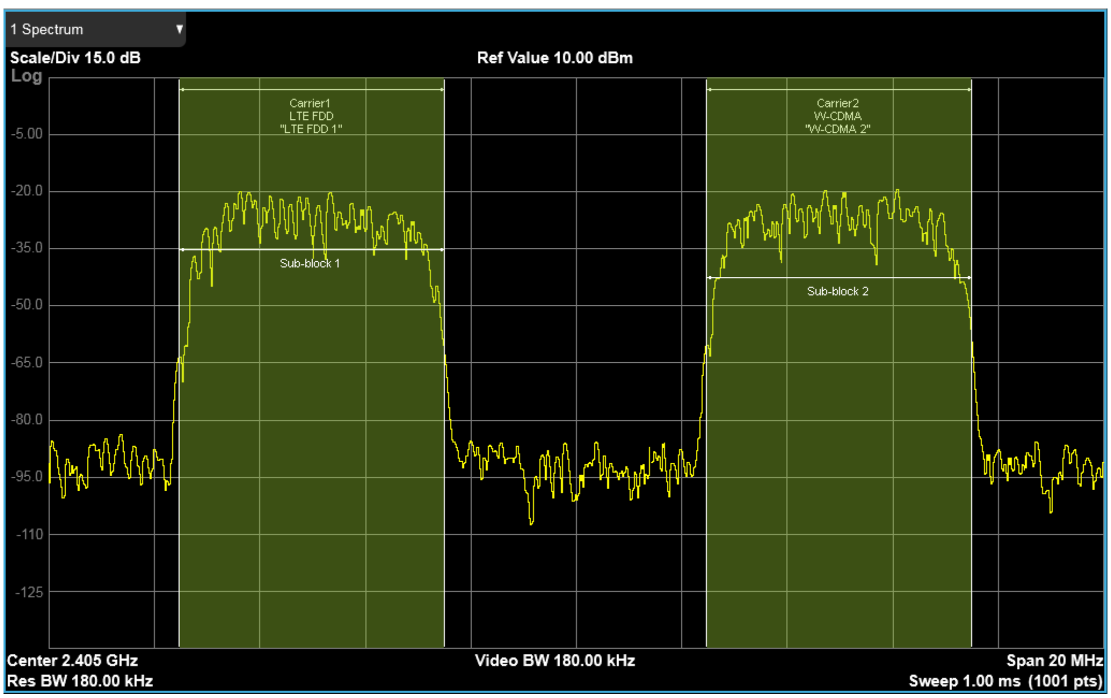


In the **LTEAFDD/LTEATDD, MSR and 5GNR modes**, multi-carriers are supported. The Carrier Attribute on/off and Sub-block Attribute on/off settings (under Display, Meas Display) are defined to allow the carrier and sub-block legends to display.

When the Carrier Attribute is on, the carrier identification and name are shown on the spectrum trace:



When Carrier and Sub-block attributes are both on, the sub-block scope and name are also shown on the spectrum trace:



3.2.3 Amplitude

Activates the Amplitude menu and selects Reference Level or Reference Value as the active function, depending on the measurement.

Some features in this menu apply to multiple measurements. Some other features apply only to specific measurements and their controls are blanked or grayed-out in measurements that do not support the feature.

3.2.3.1 Y Scale

Contains controls that pertain to the Y-Axis parameters of the measurement. These parameters control how data on the vertical (Y) axis is displayed, and control instrument settings that affect the vertical axis.

Ref Value

Sets the value for the absolute power reference. The reference line is at the top, center, or bottom of the graticule, depending on the value of "Ref Position" on page 177.

Remote Command	`:DISPlay:MONitor:WINDow[1]:TRACe:Y[:SCALe]:RLEVel <real>` `:DISPlay:MONitor:WINDow[1]:TRACe:Y[:SCALe]:RLEVel?`
Example	`:DISP:MON:WIND:TRAC:Y:RLEV 2.0` `:DISP:MON:WIND:TRAC:Y:RLEV?`
Couplings	When "Auto Scaling" on page 177 is ON (default), this value is automatically determined by the measurement result. When you set a value manually, **Auto Scaling** changes to `OFF` Attenuation is not coupled to "Ref Value" on page 176
Preset	10.00 dBm
State Saved	Saved in instrument state
Min/Max	-250.00 dBm / 250.00 dBm
Annotation	Ref <value> top left of graph
Backwards Compatibility SCPI	`:DISPlay:MONitor:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:RLEVel`

Scale/Div

For measurements that support a logarithmic Y-Axis, **Scale/Div** sets the height of one division of the graticule in the current Y-Axis unit.

Scale/Div also determines the displayed amplitude range in the log plot graph. Since there are usually 10 vertical graticule division on the display, the total amplitude range of the graph is typically 10x this amount. For example, if **Scale/Div** is 10 dB, then the total range of the graph is 100 dB.

Remote Command	`:DISPlay:MONitor:WINDow[1]:TRACe:Y[:SCALe]:PDIVision <rel_ampl>` `:DISPlay:MONitor:WINDow[1]:TRACe:Y[:SCALe]:PDIVision?`

Example	:DISP:MON:WIND:TRAC:Y:PDIV 5.0 dB :DISP:MON:WIND:TRAC:Y:PDIV?
Couplings	When "Auto Scaling" on page 177 is ON, this value is automatically determined by the measurement result. When you set a value manually, **Auto Scaling** automatically changes to OFF
Preset	10.00 dB / Div
State Saved	Saved in instrument state
Min	0.10 dB
Max	20 dB
Annotation	<value> dB/ left upper of graph
Backwards Compatibility SCPI	:DISPlay:MONitor:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:PDIVision

Ref Position

Positions the reference level at the top, center, or bottom of the Y Scale display. Changing the reference position does not change the reference level value.

Remote Command	:DISPlay:MONitor:WINDow[1]:TRACe:Y[:SCALe]:RPOSition TOP | CENTer | BOTTom :DISPlay:MONitor:WINDow[1]:TRACe:Y[:SCALe]:RPOSition?
Example	:DISP:MON:WIND:TRAC:Y:RPOS CENT :DISP:MON:WIND:TRAC:Y:RPOS?
Preset	TOP
State Saved	Saved in instrument state
Range	TOP|CENTer|BOTTom
Annotation	The greater than (>) and less than (<) symbols are displayed on both sides of the graph to indicate the Reference Position
Backwards Compatibility SCPI	:DISPlay:MONitor:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:RPOSition

Auto Scaling

Toggles the **Auto Scaling** function On or Off.

Remote Command	:DISPlay:MONitor:WINDow[1]:TRACe:Y[:SCALe]:COUPle 0 | 1 | OFF | ON :DISPlay:MONitor:WINDow[1]:TRACe:Y[:SCALe]:COUPle?
Example	:DISP:MON:WIND:TRAC:Y:COUP OFF :DISP:MON:WIND:TRAC:Y:COUP?
Couplings	When **Auto Scaling** is ON, and the **Restart** front-panel key is pressed, this function automatically sets the

	scale per division to 10 dB and determines the reference values based on the measurement results When you set a value to either Scale/Div or Ref Value manually, **Auto Scaling** automatically changes to `OFF`
Preset	1
State Saved	Saved in instrument state
Range	`OFF|ON`
Backwards Compatibility SCPI	`:DISPlay:MONitor:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:COUPle`

3.2.3.2 Attenuation

Controls the attenuator functions and interactions between the attenuation system components.

There are two attenuator configurations in the X-Series. One is a Dual-Attenuator configuration consisting of a mechanical attenuator and an optional electronic attenuator. The other configuration uses a single attenuator with combined mechanical and electronic sections thatcontrols all the attenuation functions. Different models in the X-Series come with different configurations.

– See "Dual-Attenuator Configurations" on page 179

– See "Single-Attenuator Configuration" on page 179

Most attenuation settings are the same for all measurements – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset.

This tab is only available when the hardware set includes an input attenuator, which is typically only the case when using Keysight’s box instruments. For example, this tab does not appear in:

– VXT models M9420A/21A/10A/11A

– E7760

– M9391A

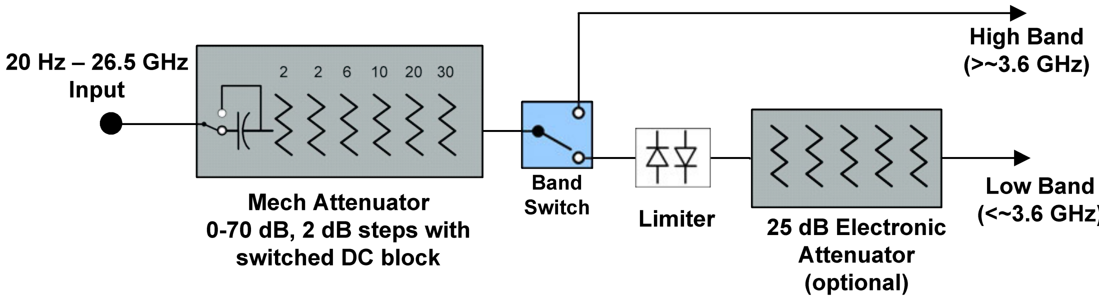
– M9393A

This tab also does not appear in UXM. In UXM all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

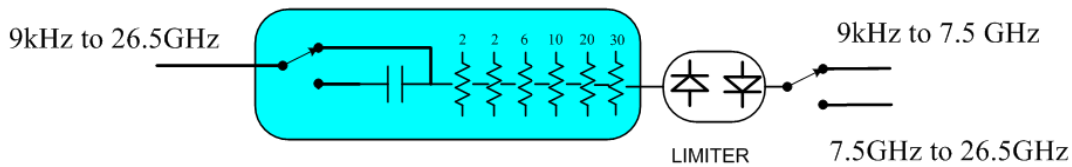
Dependencies	In measurements that support the I/Q inputs, this tab is unavailable when I/Q is the selected input, and is replaced by the Range tab in that case

Dual-Attenuator Configurations

Configuration 1: Mechanical attenuator + optional electronic attenuator

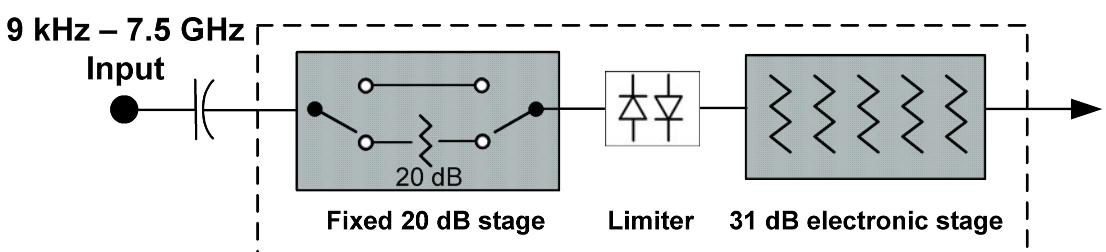


Configuration 2: Mechanical attenuator, no optional electronic attenuator

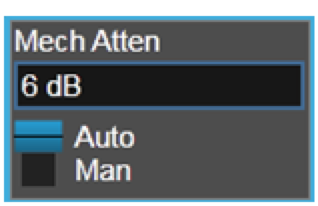


(note that Configuration 2 is not strictly speaking a dual-section attenuator, since there is no electronic section available. However, it behaves exactly like Configuration 1 without the Electronic Attenuator option EA3, therefore for the sake of this document it is grouped into the “Dual-Attenuator” configuration)

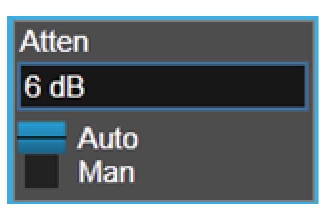
Single-Attenuator Configuration



You can tell which attenuator configuration you have by pressing the Attenuation tab, which (in most Modes) opensthe Attenuation menu. If the first control in the Attenuation menu says **Mech Atten** you have the Dual-Attenuator configuration. If the first control says **Atten** you have the Single-Attenuator configuration.



Dual Attenuator



Single Attenuator

(Note that depending on the measurement, there may be no Auto/Man functionality on the Mech Atten control).

In the Single-Attenuator configuration, youcontrol the attenuation with a single control, as the fixed stage has only two states. In the Dual-Attenuator configuration, both stages have significant range so you are given separate control of the mechanical and electronic attenuator stages.

When you have the Dual-Attenuator configuration, you may still have only a Single-Attenuator, because unless option EA3 (the Electronic Attenuator option) is available, and you purchase it, you will have only the mechanical attenuator.

Full Range Atten

The **Full Range Atten** control and **Attenuator Summary** only appear in N9041B, when the RF input is selected and the RF Input Port is set to RF Input 2, and the Full Range Attenuator is installed. The Full Range Attenuator adds a second input attenuator at the beginning of the RF Input 2, which enhances the protection and optimizes the performance of the extra internal mixers used by RF Input 2.

Remote Command	`[:SENSe]:POWer[:RF]:FRATten <rel_ampl>` `[:SENSe]:POWer[:RF]:FRATten?`
Example	`:POW:FRAT 14` `:POW:FRAT?`
Notes	When you enter an amplitude value that falls between valid values, the value will be incremented to the next smallest valid value
Dependencies	Only appears if input RF is selected, and RF Input Port 2 is selected, and the Full Range Attenuator exists
Couplings	This value is never changed by any coupling, however other couplings use this value. See the **Reference Level** and "Mech Atten" on page 1750 command descriptions
Preset	20 dB
State Saved	Saved in instrument state
Min	0 dB
Max	Only valid values are 0, 6, 14, 20 dB
Annotation	When the Input is RF, and the Input Port is RF Input 2, and the Full Range Attenuator is installed: On the Meas Bar, the field “Atten” displays as follows: – If the sweep is entirely < 50 GHz, the value shown after “Atten:” is equal to Mech Atten + Elec Atten + Full Range Atten – If the sweep is entirely > 50 GHz, the value shown after “Atten:” is equal to Full Range Atten – If the sweep straddles 50 GHz, the value shown after “Atten:” is preceded by the symbol “>=” and is equal to Full Range Atten In the **Amplitude**, "Attenuation" on page 1747 menu, and the Atten Meas Bar dropdown menu panel, a

	summary is displayed as follows: “Total Atten below 50 GHz” followed by the value of Full Range Atten + Mech Atten + Elec Atten “Total Atten above 50 GHz” followed by the value of Full Range Atten For example, if Mech Atten = 6 dB, Elec Atten = 4 dB, and Full Range Atten = 20 dB, the summary below is shown: – Attenuator summary: – Total Atten below 50 GHz: 30 dB – Total Atten above 50 GHz: 20 dB

Mech Atten

This control is labeled **Mech Atten** in Dual-Attenuator models and **Atten** in Single-Attenuator models. In the Dual-Attenuator configuration, this control only affects the mechanical attenuator.

This control lets you modify the attenuation applied to the RF input signal path. This value is normally auto coupled to the Ref Level, the Internal Preamp Gain, any External Gain that is entered, and the Max Mixer Level, as described in the table below.

See "Attenuator Configurations and Auto/Man" on page 183

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation <rel_ampl>`
	`[:SENSe]:POWer[:RF]:ATTenuation?`
	`[:SENSe]:POWer[:RF]:ATTenuation:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:POWer[:RF]:ATTenuation:AUTO?`

Example	`:POW:ATT 20`
	Dual-Attenuator configuration: sets the mechanical attenuator to 20 dB
	Single-Attenuator mode: sets the main attenuation to 20 dB (see below for definition of “main” attenuation)
	In either case, if the attenuator was in Auto, it is set to Manual
	`:POW:ATT:AUTO ON`
	Turn Auto Mech Atten ON

Dependencies	Some measurements do not support the Auto setting of "Mech Atten" on page 181. In these measurements, the Auto/Man selection is not available, and the Auto/Man toggle function is not available In Dual-Attenuator configurations, when the electronic attenuator is enabled, the mechanical attenuator has no auto setting and the Auto/Man toggle function is not available. The state of Auto/Man is remembered and restored when the electronic attenuator is once again disabled. This is described in more detail in "Elec Atten" on page 1753 See "Attenuator Configurations and Auto/Man" on page 183 for more information on the Auto/Man functionality `:POW:ATT:AUTO` is only available in measurements that support Mech Atten Auto, such as Swept SA

Couplings	If the RF Input Port is the RF Input: – If the USB Preamp is connected to USB, use 0 dB for Mech Atten – Otherwise compute the auto-selected value of Mech Atten based on **Reference Level**, Int Preamp, External Gain, Ref Level Offset, Max Mixer Level, µW Path Control and IF Gain settings. Limit this value to be no less than 6 dB (total attenuation below 6 dB can never be chosen by Auto) – In the N9041B, if the RF Input Port is RF Input 2, use the formula above and subtract the Full Range Atten value from the result to determine the Mech Atten. Limit the value so that it is never lower than 0 dB and so that total attenuation, including Full Range Atten, is never less than 6 dB (total attenuation, including Full Range Atten below 6 dB, can never be chosen by Auto) In External Mixingand BBIQ, where the Attenuator is not in the signal path, the Attenuator setting changes as described above when "Mech Atten" on page 181 is in Auto, but no changes are made to the actual attenuator hardware setting until the input is changed back to the RF Input For CXA-m with option FSA (Fine-Step Attenuator or 2 dB steps), the FSA-like behavior is only available when the frequency setting is <= 7.5GHz. So, when the frequency is changed from below 7.5GHz to above 7.5GHz, the attenuation setting will be changed to a multiple of 10dB which will be no smaller than the previous setting. For example, 4dB attenuation will be changed to 10dB
Preset	The preset for Mech Attenuation is “Auto” The Auto value of attenuation is 10 dB ON
State Saved	Saved in instrument state
Min	0 dB The attenuation set by this control cannot be decreased below 6 dB with the knob or step keys. Values below 6 dB must be directly entered from the keypad or via SCPI. This protects against setting a dangerously small attenuation value, which can put the instrument at risk of damage to input circuitry. If the current mechanical attenuation is below 6 dB, it can be increased with the knob and step keys, but not decreased
Max	CXA Option 503 or 507: 50 dB EXA: 60 dB All other models: 70 dB Note that in the Single-Attenuator configuration, the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB.
Annotation	The current value for Total Atten is displayed in the Measurement Bar at the top of the display. A value appears for Electronic Attenuation only if the Electronic Attenuator is enabled. The annotation appears as Atten: <total> dB (e<elec>) The e letter is in amber in Single-Attenuator configurations For example: Dual-Attenuator configuration: Atten: 24 dB (e14) Indicating the total attenuation is at 24 dB and the electronic attenuation is at 14 dB Single-Attenuator configuration:

A: 24 dB (e14)

Indicating the total attenuation is at 24 dB and the “soft” attenuation is at 14 dB (see below for definition of “soft” attenuation)

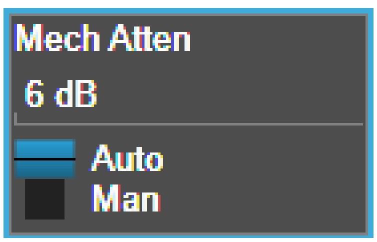
When in Manual, a # sign appears in front of Atten in the annotation

Attenuator Configurations and Auto/Man

As described in "Attenuation" on page 1747 , there are two distinct attenuator configurations available in the X-Series, the single attenuator and Dual-Attenuator configurations. In Dual-Attenuator configurations, we have the mechanical attenuation and the electronic attenuation, and the current total attenuation is the sum of the electronic + mechanical attenuation. In Single-Attenuator configurations, we refer to the attenuation set using "Mech Atten" on page 181 (or `:POW:ATT`) as the “main” attenuation; and the attenuation that is set by `:POW:EATT` as the “soft” attenuation (`:POW:EATT` is honored even in the Single-Attenuator configuration, for compatibility purposes). Then the current total attenuation is the sum of the main + soft attenuation. See "Elec Atten" on page 1753 for more on “soft” attenuation.

NOTE

In some measurements, the **Mech Atten** control has an Auto/Man function. In these measurements, an Auto/Man switch is shown on the **Mech Atten** control:



Note that in configurations that include an Electronic Attenuator, this switch is only shown when the Electronic Attenuator is disabled.

In other measurements, **Mech Atten** has no Auto/Man function. In these measurements, no switch is shown on the **Mech Atten** control:

Mech Atten also appears with no switch, as above, in configurations that include an Electronic Attenuator but when the Electronic Attenuator is enabled.

Elec Atten

Controls the Electronic Attenuator in Dual-Attenuator configurations. This control does not appear in Single-Attenuator configurations, as the control of both the mechanical and electronic stages of the Single-Attenuator is integrated into the single **Atten** control.

This control includes an Enable/Disable toggle switch; it is only possible to enter a value for the Electronic Attenuator when this switch is in the “Enable” position.

See "More Information" on page 185

Remote Command	`[:SENSe]:POWer[:RF]:EATTenuation <rel_ampl>`
	`[:SENSe]:POWer[:RF]:EATTenuation?`
	`[:SENSe]:POWer[:RF]:EATTenuation:STATe OFF | ON | 0 | 1`
	`[:SENSe]:POWer[:RF]:EATTenuation:STATe?`

Example	`:POW:EATT 10`
	`:POW:EATT?`
	`:POW:EATT:STAT ON`
	`:POW:EATT:STAT?`

Notes	Electronic Attenuation’s specification is defined only when Mechanical Attenuation is 6 dB
Dependencies	This control only appears in Dual-Attenuator models with an Electronic Attenuator installed and licensed. It does not appear in models with the Single-Attenuator configuration, as in the Single-Attenuator configuration there is no “electronic attenuator” there is only a single integrated attenuator (which has both a mechanical and electronic stage). However, in the Single-Attenuator configuration, EATT SCPI commands are accepted for compatibility with other X-series instruments and set a “soft” attenuation as described in . The “soft” attenuation is treated as an addition to the “main” attenuation value set by the Atten control or the POW:ATT SCPI command and affects the total attenuation displayed on the Atten control and the Meas Bar The electronic attenuator (and the “soft” attenuation function provided in Single-Attenuator configurations) is unavailable above the low band (0-3.6 GHz, 0-3.4 GHz 0-3GHz, depending on the model). If the low band ranges from 0-3.6GHz, and Stop Frequency of the instrument is > 3.6 GHz, then the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed out If the Internal Preamp is on, meaning it is set to Low Band or Full, the electronic attenuator (and the “soft” attenuation function provided in Single-Attenuator configurations) is unavailable. In this case the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed out If either of the above is true, if the SCPI command is sent, an error indicating that the electronic attenuator is unavailable will be sent If both of the above are true, pressing the control will generate error message -221, in other words, the frequency range lockout takes precedence If the electronic/soft Attenuator is enabled, then the Stop Freq of the instrument is limited to 3.6 GHz and the Internal Preamp is unavailable The SCPI-only “soft” electronic attenuation for the single-attenuator configuration is not available in all measurements; in particular, it is not available in the Swept SA measurement
Couplings	Enabling and disabling the Electronic Attenuator affects the setting of the Mechanical Attenuator (in Dual-Attenuator configurations). This is described in more detail below and in the section "Attenuator Configurations and Auto/Man" on page 1752
Preset	`OFF` (Disabled) for Swept SA measurement `ON` (Enabled) for all other measurements that support the electronic attenuator
State Saved	Saved in instrument state

Min	0 dB
Max	Dual-Attenuator configuration: 24 dB Single-Attenuator configuration: the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB
Annotation	See Annotation under the **Mech Atten** control description

More Information

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear. These advantages primarily aid in remote operation and are negligible for front panel use. See "Using the Electronic Attenuator: Pros and Cons" on page 186 for a detailed discussion of the pros and cons of using the electronic attenuator.

For the Single-Attenuator configuration, for SCPI backwards compatibility, the “soft” attenuation feature replaces the Dual-Attenuator configuration’s electronic attenuator. All the same couplings and limitations apply. See "Attenuator Configurations and Auto/Man" on page 1752

Mechanical Attenuator Transition Rules

When the Electronic Attenuator is enabled, the Mechanical Attenuator transitions to a state that has no Auto function. Below are the rules for transitioning the Mechanical Attenuator. Note that the information below ONLY applies to the Dual-Attenuator configurations, and ONLY when the Electronic Attenuator is installed:

When the Electronic Attenuation is enabled from a disabled state:

The Mechanical Attenuator is initialized to 10 dB (this is its optimal performance setting). You can then set it as desired with SCPI, numeric keypad, step keys, or knob, and it behaves as it normally would in manual mode

The Auto/Man state of (Mech) Atten is saved

The Auto/Man toggle on the (Mech) Atten control disappears and the auto rules are disabled

The Electronic Attenuator is set to 10 dB less than the previous value of the Mechanical Attenuator, within the limitation that it must stay within the range of 0 to 24 dB of attenuation

Examples in the Dual-Attenuator configuration:

Mech Atten at 20 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 10 dB. New total attenuation equals the value before Elec Atten enabled

Mech Atten at 0 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 0 dB. New total attenuation does not equal the value before Elec Atten enabled

Mech Atten at 40 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 24 dB. New total attenuation does not equal the value before Elec Atten enabled

When the Electronic Attenuation is disabled from an enabled state:

The Elec Atten control is grayed out

- The Auto/Man state of (Mech) Atten is restored

If now in Auto, (Mech) Atten recouples

If now in Man, (Mech) Atten is set to the value of total attenuation that existed before the Elec Atten was disabled. The resulting value is rounded up to the smallest value possible given the (Mech) Atten Step setting - (That is, 57 dB changes to 58 dB when (Mech) Atten Step is 2 dB)

Using the Electronic Attenuator: Pros and Cons

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear.

The “finer steps” advantage of the electronic attenuator is beneficial in optimizing the alignment of the instrument dynamic range to the signal power in the front panel as well as remote use. Thus, you can achieve improved relative signal measurement accuracy. Compared to a mechanical attenuator with 2 dB steps, the 1 dB resolution of the electronic attenuator only gives better resolution when the odd-decibel steps are used. Those odd-decibel steps are less accurately calibrated than the even-decibel steps, so one tradeoff for this superior relative accuracy is reduced absolute amplitude accuracy.

Another disadvantage of the electronic attenuator is that the spectrum analyzer loses its “Auto” setting, making operation less convenient.

Also, the relationship between the dynamic range specifications (TOI, SHI, compression, and noise) and instrument performance are less well-known with the electrical attenuator. With the mechanical attenuator, TOI, SHI, and compression threshold levels increase dB-for-dB with increasing attenuation, and the noise floor does as well. With the electronic attenuator, there is an excess attenuation of about 1 to 3 dB between 0 and 3.6 GHz, making the effective TOI, SHI, and so forth, less well known. Excess attenuation is the actual attenuation relative to stated attenuation. Excess attenuation is accounted for in the instrument calibration

Mech Atten Step

Controls thestep size used when making adjustments to the input attenuation.

This control is labeled **Mech Atten Step** in Dual-Attenuator models and **Atten Step** in Single-Attenuator models. In the Dual-Attenuator configuration, this control only affects the step size of the mechanical attenuator.

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement] 10 dB | 2 dB` `[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement]?`

Example	`:POW:ATT:STEP 2` `:POW:ATT:STEP?`
Notes	This feature has a toggle choice from the front panel, but it takes a specific value (in dB) when used remotely. The only valid values are 2 and 10
Dependencies	Blanked in EXA, CXA and CXA-m if option FSA (2 dB steps) is not present. If blanked, attempts to set it via SCPI yield an error
Couplings	When the attenuation step size changes, the current mechanical attenuation value is adjusted (if necessary) to be quantized to the new step size. That is, if step is set to 10 dB, mech atten is increased if necessary so it is a multiple of 10 dB
Preset	EXA, CXA and CXA-m: 10 dB (2 dB with option FSA) All other models: 2 dB
State Saved	Saved in instrument state

3.2.3.3 Range (Non-attenuator models)

This tab is only available for Keysight's modular signal analyzers and certain other Keysight products. Examples include:

– VXT

– E7760

– M9391A

– M9393A

This tab also does not appear in UXM. In UXM, all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

State Saved	No

Range

Represents the amplitude of the largest sinusoidal signal that could be present within the IF without being clipped by the ADC. For signals with high peak-to-average ratios, the range may need to exceed the rms signal power by a significant amount to avoid clipping.

This is a measurement global setting.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe <real>` `[:SENSe]:POWer[:RF]:RANGe?`
Example	`:POW:RANG 10 dBm`

	:POW:RANG?
Notes	The MIN and MAX values are affected by the External Gain parameters, and by the **Center Frequency** The hardware compensates for frequency response and alters the Range setting
Preset	0 dBm
State Saved	Yes
Min	-100
Max	100
Annotation	Meas Bar

Adjust Range for Min Clipping

Sets the combination of attenuation and gain based on the current measured signal level so that clipping will be at a minimum.

This is an "immediate action" function, that is, it executes once, when the key is pressed.

This key does not appear in measurements that do not support this functionality.

Remote Command	[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate
Notes	Executing Adjust Range for Min Clipping initiates the measurement
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760

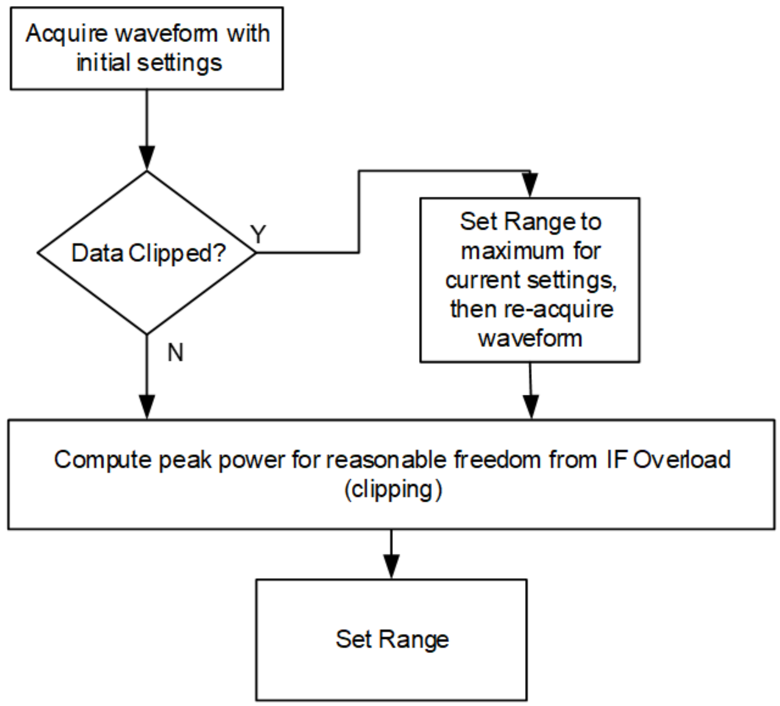
Pre-Adjust for Min Clipping

If this function is ON, it applies the adjustment described under Adjust Range For Min Clipping each time a measurement restarts. Therefore, in Continuous measurement mode, it only executes before the first measurement.

Remote Command	[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation OFF | ON | ELECtrical | COMBined [:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation?
Notes	Because there is no attenuator control available in these models, the control displays only ON and OFF choices. However, for SCPI compatibility with other platforms, all three parameters (ELECtrical, COMBined, and ON) are honored and all are mapped to ELECtrical, so if any of these three parameters is sent, a subsequent query will return ELEC
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760
Preset	OFF for Swept SA measurement; ON for all other measurements that support **Pre-Adjust for Min Clipping**
State Saved	Saved in instrument state

Adjustment Algorithm

The algorithm for the adjustment is documented below:



Peak-to-Average Ratio

Used with "Range (Non-attenuator models)" on page 1864 to optimize the level control in the instrument. The value is the ratio, in dB, of the peak power to the average power of the signal to be measured. A ratio of 0 should be used for sinusoidal signals; for 802.11g OFDM signals use 9 dB.

All Applications (Modes) show the current value of Peak-to-Average ratio on the control. However, some applications do not permit changing the value. In these situations, the control is grayed-out.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:PARatio <real>` `[:SENSe]:POWer[:RF]:RANGe:PARatio?`
Example	`:POW:RANG:PAR 12 dB`
Notes	In some Applications (Modes) this parameter is read-only; meaning the value will appear on the control and query via SCPI, but is not changeable. In such applications the control is grayed-out. Attempting to change the value via SCPI will be ignored but no error message will be generated
Dependencies	This control does not appear in Spectrum Analyzer Mode
Preset	10 dB VXT Models M9410A/11A: 0 dB
State Saved	Saved in instrument state

Min	0 dB
Max	20 dB VXT Models M9410A/11A: 50 dB

Mixer Lvl Offset

This is an advanced setting to adjust target Range at the input mixer, which in turn affects the signal level in the instrument's IF. This setting can be used when additional optimization is needed after setting "Peak-to-Average Ratio" on page 1866. Positive values of offset optimize noise performance over distortion, negative values optimize distortion performance over noise.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet <real>` `[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet?`
Example	`:POW:RANG:MIX:OFFS -5 dB`
Preset	0 dB
State Saved	Saved in instrument state
Min	-35 dB VXT Models M9410A/11A: -34 dB
Max	30 dB

3.2.3.4 Signal Path

Contains controls that pertain to the routing of the signal through the frontend of the instrument.

In general, this tab only appears in instruments whose hardware supports this signal routing. For example, this tab does not appear in many of the modular instrument products, including VXT Models M9420/21A. It also does not appear in UXM.

This tab *does* appear in VXT Models M9410A/11A because the Software Preselection control is in this tab, and VXT Models M9410A/11A implement a version of Software Preselection.

Presel Center

Pressing this control adjusts the centering of the preselector filter to optimize the amplitude accuracy at the frequency of the selected marker. If the selected marker is not on when **Presel Center** is pressed, the instrument turns on the selected marker, performs a peak search, and then performs centering on the marker's center frequency. If the selected marker is already on and between the start and stop frequencies of the instrument, the instrument performs the preselector calibration on that marker's frequency. If the selected marker is already on, but outside the frequency range between Start Freq and Stop Freq, the instrument first performs a peak search, and then performs centering on the marker's center frequency.

The value displayed on "Preselector Adjust" on page 1869 will change to reflect the new preselector tuning.

A number of considerations should be observed to ensure proper operation. See "Proper Preselector Operation" on page 191.

Remote Command	`[:SENSe]:POWer[:RF]:PCENter`
Example	`:POW:PCEN`
Notes	Note that the rules outlined above under the control description apply for the remote command as well as the key. The result of the command is dependent on marker position, etc. Any message shown by the control press is also shown in response to the remote command
Dependencies	Does not appear in CXA-m Does not appear in VXT Models M9410A/11A Grayed-out if the microwave preselector is off – If the selected marker's frequency is below Band 1, an advisory message is generated "Preselector not used in this frequency range" and no action is taken – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz – Blank in models that do not include a preselector, such as option 503. If the remote command is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View
Couplings	The active marker position determines where the centering will be attempted If the instrument is in a measurement such as averaging when centering is initiated, the act of centering the preselector restarts averaging, but the first average trace will not be taken until the centering is completed The offset applied to do the centering reads out on the "Preselector Adjust" on page 1869 control
Status Bits/OPC dependencies	When centering the preselector, `*OPC` will not return true until the process is complete and a subsequent measurement has completed, nor will results be returned to `:READ` or `:MEASure` queries The Measuring bit should remain set while this command is operating and should not go false until the subsequent sweep/measurement has completed

Proper Preselector Operation

A number of considerations should be observed to ensure proper operation:

1 If the selected marker is off, the instrument turns on a marker, performs a peak search, and adjusts the preselector using the selected marker's frequency. It uses the "highest peak" peak search method unqualified by threshold or excursion, so that there is no chance of a 'no peak found' error. It continues with that peak, even if it is the peak of just noise. Therefore, for this operation to work properly, there should be a signal on screen in a preselected range for the peak search to find

2 If the selected marker is already on, the instrument attempts the centering at that marker's frequency. There is no preselector for signals below about 3.6 GHz, so if the marker is on a signal below 3.6 GHz, no centering will be attempted and an advisory message generated

3 In some models, the preselector can be bypassed. If it is bypassed, no centering will be attempted in that range and a message will be generated

Preselector Adjust

Allows you to manually adjust the preselector filter frequency to optimize its response to the signal of interest. This function is only available when "Presel Center" on page 1868is available.

For general purpose signal analysis, using **Presel Center** is recommended. Centering the filter minimizes the impact of long-term preselector drift. **Preselector Adjust** can be used instead to manually optimize the preselector. One application of manual optimization would be to peak the preselector response, which both optimizes the signal-to-noise ratio and minimizes amplitude variations due to small (short-term) preselector drifting.

When **Presel Center** is performed, the offset applied to do the centering becomes the new value of **Preselector Adjust**.

Remote Command	`[:SENSe]:POWer[:RF]:PADJust <freq>` `[:SENSe]:POWer[:RF]:PADJust?`
Example	`:POW:PADJ 100KHz` `:POW:PADJ?`
Notes	The value on the control reads out to 0.1 MHz resolution
Dependencies	– Does not appear in CXA-m – Does not appear in VXT Models M9410A/11A – Grayed-out if microwave preselector is off – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz – Blank in models that do not include a preselector, such as option 503. If the SCPI is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View
Preset	0 MHz
State Saved	The **Preselector Adjust** value set by **"Presel Center" on page 1868**, or by manually adjusting **Preselector Adjust** It is not saved in instrument state, and does not survive a Preset or power cycle

Min	-500 MHz
Max	500 MHz
Backwards Compatibility SCPI	[:SENSe]:POWer[:RF]:MW:PADJust [:SENSe]:POWer[:RF]:MMW:PADJust

Notes	PSA had multiple preselectors, and you could select which preselector to adjust. Since the X-Series has only one mm/uW preselector, the preselector selection control is no longer available. However, to provide backward compatibility, we accept the legacy remote commands The command form has no effect, the query always returns MWAVe
Backwards Compatibility SCPI	[:SENSe]:POWer[:RF]:PADJust:PRESelector MWAVe | MMWave | EXTernal [:SENSe]:POWer[:RF]:PADJust:PRESelector?

Internal Preamp

Accesses a menu of controls for the internal preamps. Turning on the preamp gives a better noise figure, but a poorer inter-modulation distortion (TOI) to noise floor dynamic range. You can optimize this setting for your particular measurement.

The instrument takes the preamp gain into account as it sweeps. If you sweep outside of the range of the preamp, the instrument will also account for that. The displayed result always reflects the correct gain.

For some measurements, when the preamp is on and any part of the displayed frequency range is below the lowest frequency for which the preamp has specifications, a warning condition message appears in the status line. For example, for a preamp with a 9 kHz lowest specified frequency: "Preamp: Accy unspec'd below 9 kHz".

Selection	Example	Note
Off	:POW:GAIN OFF	
Low Band	:POW:GAIN ON :POW:GAIN:BAND LOW	Sets the internal preamp to use only the low band. The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Low Band selection in the dropdown
Full Range	:POW:GAIN ON :POW:GAIN:BAND FULL	Sets the internal preamp to use its full range. The low band (0-3.6 GHz, 0-3.4 GHz, 0-3GHz, depending on the model) is supplied by the low band preamp and the frequencies above low band are supplied by the high band preamp The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Full Range selection in the dropdown. If the high band option is not installed the Full Range selection does not appear

Remote Command	`[:SENSe]:POWer[:RF]:GAIN:BAND LOW | FULL`
	`[:SENSe]:POWer[:RF]:GAIN:BAND?`
	`[:SENSe]:POWer[:RF]:GAIN[:STATe] OFF | ON | 0 | 1`
	`[:SENSe]:POWer[:RF]:GAIN[:STATe]?`

Example	`:POW:GAIN:BAND LOW`
	`:POW:GAIN:BAND?`
	`:POW:GAIN OFF`
	`:POW:GAIN?`

Dependencies	Preamp is not available on all hardware platforms. If the preamp is not present or is unlicensed, the control is not shown Does not appear in VXT Models M9410A/11A/15A If `:POW:GAIN:BAND FULL` is sent when a low band preamp is available, the preamp band parameter is set to `LOW` instead of `FULL`, and an "Option not installed" message is generated The preamp is not available when the electronic/soft attenuator is enabled
Preset	`LOW` `OFF`
State Saved	Saved in instrument state
Annotation	When the USB Preamp is not connected to USB, the Preamp annotation in the Meas Bar says “Off” if the preamp is off and displays the frequency range of the low band or full range preamp depending on the setting. For example, if the Preamp is set to Low Band and the Low Band is 3.6 GHz the annotation says “3.6 GHz”. If it is a 13.6 GHz preamp and it is set to Full Range the annotation says “13.6 GHz” When the USB Preamp is connected to USB, the Preamp annotation says “Preamp: USB” if the internal preamp is off or “Preamp: USB, Int” if the internal preamp is on (only for measurements that support the USB preamp)

LNA

Lets you turn the Low Noise Amplifier (**LNA**) on or off.

The LNA is an additional preamplifier that provides superior DANL and frequency range compared to the Internal Preamp. The LNA provides lower system noise figure, especially at frequencies above 100 MHz, and can be operated up to the full range of 50 GHz instruments.

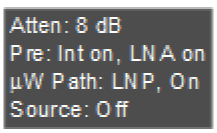
For best possible sensitivity, the LNA can be turned on together with the "Internal Preamp" on page 1870, although if you operate both preamps together, note that the TOI (distortion) specifications are impacted. The sensitivity improvement of this combination is substantial when operating in high band (frequencies above 3.6 GHz).

See "More Information" on page 195

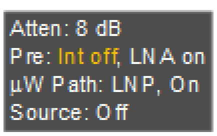
Remote Command	`[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe] OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe]?`
Example	`:POW:GAIN:LNA ON`
Dependencies	Requires option LNA Option LNA is not required by VXT model M9415A Does not appear in VXT models M9420A/21A/10A/11A May not appear in some measurements
Preset	`OFF`
State Saved	Saved in State

More Information

When the LNA is installed, the preamp annotation changes to show the state of both the LNA and the Internal Preamp. Below is an example:



Note that when operating entirely in the low band (below about 3.6 GHz), if the LNA is on, the Internal Preamp is switched off (even if you have its switch set to ON). This is because the noise performance is actually degraded in low band if both preamps are on. In this case, the annotation reflects the actual state of the two preamps, but the Internal Preamp annotation displays in amber, to warn you that the actual state of the Internal Preamp does not match the **Internal Preamp** switch control display:



µW Path Control

Options for this control include **µW Preselector Bypass** (Option MPB), **Low Noise Path** (Option LNP) and **Full Bypass Enable** in the High Band path circuits.

When the µW Preselector is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. When **Low Noise Path Enable** is selected, the instrument automatically bypasses certain circuitry in the high frequency bands that can contribute to noise, when it is appropriate based on other instrument settings.

For most applications, the preset state is **Standard Path**, which provides the best remote-control throughput, minimizes acoustic noise from switching and minimizes the risk of wear in the hardware switches, particularly in remote test scenarios where both low band and high band setups will follow in rapid succession. In this path, the bypass of the low band/high band switch and microwave preamp is never activated, which can cause some noise degradation but preserves the life of the bypass switch.

For applications that utilize the wideband IF paths, the preset state is **µW Preselector Bypass**, if option MPB is present. This is because, when using a wideband IF such as the 140 MHz IF, the µW Preselector's bandwidth can be narrower than the available IF bandwidth, causing degraded amplitude flatness and phase linearity, so it is desirable to bypass the preselector in the default case.

You may choose **Low Noise Path Enable** for a lower noise floor, especially in the 21-26.5 GHz region, though without improving many measures of dynamic range, and without giving the best possible noise floor. The preamp, if purchased and used, gives better noise floor than does **Low Noise Path Enable**, but the preamp's compression threshold and third-order intercept are much poorer than that of **Low Noise Path Enable**.

A fourth choice is **Full Bypass Enable**, which combines **µW Preselector Bypass** and **Low Noise Path Enable**. Because this can bypass most of the circuitry between the input and the first mixer, care should be taken when using this setting to avoid damaging the mixer. **Full Bypass Enable** is only available if both options LNP and MPB are present, as well as option FBP.

Path	Example	Note
Standard Path	:POW:MW:PATH STD	Normal setting for most measurements. µW Preselector in circuit, Low Noise Path disabled
Low Noise Path Enable	:POW:MW:PATH LNP	See "Low Noise Path Enable" on page 200
µW Preselector Bypass	:POW:MW:PATH MPB	See "µW Preselector Bypass" on page 202
Full Bypass Enable	:POW:MW:PATH FULL	See "Full Bypass Enable" on page 202

Remote Command	[:SENSe]:POWer[:RF]:MW:PATH STD | LNPath | MPBypass | FULL [:SENSe]:POWer[:RF]:MW:PATH?
Example	:POW:MW:PATH LNP Enables the Low Noise path :POW:MW:PATH?
Notes	If "Presel Center" on page 1868 is performed, the instrument will momentarily switch to the Standard Path, regardless of the setting of **µW Path Control** The DC Block will always be switched in when the low noise path is switched in, to protect succeeding circuitry from DC. Note that this does not mean "when the low noise path is enabled" but when, based on the Low Noise Path rules, the path is actually switched in. This can happen when the selection is **Low Noise Path Enable** or **Full Bypass Enable**. In the case where the DC Block is switched in the instrument is now AC coupled. However, if you selected DC coupling, the UI would still behave as though it were DC coupled, including all annunciation, warnings, status bits, and responses to SCPI queries. This is because, based on other settings, the instrument could switch out the low noise path at

	any time and hence go back to being DC coupled Alignment switching ignores the settings in this menu, and restores them when finished
Dependencies	Does not appear in CXA-m Does not appear in VXT Models M9410A/11A Does not appear in BBIQ and External Mixing The **Low Noise Path Enable** selection does not appear unless Option LNP is present and licensed The **µW Preselector Bypass** selection does not appear unless Option MPB is present and licensed The **Full Bypass Enable** selection does not appear unless options LNP and MPB are both present as well as option FBP In any of these cases, if the required options are not present and the SCPI command is sent, error -241, "Hardware missing; Option not installed" is generated **Low Noise Path Enable** and **Full Bypass Enable** are grayed-out if the current measurement does not support them **Low Noise Path Enable** and **Full Bypass Enable** are not supported in Avionics and MMR Modes. In any of these cases (that is, the feature is not supported in either measurement or mode), if the SCPI command is sent, the following error is generated: -221, “Setting Conflict; Feature not supported for this measurement”
Preset	All except modes specified below: `STD` IQ Analyzer, VXA, Pulse and Avionics mode: – MPB option present and licensed: `MPB` – MPB option not present and licensed: `STD`
State Saved	Save in instrument state
Range	Standard Path|Low Noise Path Enable|µW Presel Bypass|Full Bypass Enable
Annotation	In the Meas Bar, if the Standard path is chosen, it says: µW Path: Standard If Low Noise Path is enabled but the LNP switch is not thrown, it shows: µW Path: LNP,Off If the Low Noise Path is enabled and the LNP switch IS thrown, it shows: µW Path: LNP,On If the preselctor is bypassed, it says: µW Path: Bypass If Full Bypass Enable is selected but the LNP switch is not thrown, it shows: µW Path: FByp,Off If Full Bypass Enable is selected and the LNP switch IS thrown, it shows: µW Path: FByp,On

µW Path Control Auto [Mode: VMA, WLAN, NR5G, CQM]

In VMA, WLAN, 5G NR, CQM modes, an Auto/Man switch is added to **µW Path Control**:

This allows the function to automatically switch based on certain Auto Rules as shown below:

VMA Mode

Measurement	When µW Path Control is in Auto:
Digital Demod	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Custom OFDM	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Presel Bypass
SEM	Always Presel Bypass
Spurious Emissions	Always Standard Path

WLAN Mode

Measurement	When µW Path Control is in Auto:
Modulation Analysis	Always Presel Bypass
Spectral Flatness	Always Presel Bypasss
Power vs Time	Always Presel Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Always Presel Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Always Presel Bypass
SEM	1. For 11be 320M, when 'Enabled Wideband IF for FFT' is OFF or 'Sweep Type Rule' is Best Dynamic Range, auto µW path is standard. 2. For other cases, auto µW path is presel bypass if presel bypass is enabled,

Measurement	When µW Path Control is in Auto:
	auto µW path is standard if presel bypass is not enabled.
Spurious Emissions	Always Standard Path

5G NR Mode

Measurement	When µW Path Control is in Auto:
Modulation Analysis	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and “Allow Full Bypass in Auto” is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and “Allow Full Bypass in Auto” is On), otherwise choose Preselector Bypass
Channel Power	Always Standard Path
Occupied BW	Always Standard Path
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Standard Path
SEM	Always Standard Path
Spurious Emissions	Always Standard Path
Transmit On|Off Power	Use Standard Path unless tuned frequency > 3.6 GHz and Info BW > 15 MHz, in which case choose Preselector Bypass

Channel Quality Mode

Measurement	When µW Path Control is in Auto:
Group Delay	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and “Allow Full Bypass in Auto” is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass

Remote Command	`[:SENSe]:POWer[:RF]:MW:PATH:AUTO ON | OFF | 1 | 0` `[:SENSe]:POWer[:RF]:MW:PATH:AUTO?`
Example	`:POW:MW:PATH:AUTO ON` `:POW:MW:PATH:AUTO?`

Dependencies	Only appears in VMA, WLAN, 5G NR and CQM modes
Couplings	See the tables above
Preset	ON
Range	ON|OFF

Low Noise Path Enable

You may select **Low Noise Path Enable**, which gives a lower noise floor under some circumstances, particularly when operating in the 21-26.5 GHz region. With the Low Noise Path enabled, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

- The instrument is not in the Low Band, meaning:
- the start frequency is above 3.5 GHz and
- the stop frequency is above 3.6 GHz
- the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Low Noise Path Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Low Noise Path Enable** is selected in the user interface. The only time the Low Noise Path is used is when **Low Noise Path Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

For measurements that use IQ acquisition, the low noise path is used when **Center Frequency** is in High Band (> 3.6 GHz) and no preamp is in use. In other words, the rules above are modified to use only the center frequency to qualify which path to switch in. This is not the case for FFTs in the Swept SA measurement; they use the same rules as swept measurements.

Note that the Low Noise Path, while giving improved DANL, has the disadvantage of decreased TOI performance and decreased gain compression performance relative to the standard path.

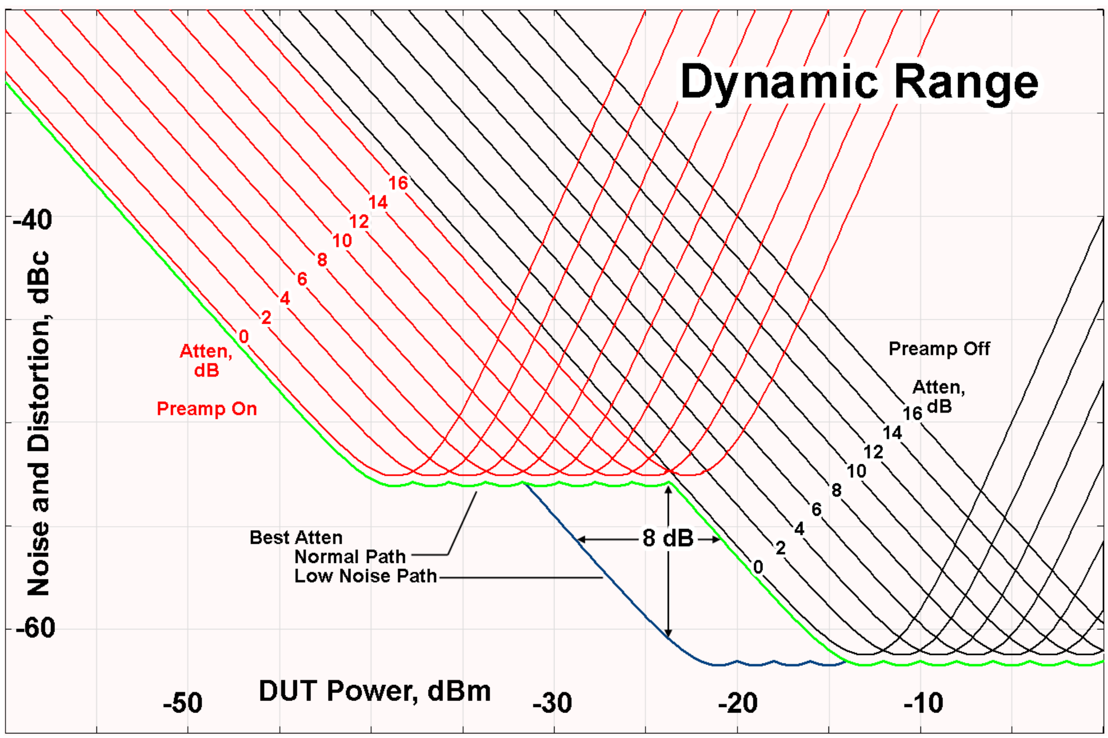
Note also that the bypass switch is a mechanical switch and has finite life, so if the **Low Noise Path Enable** is selected, it is possible to cause frequent cycling of this switch by frequently changing instrument settings such that the above conditions hold true only some of the time. A user making tests of this nature should consider opting for the **Standard Path**, which will never throw the bypass switch, at the expense of some degraded noise performance.

The low noise path is useful for situations where the signal level is so low that the instrument performance is dominated by noise even with 0 dB attenuation, but still high enough that the preamp option would have excessive third-order intermodulation or compression. The preamp, if purchased and used, gives better

noise floor than does the “Low Noise Path.” However, its compression threshold and third-order intercept are much poorer than that of the non-preamp path.

There are some applications, typically for signals around –30 dBm, for which the third-order dynamic range of the standard path is good enough, but the noise floor is not low enough even with 0 dB input attenuation. When the third-order dynamic range of the preamp path is too little and the noise floor of the standard path is too high, the Low Noise Path can provide the best dynamic range

The graph below illustrates the concept. It shows, in red, the performance of an instrument at different attenuation settings, both with the preamp on and off, in a measurement that is affected by both instrument noise and instrument TOI. The green shows the best available dynamic range, offset by 0.5 dB for clarity. The blue shows how the best available dynamic range improves for moderate signal levels with the low noise path switched in. In this illustration, the preamp improves the noise floor by 15 dB while degrading the third-order intercept by 30 dB, and the low noise path reduces loss by 8 dB. The attenuator step size is 2 dB.



There are other times where selecting the low noise path improves performance, too. Compression-limited measurements such as finding the nulls in a pulsed-RF spectrum can profit from the low noise path in a way similar to the TOI-limited measurement illustrated. Accuracy can be improved when the low noise path allows the optimum attenuation to increase from a small amount like 0, 2 or 4 dB to a larger amount, giving better return loss at the instrument input. Harmonic measurements, such as second and third harmonic levels, are much improved using the low noise path because of the superiority of that path for harmonic (though not intermodulation) distortion performance.

µW Preselector Bypass

Toggles the preselector bypass switch for band 1 and higher. When the microwave presel is on, the signal path is preselected. When the microwave preselector is off, the signal path is not preselected. The preselected path is the normal path for the instrument.

The preselector is a tunable bandpass filter which prevents signals away from the frequency of interest from combining in the mixer to generate in-band spurious signals (images). The consequences of using a preselector filter are its limited bandwidth, the amplitude and phase ripple in its passband, and any amplitude and phase instability due to center frequency drift.

Option MPB or pre-selector bypass provides an unpreselected input mixer path for certain X-Series signal analyzers with frequency ranges above 3.6 GHz. This signal path allows a wider bandwidth and less amplitude variability, which is an advantage when doing modulation analysis and broadband signal analysis. The disadvantage is that, without the preselector, image signals will be displayed. Another disadvantage of bypassing the preselector is increased LO emission levels at the front panel input port.

Image responses are separated from the real signal by twice the 1st IF. For IF Paths of 10 MHz and 25 MHz, the 1st IF is 322.5 MHz, so the image response and the real signal will be separated by 645 MHz. The 1st IF will be different for other IF Path settings. When viewing a real signal and its corresponding image response in internal mixing, the image response will be to the left of the real signal.

Also, the image response and the real signal typically have the same amplitude and exhibit the same shape factor.

However, if Option FS1, Fast Sweep Capability, is enabled, the image response in the Swept SA measurement appears lower in amplitude and has a much wider shape factor compared to the real signal.

Full Bypass Enable

With **Full Bypass Enable** selected, the microwave preselector is bypassed. In addition, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

- The instrument is not in the Low Band, meaning:
- the start frequency is above 3.5 GHz and
- the stop frequency is above 3.6 GHz.
- the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. The only time the Low

Noise Path is used is when **Full Bypass Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

CAUTION

When **Full Bypass Enable** is selected, and "Attenuation" on page 1747 is set to 0 dB, there will be a direct AC connection between the input and the first converter when the Low Noise Path switches in (when Start Freq >3.6 GHz and the Preamp is either not licensed, set to Low Band, or Off). This puts the first converter at high risk to be damaged by high AC power. Consequently, whenever **Full Bypass Enable** is selected, a warning message appears in the status bar:

Full Bypass Enabled, maximum safe input power reduced

Microwave Preselector Bypass Backwards Compatibility

Example	`:POW:MW:PRES OFF` Bypasses the microwave preselector
Notes	Included for Microwave Preselector Bypass backwards compatibility The `ON` parameter sets the `STD` path (`:POW:MW:PATH STD`) The `OFF` parameter sets path `MPB` (`:POW:MW:PATH MPB`)
Preset	`ON`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe] ON | OFF | 0 | 1` `[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe]?`

Frequency Extender Preselection Bypass

Frequency Extender Preselection Bypass only applies to the high frequency path of the Frequency Extender and only if the Frequency Extender allows it. For example, the V3050A high frequency path is 50 – 110 GHz and does allow control of the preselector bypass.

When the Frequency Extender's preselection is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. For bandwidths greater than 2.5 [GHz], it is recommended that the signal bypass the Frequency Extender Preselector since the max bandwidth of the Preselector can be as narrow as 2.5 [GHz].

For most applications, the preset state is `OFF`, which gives the best remote-control throughput, minimizes acoustic noise from switching, minimizes out of band spurs, and minimizes the risk of wear in the hardware switches.

Coupling with Microwave Preselector Control

The control of whether to apply or bypass the Frequency Extender's preselection is dependent on the Microwave Path Control setting.

The coupling between the Microwave Path Control and Frequency Extender Preselector Bypass is described below.

UW PATH CTRL	UW PRESELECTOR	VIKING PRESELECTOR
Standard Path	On	**On**
Low Noise Path Enable	On	**On**
uW Presel Bypass	Off	**Off**
Full Bypass Enable	Off	**Off**

In other words…

uW Path Ctrl == Standard
uW Path Ctrl == Low Noise
→ Viking PreselBypass == Off

uW Path Ctrl == Bypass
uW Path Ctrl == Full Bypass
→ Viking PreselBypass == On

For the Frequency Extender Preselector Bypass to take effect, it requires a Frequency Extender device (such as V3050A) be connected and External RF (ERFIN) selected as the input.

The Frequency Extender Preselector is applied or bypassed depending on the Microwave Path Control setting only when the acquisition is above 50 [GHz]. Hence, it will be bypassed only when the acquisition is above 50 [GHz].

Preselector and Bandwidth Conflict

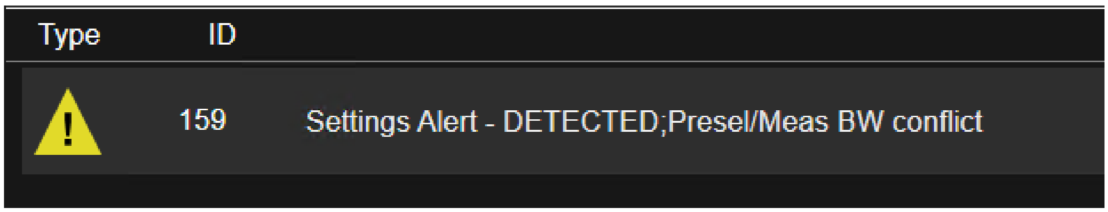
When the Frequency Extender Preselector is applied and the signal bandwidth is greater than 2.5 [GHz], then a settings alert message will show to warn the user that the signal may be distorted due to the limitation of the Frequency Extender Preselector bandwidth.

An example of the settings alert message is shown below.

Settings Alert message in the Status Bar at the bottom of the display.

Settings Alert message in the error queue

.



Software Preselection

Software Preselection is provided in some instruments, either to compensate for issues with provided hardware preselection or to provide the preselection function when there is no hardware preselector.

N9041B

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 50 GHz, software preselection must be used to suppress and separate images above 50 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

In the N9041B, Software Preselection only applies for frequencies above 50 GHz, therefore it is only used for RF Input 2. Even if it is turned on, it will not be used for other inputs and never for frequencies below 50 GHz. This is why the label of this control contains the parenthetical note “(>~50 GHz)”.

Note that in the N9041B, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

N9042B+V3050A

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 88 GHz, software preselection must be used to suppress and separate images above 88 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

For N9042B+V3050A, Software Preselection only applies for frequencies above 88 GHz, therefore it is only used for External RF. Even if it is turned on, it will not be used for other inputs and never for frequencies below 88 GHz. This is why the label of this control contains the parenthetical note “(>~88 GHz)”.

Note that for N9042B+V3050A, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

VXT models M9410A/11A

Software Preselection is used to provide the preselection function, as there is no hardware preselector in these models. Two background traces are taken and compared point by point, and the point with the lowest amplitude from the two traces is used. This provides a method to reduce spurs that are internally generated within the VXT, but the user should note the following when using Software Preselection:

- There is some speed cost due to the need to take multiple captures
- Taking the point with the lowest amplitude in each trace will make the average noise level lower at all points that do not have a spur. This can reduce the accuracy of the measurement of noise and noise-like signals.

Because of the difficulty in identifying spurs manually, you are encouraged to leave Software Preselection ON at all times in VXT models M9410A/11A. If you turn it off in order to speed up your measurement or improve noise accuracy, be aware of unwanted onscreen spurs.

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel:STATe 0 | 1 | ON | OFF` `[:SENSe]:POWer[:RF]:SWPresel:STAT?`
Example	`:POW:SWPR:STAT 1` `:POW:SWPR:STAT?`
Dependencies	Only appears in N9041B, N9042B+V2050A, and VXT models M9410A/11A. Does not appear in all measurements
Couplings	Sweep Time is affected by SW Preselection. Also Auto Tune supports SW Preselection, so set SW Preselection state and then do Auto Tune
Preset	N9041B: OFF N9042B+V3050A: ON M9410A/11A: ON
State Saved	Saved in instrument state

SW Preselection Type

Specifies the algorithm used for software preselection.

Two hidden sweeps are taken in succession. The second sweep is offset in LO frequency by 2*IF/N. For each point in each trace, the smaller amplitude from the two traces is taken and placed in that point in the selected trace. The Peak detector is auto-selected to improve the image suppression effectiveness. Responses of each trace that lie on top of one another will remain and are valid signals. Other signals are images and are suppressed. The action of taking the smaller of the two traces will make the average noise level lower in all points that do not have an image, thus reducing the accuracy of the measurement of noise and noise-like signals.

- NORMal - mathematically removes all image and multiple responses of signals present at the input
- ADVanced - any trace processing (such as “max hold” or trace averaging) is performed on the points of both candidate traces before the “select minimum” operation occurs. This form of processing works better for non-stationary signals, such as pulsed-RF signals

Remote Command	[:SENSe]:POWer[:RF]:SWPResel NORMal | ADVanced [:SENSe]:POWer[:RF]:SWPResel?
Example	:POW:SWPR NORM :POW:SWPR?
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed-out. Its grayout message is “Unavailable unless SW Presel enabled”
Preset	N9041B: ADVanced N9042B+V3050A: NORMal
State Saved	Saved in instrument state

SW Preselection BW

Specifies the effective bandwidth to be used for Software Preselection.

The choices are:

- NORMal – when making Swept measurements, a software preselection algorithm is used which takes up to 4 background acquisitions, then post-processes the result. This algorithm can remove images from signals with an occupied bandwidth up to around 3 GHz. (Default/Preset setting). When making FFT measurements, this algorithm is not used, instead the same algorithm is used as for NARRow (below)
- NARRow– a software preselection algorithm is used which takes two background acquisitions, then post-processes the result to detect and remove images from wideband signals with occupied bandwidths up to 2 GHz. This increases the risk of images failing to be rejected, but improves the measurement speed

Remote Command	[:SENSe]:POWer[:RF]:SWPResel:BW NORMal | NARRow [:SENSe]:POWer[:RF]:SWPResel:BW?
Example	:POW:SWPR:BW NARR
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed out. Its grayout message is “Unavailable unless SW Presel enabled” For N9042B+V3050A the parameter is SCPI only and always set to NARRow when Software

	Preselection is enabled
Preset	N9041B: NORMal N9042B+V3050A: NARRow
State Saved	Saved in instrument state

High Freq Prefilter

Lets you set the state of Prefilter for Center Frequencies above 1310 MHz.

In VXT Models M9410A/11A, the Receiver RF path has a bank of filters that come after the RF Attenuator in the signal path. Since this bank of filters precedes the mixer they are known as the “Prefilter” bank. Their purpose is to eliminate unwanted in-band mixing products by filtering out all but the desired frequencies before the signals get to the mixer. There are 13 prefilter bands to cover the frequencies between 9 kHz and 6000 MHz. The Prefilter provides the necessary rejection of the unwanted signal.

Remote Command	`[:SENSe]:<measurement>:PFILter[:STATe] ON | OFF | 1 | 0` `[:SENSe]:<measurement>:PFILter[:STATe]?`

Example	For example, to enable High Freq Prefilter in IQ Analyzer Mode:
	For the Complex Spectrum Measurement:
	`:SPEC:PFIL ON`
	For the IQ Waveform Measurement:
	`:WAV:PFIL ON`
	`:`

Dependencies	This control only appears in VXT models M9410A/11A with center frequency above 1310 MHz
Preset	See “Prefilter Presets” below
State Saved	Saved in instrument state

Prefilter Presets

Meas	Mode	Preset
SPEC	BASIC	OFF
WAV	BASIC, WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
MON	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
RHO	WCDMA	OFF
CDP	WCDMA	OFF
PCON	WCDMA	OFF
EVMQ	WCDMA	OFF
CHP	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF

Meas	Mode	Preset
OBW	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
ACP	WCDMA, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
SEM	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PST	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PVT	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF
EVM	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF
FLAT	WLAN	OFF
EVMM	WLAN	OFF
CEVM	LTEAFDD, LTEATDD	OFF
PAVT	5GNR, VMA	OFF
DDEM	VMA	OFF
OFDM	VMA	OFF
SAN	SA	ON
HARM	SA	ON

3.2.4 BW

Opens the Bandwidth (**BW**) menu, which contains controls for the Resolution Bandwidth and Video Bandwidth functions of the instrument.

3.2.4.1 Settings

Contains the basic bandwidth functions. It is the only tab under **BW**.

Res BW

Activates the resolution bandwidth active function, which allows you to manually set the Resolution Bandwidth (RBW) of the instrument.

Normally, **Res BW** (Auto) selects automatic coupling of the Res BW to Span using the ratio set by the Span:3 dB RBW control (some measurements do not have a Span:3 dB RBW control, in which case the measurement chooses the optimal ratio). To decouple the resolution bandwidth, press the **Auto/Man** toggle on the **Res BW** control, or simply enter a different value for **Res BW**.

When the **Res BW** is manually selected, it may be returned to the coupled state by pressing the **Auto/Man** toggle on the **Res BW** control. This may also be done by pressing Auto Couple or by performing a **Preset**.

Only certain discrete resolution bandwidths are available. The available bandwidths are dependent on the **EMC Standard**. If an unavailable bandwidth is entered with the numeric keypad, the closest available bandwidth is selected.

See "RBW Presets" on page 210

Remote Command	[:SENSe]:MONitor:BANDwidth[:RESolution] <bandwidth> [:SENSe]:MONitor:BANDwidth[:RESolution]? [:SENSe]:MONitor:BANDwidth[:RESolution]:AUTO ON | OFF | 1 | 0 [:SENSe]:MONitor:BANDwidth[:RESolution]:AUTO?
Example	:MON:BAND 5 MHz :MON:BAND? :MON:BAND:AUTO ON :MON:BAND:AUTO?
Notes	For numeric entries, all RBW Types choose the nearest (arithmetically, on a linear scale, rounding up) available RBW to the value entered The setting and querying of values depends on the current bandwidth type
Couplings	Sweep time is coupled to the RBW. As the RBW changes, the sweep time (if set to Auto) is changed to maintain amplitude calibration Video bandwidth (VBW) is coupled to the RBW. As the resolution bandwidth changes, the video bandwidth (if set to Auto) changes to maintain the ratio of VBW/RBW (10:1) When the Res BW is set to Auto, the resolution bandwidth is auto-coupled to the span. The ratio of Span/RBW is approximately 106:1 when auto coupled. When Res BW is set to Man, and the bandwidths are entered manually, these bandwidths are used regardless of other instrument settings
Preset	Auto (unless noted in the table below) See "RBW Presets" on page 210 below
State Saved	Saved in instrument state
Min	1 Hz
Max	8 MHz is the max equivalent –3 dB RBW, which means that the named RBW (the one shown on the control etc.) can actually exceed 8 MHz if using a filter other than –3 dB Gaussian
Annotation	A “#” mark appears before “RBW” in the annotation when it is switched from Auto to Manual coupling
Backwards Compatibility Notes	For backwards compatibility this command obeys both the BANDwidth and BWIDth forms For ESA, the maximum Res BW was 5 MHz; on X-Series it is 8 MHz

RBW Presets

Unless noted in the table below, the Preset value of RBW is **Auto**.

Mode	Preset RBW
WLAN	100 kHz
LTE, LTETDD, LTEAFDD, LTEATDD	100 kHz
5GNR	100 kHz

Video BW

Lets you change the instrument post-detection filter (VBW or "video bandwidth") from 1 Hz to 8 MHz in approximately 10% steps. In addition, a wide-open video filter bandwidth may be chosen by selecting 50 MHz. The VBW is annotated at the bottom of the display, in the center.

Normally, **Video BW (Auto)** selects automatic coupling of the Video BW to RBW using the ratio set by the VBW:3 dB RBW control. To decouple the resolution bandwidth, press the **Auto/Man** toggle on the **Video BW** control, or simply enter a different value for **Video BW**.

When the **Video BW** is manually selected, it may be returned to the coupled state by pressing the **Auto/Man** toggle on the **Video BW** control. This may also be done by pressing Auto Couple or by performing a **Preset**.

Remote Command	`[:SENSe]:MONitor:BANDwidth:VIDeo <bandwidth>`
	`[:SENSe]:MONitor:BANDwidth:VIDeo?`
	`[:SENSe]:MONitor:BANDwidth:VIDeo:AUTO ON | OFF | 1 | 0`
	`[:SENSe]:MONitor:BANDwidth:VIDeo:AUTO?`

Example	`:MON:BAND:VID 2.4 MHz`
	`:MON:BAND:VID?`
	`:MON:BAND:VID:AUTO ON`
	`:MON:BAND:VID:AUTO?`

Notes	For numeric entries, the instrument chooses the nearest (arithmetically, on a linear scale, rounding up) available VBW to the value entered. The 50 MHz VBW is defined to mean "wide open" The values shown in this table reflect the conditions after a Mode Preset
Dependencies	Sometimes the displayed Video BW is not actually used to process the trace data: – When the Average Detector is selected and **Sweep Type** is set to **Swept**, the video bandwidth filter cannot be used, because it uses the same hardware as the Average Detector – When the Quasi-Peak, EMI Average or RMS Average detector is selected the VBW is implemented by the digital IF as part of the detector When this is the case, the VBW still acts to change the Sweep Time, if Sweep Time is in Auto, and still affects the data on other traces for which this is not the case
Couplings	Video bandwidth (VBW) is normally coupled to RBW. If **VBW** is set to Auto, then the VBW is changed as the RBW changes, to maintain the ratio set by the VBW:3 dB RBW control (usually 10:1 for measurements that do not have a VBW:3 dB RBW control)
Preset	Auto (unless noted in table below) `ON`
State Saved	Saved in instrument state
Min	1 Hz

Max	50 MHz
Annunciation	A "#" mark appears before "VBW" in the annotation when it is not coupled
Annotation	In the bottom center of the screen, "VBW <value> <units>" indicates the current video bandwidth value. Note that for some detectors this is not the value actually used for VBW (see above)
Backwards Compatibility Notes	For backwards compatibility this command obeys both the `BANDwidth` and `BWIDth` forms

VBW Presets

Unless noted in the table below, the Preset value of VBW is **Auto**.

Mode	Preset VBW
`WLAN`	1 MHz
`LTE, LTETDD, LTEAFDD, LTEATDD`	1 MHz
`5GNR`	1 MHz

VBW:3dB RBW

Selects the ratio between the video bandwidth and the equivalent 3 dB resolution bandwidth to be used for setting VBW when VBW is in Auto.

VBW:3dB RBW (Auto) selects automatic coupling of the VBW:3 dB RBW ratio to Detector using the rules described below in "Coupling Auto Rules" on page 213 To decouple the ratio, press the **Auto/Man** toggle on the VBW:3 dB RBW control, or simply enter a different value for VBW:3 dB RBW.

When the VBW:3dB RBW is manually selected, it may be returned to the coupled state by setting the toggle on the VBW:3 dB RBW control back to **Auto**. This may also be done by pressing Auto Couple or by performing a **Preset**.

Remote Command	`[:SENSe]:MONitor:BANDwidth:VIDeo:RATio <real>`
	`[:SENSe]:MONitor:BANDwidth:VIDeo:RATio?`
	`[:SENSe]:MONitor:BANDwidth:VIDeo:RATio:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:MONitor:BANDwidth:VIDeo:RATio:AUTO?`

Example	`:MON:BAND:VID:RAT 2`
	`:MON:BAND:VID:RAT?`
	`:MON:BAND:VID:RAT:AUTO 0`
	`:MON:BAND:VID:RAT:AUTO?`

Notes	The values shown in this table reflect the conditions after a Mode Preset
Couplings	See "Coupling Auto Rules" on page 213

Preset	1 ON
State Saved	Saved in instrument state
Min	0.00001
Max	3000000
Backwards Compatibility Notes	For backwards compatibility this command accepts both the `BANDwidth` and `BWIDth` forms

Coupling Auto Rules

The Auto Rules for the **VBW:3dB RBW** function are as follows.

First, if Source Mode is set to "Tracking": Use 1.0

Otherwise, we go through the following list of detector numbers and find the lowest numbered detector being used on any active traces (traces for which Update is On):

1. Peak
2. Normal
3. Average
4. Sample
5. Negative Peak
6. EMI Average
7. Quasi Peak
8. RMS Average

Use that detector to pick the ratio based on the following criteria:

1. If the measurement supports EMC Standard, and the detector is Peak and the EMC Standard is set to either CISPR or MIL, use 10.0 (we use wide VBWs to capture peak levels accurately).
2. Otherwise, if the detector is **Negative Peak**, use 1.0 (in the Negative Peak case, there are no known significant use models so we use a medium ratio).
3. Otherwise, if the detector is **Normal**, use 1.0.
4. Otherwise, if the detector is **Average**, and the span is nonzero, use 0.1. The use of a small ratio in Average detection is desirable because of its effect on the sweep time equations. The VBW filter is not actually in-circuit when the average detector is on. If the detector is Average, and the span is zero, use 10.0, which gives optimal behavior for Interval Markers in zero span. Note that only the Swept SA measurement supports Zero Span.

5. Otherwise, if the detector is EMI Average, Quasi Peak or RMS Average, use 10.0. In fact, this is a “don’t care” since no VBW is used for these detectors, as noted under “Dependencies” for the VBW control

6. Otherwise, the detector is simply **Peak** or **Sample**. These two detectors can use the same rules. In these cases, if any active trace is in max hold or min hold, use 10.0, because Max and Min Hold operations will usually be intended to capture peaks and pits without smoothing from the VBW filter; otherwise, use 1.0 as a compromise, because you have not set the instrument in a way that implies that you are measuring noise, pulsed-RF or CW signals, and for backward compatibility with earlier instruments.

Note that because the above couplings depend on which traces are active, they are re-examined whenever any trace goes active or inactive, except when this leaves no traces active. Transitioning to the state where no traces are active should not affect the couplings; in that way, the annotation will always reflect the state of the last trace which was active.

Note also that some detectors are not available in some measurements, but because of the way the above rules that does not change the logic of the rules.

Span:3dB RBW

Selects the ratio between span and resolution bandwidth.

Normally, Span:3dB RBW (Auto) selects a Span:3 dB RBW ratio of 106:1. If you manually enter the ratio, the toggle on the Span:3dB RBW control will change to **Man.** This enables you to manually select ratios more suitable for certain measurements.

When the Span:3dB RBW is manually selected, it may be returned to the coupled state by setting the toggle on the RBW:3 dB RBW control back to **Auto**. This may also be done by pressing Auto Couple or by performing a **Preset**.

Remote Command	`[:SENSe]:MONitor:FREQuency:SPAN:BANDwidth[:RESolution]:RATio <integer>`
	`[:SENSe]:MONitor:FREQuency:SPAN:BANDwidth[:RESolution]:RATio?`
	`[:SENSe]:MONitor:FREQuency:SPAN:BANDwidth[:RESolution]:RATio:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:MONitor:FREQuency:SPAN:BANDwidth[:RESolution]:RATio:AUTO?`

Example	`:MON:FREQ:SPAN:BAND:RAT 200`
	`:MON:FREQ:SPAN:BAND:RAT?`
	`:MON:FREQ:SPAN:BAND:RAT:AUTO ON`
	`:MON:FREQ:SPAN:BAND:RAT:AUTO?`

Notes	The values shown in this table reflect the conditions after a Mode Preset

Preset	106 ON
State Saved	Saved in instrument state
Min	2
Max	10000
Backwards Compatibility SCPI	[:SENSe]:MONitor:FREQuency:SPAN:BWIDth[:RESolution]:RATio

3.2.5 Display

Opens the **Display** menu, which lets you configure display items for the current Mode, Measurement View or Window.

3.2.5.1 View

Contains controls for selecting the current **View**, and for editing User Views.

Views

For modes other than MSR, LTEAFDD/LTEATDD and 5GNR, there is a single view, **Normal**.

For the MSR, LTEAFDD/LTEATDD and 5GNR modes, there are two views, **Normal** and **Carrier Info**, as described in the table below. The **Normal** view is the same as the common Monitor Spectrum view in other Modes. Carrier Info is available on the spectrum trace.

"Normal" on page 216	This is a single window view of the spectrum In MSR, LTEAFDD/LTEATDD and 5GNR modes you can turn on attributes that show the defined carriers and the sub-blocks also
Carrier Info	This view shows the spectrum in the top window and a carrier configuration summary in the bottom window Carrier center frequency can be displayed in either offset or absolute frequency depending on Carrier Freq

View Selection by Name (MSR, LTEAFDD/LTEATDD and 5GNR only)

Remote Command	:DISPlay:MONitor:VIEW[:SELect] RTRace | CINFormation :DISPlay:MONitor:VIEW[:SELect]?
Example	:DISP:MON:VIEW RTR :DISP:MON:VIEW?

Preset	RTRace
State Saved	Saved in instrument state
Range	Power Results|Carrier Info

View Selection by Number (MSR, LTE-A FDD/TDD and 5G NR only)

Remote Command	`:DISPlay:MONitor:VIEW:NSELect <integer>` `:DISPlay:MONitor:VIEW:NSELect?`
Example	`:DISP:MON:VIEW:NSEL 1` `:DISP:MON:VIEW:NSEL?`
Preset	1
State Saved	Saved in instrument state
Min/Max	1/2

Normal

Windows: "Spectrum" on page 174

Single window view of the graph.

Example	`:DISP:MON:VIEW RTR`
Dependencies	This command is only available in the MSR, LTE-A FDD/TDD and 5G NR modes. In other Modes this is the only View

User View

Lets you choose a View from the saved User Views for the current measurement. This panel only appears if a User View exists for the current measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:SELect <alphanumeric>` `:DISPlay:VIEW:ADVanced:SELect?`
Example	Select Baseband as the current View `:DISP:VIEW:ADV:SEL “Baseband”`
Notes	You must be in the measurement whose View you are trying to set to send the command. You can only set Views for the current measurement using this command For predefined views, the parameter is derived from the view name that is shown in the View list in the user interface. For example, if you are trying to select the Trace Zoom view in the Swept SA measurement, you send: `:DISP:VIEW:ADV:SEL "Trace Zoom"` because “Trace Zoom” is the name of the View as seen in the Mode/Meas dialog or in the Display, View menu

	You *cannot* use the legacy View parameter (which in this case would be `TZOom`) with `:DISP:VIEW:ADV:SEL`
	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case. Thus, both of the following forms work:
	`:DISP:VIEW:ADV:SEL "Trace Zoom"`
	`:DISP:VIEW:ADV:SEL "TRACE ZOOM"`
	If the specified view is not a valid View, the query returns the error message "-224, Illegal parameter value; View with the name <alphanumeric> does not exist"
	If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Backwards Compatibility SCPI	The legacy node `:DISPlay:VIEW[:SELect]` is retained for backwards compatibility, but it only supports predefined views

Restore Layout to Default

Restores the Layout to the default for Basic.

Modified Views are very temporary; if you exit the current measurement they are discarded, and they are not saved in State. To retain this View for later use, and to be able to return easily to your original Basic View, you can save your edited View as a "User View".

Save Layout as New View

Saves your new View as a User View. An alpha keyboard appears, which lets you name your new View; the default is the old View name plus a number.

Remote Command	`:DISPlay:VIEW:ADVanced:NAME <alphanumeric>`
Example	`:DISP:VIEW:ADV:NAME "Baseband"` Creates a new View named `Baseband` from the current View, and selects it as the current View
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If `<alphanumeric>` name already exists as a View, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; User View SCPI cannot be used while Display is disabled" is generated

Re-Save User View

You can re-edit a User View; if you make changes, then an asterisk will appear next to the User View's name. You can then tap **Re-Save User View** to save it back to its existing name, or **Save Layout as New View** to add another, new User View.

This is a front panel function only, there is no remote command available to perform this function. To do this remotely, you must first perform **Save Layout as New View**, then delete the old User View and rename the new one with the name of the View you just deleted.

Rename User View

You can rename the current View by giving it a new unique name. Only User Views can be renamed, if the current View is a Predefined View, an error occurs.

Remote Command	`:DISPlay:VIEW:ADVanced:REName <alphanumeric>`
Example	`:DISP:VIEW:ADV:REN "Baseband"`
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the `<alphanumeric>` specifying the new name is already present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot rename a Predefined View" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete User View

You can delete the current View if it is a User View. The default view becomes the current view for the Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:DELete`
Example	`:DISP:VIEW:ADV:DEL`
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the `<alphanumeric>` is not present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> does not exist" is generated If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot delete a Predefined View" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete All User Views

Deletes all previously saved User Views. The default view becomes the current view for the Measurement if a User View was the current view when this command was executed.

Remote Command	`:DISPlay:VIEW:ADVanced:DELete:ALL`
Example	`:DISP:VIEW:ADV:DEL:ALL`
Notes	Disabled if there are no User Views

View Editor Remote Commands

The following remote commands help you manage Views and User Views. Note that the SCPI node for User Views handles both Predefined and User Views. The legacy nodes, `:DISPlay:VIEW[:SELect]` and `:DISPlay:VIEW:NSEL`, are retained for backwards compatibility, but they only support predefined views.

View Listing Query

Returns a string containing a comma-separated list of names for *all* the Views, including User Views, available for the current Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:CATalog?`
Example	`:DISP:VIEW:ADV:CAT?`
Notes	Returns a quoted string of the available Views for the current measurement, separated by commas. The list includes names for *all* the Views, including User Views, available for the current Measurement Example: `"Normal,Trace Zoom,Spectrogram,Baseband,myView1,yourView1"` No distinction is made between Predefined and User Views If you switch measurements with the display disabled (via `:DISP:ENAB OFF`), then query the list of available Views, the result is undefined

User View Listing Query

Returns a string containing a comma-separated list of names for *only* the User Views available for the current Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:USER:CATalog?`
Example	`:DISP:VIEW:ADV:USER:CAT?`
Notes	Returns a quoted string of the available User Views for the current measurement, separated by commas. Example: `"Baseband,myView1,yourView1"` If you switch measurements with the display disabled (see "Display Enable (Remote Command Only)" on page 1894), then query the list of available Views, the result is undefined

3.2.5.2 Annotation

Contains controls for setting up the annotation for the current Mode or Measurement.

Graticule

Turns the display graticule On or Off for all windows with graticules in all measurements in the current Mode. Also turns the graticule Y-Axis annotation on and off.

Remote Command	`:DISPlay:GRATicule[:STATe] OFF | ON | 0 | 1` `:DISPlay:GRATicule[:STATe]?`
Example	`:DISP:GRAT OFF`
Notes	The graticule is the set of horizontal and vertical lines that make up the grid/divisions for the X-Axis and Y-Axis
Preset	`ON`
State Saved	Saved in instrument state

Backwards Compatibility SCPI	`:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe] OFF | ON | 0 | 1`
	`:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe]?`
	This command is accepted for backwards compatibility with older instruments, but the `WINDow`, `TRACe` and `GRID` parameters are ignored

Screen Annotation

Controls the display of the annunciation and annotation around the graticule, including any annotation on lines (such as the display line, the threshold line, etc.) and the Y-Axis annotation, for all windows with screen annotation in all measurements in the current Mode.

This does *not* include marker annotation (or the N dB result). When `OFF`, the graticule expands to fill the entire graticule area, leaving only the 1.5% gap above the graticule, as described in the **Trace** section.

Remote Command	`:DISPlay:ANNotation:SCReen[:STATe] OFF | ON | 0 | 1` `:DISPlay:ANNotation:SCReen[:STATe]?`
Example	`:DISP:ANN:SCR OFF`
Dependencies	Grayed-out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Trace Annotation

Turns on and off the labels on the traces, showing their detector (or their Math Mode) as described in the **Trace** section, for all windows in all measurements in the current Mode for which Trace Annotation on/off is supported.

If Trace Math is being performed on a trace, then the Trace Math annotation replaces the detector annotation.

For measurements that support limit lines, this key also turns on and off the labels on the Limit Lines. The label is the Limit number annotation and Limit Comment displayed on the graph. If the length of the comment is greater than 20 characters, the first 8 characters and the last 8 characters are displayed, joined with ....

Remote Command	`:DISPlay:ANNotation:TRACe[:STATe] ON | OFF | 1 | 0` `:DISPlay:ANNotation:TRACe[:STATe]?`
Example	`:DISP:ANN:TRAC OFF`
Preset	`OFF`
State Saved	Saved in instrument state

Control Annotation

Turns on and off the display of values on the Active Function controls for all measurements in the current Mode. This is a security feature.

Remote Command	`:DISPlay:ACTivefunc[:STATe] ON | OFF | 1 | 0` `:DISPlay:ACTivefunc[:STATe]?`
Example	`:DISP:ACT OFF`
Dependencies	Grayed out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Meas Bar

Turns the Measurement Bar at the top of the screen on and off for all measurements in the current Mode. When `OFF`, the graticule area expands to fill the area formerly occupied by the Measurement Bar.

Remote Command	`:DISPlay:ANNotation:MBAR[:STATe] OFF | ON | 0 | 1` `:DISPlay:ANNotation:MBAR[:STATe]?`
Example	`:DISP:ANN:MBAR OFF`
Dependencies	Grayed out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`

Preset	ON This remains OFF through a Preset when **System Display Settings**, **Annotation** is set to OFF
State Saved	Saved in instrument state

Display Enable (Remote Command Only)

Turns the display on/off, including the display drive circuitry. The backlight stays lit to confirm that the instrument is on. The display enable setting is mode global. Theare three reasons for turning the display off:

1. To increase speed as much as possible by freeing the instrument from having to update the display
2. To reduce emissions from the display, drive circuitry
3. For security purposes

If you have turned off the display:

- and you are in local operation, the display can be turned back on by pressing any key or by sending `:SYSTem:DEFaults MISC` or `:DISPlay:ENABle ON` (neither `*RST` nor :SYSTem:PRESet enable the display)
- and you are in remote operation, the display can be turned back on by pressing the **Local** or **Esc** keys, or by sending `:SYSTem:DEFaults MISC` or `:DISPlay:ENABle ON` (neither `*RST` nor `:SYSTem:PRESet` enable the display)
- and you are using either the `:SYSTem:KLOCk` command or GPIB local lockout, then *no* front-panel key press will turn the display back on. You must turn it back on remotely.

If the display is `OFF`, many SCPI commands related to User Views and Multiscreen functionality do not work, and return the error messages “-221, Settings conflict; Screen SCPI cannot be used when Display is disabled” or “221, Settings conflict; View SCPI cannot be used while Display is disabled”. These commands include:

Name	Command
Select User View	:DISPlay:VIEW:ADVanced:SELect
Rename User View	:DISPlay:VIEW:ADVanced:REName
Delete User View	:DISPlay:VIEW:ADVanced:DELete
Create User View	:DISPlay:VIEW:ADVanced:NAME
Select Screen	:INSTrument:SCReen:SELect
Delete Screen	:INSTrument:SCReen:DELete
Delete All But This Screen	:INSTrument:SCReen:DELete:ALL
Add Screen	:INSTrument:SCReen:CREate
Rename Screen	:INSTrument:SCReen:REName
Sequencer On/Off	:SYSTem:SEQuencer

Remote Command	`:DISPlay:ENABle OFF | ON | 0 | 1` `:DISPlay:ENABle?`
Example	`:DISP:ENAB OFF`
Couplings	`:DISP:ENAB OFF` turns Backlight `OFF` and `:DISP:ENAB ON` turns Backlight `ON`, but changing Backlight settings does *not* change the state of `:DISP:ENAB`
Preset	`ON` Set by `:SYST:DEF MISC`, but not affected by `*RST` or `:SYSTem:PRESet`
State Saved	Not saved in instrument state
Backwards Compatibility Notes	`:SYST:PRES` no longer turns on `:DISPlay:ENABle` as it did in legacy analyzers

3.2.6 Freq

Opens the **Frequency** menu, which contains controls that allow you to control the Frequency and Channel parameters of the instrument.

Some features in this menu are the same for all measurements in the current Mode – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset. For example, the Center Freq setting is the same for all measurements - it does not change as you change measurements.

3.2.6.1 Settings

The Settings tab contains the basic Bandwidth functions. In most measurements it is the only tab under Bandwidth.

Center Frequency

Sets the frequency that corresponds to the horizontal center of the graticule. While adjusting the Center Frequency the Span is held constant.

The center frequency setting is the same for all measurements within a mode, that is, it is Meas Global. Some modes are also able to share a Mode Global center frequency value. If this is the case, the Mode will have a **Global** tab in its **Meas Setup** menu.

The **Center Freq** function sets (and queries) the Center Frequency for the currently selected input. If your instrument has multiple inputs, and you select another input, the Center Freq changes to the value for that input. SCPI commands are available to directly set the Center Freq for a specific input.

Center Freq is remembered as you go from input to input. Thus, you can set a Center Freq of 10 GHz with the RF Input selected, change to BBIQ, and set a Center Freq of 20 MHz, then switch to External Mixing and set a Center Freq of 60 GHz, and when

you go back to the RF Input the Center Freq will go back to 10 GHz; back to BBIQ and it is 20 MHz; back to External Mixing and it is 60 GHz.

See:

– "Center Frequency Presets" on page 226
– "VXT Models with Radio Heads/CIU Frequency Range" on page 228
– "RF Center Freq" on page 228
– "Ext Mix Center Freq" on page 228
– "I/Q Center Freq" on page 229

Remote Command	`[:SENSe]:FREQuency:CENTer <freq>` `[:SENSe]:FREQuency:CENTer?`

Example	`:FREQ:CENT 50 MHz`
	sets Center Frequency to 50 MHz
	`:FREQ:CENT UP`
	increments the Center Frequency by the value of CF Step
	`:FREQ:CENT?`
	returns the current value of Center Frequency

Notes	Sets the RF, External Mixing or I/Q Center Frequency depending on the selected input: – For RF input it is equivalent to `:FREQ:RF:CENT` – For I/Q input it is equivalent to `:FREQ:IQ:CENT` – For External Mixer it is equivalent to `:FREQ:EMIX:CENT` Preset and Max values are dependent on Hardware Options (5xx) If no terminator (for example, MHz) is sent, the terminator Hz is used. If a terminator with unit other than Frequency is used, an invalid suffix error message is generated
Couplings	In LTEAFDD/LTEATDD and 5GNR: Center Frequency, Center Frequency Offset and Carrier Reference Frequency are coupled with the following equation: Center Frequency = Carrier Reference Frequency + Center Frequency Offset If the following conditions are satisfied at the same time: – the Num Component Carrier equals to 1 – the Center Frequency Offset equals to 0 Hz – the mode of the Center Frequency is Auto the Center Frequency is equivalent to Carrier Reference Frequency The major purpose of this coupling is to keep BWCC with legacy LTE, in which

	`:SENSe:FREQuency:CENTer` is used to set up the Frequency of the measurement Otherwise, the Center Frequency Offset is changed following the Center Frequency and the Carrier Reference Frequency keeps intact In MSR, Center Freq, Center Freq Offset and Carrier Ref Freq are coupled with the equation, Center Freq = Carrier Ref Freq + Center Freq Offset. When Center Freq is changed, Center Freq Offset is updated and Carrie Ref Freq is not When auto, Center Freq Offset remains the same value. Thus, Center Freq changes the same amount of Carrier Ref Freq change when Carrier Ref Freq is changed. The auto state changes to manual when either Center Freq is changed In BT Mode: – Center Frequency is coupled to Channel and Geography – If Geography is France: Center Frequency 2454 MHz + (channel number* channel space) MHz – If Geography is Others: Center Frequency 2402 MHz + (channel number* channel space) MHz – If Radio Stand is Basic or EDR, channel space is 1 MHz – If Radio Stand is Low Energy, channel space is 2 MHz In other Modes: Any value of the Center Frequency or Span that keeps start frequency and stop frequency within the frequency range of the instrument is allowed when the value is being set through the front panel numeric keypad or the SCPI command. Other frequency parameters are forced to different values if needed, to keep the start and stop frequencies within the instrument's frequency range
Preset	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 226, "RF Center Freq" on page 228, "Ext Mix Center Freq" on page 228, "I/Q Center Freq" on page 229 and "VXT Models with Radio Heads/CIU Frequency Range" on page 228
State Saved	Saved in instrument state
Min/Max	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 226, "RF Center Freq" on page 228, "Ext Mix Center Freq" on page 228, "I/Q Center Freq" on page 229 and "VXT Models with Radio Heads/CIU Frequency Range" on page 228
Annotation	Center <value> appears in the lower left corner of the display
Status Bits/OPC dependencies	Non-overlapped

Remote Command	`[:SENSe]:FREQuency:CENTer:AUTO ON | OFF | 1 | 0` `[:SENSe]:FREQuency:CENTer:AUTO?`
Example	`:FREQ:CENT:AUTO OFF` `:FREQ:CENT:AUTO?`
Dependencies	This is only available in the MSR, LTEAFDD/LTEATDD and 5GNR modes
Couplings	When the Center Frequency is changed, the state is automatically changed to Manual **Center Frequency**, **Center Frequency Offset** and **Carrier Reference Frequency** are coupled. When

	Carrier Reference Frequency changes: – Center Frequency : Auto Center Frequency = Carrier Reference Frequency + Center Frequency Offset (fixed) – Center Frequency : Man Center Frequency (fixed) = Carrier Reference Frequency + Center Frequency Offset
Preset	ON
State Saved	Saved in instrument state
Range	Auto|Man

Center Frequency Presets

The following table provides the Center Frequency Presets for the Spectrum Analyzer mode, and the Max Freq, for the various frequency options:

Freq Option	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
503 (all but CXA)	1.805 GHz	3.6 GHz	3.7 GHz
503 (CXA)	1.505 GHz	3.0 GHz	3.08 GHz
507 (all but CXA)	3.505 GHz	7.0 GHz	7.1 GHz
507 (CXA)	3.755 GHz	7.5 GHz	7.58 GHz
508 (all but MXE)	1.805 GHz	3.6 GHz	8.5 GHz
508 (MXE)	4.205 GHz	8.4 GHz	8.5 GHz
513	6.805 GHz	13.6 GHz	13.8 GHz
526 (except CXA and MXE)	13.255 GHz	26.5 GHz	27.0 GHz*
526 (CXA)	13.255 GHz	26.5 GHz	26.55 GHz
526 (MXE)	1.805 GHz	3.6 GHz	27.0 GHz
532	16.005 GHz	32.0 GHz	32.5 GHz
540	20.005 GHz	40.0 GHz	40.5 GHz
543	21.505 GHz	43.0 GHz	43.0 GHz
544	22.005 GHz	44.0 GHz	45.0 GHz
550	25.005 GHz	50.0 GHz	52 GHz
F03 (CXA-m)	1.505 GHz	3.0 GHz	3.08 GHz
F07 (CXA-m)	3.755 GHz	7.5 GHz	7.575 GHz
F13 (CXA-m)	6.805 GHz	13.6 GHz	13.8 GHz
F26 (CXA-m)	13.255 GHz	26.5 GHz	26.55 GHz
504 (M9420A/21A, M8920A)	2.145 GHz	3.88GHz	3.88 GHz
506 (M9420A/21A, M8920A)	3.245 GHz	6.08GHz	6.08 GHz
F06 (M9410A/11A)	1.0 GHz	6.08 GHz	6.08 GHz

Freq Option	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
F06 (M9415A)	1 GHz	1.08 GHz	6.6 GHz
F08 (M9415A)	1 GHz	1.08 GHz	8.6 GHz
F12 (M9415A)	1 GHz	1.08 GHz	12.9 GHz

*For option 526, the Max CF in RTSA is 26.999999995 GHz.

N9041B Center Freq Presets

Input	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
Input 1, all models	25.005 GHz	50.0 GHz	52 GHz
Input 2, opt 585	42.505 GHz	85.0 GHz	86 GHz
Input 2, opt 590	45.005 GHz	90.0 GHz	92 GHz
Input 2, opt 5CX	55.005 GHz	110.0 GHz	110 GHz

Input 2, CXA and MXE

Model	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
CXA opt C75	0.7505 GHz	1.5 GHz	1.58 GHz
MXE	505 MHz	1 GHz	1.000025 GHz

Tracking Generator Frequency Limits (CXA only)

Tracking Generator Option	Min Freq (clips to this freq when turn TG on and can’t tune below while TG on)	If above this Freq, Stop Freq clipped to this Freq when TG turned on	Max Freq (can't tune above) while TG on
T03	9 kHz	3.0 GHz	3.08 GHz
T06	9 kHz	6.0 GHz	6.05 GHz

Tracking Generator Frequency Limits(CXA-m only)

Tracking Generator Option	Min Freq (clips to this freq when turn TG on and can’t tune below while TG on)	If above this Freq, Stop Freq clipped to this Freq when TG turned on	Max Freq (can't tune above) while TG on
T03	2 MHz	3.08 GHz	3.08 GHz
T07	2 MHz	7.575 GHz	7.575 GHz
T13	2 MHz	13.8 GHz	13.8 GHz
T26	2 MHz	26.55 GHz	26.55 GHz

VXT Models with Radio Heads/CIU Frequency Range

The following table shows the Center Frequency Presets and Range for VXT modes with Radio Heads/CIU.

Products with Radio Heads/CIU	Preset	Start frequency	Stop frequency
M9421A + CIU	6 GHz	5.9 GHz	12 GHz
M9410A + CIU	6 GHz	5.9 GHz	12 GHz
M9410A + CIU + RRH	25 GHz	24.25 GHz	43.5 GHz

RF Center Freq

Specifies the RF Center Frequency. This command sets the Center Frequency to be used when the RF input is selected, even if the RF input is not the input that is selected at the time the command is sent. Note that "Center Frequency" on page 223 in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:RF:CENTer <freq>` `[:SENSe]:FREQuency:RF:CENTer?`
Example	`:FREQ:RF:CENT 30 MHz` `:FREQ:RF:CENT?`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So, the value is independent in each mode and common across all the measurements in the mode
Dependencies	If the electronic/soft attenuator is enabled, any attempt to set Center Frequency such that the Stop Frequency would be >3.6 GHz fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a “-221, Settings conflict” warning
Preset	See "Center Frequency Presets" on page 226 above
State Saved	Saved in instrument state
Min	-79.999995 MHz
Max	See table above. Basically, instrument maximum frequency - 5 Hz If the knob or step keys are being used, also depends on the value of Span

Ext Mix Center Freq

Specifies the External Mixer Center Frequency. This command sets the Center Frequency to be used when the External Mixer is selected, even if the External Mixer input is not the input that is selected at the time the command is sent. Note that "Center Frequency" on page 223 in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:EMIXer:CENTer <freq>` `[:SENSe]:FREQuency:EMIXer:CENTer?`
Example	`:FREQ:EMIX:CENT 60 GHz`

	`:FREQ:EMIX:CENT?`
Notes	This command is the same in all Modes, but the parameter is Measurement Global. So, the value is independent in each mode and common across all the measurements in the mode
Couplings	When returning to External Mixing after having been switched to one of the other inputs (e.g., RF), you will come back into the settings that you had when you left External Mixing. So, you will come back to the band you were in with the Center Frequency that you had. However, Span is not an input-dependent parameter, therefore you will bring the span over from the other input. Therefore, the instrument comes back with the span from the previous input, limited as necessary by the current mixer setup
Preset	When a Mode Preset is performed while in External Mixing, the Start frequency of the current Mode is set to the nominal Min Freq of the lowest harmonic range in the Harmonic Table for the current mixer setup. Similarly, the Stop frequency of the current Mode is set to the nominal Max Freq of the highest harmonic range in the Harmonic Table. The Center Freq thus presets to the point arithmetically equidistant from these two frequencies Note that, if the current measurement has a limited Span available to it, and cannot achieve the Span shown in the table (Span=Stop Freq – Start Freq), the instrument uses the maximum Span the measurement allows, and still sets the Center Freq to the midpoint of the Start and Stop Freq values in the Harmonic Table When Restore Input/Output Defaults is performed, the mixer presets to the 11970A, whose Start and Stop frequencies are 26.5 and 40 GHz respectively. The center of these two frequencies is 33.25 GHz Therefore, after a Restore Input/Output Defaults, if you go into External Mixing and do a Mode Preset while in the Spectrum Analyzer Mode, the resulting Center Freq is 33.25 GHz
State Saved	Yes
Min	The minimum frequency in the currently selected mixer band + 5 Hz If the knob or step keys are being used, also depends on Span
Max	The maximum frequency in the currently selected mixer band - 5 Hz If the knob or step keys are being used, also depends on Span

I/Q Center Freq

Specifies the I/Q Center Frequency. This command sets the Center Frequency to be used when the I/Q input is selected, even if the I/Q input is not the input that is selected at the time the command is sent. Note that "Center Frequency" on page 223 in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:IQ:CENTer <freq>` `[:SENSe]:FREQuency:IQ:CENTer?`
Example	`:FREQ:IQ:CENT 30 MHz`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So, the value is independent in each mode and common across all the measurements in the mode
Preset	0 Hz
State Saved	Saved in instrument state
Min	-40.049995 MHz
Max	40.049995 MHz

Span

Changes the displayed frequency range symmetrically about the center frequency. While adjusting the Span, the Center Frequency is held constant, this means that both Start Frequency and Stop Frequency will change.

If the Span is set to a value greater than the maximum allowable span of the instrument, an error message is generated indicating the data is out of range and was clipped to upper limit.

See "Span Presets" on page 230

Remote Command	`[:SENSe]:MONitor:FREQuency:SPAN <freq>` `[:SENSe]:MONitor:FREQuency:SPAN?`
Example	`:MON:FREQ:SPAN 10 MHz` `:MON:FREQ:SPAN?`
Dependencies	If the electrical attenuator is enabled, any attempt to set Span such that the Stop Frequency would be >3.6 GHz results in an error In instruments with an RF Preselector, such as MXE, you cannot sweep across the band break at 3.6 GHz while the RF Preselector is on in Continuous sweep, as there is a mechanical switch which bypasses the RF Preselector above 3.6 GHz
Couplings	Span affects RBW, sweeptime, FFT & Sweep choice (including FFT Width, Phase Noise Optimization and ADC Dither auto couplings) – Any value of the Center Frequency or Span that is within the frequency range of the instrument is allowed when the value is being set through the front panel numeric keypad or the SCPI command. The other parameter is forced to a different value if needed, to keep the Start and the Stop Frequencies within the instrument's frequency range – When using the knob or the step up/down keys or the UP|DOWN keywords in SCPI, the value that is being changed i.e., the Center Frequency or Span, is limited so that the other parameter is not forced to a new value
Preset	Depends on instrument maximum frequency, mode, measurement, and selected input See "Span Presets" on page 230
State Saved	Saved in instrument state
Min	10 Hz
Max	Depends on instrument maximum frequency, mode, measurement, and selected input; see "Span Presets" on page 230 If the knob or step keys are being used, depends on the value of the other three interdependent parameters Center Frequency, Start Frequency, Stop Frequency
Annunciation	Data out of range, value clipped to upper limit
Annotation	Span <value> appears on the first line of the annotation in the lower right corner of display

Span Presets

The following table provides the Max Span, for the various frequency options:

Freq Option	Max Span (can't set higher than this)
503 (all but CXA)	3.7 GHz
503, F03 (CXA, CXA-m)	3.08 GHz
507 (all but CXA)	7.1 GHz
507 (CXA, CXA-m)	7.575 GHz
508 (all but MXE)	8.5 GHz
508 (MXE)	8.5 GHz
513, F13	13.8 GHz
526 (all but CXA and MXE)	27.0 GHz
526 (MXE)	27.0 GHz
526, F26 (CXA, CXA-m)	26.55 GHz
544	44.5 GHz
550	52 GHz
M9415A-F06	6.27 GHz
M9415A-F08	8.27 GHz
M9415A-F12	12.57 GHz

Input 2:

Model	Max Span (can't set higher than this)
CXA opt C75	1.58 GHz
MXE	1.000025 GHz

Note that if you are in External Mixing, the maximum Span will be equal to the Maximum Stop Frequency – Minimum Start Frequency for the currently selected mixer.

Span Presets by Mode

Mode	Radio Std	Preset Value
WCDMA		10.0 MHz
PN		1.0 MHz
GSM/EDGE		1.0 MHz
WLAN	802.11a/b/g/n/ac/ax/be (20 MHz)	25 MHz
	802.11n/ac/ax/be (40MHz)	50 MHz
	802.11ac/ax/be (80MHz)	100 MHz
	802.11ac /ax/be (160MHz)	200 MHz
	802.11be (320MHz)	400 MHz
MSR		20 MHz
LTEAFDD, LTEATDD		20 MHz

Mode	Radio Std	Preset Value
5GNR		150 MHz
RTS		40 kHz
CQM		10 MHz

CF Step

Changes the step size for the center frequency and start and stop frequency functions. Once a step size has been selected and the center frequency function is active, the step keys (and the UP|DOWN parameters for Center Frequency from remote commands) change the center frequency by the step-size value. The step size function is useful for finding harmonics and sidebands beyond the current frequency span of the instrument.

Note that the start and stop frequencies also step by the CF Step value.

Remote Command	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement] <freq>`
	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement]?`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO?`

Example	`:FREQ:CENT:STEP 500 MHz`
	`:FREQ:CENT UP`
	increases the current center frequency value by 500 MHz
	`:FREQ:CENT:STEP?`
	`:FREQ:CENT:STEP:AUTO ON`
	`:FREQ:CENT:STEP:AUTO?`

Notes	Preset and Max values are dependent on Hardware Options
Dependencies	Not available in the MSR, LTEAFDD/LTEATDD, 5GNR and Channel Quality modes If the electronic/soft attenuator is enabled, any attempt to change the value of the center frequency >3.6 GHz by pressing the Up-arrow key, fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning
Couplings	When auto-coupled, the center frequency step size is set to 10% of the span
Preset	Auto `ON`
State Saved	Saved in instrument state
Min	– (the maximum frequency of the instrument). That is, 27 GHz max freq instrument has a CF step range of +/- 27 GHz. Note that this is the maximum frequency given the current settings of the instrument, so in External Mixing, for example, it is the maximum frequency of the current mixer band
Max	The maximum frequency of the instrument. That is, 27 GHz max freq instrument has a CF step range of

	+/- 27 GHz. Note that this is the maximum frequency given the current settings of the instrument, so in External Mixing, for example, it is the maximum frequency of the current mixer band
Status Bits/OPC dependencies	non-overlapped

3.2.7 Marker

Accesses a menu that enables you to select, set up and control the markers for the current measurement. If there are no active markers, **Marker** selects marker 1, sets it to Normal and places it at the center of the display. If the selected marker is Off, it is set to Normal and placed it at the center of the screen on the trace determined by the **Marker Trace** rules.

For more detailed information on the types of Markers and the interaction between Markers, see the Marker section of the Swept SA measurement.

3.2.7.1 Select Marker

Specifies the *selected marker*. The term “selected marker” is used throughout this document to specify which marker will be affected when you change marker settings, perform a Peak Search, etc.

This control appears above the menu panel, indicating that it applies to all controls in the Marker menu panels. Select Marker is blanked if you select a tab whose controls do *not* depend on the selected marker (for example, Counter).

On any menu tab for which Select Marker displays, the first control is always **Marker Frequency|Time**.

Notes	The selected marker is remembered even when not in the Marker menu and is used if a Search is done or a Band Function is turned on or for Signal Track or Continuous Peak
Preset	Marker 1
State Saved	The number of the selected marker is saved in instrument state
Annunciation	Appears in the marker results block label for **Normal** and **Delta** markers

3.2.7.2 Settings

The controls on this tab include the Marker active function and a radio button selection of the marker control mode (Normal, Delta, or Off) for the selected marker, as well as additional functions that help you use markers.

Marker Frequency

Sets the marker X Axis value in the current marker X Axis Scale unit. It has no effect if the control mode is **Off,** but is the SCPI equivalent of entering an X value if the control mode is **Normal** or **Delta**.

Remote Command	`:CALCulate:MONitor:MARKer[1]|2|...|12:X <freq>` `:CALCulate:MONitor:MARKer[1]|2|...|12:X?`
Example	`:CALC:MON:MARK3:X 0` `:CALC:MON:MARK3:X?`
Notes	If no suffix is sent, uses the fundamental units for the current marker X Axis Scale. If a suffix is sent that does not match the current marker X Axis Scale unit, an error "Invalid suffix" is generated The query returns the marker's absolute X Axis value if the control mode is **Normal**, or the offset from the marker's reference marker if the control mode is **Delta**. The query is returned in the fundamental units for the current marker X Axis scale: Hz for **Frequency** and Inverse Time, seconds for Period and Time
Preset	After a preset, all markers are turned OFF, so Marker X Axis Value query returns a not a number (NAN)
State Saved	Saved in instrument state
Min	-9.9E+37
Max	9.9E+37
Annotation	Mkr # <X value> and <Marker value> upper right on graph

Marker X Axis Position (Remote Command Only)

Sets the marker X Axis Scale position in trace points. This setting has no effect if the control mode is Off, but is the SCPI equivalent of entering a value if the control mode is Normal or Delta - except in trace points rather than X Axis Scale units. The entered value is immediately translated into the current X Axis Scale units for setting the value of the marker.

Remote Command	`:CALCulate:MONitor:MARKer[1]|2|...|12:X:POSition <real>` `:CALCulate:MONitor:MARKer[1]|2|...|12:X:POSition?`
Example	`:CALC:MON:MARK:X:POS 0` `:CALC:MON:MARK:X:POS?`
Notes	The query returns the marker's absolute X Axis value in trace points if the control mode is **Normal**, or the offset from the marker's reference marker in trace points if the control mode is **Delta**. The value is returned as a real number, not an integer, corresponding to the translation from X Axis Scale units to trace points . When a Marker is turned on, it is placed center of the screen on the trace. Therefore, the default value depends on instrument condition. If the marker is Off the response is not a number
Preset	After a preset, all markers are turned `OFF`, so Marker X Axis Value query returns a not a number (`NAN`)
State Saved	Saved in instrument state
Min	-9.9E+37
Max	9.9E+37

Marker Y Axis Value (Remote Command only)

Returns the marker Y Axis value in the current marker Y Axis unit.

Remote Command	`:CALCulate:MONitor:MARKer[1]|2|...|12:Y?`

Example	:CALC:MON:MARK11:Y?
Notes	The query returns the marker Y-axis result if the control mode is **Normal** or **Delta.** If the marker is **Off** the response is Not A Number
Preset	Result dependent on Markers setup and signal source
State Saved	No
Backwards Compatibility SCPI	:CALCulate:MONitor:MARKer[1]|2|...|12:FUNCtion:RESult?

Marker Mode

Sets the marker control mode to **Normal** (POSition), **Delta**, or **Off**. All interactions and dependencies detailed under the control description are enforced when the remote command is sent. If the selected marker is Off, pressing Marker sets it to Normal and places it at the center of the screen on the trace determined by the **Marker Trace** rules. At the same time, **Marker X Axis Value** appears on the Active Function area.

The default active function is the active function for the currently selected marker control mode. If the current control mode is **Off**, there is no active function and the active function is turned off.

Remote Command	:CALCulate:MONitor:MARKer[1]|2|...|12:MODE POSition | DELTa | OFF :CALCulate:MONitor:MARKer[1]|2|...|12:MODE?
Example	:CALC:MON:MARK:MODE POS :CALC:MON:MARK:MODE?
Preset	OFF
State Saved	Saved in instrument state
Range	POSition|DELTa|OFF
Annotation	Mkr # <X value> and <Marker value> upper right on graph

Backward Compatibility SCPI Commands

Sets or queries the state of a marker. Setting a marker that is OFF to ON (1) puts it in **Normal** mode and places it at the center of the screen.

Remote Command	:CALCulate:MONitor:MARKer[1]|2|...|12:STATe OFF | ON | 0 | 1 :CALCulate:MONitor:MARKer[1]|2|...|12:STATe?
Example	:CALC:MON:MARK3:STAT ON :CALC:MON:MARK3:STAT?
Preset	OFF

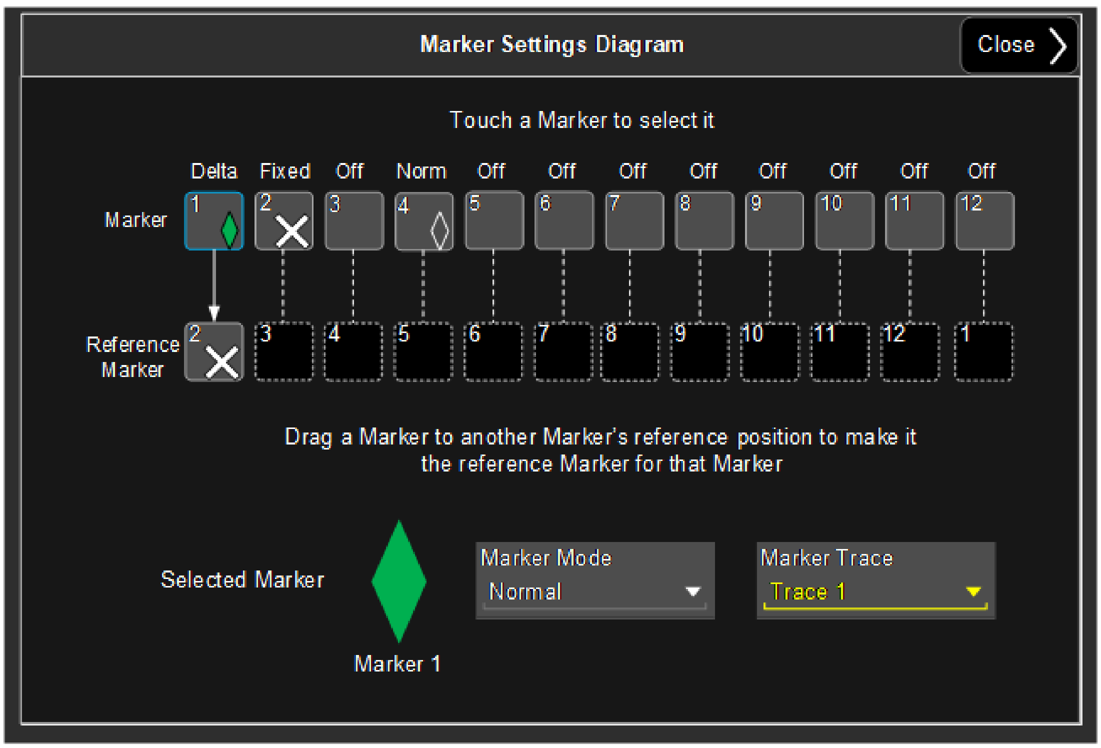
State Saved	Saved in instrument state
Range	OFF | ON

Delta Marker (Reset Delta)

Pressing this button has exactly the same effect as selecting the **Delta** selection in "Marker Mode" on page 235. The selected marker becomes a Delta Marker. If the selected marker is already a Delta marker, the reference marker is moved to the current position of the selected marker, thus resetting the Delta to zero.

Marker Settings Diagram

Lets you configure the Marker system using a visual utility.



All Markers Off

Turns off all markers.

Remote Command	:CALCulate:MONitor:MARKer:AOFF
Example	:CALC:MON:MARK:AOFF

Couple Markers

When this function is ON, moving any marker causes an equal X Axis movement of every other marker that is not Off. By "equal X Axis movement" we mean that we preserve the difference between each marker's X Axis value (in the fundamental x-axis units of the trace that marker is on) and the X Axis value of the marker being moved (in the same fundamental x-axis units).

This may result in markers going off screen.

Remote Command	`:CALCulate:MONitor:MARKer:COUPle[:STATe] ON | OFF | 1 | 0` `:CALCulate:MONitor:MARKer:COUPle[:STATe]?`
Example	`:CALC:MON:MARK:COUP ON` `:CALC:MON:MARK:COUP?`
Preset	`OFF` Presets on Mode Preset and All Markers Off
State Saved	Saved in instrument state

3.2.7.3 Peak Search

The controls on this tab allow you to move the marker to selected peaks of the signal, giving you enormous analysis capabilities, particularly when combined with the Delta Marker function.

NOTE Pressing the **Peak Search** hardkey automatically moves you to the **Peak Search** page of the **Marker** menu and performs a Peak Search.

Pressing the **Peak Search** tab once you are already *in* the **Marker** menu does *not* perform a Peak Search.

Marker Frequency

This is the fundamental control that you use to move a marker around on the trace. This is the same as "Marker Frequency" on page 233 on the **Settings** tab.

Peak Search

Moves the selected marker to the trace point which has the maximum y-axis value for that marker's trace.

NOTE Pressing the **Peak Search** hardkey automatically moves you to the **Peak Search** page of the **Marker** menu and performs a Peak Search.

If the selected marker was off, then it is turned on as a normal marker, and a peak search is performed.

Remote Command	`:CALCulate:MONitor:MARKer[1]|2|...|12:MAXimum`

Example	`:CALC:MON:MARK2:MAX`
	`:SYST:ERR?`
	can be used to query the errors to determine if a peak is found. If a search is unsuccessful, then the message "Execution error; No peak found" (-200) will be returned

Notes	Sending this command selects the subopcoded marker

Next Peak

Moves the selected marker to the peak that is next lower in amplitude than the current marker value. If there is no valid peak lower than the current marker value, an "Execution error; No peak found" message is generated and the marker is not moved.

If the selected marker was off, then it is turned on as a normal marker and a peak search is performed.

Remote Command	`:CALCulate:MONitor:MARKer[1]|2|...|12:MAXimum:NEXT`
Example	`:CALC:MON:MARK2:MAX:NEXT` selects marker 2 and moves it to the peak that is next lower in amplitude than the current marker value
Notes	Sending this command selects the subopcoded marker
State Saved	Not part of saved state

Marker Delta

Pressing this control has exactly the same effect as selecting the **Delta** selection in "Marker Mode" on page 235 on the **Settings** tab. The selected marker becomes a Delta Marker. If the selected marker is already a Delta marker, the reference marker is moved to the current position of the selected marker, thus resetting the Delta to zero.

The control is duplicated here to allow you to conveniently perform a peak search and change the marker's control mode to Delta without having to access two separate menus.

3.2.7.4 Properties

The controls on this tab are used to set certain properties of the selected marker.

Marker Frequency

This is the fundamental control that you use to move a marker around on the trace. This is the same as "Marker Frequency" on page 233 on the **Settings** tab.

Relative To

Selects the marker to which the selected marker is relative (its reference marker).

Every marker has another marker to which it is relative. This marker is referred to as the “reference marker” for that marker. This attribute is set by the **Marker, Properties, Relative To** key. The marker must be a **Delta** marker to make this attribute relevant. If it is a **Delta** marker, the reference marker determines how the marker is controlled and how its value is displayed. A marker cannot be relative to itself.

Remote Command	`:CALCulate:MONitor:MARKer[1]|2|...|12:REFerence <integer>` `:CALCulate:MONitor:MARKer[1]|2|...|12:REFerence?`
Example	`:CALC:MON:MARK2:REF 1` `:CALC:MON:MARK2:REF?`
Notes	This command causes the marker specified with the subopcode to become selected Range (for SCPI command): 1 to 12. If the range is exceeded the value is clipped A marker cannot be relative to itself so that choice is not available, and if sent from SCPI generates error -221: “Settings conflict; marker cannot be relative to itself” When queried a single value is returned (the specified marker numbers relative marker)
Couplings	The act of specifying the selected marker’s reference marker makes the selected marker a Delta marker If the reference marker is off it is turned on in **Normal** mode at the delta marker location
Preset	The preset default “Relative To” marker (reference marker) is the next higher numbered marker (current marker +1). For example, if marker 2 is selected, then it’s default reference marker is marker 3. The exception is marker 12, which has a default reference of marker 1 Set to the defaults by using **Restore Mode Defaults**. This is not reset by **Marker Off**, **All Markers Off**, or **Preset**
State Saved	Saved in instrument state. Not affected by Marker Off and hence not affected by Preset or power cycle
Min	1
Max	12
Annunciation	Appears in the marker label of a **Delta** marker

Marker Trace

Selects the trace on which you want your marker placed. A marker is associated with one and only one trace. This trace is used to determine the placement, result, and X-Axis Scale of the marker. All markers have an associated trace; it is from that trace that they determine their attributes and behaviors, and it is to that trace that they go when they become Normal markers.

Specifying a Marker Trace manually or with this command associates the marker with the specified trace. If the marker is not OFF, it moves the marker from the trace it was on to the new trace. If the marker is OFF, it stays off but is now associated with the specified trace.

The query returns the number of the trace on which the marker is currently placed.

Remote Command	`:CALCulate:MONitor:MARKer[1]|2|...|12:TRACe 1 | 2 | 3` `:CALCulate:MONitor:MARKer[1]|2|...|12:TRACe?`
Example	`:CALC:MON:MARK:TRAC 1` `:CALC:MON:MARK:TRAC?`
Notes	A marker may be placed on a blanked and/or inactive trace, even though the trace is not visible and/or updating An application may register a trace name to be displayed on the control instead of a trace number
Couplings	The state of Marker Trace is not affected by the "Auto Couple" on page 1718 key Sending the remote command causes the addressed marker to become selected.
Preset	1
State Saved	Saved in instrument state.
Min	1
Max	3

Marker Settings Diagram

Lets you configure the Marker system using a visual utility. This is the same as the "Marker Settings Diagram" on page 236 control on the **Settings** tab.

3.2.7.5 Marker Function

The controls on this tab allow you to control the Marker Functions of the instrument. Marker Functions perform post-processing operations on marker data.

The **Marker Function** menu controls which marker functions are turned on and allows you to adjust the setup parameters for each function. These parameters include the following, but only one parameter can be assigned to a given marker:

- Marker Noise
- Band Power
- Band Density
- Off

Marker Frequency

This is the fundamental control that you use to move a marker around on the trace. This is the same as "Marker Frequency" on page 233 on the **Settings** tab.

Marker Function

Sets the marker control function type to one of the following:

NOISe	Marker Noise
BPOWer	Band Power
BDENsity	Band Density
OFF	Marker Function Off

Remote Command	:CALCulate:MONitor:MARKer[1]|2|...|12:FUNCtion NOISe | BPOWer | BDENsity | OFF :CALCulate:MONitor:MARKer[1]|2|...|12:FUNCtion?
Example	:CALC:MON:MARK:FUNC NOIS :CALC:MON:MARK:FUNC?
Preset	OFF
State Saved	Yes
Range	NOISe|BPOWer|BDENsity|OFF
Annotation	Mkr # <X value> and <Marker value> upper right on graph

Band Span

Sets the width of the frequency span for the selected marker.

Remote Command	:CALCulate:MONitor:MARKer[1]|2|...|12:FUNCtion:BAND:SPAN <freq> :CALCulate:MONitor:MARKer[1]|2|...|12:FUNCtion:BAND:SPAN?
Example	:CALC:MON:MARK12:FUNC:BAND:SPAN 20 MHz :CALC:MON:MARK12:FUNC:BAND:SPAN?
Couplings	Changing the Band Span necessarily changes the Band Left and Band Right values
Preset	Depends on X axis range of selected Trace 10% of Span
State Saved	Yes
Min	-9.9E+37 0
Max	9.9E+37

	26.5GHz

Band Left

Sets the left edge frequency or time value for the band of the selected marker.

Remote Command	:CALCulate:MONitor:MARKer[1]|2|...|12:FUNCtion:BAND:LEFT <freq> :CALCulate:MONitor:MARKer[1]|2|...|12:FUNCtion:BAND:LEFT?
Example	:CALC:MON:MARK12:FUNC:BAND:LEFT 20 GHz :CALC:MON:MARK12:FUNC:BAND:LEFT?
Couplings	Changing the Band Left necessarily changes the Band Span value
Preset	Depends on X axis range of selected Trace
State Saved	Yes
Min	-9.9E+37
Max	9.9E+37

Band Right

Sets the right edge frequency or time value for the band of the selected marker.

Remote Command	:CALCulate:MONitor:MARKer[1]|2|...|12:FUNCtion:BAND:RIGHt <freq> :CALCulate:MONitor:MARKer[1]|2|...|12:FUNCtion:BAND:RIGHt?
Example	:CALC:MON:MARK12:FUNC:BAND:RIGH 20 GHz :CALC:MON:MARK12:FUNC:BAND:RIGH?
Couplings	Changing the Band Right necessarily changes the Band Span value
Preset	Depends on X axis range of selected Trace
State Saved	Yes
Min	-9.9E+37
Max	9.9E+37

3.2.8 Meas Setup

This menu panel contains functions for setting up the measurement parameters and also contains functions for setting up parameters global to all measurements in the Mode.

3.2.8.1 Settings

Contains frequently used Meas Setup functions to which you will want the fastest access.

Avg|Hold Num

Specifies the number of measurement averages used when calculating the measurement result. The average is displayed at the end of each sweep.

After the specified number of average counts, the averaging mode (terminal control) setting determines the averaging action.

Remote Command	`[:SENSe]:MONitor:AVERage:COUNt <integer>` `[:SENSe]:MONitor:AVERage:COUNt?`
Example	`:MON:AVER:COUN 25` `:MON:AVER:COUN?`
Preset	10
State Saved	Yes
Min/Max	1/1000
Annotation	The average count is displayed in the measurement bar on the front panel display. The annotation appears in the format n/N where n is the current average and N is the average count

Averaging On/Off

Turns averaging on or off.

Remote Command	`[:SENSe]:MONitor:AVERage[:STATe] OFF | ON | 0 | 1` `[:SENSe]:MONitor:AVERage[:STATe]?`
Example	`:MON:AVER ON` `:MON:AVER?`
Preset	`OFF`
State Saved	Yes
Range	`OFF|ON`

Average Mode

Toggles the average mode between exponential (Exp) and Repeat.

– `EXPonential`- continues measurement averaging, using the specified number of averages to compute each averaged value. The average is displayed at the end of each sweep

– REPeat- causes the measurement to reset the average counter each time the specified number of averages is reached

Remote Command	[:SENSe]:MONitor:AVERage:TCONtrol EXPonential | REPeat [:SENSe]:MONitor:AVERage:TCONtrol?
Example	:MON:AVER:TCON EXP :MON:AVER:TCON?
Preset	EXPonential
State Saved	Yes
Range	EXPonential|REPeat

Spur Avoidance

Because the VXT models M9410A/11A/15A are direct-conversion (zero-IF) receivers, feedthrough leakage from the local oscillator appears as a spurious signal (spur) at the center frequency. The **Spur Avoidance** function is provided to eliminate this spur, at the expense of some measurement speed. For Spur Avoidance, the instrument uses a software algorithm to remove this spur from the displayed measurement data.

Some measurements allow you to turn off **Spur Avoidance**, but in this measurement it is always enabled. Therefore, in this measurement the Spur Avoidance switch is unavailable (grayed out) and set to Enabled.

Furthermore, if you press the grayed-out switch, this popup message appears:

`Always enabled in this measurement. See manual for details`

Remote Command	[:SENSe]:MONitor:SAVoid[:STATe]?
Example	:MON:SAV? Always returns ON
Dependencies	This control only appears in VXT models M9410A/11A/15A
Preset	ON
State Saved	Saved in instrument state
Range	ON

Meas Setup Summary Table

Lets you view and access many of the parameters in the Meas Setup menus on one screen.

Auto Couple

Immediately puts all Auto/Man functions into Auto. The **Auto Couple** action is confined to the current measurement only. It does not affect other measurements in the mode.

In the Auto state, Auto/Man functions are said to be “coupled”, meaning their values change as you make changes to other values in the measurement. This helps ensure accurate measurements and optimum dynamic range. Auto Couple is an immediate action function, and when it is executed, all the Auto/Man controls for the current measurement are set to Auto, and all measurement settings coupled to the Auto/Man parameters are automatically set to their optimal value.

For further details of measurement-specific settings (if any), see "Measurement-Specific Details" on page 246 below.

Remote Command	`:COUPle ALL`
Example	`:COUP ALL`
Backwards Compatibility SCPI	`:COUPLE ALL | NONE`
Backwards Compatibility Notes	`:COUP:NONE` puts all Auto/Man parameters in manual mode, decoupling all the coupled instrument parameters. It is retained for backwards compatibility and is *not* recommended for making measurements or new designs

All Auto/Man parameter couplings in the measurement are set to Auto. This includes couplings that may be unavailable or grayed-out due to the current state. For example, in the Swept SA measurement, there is no Auto/Man coupling for RBW while in Zero Span. Nonetheless, if **Auto Couple** were executed while in Zero Span it would set RBW to Auto "behind the scenes" so that, on exit from Zero Span, it would be in Auto.

Any Auto/Man selection specific (local) to the other measurements in the current Mode will not be affected by **Auto Couple**. Any functions that are *not* coupled with other instrument parameters, such as ranging or leveling variables, such as "AutoRange" or "AutoScale", will not be affected.

Executing the **Auto Couple** command generates the informational message, "All Auto/Man functions have been set to Auto".

Each parameter, upon being set to Auto, selects and sets the appropriate auto-coupled value based on that parameter’s coupling rules. The Dependency Resolver orchestrates the couplings for parameters that are dependent on one or more other parameters. The coupling and dependency rules for each parameter are defined in the chapter describing that parameter.

Executing the **Auto Couple** command *does not* affect markers, marker functions, trace or display attributes, or any other instrument setting other than those specifically mentioned above.

Measurement-Specific Details

TOI

Parameters affected by Auto Couple are:

- Center Frequency Step
- Resolution Bandwidth
- Span/RBW Ratio
- Sweep Time
- Video BandwidthVBW/RBW ratio
- Upper and Lower Tone (set to Sense
-)Zero span measurement Resolution Bandwidth
- Zero span measurement Dwell Time

Harmonics

For Harmonics, these parameters are:

- Resolution Bandwidth
- Fundamental Frequency
- Dwell Time
- Range Table Resolution Bandwidths
- Range Table Dwell Times

Meas Preset

Restores all the measurement parameters to their default values.

Remote Command	`:CONFigure:MONitor`
Example	`:CONF:MON`

3.2.8.2 Radio

The Radio tab contains controls to select the Radio Device, and enable or disable HSPA/HSPA+ options.

Radio Device

Allows you to specify the device to be used.

Remote Command	`[:SENSe]:RADio:STANdard:DEVice BTS | MS` `[:SENSe]:RADio:STANdard:DEVice?`
Example	`:RAD:STAN:DEV MS` `:RAD:STAN:DEV?`
Preset	BTS
State Saved	Saved in instrument state.
Range	BTS | MS
Backwards Compatibility SCPI	`[:SENSe]:RADio:DEVice`

HSPA Enable

Allows you to turn on or off the HSDPA/HSUPA option enable. This selection is necessary because some of the auto detection functions that expect an HSPA signal are less tolerant when the signal is noisy or distorted. When the HSPA signal is not expected, turn HSPA Enable off.

Remote Command	`[:SENSe]:RADio:CONFigure:HSDPa[:STATe] 0 | 1 | OFF | ON` `[:SENSe]:RADio:CONFigure:HSDPa[:STATe]?`
Example	`:RAD:CONF:HSDP 0` `:RAD:CONF:HSDP?`
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

HSPA+ Enable

Allows you to turn on or off the HSPA+ option enable. This selection is necessary because some of the auto detection functions that expect an HSPA+ signal are less tolerant when the signal is noisy or distorted. When the HSPA+ signal is not expected, turn HSPA+ Enable off.

Remote Command	`[:SENSe]:RADio:CONFigure:EHSPa[:STATe] OFF | ON | 0 | 1` `[:SENSe]:RADio:CONFigure:EHSPa[:STATe]?`

Example	`:RAD:CONF:EHSP 0` `:RAD:CONF:EHSP?`
Notes	When HSPA enable is OFF, HSPA+ function is disabled too.
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

3.2.8.3 Advanced

Contains controls for setting advanced function s of the instrument.

This tab does not appear in EXM or VXT.

Noise Floor Extension

When this function is `ON`, the expected noise power of the instrument (derived from a factory calibration) is subtracted from the trace data. This will usually reduce the apparent noise level by about 10 dB in low band, and 8 dB in high band (>~3.6 GHz).

Noise Floor Extension works with any RBW, VBW, detector, any setting of Average Type, any amount of trace averaging, and any signal type. It is ineffective when the trace is not smoothed (smoothing processes include narrow VBWs, trace averaging, and long sweep times with the detector set to Average or Peak). It works best with extreme amounts of smoothing, and with the average detector, with the Average Type set to Power.

NOTE **Noise Floor Extensions has no effect unless the RF Input is selected, therefore it does nothing when External Mixing is selected.**

In those cases where the cancellation is ineffective, it nonetheless has no undesirable side-effects. There is no significant speed impact to having Noise Floor Extension on.

The best accuracy is achieved when substantial smoothing occurs in each point before trace averaging. Thus, when using the average detector, results are better with long sweep times and fewer trace averages. When using the sample detector, the VBW filter should be set narrow with less trace averaging, instead of a wide VBW filter with more trace averaging.

See "More Information" on page 249.

Remote Command	`[:SENSe]:CORRection:NOISe:FLOor ON | OFF | 1 | 0` `[:SENSe]:CORRection:NOISe:FLOor?`
Example	`:CORR:NOIS:FLO ON`

Dependencies	This control only appears in instruments with the NFE or NF2 license installed. In all others, the control does not appear, however the SCPI command will be accepted without error (but will have no effect)
Couplings	When NFE is enabled in any mode manually, a prompt will be displayed reminding you to perform the Characterize Noise Floor operation if it is needed. If NFE is enabled through SCPI and a Characterize Noise Floor operation is needed, an error will be entered in the system error queue
Preset	Unaffected by Mode Preset. Turned off by Restore Mode Defaults
State Saved	No

More Information

The instrument is characterized in the factory (or during a field calibration) with a model of the noise, referred to the input mixer, versus frequency in each band and path combination. Bands are 0 (low band) and 1 through 4 (high band) in a 26.5 GHz instrument, for example. Paths include normal paths, preamp paths, the electronic attenuator, etc.

In most band/path combinations, the noise can be well characterized based on just two parameters and the instrument frequency response before compensation for frequency-dependent losses.

After the noise density at the input mixer is estimated, the effects of the input attenuator, RBW, detector, etc. are computed to get the estimated input-port-referred noise level.

In the simplest case, the measured power (signal plus analyzer noise) in each display point (bucket) is compensated by subtracting the estimated noise power, leaving just the signal power. This is the operation when the detector is Average and the Average Type is set to Power.

In other cases, operation is often not quite as good but still highly effective. With peak detection, the noise floor is estimated based on the RBW and the duration of the bucket using the same equations used in the noise marker function. The voltage of the noise is subtracted from the voltage of the observed signal-plus-noise measurement to compute the estimated signal voltage. The peak detector is one example of processing that varies with detector to give good estimates of the signal level without the analyzer noise.

For best operation, the average detector and the power scale are recommended, as already stated. Peak detection for pulsed-RF can still give excellent effectiveness. FFT analysis does not work well, and does not do NFE well, with pulsed-RF signals, so this combination is not recommended. Negative peak detection is not very useful, either. Sample detection works well, but is never better than the average detector because it doesn’t smooth as well. The Normal detector is a combination of peak and negative peak behaviors, and works about as well as these.

For best operation, extreme smoothing is desirable, as already stated. Using narrow VBWs works well, but using very long bucket durations and the average detector works best. Reducing the number of trace points will make the buckets longer.

For best operation, the power scale (Average Type = Power) is optimum. When making CW measurements in the presence of noise without NFE, averaging on the decibel scale has the advantage of reducing the effect of noise. When using NFE, the NFE does an even better job than using the log scale ever could. Using NFE with the log scale is not synergistic, though; NFE with the power scale works a little better than NFE with log averaging type.

The results from NFE with internal preamp can often be lower than the theoretical noise in a signal source at room temperature, a noise density of -174 dBm/Hz. This is expected and useful behavior, because NFE is designed to report the amount of input signal that is in excess of the thermal noise, not the amount that includes the thermal noise. This can be a useful behavior because thermal noise often interferes with what you want to measure, instead of being part of what you want to measure. Note that NFE is not adequately accurate to always be able to read below kTB.

On instruments with the NF2 license installed, the calibrated Noise Floor used by Noise Floor Extensions should be refreshed periodically. Keysight recommends that the **Characterize Noise Floor** operation be performed after the first 500 hours of operation, and once every calendar year. The key to perform this is located in the **System, Alignments, Advanced** menu. If you have not done this yourself at the recommended interval, then when you turn on Noise Floor Extensions, the instrument will prompt you to do so with a dialog that says:

This action will take several minutes to perform. Please disconnect all cables from the RF input and press Enter to proceed. Press ESC to cancel, or Postpone to postpone for a week

If you Cancel, you will be prompted again the next time you turn NFE on. If you postpone, you will be prompted again after a week passes and you then turn NFE on.

Conversion

Access a menu of functions that enable you to control the frequency conversion type for the current measurement. The following choices are available:

Auto	`AUTO`	Auto optimizes demodulation quality by selecting single conversion when available. Default value
Single High Side	`SHSide`	Single downconversion with the LO frequency above the receiver frequency. Not image protected, and available only above 400 MHz or at all frequencies under specific condition
Single Low Side	`SLSide`	Single downconversion with the LO frequency below the receiver frequency. Not image protected, and available only above 1.1 GHz
Image Protect	`IPRotect`	Double downconversion with pre-selection filtering. Available at all frequencies

Remote Command	`[:SENSe]:MONitor:CONversion:TYPE AUTO | SHSide | SLSide | IPRotect` `[:SENSe]:MONitor:CONversion:TYPE?`

Example	:MON:CON:TYPE AUTO :MON:CON:TYPE?
Dependencies	This control only appears in the M9391A
Couplings	The availabilities of SingleHighSide and SingleLowSide depend on the current Sweep Parameters such as Center Freq, Span, Res BW and Points
Preset	AUTO
State Saved	Yes
Range	AUTO|SHSide|SLSide|IPRotect

Phase Noise Optimization

Access a menu of functions that enable you to control the phase noise optimization for the current measurement. The following choices are available:

Normal	NORmal	Sets the Synthesizer's Phase Lock Loop to the Normal setting (Best Close-In)
Best Wide Offset	BWOffset	Sets the Synthesizer's Phase Lock Loop for narrow bandwidth to improve ORFS and EVM measurements for wide modulation

Remote Command	[:SENSe]:MONitor:PNOise:OPTion NORmal | BWOffset [:SENSe]:MONitor:PNOise:OPTion?
Example	:MON:PNO:OPT NOR :MON:PNO:OPT?
Dependencies	This control only appears in the M9391A
Preset	NORmal
State Saved	Yes
Range	NORmal|BWOffset

3.2.8.4 Global

The controls in this menu apply to all Modes in the instrument.

Some controls (for example, **Global Center Freq**) allow you to switch certain Meas Global parameters to a Mode Global state. These switches apply to all Modes that support global settings. For example, no matter what Mode you are in when you set **Global Center Freq** to ON, it applies to all Modes that support Global Settings.

Other controls (for example, **Extend Low Band**) are actually set in this menu, but apply to all Modes.

Global Center Freq

The software maintains a Mode Global value called **Global Center Freq**.

When **Global Center Freq** is switched ON, the current Mode’s center frequency is copied into the **Global Center Frequency**, and from then on all Modes that support global settings use the **Global Center Frequency**, so you can switch between any of these Modes and the Center Freq will remain unchanged.

Adjusting the Center Freq of any Mode that supports Global Settings, while **Global Center Freq** is ON, modifies the Global Center Frequency.

When **Global Center Freq** is switched OFF, the Center Freq of the current Mode is unchanged, but now the Center Freq of each Mode is once again independent.

When **Mode Preset** is pressed while **Global Center Freq** is ON, the Global Center Freq is preset to the preset Center Freq of the current Mode.

This function is reset to OFF when "Restore Defaults" on page 1737 (in this tab) is pressed, or when **System**, **Restore Defaults**, **All Modes** is pressed.

Remote Command	`:INSTrument:COUPle:FREQuency:CENTer ALL | NONE` `:INSTrument:COUPle:FREQuency:CENTer?`
Example	`:INST:COUP:FREQ:CENT ALL` `:INST:COUP:FREQ:CENT?`
Preset	Set to OFF on **Global** Settings, **Restore Defaults** and **System, Restore Defaults, All Modes**
Range	ALL|NONE

Preset	OFF
Backwards Compatibility SCPI	`:GLOBal:FREQuency:CENTer[:STATe] 1 | 0 | ON | OFF` `:GLOBal:FREQuency:CENTer[:STATe]?`

Global EMC Std

When this control is switched ON, the current Mode’s EMC Std is copied into the **Global EMC Std**, and from then on all Modes that support global settings use the Global EMC Std, so you can switch between any of these Modes and the EMC Std will remain unchanged.

Adjusting the EMC Std of any Mode that supports Global Settings, while Global EMC Std is ON, will modify the **Global EMC Std**.

When **Global EMC Std** is switched OFF, the EMC Std of the current Mode is unchanged, but now the EMC Std of each Mode is once again independent. When

Mode Preset is pressed while **Global EMC Std** is ON, the Global EMC Std is preset to the preset EMC Std of the current Mode.

This function is reset to OFF when "Restore Defaults" on page 1737 (in this tab) is pressed, or when **System, Restore Defaults, All Modes** is pressed.

Remote Command	`:INSTrument:COUPle:EMC:STANdard ALL | NONE` `:INSTrument:COUPle:EMC:STANdard?`
Example	`:INST:COUP:EMC:STAN ALL` `:INST:COUP:EMC:STAN?`
Dependencies	Only available if option EMC is installed
Preset	Set to OFF on **Global** Settings, **Restore Defaults** and **System, Restore Defaults, All Modes**
Range	ALL|NONE

Extend Low Band

The software maintains a Mode Global value called **Extend Low Band**.

Under the current sweep configuration crossing over two bands, when **Extend Low Band** is turned ON, the instrument checks whether one band can cover the whole sweep frequency range or not. If it can, then the instrument locks the band; otherwise, it does nothing (the band crossover occurs).

This function does *not* work when **Band Lock** under **System** > **Service** > **Lock Functions** is not -1 (no Band Lock). In that case, **Band Lock** takes priority over **Extend Low Band**.

This function is reset to OFF when "Restore Defaults" on page 1737 (in this tab) is pressed, or when **System**, **Restore Defaults**, **All Modes** is pressed.

This parameter is available for SA, RTSA, WCDMA, WIMAX OFDMA, LTEAFDD, LTEATDD Modes.

Remote Command	`:INSTrument:COUPle:FREQuency:BAND:EXTend 0 | 1 | ON | OFF` `:INSTrument:COUPle:FREQuency:BAND:EXTend?`
Example	`:INST:COUP:FREQ:BAND:EXT 1` `:INST:COUP:FREQ:BAND:EXT?`
Dependencies	Only applies to UXA, PXA, MXA and EXA
Preset	Set to OFF by **Global** Settings > **Restore Defaults** and **System** > **Restore Defaults** > **All Modes**
Range	ON|OFF

Restore Defaults

Resets all of the functions in the **Global** Settings menu to OFF. This also occurs when **System**, **Restore Defaults**, **All Modes** is pressed.

Remote Command	`:INSTrument:COUPle:DEFault`
Example	`:INST:COUP:DEF`
Backwards Compatibility SCPI	`:GLOBal:DEFault`

3.2.9 Sweep

Accesses controls that enable you configure and control the acquisition of data and the X-axis parameters of the instrument. These controls might include Sweep Time, Continuous/Single, Pause/Resume, X Scale, and number of Points.

3.2.9.1 Sweep/Control

Contains controls for the Sweep and Control functions of the instrument, such as Sweep Time and Continuous/Single.

Sweep Time

Controls the time the instrument takes to sweep the current frequency span in swept measurements, and displays the sweep time in swept measurements.

NOTE

In instruments without sweeping hardware, this control is grayed out. The value shown on this control is an estimate. It is the measurement's turnaround time, which is the sum of signal acquisition time, FFT time, and other overhead time, to complete the entire span of the measurement.

On non-sweeping hardware, the measurement does not provide a user-settable "Sweep Time" parameter, because such hardware does not sweep, so specifying "Sweep Time" is not straightforward.

Instead, we recommend using "Minimum Acquisition Time" on page 256, which provides better control.

If you need to specify the same "Sweep Time" as you would for sweeping hardware, you can send the SCPI command `[:SENSe]:MONitor:SWEep:TIME <time>`. The measurement emulates the "Sweep Time" effect, but again this emulation is not straightforward, and therefore the behavior is not specified.

When Sweep Time is in Auto, the instrument computes a time that will give accurate measurements based on other settings of the instrument, such as RBW and VBW.

You can choose a shorter sweep time to improve the measurement throughput (with some potential unspecified accuracy reduction), but the Meas Uncal indicator will come on if the sweep time you set is less than the calculated Auto Sweep time.

You can also select a longer sweep time, which can be useful (for example) for obtaining accurate insertion loss measurements on very narrowband filters.

NOTE Significantly faster sweep times are available with Option FS1.

NOTE The Meas Uncal (measurement uncalibrated) warning is given in the Status Bar at the bottom of the screen when the manual Sweep time entered is faster than the time computed by the instrument's Sweep time equations, that is, the Auto Sweep Time. The instrument's computed Sweep time will give accurate measurements; if you sweep faster than this, your measurements may be inaccurate. A Meas Uncal condition may be corrected by returning the Sweep Time to Auto; by entering a longer Sweep Time; or by choosing a wider RBW and/or VBW.

Remote Command	`[:SENSe]:MONitor:SWEep:TIME <time>`
	`[:SENSe]:MONitor:SWEep:TIME?`
	`[:SENSe]:MONitor:SWEep:TIME:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:MONitor:SWEep:TIME:AUTO?`

Example	`:MON:SWE:TIME 100 ms`
	`:MON:SWE:TIME?`
	`:MON:SWE:TIME:AUTO OFF`
	`:MON:SWE:TIME:AUTO?`

Dependencies	In certain instruments without sweeping hardware, such as VXT models M9420A/21A, the Sweep Time control is grayed out, and the Auto/Man toggle disappears. The read-only control shows estimated sweep time. In those instruments, the "Minimum Acquisition Time" on page 256 control is available
Couplings	Sweep time is coupled to RBW when Sweep Time is set to Auto; in this case the sweep time is changed as the RBW changes, to maintain amplitude calibration Sweep Time is also coupled to the Video Bandwidth (VBW). As the VBW is changed, the sweep time (when set to Auto) is changed to maintain amplitude calibration. This occurs because of common hardware between the two circuits
Preset	Automatically Calculated ON
State Saved	Saved in instrument state
Min	Typically: 1 ms
Max	In swept spans: 4000 s
Annotation	The sweep time is displayed in the lower-right corner of the screen. The number of points is displayed parenthetically, as Sweep 13.3 ms (1001 points) A "#" mark appears before "Sweep" in the annotation when it is switched from Auto to Manual coupling
Status Bits/OPC dependencies	Meas Uncal is Bit 0 in the STATus:QUEStionable:INTegrity:UNCalibrated register

Minimum Acquisition Time

Minimum Acquisition Time is available on non-sweeping platforms.

This parameter specifies the minimum acquisition time for each "chunk" of the measurement result. The instrument automatically divides Span into multiple chunks if needed. Therefore, the total signal acquisition time for the entire Span is ~ (>~Minimum Acquisition Time) * (The number of chunks).

When in Auto, this parameter's value is determined by other parameters, such as Span, RBW and VBW.

You can manually increase this parameter value from this Auto value.

If increased, the instrument acquires signal for the specified time duration for each chunk. It performs additional FFTs, and averages or peak-holds the FFT results for a chunk, depending on Detector settings.

Note that the actual acquisition time for each chunk may exceed the Minimum Acquisition Time value, in order to satisfy FFT time required by other parameters, and to perform an integral number of FFTs.

Remote Command	`[:SENSe]:MONitor:SWEep:ACQuisition:TIME <time>`
	`[:SENSe]:MONitor:SWEep:ACQuisition:TIME?`
	`[:SENSe]:MONitor:SWEep:ACQuisition:TIME:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:MONitor:SWEep:ACQuisition:TIME:AUTO?`

Example	`:MON:SWE:ACQ:TIME 500 ms`
	`:MON:SWE:ACQ:TIME?`
	`:MON:SWE:ACQ:TIME:AUTO OFF`

Dependencies	The "Minimum Acquisition Time" control is available only on non-sweeping hardware
Couplings	If Minimum Acquisition Time is set to Auto, it is coupled to Span, RBW, and VBW
Preset	Automatically calculated ON
State Saved	Saved in instrument state
Min	100 ns
Max	4.0 ks

Sweep Time Annotation (Remote Command Only)

Returns the Sweep Time Annotation value. This query is available only on non-sweeping hardware.

This value is also displayed in the result trace window.

The value returned is the turnaround time of each measurement cycle, in seconds. The turnaround time is the sum of the signal acquisition time, FFT time, and other overhead time, to complete the entire span of each measurement cycle.

Remote Command	`[:SENSe]:MONitor:SWEep:ETIMe?`
Example	`:MON:SWE:ETIMe?`
Dependencies	Available only on non-sweeping hardware
Preset	Automatically calculated

Sweep/Measure

Allows you to toggle between Continuous and Single sweep or measurement operation. The Single/Continuous state is Meas Global, so the setting affects *all* measurements.

The front-panel key **Single/Cont** performs exactly the same function

NOTE In the `WAVeform` measurement, this control only appears in the Meas Bar, and not in the **Sweep/Control** tab.

See "More Information" on page 257

Remote Command	`:INITiate:CONTinuous OFF | ON | 0 | 1` `:INITiate:CONTinuous?`

Example	`:INIT:CONT 0`
	`:INIT:CONT OFF`
	puts instrument into Single measurement operation
	`:INIT:CONT 1`
	`:INIT:CONT ON`
	puts instrument into Continuous measurement operation

Preset	ON Note that `:SYST:PRES` sets `:INIT:CONT` to `ON` but `*RST` sets `:INIT:CONT` to `OFF`
State Saved	Saved in instrument state
Annunciation	The **Single/Continuous** icon in the Meas Bar changes depending on the setting: – A line with an arrow is Single – A loop with an arrow is Continuous

More Information

With **Avg/Hold Num** (in the **Meas Setup** menu) set to **Off** or set to **On** with a value of 1, a sweep is taken after the trigger condition is met; and the instrument continues to take new sweeps after the current sweep has completed and the trigger condition is again met. However, with **Avg/Hold Num** set to On with a value >1, multiple sweeps (data acquisitions) are taken for the measurement. The trigger condition must be met prior to each sweep. The sweep is not stopped when the average count k equals the number N set for Avg/Hold Num is reached, but the number k stops incrementing. A measurement average usually applies to all traces, marker results, and numeric results, but sometimes only applies to the numeric results.

If the instrument is in Single measurement, pressing the **Cont/Single** toggle control does not change k and does not cause the sweep to be reset; the only action is to put the instrument into Continuous measurement operation.

If it is already in Continuous sweep:

– the `:INIT:CONT 1` command has no effect

– the `:INIT:CONT 0` command will place the instrument in Single Sweep but will have no effect on the current sequence until k = N, at which point the current sequence will stop and the instrument will go to the idle state.

See "Restart" on page 1738 control description for details on the `:INIT:IMM` (Restart) function.

If you are already in Single sweep, the `:INIT:CONT OFF` command has no effect.

If you are already in Single Sweep, then pressing the **Cont/Single** toggle control in the middle of a sweep does not restart the sweep or sequence. Similarly, pressing the **Cont/Single** toggle control does not restart the sweep or sequence if the sweep is not in the idle state (for example, if you are taking a very slow sweep, or the instrument is waiting for a trigger). Even though pressing the **Cont/Single** toggle control in the middle of a sweep does *not* restart the sweep, sending `:INIT:IMM` *does* reset it.

Restart

The **Restart** function restarts the current sweep, or measurement, or set of averaged/held sweeps or measurements. In measurements that support pausing, if you are Paused, pressing **Restart** performs a **Resume**.

The Restart function is accessed in several ways:

– Pressing the **Restart** key

– Sending the remote command `:INIT:IMM`

– Sending the remote command `:INIT:REST`

See "More Information" on page 259

Remote Command	`:INITiate[:IMMediate]` `:INITiate:RESTart`
Example	`:INIT:IMM`

	`:INIT:REST`
Notes	`:INIT:REST` and `:INIT:IMM` and the front-panel **Restart** key perform exactly the same function
Couplings	Resets average/hold count k For the first sweep, overwrites all active (update=on) traces with new current data For application modes, resets other parameters as required by the measurement
Status Bits/OPC dependencies	This is an Overlapped command The `:STATus:OPERation` register bits 0 through 8 are cleared The `:STATus:QUEStionable` register bit 9 (INTegrity sum) is cleared The `SWEEPING` bit is set The `MEASURING` bit is set
Backwards Compatibility Notes	For Spectrum Analysis mode in ESA and PSA, the **Restart** hardkey and the `:INIT:REST` command restart trace averages (displayed average count reset to 1) for a trace in **Clear Write**, but did not restart **Max Hold** and **Min Hold** In the X-Series, the **Restart** hardkey and the `:INIT:REST` command restart not only **Trace Average**, but **Max Hold** and **Min Hold** traces as well For wireless comms modes in ESA and PSA, the **Restart** hardkey and the `:INIT:REST` command restarted every measurement, including all traces and numeric results. There is no change to this operation

More Information

The **Restart** function first aborts the current sweep or measurement as quickly as possible. It then resets the sweep and trigger systems, sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is in the process of aligning when a Restart is executed, the alignment finishes before the restart function is performed.

Even when set for Single operation, multiple sweeps may be taken when **Restart** is pressed (for example, when averaging/holding is on). Thus when we say that Restart "restarts a measurement," depending on the current settings, we may mean:

- It restarts the current sweep
- It restarts the current measurement
- It restarts the current set of sweeps if any trace is in Trace Average, Max Hold or Min Hold
- It restarts the current set of measurements if Averaging, or Max Hold, or Min Hold is on for the measurement

With Average/Hold Number (in Meas Setup menu) set to 1, or Averaging off, or no trace in Trace Average or Hold, a single sweep is equivalent to a single measurement. A single sweep is taken after the trigger condition is met; and the instrument stops sweeping once that sweep has completed. However, with Average/Hold Number >1 and at least one trace set to Trace Average, Max Hold, or Min Hold (SA Measurement) or Averaging on (most other measurements), multiple sweeps/data acquisitions are taken for a single measurement. The trigger condition must be met prior to each sweep. The sweep is stopped when the average count k equals the number N set for Average/Hold Number. A measurement average usually applies to all traces, marker results, and numeric results, but sometimes only applies to the numeric results.

Once the full set of sweeps has been taken, the instrument will go to the idle state. To take one more sweep without resetting the average count, increment the average count by 1, by pressing the step up key while Average/Hold Number is the active function, or by sending the remote command `:CALC:AVER:TCON UP`.

Pause/Resume

Pauses a measurement after the current data acquisition is complete.

When a measurement is paused:

- The label on this control changes to **Resume**. Pressing **Resume** un-pauses the measurement.
- Pressing **Restart** also performs a **Resume**.

Remote Command	`:INITiate:PAUSe` `:INITiate:RESume`
Example	`:INIT:PAUS` `:INIT:RES`
Dependencies	Not displayed in Modes that do not support pausing
Couplings	When Averaging is On, if the measurement is paused no more updates will occur until either a Resume or Restart occurs If the measurement is resumed, the averaging continues to use the traces from before the Pause occurred and continues to use the traces from the point where the Resume occurred. This still provides real-time traces, but they will no longer be gap free In a view with a Waterfall window, when the measurement is paused, the Waterfall stops updating. When Resume is selected, the Waterfall will retain the existing traces and continue updating using traces from the point at which Resume was selected. The time stamp of the individual Waterfall traces will show the time from the beginning of the measurement the trace relates to, showing there was a gap in the Waterfall capture In Density view, when the measurement is paused, the Density Display stops updating. When the measurement is resumed, if Persistence is `ON`, the persistence fading will continue from the point when the measurement was paused If a Restart occurs, the average counter is reset and all results are discarded. The measurement begins again, using traces after the Restart occurred

Abort (Remote Command Only)

This command stops the current measurement. It aborts the current measurement as quickly as possible, resets the sweep and trigger systems, and puts the measurement into an "idle" state. If the instrument is in the process of aligning when `:ABORt` is sent, the alignment finishes before the abort function is performed, so `:ABORt` does *not* abort an alignment.

If the instrument is set for Continuous measurement, it sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is set for Single measurement, it remains in the "idle" state until an `:INIT:IMM` command is received.

Remote Command	`:ABORt`
Example	`:ABOR`
Notes	If `:INIT:CONT` is `ON`, then a new continuous measurement will start immediately, with sweep (data acquisition) occurring once the trigger condition has been met If `:INIT:CONT` is `OFF`, then `:INIT:IMM` is used to start a single measurement, with sweep (data acquisition) occurring once the trigger condition has been met
Dependencies	For continuous measurement, `:ABORt` is equivalent to the **Restart** key Not all measurements support the abort command
Status Bits/OPC dependencies	The `:STATus:OPERation` register bits 0 through 8 are cleared The `:STATus:QUEStionable` register bit 9 (INTegrity sum) is cleared Since all the bits that feed into OPC are cleared by `:ABORt`, the `:ABORt` will cause the *OPC query to return true

3.2.9.2 Sweep Config

Accesses controls that enable you to configure the Sweep and Control functions of the instrument, such as Sweep Rules.

Points

Sets the number of points taken per sweep, and displayed in the traces. The current value of points is displayed parenthetically, next to the sweep time in the lower-right corner of the display. Using more points provides greater resolution. Using fewer points compacts the data and decreases the time required to access a trace over the remote interface.

Increasing the number of points does not increase the sweep time. However, it can slightly impact the trace processing time and therefore the overall measurement speed. Decreasing the number of points does not decrease the sweep time, but it may speed up the measurement, depending on the other sweep settings (for example, in FFT sweeps). Fewer points will always speed up the I/O.

Due to minimum sweep rate limitations of the hardware, the minimum sweep time available to the user will increase above its normal value of 1 ms as the number of sweep points increases above 15001.

Changing the number of sweep points has several effects on the instrument.Since markers are read at the point location, the marker reading may change.The sweep time resolution will change. Trace data for all the traces will be cleared and, if Sweep is in Cont, a new trace taken. If any trace is in average or hold, the averaging starts over.

Because of sweep time quantization issues, the knob and up/down keys cannot be used to adjust the number of points.

When in a split screen display each window may have its own value for points.

When sweep points is changed, an informational message "Sweep points changed, all traces cleared" is displayed and in the 5G NR mode, Auto Sweep Points is set to OFF(0).

Remote Command	`[:SENSe]:MONitor:SWEep:POINts <integer>` `[:SENSe]:MONitor:SWEep:POINts?`
Example	`:MON:SWE:POIN 1000` `:MON:SWE:POIN?`
Dependencies	This function is not available when Signal ID is set to On in External Mixing Neither the knob nor the step keys can be used to change this value. If it is tried, a warning is given Not displayed in modes that do not support Swept
Couplings	Whenever the number of sweep points change: – All trace data is erased – Any traces with Update Off will also go to Display Off (like going from View to Blank in the older instruments) – Sweep time is re-quantized – Any limit lines that are on will be updated – If averaging/hold is on, averaging/hold starts over – Auto Sweep Points is OFF (Only 5GNR) The resolution of setting the sweep time depends on the number of points selected
Preset	1001 unless noted below 2001: 5GNR
State Saved	Saved in instrument state
Min	1
Max	20001
Annotation	On second line of annotations, in lower right corner in parenthesis behind the sweep annotation

3.2.10 Trace

Lets you control the acquisition, display, storage, detection, and manipulation of trace data for the available traces.

The "Trace Control" on page 263 tab in this menu contains radio-button selections for the trace type (**Clear/Write, Trace Average, Max Hold, Min Hold**) and **View/Blank** setting for the selected trace.

3.2.10.1 Select Trace

Specifies the selected trace. The term “selected trace” is used to specify which trace will be affected when you change trace settings.

The Select Trace control appears above the menu panel, indicating that it applies to all controls in the menu panel. Select Trace is blanked if you select a tab whose controls do *not* depend on the selected trace (e.g., Normalize).

Notes	The selected trace is remembered even when not in the trace menu
Preset	Trace 1
State Saved	The number of the selected trace is saved in instrument state

3.2.10.2 Trace Control

The controls on this tab allow you to set the type of the Trace and its update mode.

There are four trace Types: **Clear/Write, Trace Average, Max Hold** and **Min Hold.** Each type handles data in a different way.

Each trace also has two values that determine whether it is being written or not and whether it is being displayed or not. These values, **Update** and **Display,** are described more fully in the View/Blank control description, but suffice it to say that when **Update** is On a trace is updating and when **Update** is Off it is not; and when **Display** is On it is visible and when **Display** is Off it is not. These terms are used throughout the descriptions below.

When Trace Annotation (see Display menu) is On, each non-blanked trace is labeled on the trace with the detector used to take it.

For slower sweeps a visual indicator exists on the trace where the new data is being written, a green “caret” or ^ symbol, which moves across the bottom of the graticule showing the current trace point.

Trace Type

Allows you to select the type of trace you want to you use for the current measurement. There are four trace Types: Clear/Write, Trace Average, Max Hold and

Min Hold.

Besides the **Trace Type**, the **View/Blank** state must be set to **Active** (**Update** On, **Display** On) for a trace to be updating and visible. Selecting any **Trace Type** automatically makes the trace **Active**. See also the **View/Blank** menu description.

Remote Command	`:TRACe[1]|2|3:MONitor:TYPE WRITe | AVERage | MAXHold | MINHold` `:TRACe[1]|2|3:MONitor:TYPE?`
Example	`:TRAC:MON:TYPE WRIT` `:TRAC:MON:TYPE?`
Notes	`WRITe` = Clear Write. In **Clear/Write** type each trace update replaces the old data in the trace with new data `AVERage` = Average. In **Trace Average** type the instrument maintains and displays an average trace, which represents the cumulative average on a point-by-point basis of the new trace data and previous averaged trace data `MAXHold` = Maximum Hold. In **Max Hold** type the instrument maintains and displays a max hold trace, which represents the maximum data value on a point-by-point basis of the new trace data and previous trace data `MINHold` = Minimum Hold. In **Min Hold** type the instrument maintains and displays a min hold trace, which represents the minimum data value on a point-point basis of the new trace data and previous trace data
Preset	`WRITe`
State Saved	Saved in instrument state
Backwards Compatibility SCPI	`:DISPlay:MONitor:VIEW:WINDow:TRACe[1]|2|3:TYPE`

Clear and Write | Restart Averaging | Restart Max/Min Hold

Starts the trace writing as though the trace type had just been selected. Pressing this control has exactly the same effect as selecting the current trace type again – the control is provided because it may not be obvious that re-selecting the current selection from a radio button menu will take an action.

The label of this control depends on the Trace Type:

- Clear/Write: Clear and Write
- Trace Average: Restart Averaging
- Max Hold: Restart Max Hold
- Min Hold: Restart Min Hold

View/Blank

This radio button box lets you set the state of the two trace values, Update and Display. The four choices available are:

- Active: Update and Display both On
- View: Update Off and Display On
- Blank: Update Off and Display Off
- Background: Update On, Display Off (this allows a trace to be blanked and continue to update “in the background”, which was not possible in the past)

See tables below for detail onthe SCPI remote commands to control these two variables.

Preset	Trace On
State Saved	Saved in instrument state
Range	Trace On|Blank

Trace Update State On/Off

Toggles a trace Update state between On and Off. The Off selection makes the trace inactive. This does not affect whether the trace is visible or not. To change the trace visibility, see "Trace Display State On/Off" on page 265

Remote Command	`:TRACe[1]|2|3:MONitor:UPDate[:STATe] ON | OFF | 0 | 1` `:TRACe[1]|2|3:MONitor:UPDate[:STATe]?`
Example	`:TRAC3:MON:UPD OFF` `:TRAC3:MON:UPD?`
Couplings	Whenever you set **Update** to **On** for any trace, the **Display** is set to **On** for that trace
Preset	1|1|1 (**On** for Trace 1; **Off** for 2 &3)
State Saved	Saved in instrument state

Trace Display State On/Off

Toggles a trace Display state between On and Off. The Off selection makes the trace not visible. This does not affect whether the trace is updating or not.

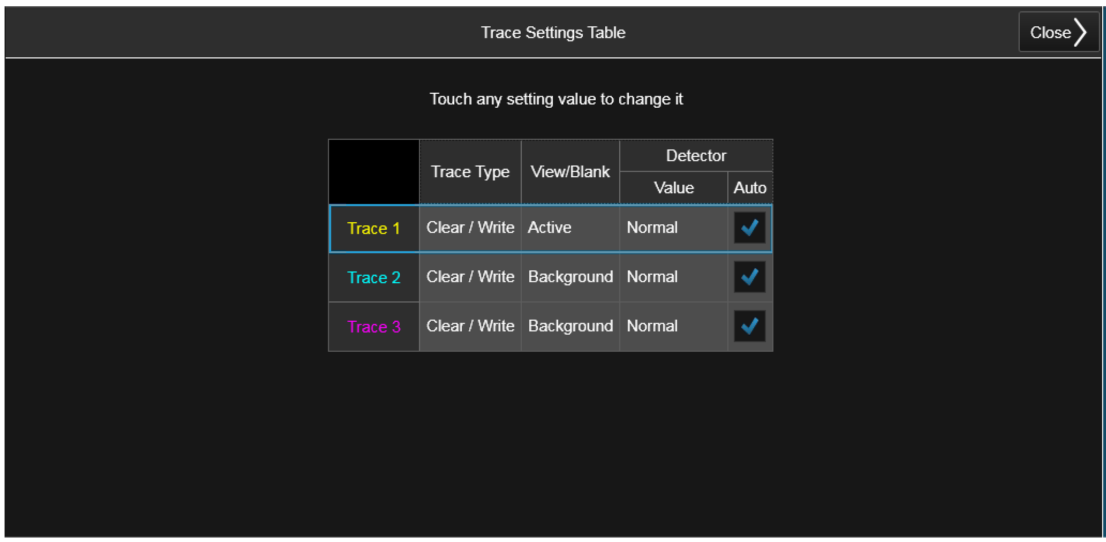
Even when not visible, traces may be queried and markers may be placed on them.

Remote Command	`:TRACe[1]|2|3:MONitor:DISPlay[:STATe] ON | OFF | 0 | 1` `:TRACe[1]|2|3:MONitor:DISPlay[:STATe]?`
Example	`:TRAC:MON:DISP ON` `:TRAC:MON:DISP?`

Couplings	Whenever you set **Update** to **On** for any trace, the **Display** is set to **On** for that trace
Preset	1|0|0 (**On** for Trace 1; **Off** for 2 &3)
State Saved	Saved in instrument state
Range	0 1

Trace Settings Table

Lets you configure the Trace system using a visual utility.



Clear All Traces

Clears all traces from the display.

Remote Command	`:TRACe:MONitor:CLEar:ALL`
Example	`:TRAC:MON:CLE:ALL`
Backwards Compatibility SCPI	`:DISPlay:MONitor:VIEW:WINDow:TRACe:CLEar:ALL`

3.2.10.3 Detector

Lets you choose and configure detectors for the selected trace.

Detector

Allows you to select a specific detector for the current measurement. When the detector choice is Auto, the instrument selects the detector. The selected detector depends on marker functions, trace functions, and trace averaging functions for the current measurement.

The following options are available:

AUTO	The detector selected depends on marker functions, trace functions, average type, and the trace averaging function In the ACP measurement, when in AUTO, the detector selected is set to AVERage, unless the Radio Standard defaults state otherwise e.g., it is set to Peak for Radio Standard = PDC when Device = both MS and BTS, and when Radio Standard = NADC and Device = MS
NORMal	The detector determines the peak of the CW-like signals, and it yields alternating maximums and minimums of noise-like signals. This is also referred to as Rosenfell detection
AVERage	The detector determines the average of the signal within the sweep points, using RMS averaging
POSitive Peak	The detector determines the maximum of the signal within the sweep points
SAMPle	The detector indicates the instantaneous level of the signal at the center of the sweep points represented by each display point
NEGative Peak	The detector determines the minimum of the signal within the sweep points

Because they may not find a spectral component's true peak, neither AVERage nor SAMPle detectors measure amplitudes of CW signals as accurately as Peak or NORMal, but they do measure noise without the biases of Peak detection.

Remote Command	[:SENSe]:MONitor:DETector:TRACe AVERage | NEGative | NORMal | POSitive | SAMPle | RMS [:SENSe]:MONitor:DETector:TRACe?
Example	:MON:DET:TRAC NORM :MON:DET:TRAC? :MON:DET RMS Sets the detector to AVERage. AVERage uses RMS averaging, so this is equivalent to selecting RMS
Notes	The query returns a string corresponding to the detector type as shown below

String Returned	Definition
NORM	Normal
AVER	Average (RMS)

	<table><tr><th>String Returned</th><th>Definition</th></tr><tr><td>POS</td><td>Peak</td></tr><tr><td>SAMP</td><td>Sample</td></tr><tr><td>NEG</td><td>Negative Peak</td></tr></table>The RMS selection sets the detector type to AVERage with RMS averaging. Therefore, if RMS has been selected, the query returns "AVER"
Couplings	When "Detector Select Auto/Man" on page 268 is ON, the detector selected depends on the Trace (Average) type
Preset	NORMal
State Saved	Yes
Range	AVERage|NEGative|NORMal|POSitive|SAMPle|RMS
Annotation	The four letter mnemonic for the detector appears in the trace window next to the trace it applies to
Backwards Compatibility SCPI	[:SENSe]:MONitor:DETector[:FUNCtion]

Detector Select Auto/Man

This toggle sets the Detector mode to Auto or Manual. In Auto, the proper detector is chosen based on rules that take into account the measurement settings and other instrument settings.

When any detector is selected by the user, this toggles automatically set to Man (manual).

Remote Command	[:SENSe]:MONitor:DETector:AUTO ON | OFF | 1 | 0 [:SENSe]:MONitor:DETector:AUTO?
Example	:MON:DET:AUTO ON :MON:DET:AUTO?
Couplings	When this function is ON, the "Detector" on page 267 and "Trace Type" on page 263 settings automatically align as follows: – "NORMal" with Clear Write – "AVERage" with AVERage – "POSitive (Peak)" with MAXHold – "NEGative (Peak)" with MINHold
Preset	ON
State Saved	Yes

3.3 Mod Accuracy

In addition to the QPSK EVM and Symbol EVM measurements, the Composite EVM measurement is made to qualify a transmitter. QPSK EVM is for single channel analysis and does not take into account spreading and scrambling. Symbol EVM is for measuring a single coded channel. The composite EVM measurement is the modulation accuracy against the multi coded reference chip power through the spreading and scrambling circuits.

Rho is one of the key modulation quality metrics, along with EVM and Modulation Accuracy (Rho) power. Rho is the ratio of the correlated power in a multi coded channel to the total signal power. This measurement takes into account all possible error mechanisms in the entire transmission chain including: baseband filtering, I/Q modulation anomalies, filter amplitude and phase non-linearities, and power amplifier distortions.

This provides an overall indication of the performance level of the transmitter of the Unit Under Test (UUT).

Modulation Accuracy Commands

The following commands and queries are used to retrieve the measurement results:

`:CONFigure:RHO`

`:CONFigure:RHO:NDEFault`

`:INITiate:RHO`

`:FETCh:RHO[n]?`

`:READ:RHO[n]?`

`:MEASure:RHO[n]?`

Remote Command Results for Modulation Accuracy

For the queries listed above, the results returned depend on the value of `n`, as follows.

Index: n	Results Returned
0	Returns unprocessed I/Q trace data of Capture Interval, as a series of trace point values. The I values are listed first in each pair, using the 0 through even-indexed values. The Q values are the odd-indexed values
1 (or not specified)	Returns the following 16 comma-separated scalar results:

#	Result Name (Average Mode*) <explanation>
1	RMS EVM (Average) A floating point number (in percent) of EVM over the entire measurement area
2	Peak EVM (Peak Hold) A floating point number (in percent) of the peak EVM in the measurement area
3	Magnitude error (Average)

Index: n	Results Returned

#	Result Name (Average Mode*) <explanation>
	A floating point number (in percent) of the average magnitude error over the entire measurement area
4	**Phase error (Average)** A floating point number (in degree) of the average phase error over the entire measurement area
5	**I/Q origin offset (Average)** A floating point number (in dB) of the I and Q error (magnitude squared) offset from the origin
6	**Frequency error (Average)** A floating point number (in Hz) of the frequency error in the measured signal
7	**Rho (Average)** A floating point number of Rho
8	**Peak Code Domain Error (Peak Hold)** A floating point number (in dB) of the Peak Code Domain Error relative to the mean power
9	**Peak Code Domain Error Channel Number (Peak Hold)** The channel number in which the peak code domain error is detected
10	**Number of active channels. (Average)**
11	**Time offset (Average)** A floating point number (in chips) of the pilot phase timing from the acquisition trigger point
12	**CPICH power over a slot (Average)** A floating point number (in dB) of the CPICH power over a measurement slot In the MS mode, the value returned is –999
13	**Total power over a slot (Average)** A floating point number (in dBm) of the total RF power over a measurement slot
14	**First Slot Number** An integer number of the first slot in Capture Interval. This is not averaged even if the averaging function is On. It is always the last cycle of the measurement

15	**DPCCH Slot Format**
	Floating point number
	– If Sync Type is DPCCH, the DPCCH slot format value used for synchronization is returned:
	  – 0.0: Slot Format 0
	  – 1.0: Slot Format 1
	  – 2.0: Slot Format 2
	  – 3.0: Slot Format 3
	  – 4.0: Slot Format 4
	  – 5.0: Slot Format 5
	– If Sync Type is PRACH, the value returned is -999.0
	In BTS mode, the value returned is 999.0

16	**Preamble Signature**
	Floating point number
	– BTS mode
	  – The returned value is always -999.0
	– MS mode
	  – In Preamble Signature auto-detection mode, the detected signature code number (from 0.0 to 15.0) is returned when the Sync Type is PRACH Message

Index: n	Results Returned
	# **Result Name (Average Mode*)** <explanation> – In Preamble Signature manual setting mode, the retuned value is the same as the parameter setting. When the Sync Type is not PRACH Message, the returned value is -999.0 *Average Mode is one of: – Average : Averaged value in average cycle – Peak Hold : Detected Peak/Maximum value in average cycle
2	**Chip EVM** EVM trace returns a series of floating point numbers (in percent) that represent each sample in the EVM trace of Capture Interval. The first number is the symbol 0 decision point. There are X points per symbol (X = points/chip). Therefore, the decision points are at 0, 1 * X, 2 * X, 3 * X, ...
3	**Chip Magnitude Error** Magnitude error trace returns a series of floating point numbers (in percent) that represent each sample in the magnitude error trace of Capture Interval. The first number is the symbol 0 decision point. There are X points per symbol (X = points/chip). Therefore, the decision points are at 0, 1 * X, 2 * X, 3 * X, ...
4	**Chip Phase Error** Phase error trace returns a series of floating point numbers (in degrees) that represent each sample in the phase error trace of Capture Interval. There are X points per symbol (X = points/ chip). Therefore, the decision points are at 0, 1 * X, 2 * X, 3 * X ...
5	**Corrected Measured Trace** Corrected measured trace of Single Slot specified by Meas Offset returns a series of floating point numbers that alternately represent I and Q pairs of the corrected measured trace. The magnitude of each I and Q pair are normalized to 1.0. The first number is the in-phase (I) sample of the symbol 0 decision point and the second is the quadrature-phase (Q) sample of the symbol 0 decision point. There are X points per symbol (X = points/chip), so the series of numbers is: – 1st number = I of the symbol 0 decision point – 2nd number = Q of the symbol 0 decision point – ... – (2 * X) + 1th number = I of the symbol 1 decision point – (2 * X) + 2th number = Q of the symbol 1 decision point – ... – (2 * X) * Nth + 1 number = I of the symbol N decision point – (2 * X) * Nth + 2 number = Q of the symbol N decision point
6	**PASS/FAIL** Returns 6 comma-separated scalar values of the pass/fail (0.0 = passed, or 1.0 = failed) results determined by testing the following items. The pass/fail is for the peak-hold value, because the test on the peak-hold value should be more severe than the average value 1. Test result of EVM 2. Test result of Peak EVM 3. Test result of Rho 4. Test result of Peak Code Domain Error 5. Test result of Frequency Error 6. Test result of CPICH over a slot (If MS is selected, this always returns 0.0)
7	**Active Channel List** In BTS Mode, returns a series of floating point numbers: symbol rate (ex. 7.5 ksps), OVSF code number, a dummy value, power level and code domain error for the active channels for Single Slot specified by Meas Offset

Index: n	Results Returned
	In MS Mode, returns a series of floating point numbers: symbol rate (ex. 15 ksps), OVSF code number, 1.0 (I) or -1.0 (Q), power level and code domain error for the active channels for Single Slot specified by Meas Offset The results would look like the following: – 1st number = Symbol Rate for 1st Active Channel – 2nd number = OVSF Code number for 1st Active Channel – 3rd number = (in BTS) -999, or (in MS) either +1 (I) or -1 (Q) for 1st Active Channel – 4th number = Power Level (in dB) for 1st Active Channel – 5th number = Code Domain Error for 1st Active Channel – ... – (N - 1) * 5 + 1th number = Symbol Rate for Nth Active Channel – (N - 1) * 5 + 2th number = OVSF Code number for Nth Active Channel – (N - 1) * 5 + 3th number = -999 (in BTS), or either +1 (I) or -1 (Q) (in MS) for Nth Active Channel – (N - 1) * 5 + 4th number = Power Level (in dB) for Nth Active Channel – (N * 5)th number = Code Domain Error for Nth Active Channel Number of active channel is given by 10th parameter of `:MEASure:RHO[1]`
8	**Code Domain Power** Returns a series of floating point numbers (in dB) that represents all the code domain powers of Single Slot specified by Meas Offset In BTS Mode, there are 512 numbers. If the active channel occupies more than the max spreading factor (7.5 ksps) the power is duplicated (active symbol rate/7.5 ksps) times – 1st number = 1st code power over the slot – 2nd number = 2nd code power over the slot – ... – Nth number = Nth code power over the slot In MS Mode, there are 256 I/Q pairs. If the active channel occupies more than the max spreading factor (15 ksps) the power is duplicated (active symbol rate / 15 ksps) times – 1st number = 1st in-phase code power over the slot – 2nd number = 1st quad-phase code power over the slot – ... – (2 * N - 1)th number = Nth in-phase code power over the slot – (2 * N)th number = Nth quad-phase code power over a slot N = the number of codes detected. The total number of codes varies because of the different symbol rates of each code
9	**Slot RMS EVM** Slot RMS EVM trace returns a series of floating point numbers (in percent) that represent each slot RMS EVM trace of Capture Interval. The first number is of the first slot in Capture Interval. Total length of trace is equivalent to Capture Interval in slot
10	**Peak CDE** Peak CDE trace of Capture Interval, returns a series of floating point numbers that represent the Peak CDE as follows:

Index: n	Results Returned

	– 1st number = Peak CDE Symbol Rate of 1st slot in Capture Interval
	– 2nd number = Peak CDE Code Index of 1st slot in Capture Interval
	– 3rd number = I/Q Phase of Peak CDE
	  – I-Phase = 1.0 (for MS)
	  – Q-Phase = -1.0 (for MS)
	  – IQ = -999.0 (for BTS)
	– 4th number = Peak CDE Value of 1st slot in Capture Interval
	– ...
	– (4 * N + 1)th number = Peak CDE Code Level of Nth slot in Capture Interval
	– (4 * N + 2)th number = Peak CDE Code Index of Nth slot in Capture Interval
	– (4 * N + 3)th number = I/Q Phase of Peak CDE
	  – I-Phase = 1.0 (for MS)
	  – Q-Phase = -1.0 (for MS)
	  – IQ = -999.0 (for BTS)
	– (4 * N + 4)th Number = Peak CDE value of Nth slot in Capture Interval
	N is equivalent to Capture Interval in slot, and total trace length 3 * N + 3

11	**Slot Frequency Error** Slot Frequency Error trace returns a series of floating point numbers (in Hz) that represents each slot frequency error. Total length of trace is equivalent to Capture Interval in slot
12	**Slot CPICH Power** – When Radio device is BTS, Slot CPICH Power trace returns the series of floating point numbers (in dB) of the code domain power of CPICH – When Radio device is MS, dummy data (= -999.0) is returned Total length of trace is equivalent to Capture Interval in slot
13	**Slot Average Total Power** Slot Average Total Power trace returns the series of floating point numbers (in dBm) of the total power. Total length of trace is equivalent to Capture Interval in slot
14	**Average Results** Average scalar results trace returns 13 comma-separated scalar results: 1. **RMS EVM** is a floating point number (in percent) of EVM over the entire measurement area 2. **Peak EVM** is a floating point number (in percent) of peak EVM in the measurement area 3. **Magnitude error** is a floating point number (in percent) of average magnitude error over the entire measurement area 4. **Phase error** is a floating point number (in degree) holding the result with absolute maximum value of average phase error over the entire measurement area 5. **I/Q origin offset** is a floating point number (in dB) of the I and Q error (magnitude squared) offset from the origin 6. **Frequency error** is a floating point number (in Hz) holding the result with absolute maximum value of the frequency error in the measured signal

Index: n	Results Returned
	7. **Rho** is a floating point number holding the minimum result of Rho 8. **Peak Code Domain Error** is a floating point number (in dB) of the Peak Code Domain Error relative to the mean power 9. **Peak Code Domain Error Channel Number** is the channel number in which the peak code domain error is detected at the max spreading factor 10. **Number of active channels** 11. **Time offset** is a floating point number (in chip) of the pilot phase timing from the acquisition trigger point 12. **CPICH power over a slot** is a floating point number in dB of CPICH power over a measurement slot. In the MS mode the value returned is –999 13. **Total power over a slot** is a floating point number in dBm of total RF power over a measurement slot
15	Peak Hold Results Peak Hold scalar results trace returns 13 comma-separated scalar results: 1. **RMS EVM** is a floating point number (in percent) of EVM over the entire measurement area 2. **Peak EVM** is a floating point number (in percent) of peak EVM in the measurement area 3. **Magnitude error** is a floating point number (in percent) of average magnitude error over the entire measurement area 4. **Phase error** is a floating point number (in degree) holding the result with absolute maximum value of average phase error over the entire measurement area 5. **I/Q origin offset** is a floating point number (in dB) of the I and Q error (magnitude squared) offset from the origin 6. **Frequency error** is a floating point number (in Hz) holding the result with absolute maximum value of the frequency error in the measured signal 7. **Rho** is a floating point number holding the minimum result of Rho 8. **Peak Code Domain Error** is a floating point number (in dB) of the Peak Code Domain Error relative to the mean power 9. **Peak Code Domain Error Channel Number** is the channel number in which the peak code domain error is detected at the max spreading factor 10. **Number of active channels** 11. **Time offset** is a floating point number (in chip) of the pilot phase timing from the acquisition trigger point 12. **CPICH power over a slot** is a floating point number in dB of CPICH power over a measurement slot. In the MS mode the value returned is –999 13. **Total power over a slot** is a floating point number in dBm of total RF power over a measurement slot
16	Active RCDE Channel List In BTS mode, returns a series of floating point numbers: symbol rate (ex. 7.5 ksps), OVSF code number, a dummy value and relative code domain power for the active channels for Single Slot specified by Meas Offset In MS mode, returns a series of floating point numbers: symbol rate (ex. 15 ksps), OVSF code number, 1.0 (I) or –1.0 (Q) and relative code domain power for the active channels for Single Slot specified by Meas Offset. The results look like the following: – 1st number = Symbol Rate for 1st Active Channel – 2nd number = OVSF Code number for 1st Active Channel – 3rd number = (in BTS) –999, or (in MS) either +1 (I) or –1 (Q) for 1st Active Channel – 4th number = Relative Code Domain Error for 1st Active Channel – 5th number = -999 (Reserved for Mod Format for 1st Active Channel)

Index: n	Results Returned
	– ... – (N - 1) * 5 + 1th number = Symbol Rate for Nth Active Channel – (N - 1) * 5 + 2th number = OVSF Code number for Nth Active Channel – (N - 1) * 5 + 3th number = -999 (in BTS), or either +1 (I) or –1 (Q) (in MS) for Nth Active Channel – (N - 1) * 5 + 4th number = Relative Code Domain Error for Nth Active Channel – (N * 5)th number = -999 (Reserved for Mod Format for Nth Active Channel) Number of active channel is given by 10th parameter of :MEASure:RHO[1]
17	Average Results 2 This trace returns 10 comma-separated scalar results: 1. **Averaged 64QAM RCDE** is a floating point number (in dB) of the Relative Code Domain Error averaged over 64QAM channels in capture interval. In the MS mode the value returned is –999 2. **Peak Relative Code Domain Error** is a floating point number (in dB) of the Peak Relative Code Domain Error relative to the mean power. In BTS mode, the value returned is -999 3. (Reserved) The value returned is -999 4. (Reserved) The value returned is -999 5. (Reserved) The value returned is -999 6. (Reserved) The value returned is -999 7. (Reserved) The value returned is -999 8. (Reserved) The value returned is -999 9. (Reserved) The value returned is -999 10. (Reserved) The value returned is -999
18	Peak Hold Results2 This trace returns 10 comma-separated scalar results: 1. **Averaged 64QAM RCDE** is a floating point number (in dB) of the Relative Code Domain Error averaged over 64QAM channels in capture interval. In the MS mode the value returned is –999 2. **Peak Relative Code Domain Error** is a floating point number (in dB) of the Peak Relative Code Domain Error relative to the mean power. In BTS mode, the value returned is -999 3. **Peak Relative Code Domain Error Channel Symbol Rate** is a floating point number (in Symbol Per Second) holding Symbol Rate of Peak Relative Code Domain Error channel. In BTS mode, the value returned is -999 4. **Peak Relative Code Domain Error Channel Code Number** is a floating point number holding OVSF Code Number of Peak Relative Code Domain Error channel. In BTS mode, the value returned is -999 5. **Peak Relative Code Domain Error Channel I or Q** is a floating point number that specifies whether the Peak Relative Code Domain Error channel is on I (+1) or Q (-1). In the BTS mode the value returned is –999 6. (Reserved) The value returned is -999 7. (Reserved) The value returned is -999 8. (Reserved) The value returned is -999

Index: n	Results Returned
	9. (Reserved) The value returned is -999
	10. (Reserved) The value returned is -999
19	1. Returns a detected scramble code. The value returned is 0~511. (Available only when Radio Device is set to BTS and P-Scramble Code is set to Autodetect. Otherwise NaN is returned)
	2. I/Q Gain Imbalance (Average) in dB
	3. I/Q Gain Imbalance (Peak Hold) in dB
	4. I/Q Quadrature Error (Average) in degree
	5. I/Q Quadrature Error (Peak Hold) in degree
	6. (Reserved) NaN returned
	7. (Reserved) NaN returned
	8. (Reserved) NaN returned
	9. (Reserved) NaN returned
	10. (Reserved) NaN returned
20	1. I Offset (Average) in Volts
	2. I Offset (PeakHold) in Volts
	3. Q Offset(Average) in Volts
	4. Q Offset(PeakHold) in Volts
	5. IQOffset(Average) in dB
	6. IQOffset(PeakHold) in dB
	7. I Offset(Average), I Offset (PeakHold), Q Offset(Average) and Q Offset(PeakHold) are available only when N9073C-EFP is available, otherwise NaN (9.91E+37) is returned

3.3.1 Views

The table below shows the Views and Windows used for this measurement.

Some of these Views are multiple-window Views. When in a multiple window View, you select a window by touching it. The menu controls may sometimes change depending on which window is selected.

Whenever the View changes, the default menu is Frequency, unless otherwise specified in the View description.

View	Result
"I/Q Measured Polar Graph" on page 344	I/Q Measured Polar Vector Graph
	Metrics
"I/Q Error" on page 345	EVM Graph
	Mag Error Graph
	Phase Error Graph
"Code Domain Power" on page 345	Code Domain Power Graph
	Metrics
"Peak/Avg Metrics" on page 345	Peak/Average Metrics
"Capture Time Summary" on page 345	Capture Time Summary
"Slot CDE/EVM" on page 346	EVM Graph
	Peak CDE Graph
	Frequency Error Graph

View Selection Remote Commands

Allows you to select the desired measurement view:

- The Enumerated ID is used with the SCPI Command `:DISP:RHO:VIEW[:SEL]` ("View Selection by Name" on page 277)
- The Numeric ID is used with the SCPI Command `:DISP:RHO:VIEW:NSEL` ("View Selection by Name" on page 277)

Enumerated ID	Numeric ID	View Name & Details
`POLar`	1	I/Q Measured Polar Graph - Provides a combination view of an I/Q measured polar vector graph and the summary data
`ERRor`	2	I/Q Error (Tri View) - Provides a combination view of the EVM, magnitude error, and phase error graphs
`PGRaph`	3	Code Domain Power - Provides a graph of Modulation Accuracy (Rho) channels individual power in dB. A table of summary data for the Modulation Accuracy (Rho) channels is provided in the text window
`TABLe`	4	Peak/Average Metrics - Provides a table of magnitude error, phase error, EVM, and the modulation accuracy summary data such as rho, peak and rms EVM, peak Modulation Accuracy (Rho) error, magnitude error, phase error, in a text window, in terms of averaged and detected peak/maximum value in the average cycle
`SUMMary`	5	Capture Time Summary – Provides a table that summarizes measurement results through the Capture Interval. Highlights the peak/worst result through the Capture Interval slot-by-slot
`CDError`	6	Slot CDE/EVM(Tri View) – Provides a combination view of Frequency Error, Peak CDE, and EVM graphs

View Selection by Name

Allows you to specify the view via its enumerated ID string.

Remote Command	`:DISPlay:RHO:VIEW[:SELect] POLar | ERRor | PGRaph | TABLe | SUMMary | CDError` `:DISPlay:RHO:VIEW[:SELect]?`
Example	`:DISP:RHO:VIEW:SEL CDE` `:DISP:RHO:VIEW:SEL?`
Preset	POLar

State Saved	Yes
Range	I/Q Measured Polar Graph|I/Q Error|Code Domain Power|Peak/Avg Metrics|Capture Time Summary|Slot CDE/EVM

View Selection by Number

Allows you to specify the view via its numeric ID value.

Remote Command	`:DISPlay:RHO:VIEW:NSELect <integer>` `:DISPlay:RHO:VIEW:NSELect?`
Example	`:DISP:RHO:VIEW:NSEL 1` `:DISP:RHO:VIEW:NSEL?`
Preset	1
State Saved	Yes
Min/Max	1/6

3.3.1.1 I/Q Measured Polar Graph

Windows: "I/Q Measured Polar Vector Graph" on page 280,"Result Summary" on page 281

The traces and results of this view are only for the slot specified by the measurement offset. The traces are not averaged, even if the average is on. The parameters displayed in these windows differ depending on the setting of Radio Device.

Example	`:DISP:RHO:VIEW POL`

3.3.1.2 I/Q Error

Windows:"EVM Graph" on page 283, "Mag Error Graph" on page 283, "Phase Error Graph" on page 283

The traces of this view are not averaged, even if the average function is on. The parameters displayed in these windows differ depending on the setting of Radio Device.

Example	`:DISP:RHO:VIEW ERR`

3.3.1.3 Code Domain Power

Windows: "Code Domain Power Graph" on page 283, "CDP Metrics" on page 284

The traces and results of this view are only for the slot specified by the measurement offset. The results are not averaged, even if the average function is on.

The parameters displayed in these windows differ depending on the setting of Radio Device.

Example	`:DISP:RHO:VIEW PGR`

3.3.1.4 Peak/Avg Metrics

Windows: "Peak/Average Metrics" on page 285

This view has one window, the Peak/Average Metrics window, which displays two sets of data as follows:

Average	The value averaged in average-cycle
Peak Hold	The value detected and held as the Peak/Maximum in the average cycle

NOTE

The average cycle is updated when restarted, and is equal to the average count. In each average cycle, through the capture interval, the data is also averaged and detects the peak/worst values. Therefore, the metrics of this view are actually averaged by the data, which is the value of:

Average Count x Capture Interval

The parameters displayed in these windows differ depending on the setting of Radio Device.

Example	`:DISP:RHO:VIEW TABL`

3.3.1.5 Capture Time Summary

Windows:"Capture Time Summary" on page 288

The summary table displays the measurement results for multiple slots (for example 15 slots). It shows data sets slot-by-slot through the Capture Interval, and highlights the peak (or worst) slot value, and average value through the Capture Interval at the bottom of the table.

The results in this view are not averaged when restarted, even if the average is on. The parameters displayed in this window differ depending on the setting of Radio Device.

Example	`:DISP:RHO:VIEW SUMM`

3.3.1.6 Slot CDE/EVM

Windows: "Slot EVM Graph" on page 290,"Slot EVM Graph" on page 290"Slot EVM Graph" on page 290"Slot EVM Graph" on page 290"Slot Peak CDE Graph" on page 290, "Slot Frequency Error Graph" on page 290

The trace of this view is not averaged when restarted, even if the average function is on.

The parameters displayed in the windows differ depending on the setting of Radio Device in the Mode Setup.

In the graph:

– Yellow lines are the slot-by-slot results

– Blue (Cyan) lines are the test limits

Example	`:DISP:RHO:VIEW CDE`

3.3.2 Windows

This section describes the windows that are available in the Modulation Accuracy Measurement.

3.3.2.1 Window Number List

Window	Number
Result Summary	1
I/Q Measured Polar	2
EVM	3
Mag Error	4
Phase Error	5
Code Domain Power	6
CDP Metrics	7
Peak/Average Metrics	8
Capture Time Summary	9
Slot EVM	10
Peak CDE	11
Freq Error	12

I/Q Measured Polar Vector Graph

This Graph window appears in the following View:

View	Size	Position
I/Q Measured Polar Graph	Full, two-thirds width	Right

These traces and scalar results are for the slot specified by Meas Offset.

Marker Operation	None
Corresponding Trace	Corrected measured trace (n=5)

Active Channels	n=1 10th a Number of Active Channels.
Slot Number	NA

Result Summary

The Metrics window appears in the following View:

View	Size	Position
I/Q Measured Polar Graph	Full, one-thirds width	Left

Radio Device: BTS

These traces and scalar results are for the slot specified by Meas Offset.

Name	Corresponding Results	Display Format
Rho	n=1 7th rho	9.99999
EVM (rms)	n=1 1st EVM over the entire measurement area	99.99 % rms
EVM (pk)	n=1 2nd peak EVM in the measurement area	99.99 % pk
Pk CDE (dB)	n=1 8th Peak Code Domain Error relative to the mean power	-99.99 dB
Pk CDE (Ch No.)	n=1 9th Channel number in which the peak code domain error is detected at the max spreading factor	CX(Y) x=8 for downlink Y: OVSF code number (0 ... 255)
Pk Active CDE (dB)	None	-99.99 dB
Pk Active CDE (Ch No.)	None	CX(Y) X: OVSF level (2 ... 9) 2: 960ksps ... 9:7.5ksps Y: OVSF code number (0 ... 2^x-1)
Magnitude Error	n=1 3rd Average magnitude error over the entire measurement area	99.99 % rms
Phase Error	n=1 4th Average phase error over the entire measurement area	99.99 °rms
Freq Error	n=1 6th Frequency error in the measured signal	99.99 Hz
I/Q Origin Offset	n=1 5th I and Q error (magnitude squared) offset from the	-99.99 dB

Name	Corresponding Results	Display Format
	origin.	
Time Offset	N=1 11th Pilot phase timing from the acquisition trigger point	9999.99 chip
Preamble Signature	N = 1 16th Detected PRACH Preamble Signature	99

Radio Device: MS

These traces and scalar results are for the slot specified by Meas Offset.

Name	Corresponding Results	Display Format
Rho	n=1 7th rho	9.99999
EVM (rms)	n=1 1st EVM over the entire measurement area	99.99 % rms
EVM (pk)	n=1 2nd peak EVM in the measurement area	99.99 % pk
Pk CDE (dB)	n=1 8th Peak Code Domain Error relative to the mean power	-99.99 dB
Pk CDE (Ch No.)	n=1 9th Channel number in which the peak code domain error is detected at the max spreading factor	CX(Y) X=2 for uplink Y: OVSF code number (0 ... 3)
Pk Active CDE (dB)	None	-99.99 dB
Pk Active CDE (Ch No.)	None	CX(Y) X: OVSF level (1 ... 8) 1: 1920ksps ... 8:15ksps Y: OVSF code number (0 ... 2^x-1)
Magnitude Error	n=1 3rd Average magnitude error over the entire measurement area	99.99 % rms
Phase Error	n=1 4th Average phase error over the entire measurement area	99.99 °rms
Freq Error	n=1 6th Frequency error in the measured signal	99.99 Hz
I/Q Origin Offset	n=1 5th I and Q error (magnitude squared) offset from the origin	-99.99 dB
Time Offset	N=1 11th	9999.99 chip

Name	Corresponding Results	Display Format
Preamble Signature	Pilot phase timing from the acquisition trigger point N = 1 16th Detected PRACH Preamble Signature	99

EVM Graph

The EVM window appears in the following View:

View	Size	Position
I/Q Error	One-thirds, full width	Top

Marker Operation	Yes
Corresponding Trace	EVM trace (n=2)

Mag Error Graph

The Mag Error Graph window appears in the following View:

View	Size	Position
I/Q Error	One-thirds, full width	Middle

Marker Operation	Yes
Corresponding Trace	Magnitude error trace (n=3)

Phase Error Graph

The Phase Error window appears in the following View:

View	Size	Position
I/Q Error	One-thirds, full width	Bottom

Marker Operation	Yes
Corresponding Trace	Phase error trace (n=4)

Code Domain Power Graph

The Graph window appears in the following View:

View	Size	Position
Code Domain Power	Half, full width	Top

These traces and scalar results are for the slot specified by the Meas Offset.

Marker Operation	Yes
Corresponding Trace	CDP (n=8)

CDP Metrics

The Metrics window appears in the following View:

View	Size	Position
Code Domain Power	Half, full width	Bottom

Radio Device: BTS

These traces and scalar results are for the slot specified by Meas Offset.

Name	Corresponding Results	Display Format
Total Power	None Absolute Total Power	99.99 dBm
PSCH	None	99.99 dBm
SSCH	None	99.99 dBm
Active Channels	n=1 10th Number of Active Channels.	99
Code	n=7 (N-1)*5+2 number OVSF Code number for N th Active Channel	CX(Y) X: OVSF level (2 … 9) 2:960 ksps … 9:7.5 ksps Y: OVSF code number (0 … 2^x-1)
Power (dB)	n=7 (N-1)*5+4 number Power Level (in dB) for N th Active Channel	99.99
CDE (dB)	n=7 N*5 number Code Domain Error for N th Active Channel	99.99
RCDE (dB)	n=16 (N-1)*5+4 number Power Level (in dB) for N th Active Channel	99.99

Radio Device: MS

These traces and scalar results are for the slot specified by Meas Offset.

Name	Corresponding Results	Display Format
Total Power	None Absolute Total Power	99.99 dBm
Active Channels	n=1 10th Number of Active Channels	99

Name	Corresponding Results	Display Format
Code	n=7 (N-1)*5+2 number OVSF Code number for N th Active Channel	CX(Y) X: OVSF level (1 … 8) 1: 1920ksps … 8:15ksps Y: OVSF code number (0 … 2^x-1)
I/Q	N=7 (N-1)*5+3 number Either +1 (I) or -1 (Q) for N th Active Channel	I or Q
Power (dB)	n=7 (N-1)*5+4 number Power Level (in dB) for N th Active Channel	99.99
CDE (dB)	n=7 N*5 number Code Domain Error for N th Active Channel	99.99
RCDE (dB)	n=16 (N-1)*5+4 number Power Level (in dB) for N th Active Channel	99.99

Peak/Average Metrics

Radio Device: BTS

Name	Corresponding Results	Display Format
Rho	N=1 7th (Average) n=1 21st (Peak Hold) rho	9.99999
EVM (rms)	N=1 1st (Average) n=1 15th (Peak Hold) EVM over the entire measurement area	99.99 % rms
EVM (pk)	N=1 2nd (Average) n=1 16th (Peak Hold) Peak EVM in the measurement area	99.99 % pk
Pk CDE (dB)	N=1 8th (Average) n=1 22nd (Peak Hold) Peak Code Domain Error relative to the mean power	99.99 dB
Pk CDE (Ch No.)	N=1 9th (Average) n=1 23rd (Peak Hold) The channel number in which the peak code domain error is detected at the max spreading factor	CX(Y) x=8 for downlink Y: OVSF code number (0 … 255)
Pk Active CDE (dB)	None	99.99 dB

Name	Corresponding Results	Display Format
Pk Active CDE (Ch No.)	None	CX(Y) X: OVSF level (2 … 9) 2:960ksps … 9:7.5ksps Y: OVSF code number (0 … 2^x-1)
Magnitude Error	N=1 3rd (Average) n=1 17th (Peak Hold) Magnitude error over the entire measurement area	99.99 % rms
Phase Error	n=1 4th (Average) n=1 18th (Peak Hold) Average phase error over the entire measurement area	99.99 °rms
Freq Error	n=1 6th (Average) n=1 20th (Peak Hold) Frequency error in the measured signal	99.99 Hz
I/Q Origin Offset	n=1 5th (Average) n=1 19th (Peak Hold) I and Q error (magnitude squared) offset from the origin	99.99 dB
I/Q Gain Imbalance	n=19 2nd (Average) n=19 3rd (Peak Hold) I/Q Gain Imbalance	99.99 dB (IQ Comp) “(IQ Comp)” is shown when “I/Q Imbalance Compensation” is ON.
I/Q Quad. Error	n=19 4th (Average) n=19 5th (Peak Hold) I/Q Quadrature Error	99.99 °(IQ Comp) “(IQ Comp)” is shown when “I/Q Imbalance Compensation” is ON
Time Offset	n=1 11th (Average) n=1 25th (Peak Hold) Pilot phase timing from the acquisition trigger point	9999.99 chip
CPICH Power	n=1 12th (Average) n=1 26th (Peak Hold) CPICH power over a slot	99.99 dB
Total Power	n=1 13th (Average) n=1 27th (Peak Hold) Total power over a slot	99.99 dBm
64QAM RCDE	n=17 1st (Average) n=18 1st (Peak Hold) Average 64QAM RCDE in a slot	99.99 dB

Name	Corresponding Results	Display Format
Pk RCDE (dB)	Not valid for BTS	“---“ as invalid value
Pk RCDE (Ch. NO.)	Not valid for BTS	“---“ as invalid value

Radio Device: MS

Name	Corresponding Results	Display Format
Rho	N=1 7th (Average) n=1 21st (Peak Hold) rho	9.99999
EVM (rms)	N=1 1st (Average) n=1 15th (Peak Hold) EVM over the entire measurement area	99.99 % rms
EVM (pk)	N=1 2nd (Average) n=1 16th (Peak Hold) Peak EVM in the measurement area	99.99 % pk
Pk CDE (dB)	N=1 8th (Average) n=1 22nd (Peak Hold) Peak Code Domain Error relative to the mean power	99.99 dB
Pk CDE (Ch No.)	N=1 9th (Average) n=1 23rd (Peak Hold) The channel number in which the peak code domain error is detected at the max spreading factor	CX(Y) X=2 for uplink Y: OVSF code number (0 ... 3)
Pk Active CDE (dB)	None	99.99 dB
Pk Active CDE (Ch No.)	None	CX(Y) X: OVSF level (1 ... 8) 1: 1920ksps ... 8:15ksps Y: OVSF code number (0 ... 2^x-1)
Magnitude Error	N=1 3rd (Average) n=1 17th (Peak Hold) Magnitude error over the entire measurement area	99.99 % rms
Phase Error	n=1 4th (Average) n=1 18th (Peak Hold) Average phase error over the entire measurement area	99.99 °rms
Freq Error	n=1 6th (Average) n=1 20th (Peak Hold)	99.99 Hz

Name	Corresponding Results	Display Format
	Frequency error in the measured signal	
I/Q Origin Offset	n=1 5th (Average) n=1 19th (Peak Hold) I and Q error (magnitude squared) offset from the origin	99.99 dB
I/Q Gain Imbalance	n=19 2nd (Average) n=19 3rd (Peak Hold) I/Q Gain Imbalance	99.99 dB (IQ Comp) "(IQ Comp)" is shown when "I/Q Imbalance Compensation" is ON
I/Q Quad. Error	n=19 4th (Average) n=19 5th (Peak Hold) I/Q Quadrature Error	99.99 °(IQ Comp) "(IQ Comp)" is shown when "I/Q Imbalance Compensation" is ON
Time Offset	n=1 11th (Average) n=1 25th (Peak Hold) Pilot phase timing from the acquisition trigger point	9999.99 chip
CPICH Power	Not valid for MS	"---" as invalid value
Total Power	n=1 13th (Average) n=1 27th (Peak Hold) Total power over a slot	99.99 dBm
64QAM RCDE	Not valid for MS	"---" as invalid value
Pk RCDE (dB)	n=17 2nd (Average) n=18 2nd (Peak Hold) Peak RCDE in a slot	99.99 dB
Pk RCDE (Ch. NO.)	n=18 4th(Peak Hold)	CX(Y) X=2 for uplink Y: OVSF code number (0 .. 3)

Capture Time Summary

Radio Device: BTS

Name	Corresponding Results	Display Format
Slot Number	NA	0 ... 14 (CPICH Slot)
Slot RMS EVM	n=9 Slot RMS EVM	9.99999 % rms
Slot PkCDE (dB)	n=10 (3*N+3)th Peak Code Domain Error relative to the mean power [Note 1]	-99.99 dB

Name	Corresponding Results	Display Format
Slot PkCDE Channel Index	n=10 (3*N+2)th Channel index in which the peak code domain error is detected at the max spreading factor. [Note 1]	CX(Y) x=8 for downlink Y: OVSF code number (0 ... 255)
Slot Freq Error	n=11 Frequency error in slot	99.99 Hz
Slot Code Domain Power of P-CPICH	n=12 Slot code domain power of P-CPICH	-99.99 dB
Slot Total Power	n=13 Slot averaged total power	dBm

Note 1: N = Sequential slot number through the Capture Interval (for example, 0... 14)

Note 2: Through the Capture Interval, for example on the above display, Slot#0 – Slot#14, the peak/worst value is highlighted in color. Refer to the following rule table.

Name	Peak/Worst/Maximum rule
Slot RMS EVM	Maximum value in %
Slot PkCDE	Maximum value in dB
Slot PkCDE Channel Index	Peak/Worst is not highlighted
Slot Freq Error	Maximum absolute value in Hz
Slot Code Domain Power of P-CPICH	Maximum value in dB
Slot Average Total Power	Maximum value in dBm

Note 3: When a result value fails the limit test, an 'F' is shown on the right-side of the result value.

Radio Device: MS

Name	Corresponding Results	Display Format
Slot Number	CPICH slot number	0 ... 15 (CPICH Slot)
Slot RMS EVM	n=9 Slot RMS EVM	9.99999 % rms
Slot PkCDE (dB)	n=10 (3*N+3)th Peak Code Domain Error relative to the mean power	-99.99 dB
Slot PkCDE Channel Index	n=10 (3*N+2)th Channel index in which the peak code domain error is detected at the max spreading factor.	CX(Y) X=2 for uplink Y: OVSF code number (0 ... 3)
Slot Freq Error	n=11	99.99 Hz

Name	Corresponding Results	Display Format
	Frequency error in slot	
Slot Average Total Power	n=13 Slot averaged total power	dBm

Note 1: N = Sequence number through the Capture Interval (Unit = slot)

Note 2: Through the Capture Interval, for example on the above display, Slot#0 – Slot#14, the peak/worst value is highlighted in color. Refer to the following rule table.

Name	Peak/Worst rule
Slot RMS EVM	Maximum value in %
Slot PkCDE	Maximum value in dB
Slot PkCDE Channel Index	Peak/Worst is not highlighted
Slot Freq Error	Maximum absolute value in Hz
Slot Average Total Power	Maximum value in dB

Note 3: When a result value shown in the above fails the limit test, an 'F' is shown the right-side of the result value

Slot EVM Graph

This graph appears in the following View:

View	Size	Position
Slot CDE/EVM	One-thirds, full width	Top

Marker Operation	Yes
Corresponding Trace	Slot RMS EVM trace (n=9)

Slot Peak CDE Graph

This graph appears in the following View:

View	Size	Position
Slot CDE/EVM	One-thirds, full width	Middle

Marker Operation	Yes
Corresponding Trace	Slot Peak CDE trace (n=10)

Slot Frequency Error Graph

This graph appears in the following View:

View	Size	Position
Slot CDE/EVM	One-thirds, full width	Bottom

Marker Operation	Yes
Corresponding Trace	Slot Frequency error trace (n=11)

3.3.3 Amplitude

Activates the **Amplitude** menu and selects **Reference Level** or **Reference Value** as the active function, depending on the measurement.

Some features in this menu apply to multiple measurements. Some other features apply only to specific measurements and their controls are blanked or grayed-out in measurements that do not support the feature.

3.3.3.1 Y Scale

The Y Scale Tab contains controls that pertain to the Y axis parameters of the measurement. These parameters control how data on the vertical (Y) axis is displayed and control instrument settings that affect the vertical axis.

Ref Value

Sets the value for the absolute power reference. The functionality depends on the selected window.

Remote Command

```
:DISPlay:RHO:WINDow3|4|5|6|10|11|12:TRACe:Y[:SCALe]:RLEVel <amptd>
:DISPlay:RHO:WINDow3|4|5|6|10|11|12:TRACe:Y[:SCALe]:RLEVel?
```

Window numbers are as follows:

- EVM : 3
- Mag Error: 4
- Phase Error: 5
- CDP: 6
- Slot EVM: 10
- Peak CDE: 11
- Freq Error: 12

Example

3-EVM window

```
:DISP:RHO:WIND3:TRAC:Y:RLEV 0.0
```

	4-Mag Error window
	`:DISP:RHO:WIND4:TRAC:Y:RLEV 0.0`
	5-Phase Error Window
	`:DISP:RHO:WIND5:TRAC:Y:RLEV 0.0`
	6-CDP window
	`:DISP:RHO:WIND6:TRAC:Y:RLEV 0.0`
	10-Slot EVM window
	`:DISP:RHO:WIND10:TRAC:Y:RLEV 0.0`
	11-Peak CDE window
	`:DISP:RHO:WIND11:TRAC:Y:RLEV 0.0`
	12-Freq Error window
	`:DISP:RHO:WIND12:TRAC:Y:RLEV 0.0`

Couplings	When Auto Scaling is On (default), this value is automatically determined by the measurement result. When you set a value manually, Auto Scaling changes to Off
Preset	0.00
State Saved	Yes
Min/Max	

11-Peak CDE | 6-CDP	-250.0/250.0
4-Mag Error | 3-EVM | 10- Slot EVM	-500/500
5-Phase Error	-36000/36000
12-Freq Error	-4.3214/4.3214 GHz

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now only Window number is sent. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command
EVM	`DISP:RHO:VIEW2:WIND:TRAC:Y:RLEV 0.0`	`DISP:RHO:WIND3:TRAC:Y:RLEV 0.0`
Mag Error	`DISP:RHO:VIEW2:WIND2:TRAC:Y:RLEV 0.0`	`DISP:RHO:WIND4:TRAC:Y:RLEV 0.0`
Phase Error	`DISP:RHO:VIEW2:WIND3:TRAC:Y:RLEV 0.0`	`DISP:RHO:WIND5:TRAC:Y:RLEV 0.0`
CDP	`DISP:RHO:VIEW3:WIND:TRAC:Y:RLEV 0.0`	`DISP:RHO:WIND6:TRAC:Y:RLEV 0.0`
Slot EVM	`DISP:RHO:VIEW6:WIND:TRAC:Y:RLEV 0.0`	`DISP:RHO:WIND10:TRAC:Y:RLEV 0.0`
Peak CDE	`DISP:RHO:VIEW6:WIND2:TRAC:Y:RLEV 0.0`	`DISP:RHO:WIND11:TRAC:Y:RLEV 0.0`
Freq Error	`DISP:RHO:VIEW6:WIND3:TRAC:Y:RLEV 0.0`	`DISP:RHO:WIND12:TRAC:Y:RLEV 0.0`

Scale/Div

Sets the sensitivity for the vertical axis.

Remote Command	`:DISPlay:RHO:WINDow3 | 4 | 5 | 6 | 10 | 11 | 12:TRACe:Y [:SCALe]:PDIVision <real>`
	`:DISPlay:RHO:WINDow3 | 4 | 5 | 6 | 10 | 11 | 12:TRACe:Y [:SCALe]:PDIVision?`
	Window numbers are as follows:
	– EVM : 3
	– Mag Error: 4
	– Phase Error: 5
	– CDP: 6
	– Slot EVM: 10
	– Peak CDE: 11
	– Freq Error: 12

Example	3-EVM window
	`:DISP:RHO:WIND3:TRAC:Y:PDIV 10.0`
	4-Mag Error window
	`:DISP:RHO:WIND4:TRAC:Y:PDIV 10.0`
	5-Phase Error Window
	`:DISP:RHO:WIND5:TRAC:Y:PDIV 10.0`
	6-CDP window
	`:DISP:RHO:WIND6:TRAC:Y:PDIV 10.0`
	10-Slot EVM window
	`:DISP:RHO:WIND10:TRAC:Y:PDIV 10.0`
	11-Peak CDE window
	`:DISP:RHO:WIND11:TRAC:Y:PDIV 10.0`
	12-Freq Error window
	`:DISP:RHO:WIND12:TRAC:Y:PDIV 10.0`

Couplings	If Auto Scaling is set to On, this value is automatically determined by the measurement result. When you set this value manually, Auto Scaling is automatically set to Off
Preset	3-EVM | 5-Phase Error | 10-Slot EVM: 0.5 4-Mag Error | 12-Freq Error: 1.0 11-Peak CDE: 0.1 6-CDP: 10.00

State Saved	Yes
Min/Max	3-EVM | 4-Mag Error| 10-Slot EVM: 0.100/50.0 11-Peak CDE | 6-CDP: 0.100/20.0 5-Phase Error: 0.0100/360.0 12-Freq Error: 1 Hz/1 GHz

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now only Window number is sent. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command
EVM	DISP:RHO:VIEW2:WIND:TRAC:Y:PDIV 10.0	DISP:RHO:WIND3:TRAC:Y:PDIV 10.0
Mag Error	DISP:RHO:VIEW2:WIND2:TRAC:Y:PDIV 10.0	DISP:RHO:WIND4:TRAC:Y:PDIV 10.0
Phase Error	DISP:RHO:VIEW2:WIND3:TRAC:Y:PDIV 10.0	DISP:RHO:WIND5:TRAC:Y:PDIV 10.0
CDP	DISP:RHO:VIEW3:WIND:TRAC:Y:PDIV 10.0	DISP:RHO:WIND6:TRAC:Y:PDIV 10.0
Slot EVM	DISP:RHO:VIEW6:WIND:TRAC:Y:PDIV 10.0	DISP:RHO:WIND10:TRAC:Y:PDIV 10.0
Peak CDE	DISP:RHO:VIEW6:WIND2:TRAC:Y:PDIV 10.0	DISP:RHO:WIND11:TRAC:Y:PDIV 10.0
Freq Error	DISP:RHO:VIEW6:WIND3:TRAC:Y:PDIV 10.0	DISP:RHO:WIND12:TRAC:Y:PDIV 10.0

Ref Position

Positions the Y-axis scale reference level at the top, center or bottom of the display. Changing the reference position does not change the reference level value.

Remote Command	:DISPlay:RHO:WINDow3|4|5|10|11|12:TRACe:Y[:SCALe]:RPOSition TOP | CENTer | BOTTom :DISPlay:RHO:WINDow3|4|5|10|11|12:TRACe:Y[:SCALe]:RPOSition? Window numbers are as follows: – EVM : 3 – Mag Error: 4 – Phase Error: 5

	– Slot EVM: 10 – Peak CDE: 11 – Freq Error: 12

Example	3-EVM window
	`:DISP:RHO:WIND3:TRAC:Y:RPOS TOP`
	4-Mag Error window
	`:DISP:RHO:WIND4:TRAC:Y:RPOS TOP`
	5-Phase Error Window
	`:DISP:RHO:WIND5:TRAC:Y:RPOS TOP`
	10-Slot EVM window
	`:DISP:RHO:WIND10:TRAC:Y:RPOS TOP`
	11-Peak CDE window
	`:DISP:RHO:WIND11:TRAC:Y:RPOS TOP`
	12-Freq Error window
	`:DISP:RHO:WIND12:TRAC:Y:RPOS TOP`

Preset	11-Peak CDE: `TOP` 3-EVM | 10-Slot EVM: `BOTTom` 4-Mag Error | 5-Phase Error | 12-Freq Error: `CENTer`
State Saved	Yes

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now only Window number is sent. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command
EVM	`DISP:RHO:VIEW2:WIND:TRAC:Y:RPOS TOP`	`DISP:RHO:WIND3:TRAC:Y:RPOS TOP`
Mag Error	`DISP:RHO:VIEW2:WIND2:TRAC:Y:RPOS TOP`	`DISP:RHO:WIND4:TRAC:Y:RPOS TOP`
Phase Error	`DISP:RHO:VIEW2:WIND3:TRAC:Y:RPOS TOP`	`DISP:RHO:WIND5:TRAC:Y:RPOS TOP`
Slot EVM	`DISP:RHO:VIEW6:WIND:TRAC:Y:RPOS TOP`	`DISP:RHO:WIND10:TRAC:Y:RPOS TOP`
Peak CDE	`DISP:RHO:VIEW6:WIND2:TRAC:Y:RPOS TOP`	`DISP:RHO:WIND11:TRAC:Y:RPOS TOP`
Freq Error	`DISP:RHO:VIEW6:WIND3:TRAC:Y:RPOS TOP`	`DISP:RHO:WIND12:TRAC:Y:RPOS TOP`

Auto Scaling

Toggles the Auto Scaling function between On and Off. When Auto Scaling is On, pressing the Restart front-panel key results in automatically determining scale per division and reference values based on the measurement results.

When you set a value to either Scale/Div or Ref Value manually, Auto Scaling automatically changes to Off.

Remote Command	`:DISPlay:RHO:WINDow3|4|5|10|11|12:TRACe:Y[:SCALe]:COUPle 0 | 1 | OFF | ON`
	`:DISPlay:RHO:WINDow3|4|5|10|11|12:TRACe:Y[:SCALe]:COUPle?`
	Window numbers are as follows:
	– EVM : 3
	– Mag Error: 4
	– Phase Error: 5
	– Slot EVM: 10
	– Peak CDE: 11
	– Freq Error: 12

Example	3-EVM window
	`:DISP:RHO:WIND3:TRAC:Y:COUP ON`
	4-Mag Error window
	`:DISP:RHO:WIND4:TRAC:Y:COUP ON`
	5-Phase Error Window
	`:DISP:RHO:WIND5:TRAC:Y:COUP ON`
	10-Slot EVM window
	`:DISP:RHO:WIND10:TRAC:Y:COUP ON`
	11-Peak CDE window
	`:DISP:RHO:WIND11:TRAC:Y:COUP ON`
	12-Freq Error window
	`:DISP:RHO:WIND12:TRAC:Y:COUP ON`

Notes	When this parameter is set to On, pressing the front-panel Restart key activates the scale coupling function, that automatically determines scale per division and reference values based on the measurement results. When you set a value to either Scale/Div or Ref Value manually, Auto Scaling is automatically set to Off
Preset	`ON`
State Saved	Yes
Range	`OFF|ON`

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now only Window number is sent. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command
EVM	DISP:RHO:VIEW2:WIND:TRAC:Y:COUP ON	DISP:RHO:WIND3:TRAC:Y:COUP ON
Mag Error	DISP:RHO:VIEW2:WIND2:TRAC:Y:COUP ON	DISP:RHO:WIND4:TRAC:Y:COUP ON
Phase Error	DISP:RHO:VIEW2:WIND3:TRAC:Y:COUP ON	DISP:RHO:WIND5:TRAC:Y:COUP ON
Slot EVM	DISP:RHO:VIEW6:WIND:TRAC:Y:COUP ON	DISP:RHO:WIND10:TRAC:Y:COUP ON
Peak CDE	DISP:RHO:VIEW6:WIND2:TRAC:Y:COUP ON	DISP:RHO:WIND11:TRAC:Y:COUP ON
Freq Error	DISP:RHO:VIEW6:WIND3:TRAC:Y:COUP ON	DISP:RHO:WIND12:TRAC:Y:COUP ON

3.3.3.2 Attenuation

Controls the attenuator functions and interactions between the attenuation system components.

There are two attenuator configurations in the X-Series. One is a Dual-Attenuator configuration consisting of a mechanical attenuator and an optional electronic attenuator. The other configuration uses a single attenuator with combined mechanical and electronic sections thatcontrols all the attenuation functions. Different models in the X-Series come with different configurations.

– See "Dual-Attenuator Configurations" on page 298

– See "Single-Attenuator Configuration" on page 298

Most attenuation settings are the same for all measurements – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset.

This tab is only available when the hardware set includes an input attenuator, which is typically only the case when using Keysight’s box instruments. For example, this tab does not appear in:

– VXT models M9420A/21A/10A/11A

– E7760

– M9391A

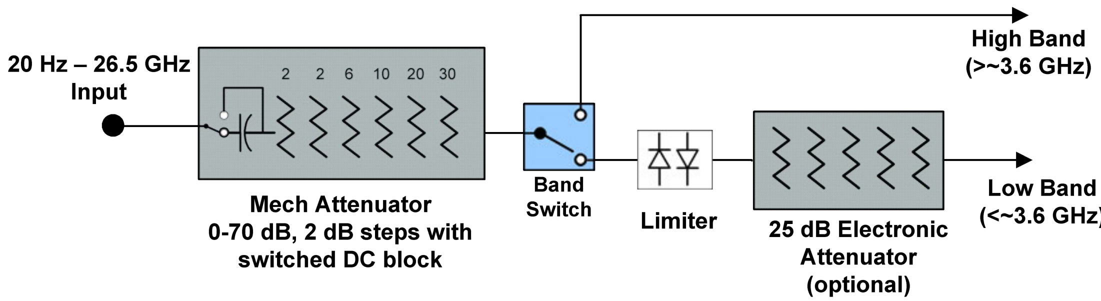
– M9393A

This tab also does not appear in UXM. In UXM all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

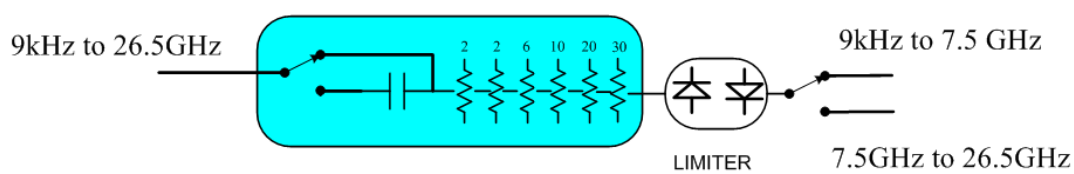
Dependencies	In measurements that support the I/Q inputs, this tab is unavailable when I/Q is the selected input, and is replaced by the Range tab in that case

Dual-Attenuator Configurations

Configuration 1: Mechanical attenuator + optional electronic attenuator

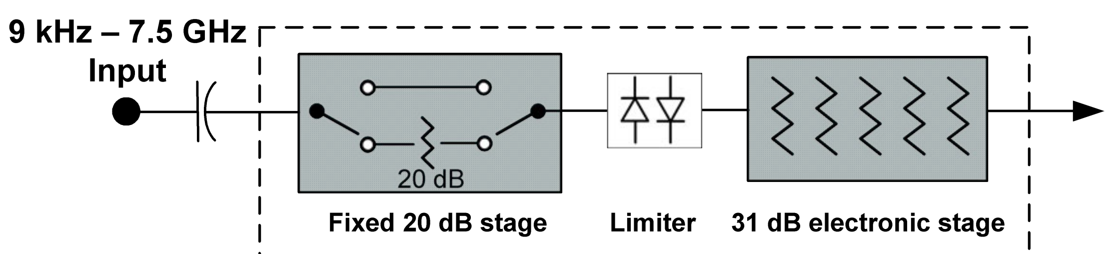


Configuration 2: Mechanical attenuator, no optional electronic attenuator

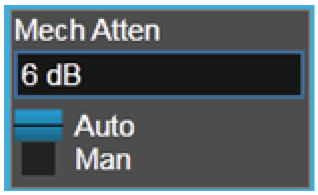


(note that Configuration 2 is not strictly speaking a dual-section attenuator, since there is no electronic section available. However, it behaves exactly like Configuration 1 without the Electronic Attenuator option EA3, therefore for the sake of this document it is grouped into the "Dual-Attenuator" configuration)

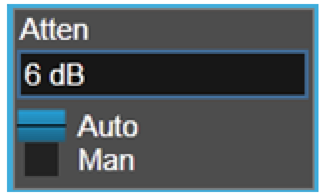
Single-Attenuator Configuration



You can tell which attenuator configuration you have by pressing the Attenuation tab, which (in most Modes) opensthe Attenuation menu. If the first control in the Attenuation menu says **Mech Atten** you have the Dual-Attenuator configuration. If the first control says **Atten** you have the Single-Attenuator configuration.



Dual Attenuator



Single Attenuator

(Note that depending on the measurement, there may be no Auto/Man functionality on the Mech Atten control).

In the Single-Attenuator configuration, youcontrol the attenuation with a single control, as the fixed stage has only two states. In the Dual-Attenuator configuration, both stages have significant range so you are given separate control of the mechanical and electronic attenuator stages.

When you have the Dual-Attenuator configuration, you may still have only a Single-Attenuator, because unless option EA3 (the Electronic Attenuator option) is available, and you purchase it, you will have only the mechanical attenuator.

Full Range Atten

The **Full Range Atten** control and **Attenuator Summary** only appear in N9041B, when the RF input is selected and the RF Input Port is set to RF Input 2, and the Full Range Attenuator is installed. The Full Range Attenuator adds a second input attenuator at the beginning of the RF Input 2, which enhances the protection and optimizes the performance of the extra internal mixers used by RF Input 2.

Remote Command	`[:SENSe]:POWer[:RF]:FRATten <rel_ampl>` `[:SENSe]:POWer[:RF]:FRATten?`
Example	`:POW:FRAT 14` `:POW:FRAT?`
Notes	When you enter an amplitude value that falls between valid values, the value will be incremented to the next smallest valid value
Dependencies	Only appears if input RF is selected, and RF Input Port 2 is selected, and the Full Range Attenuator exists
Couplings	This value is never changed by any coupling, however other couplings use this value. See the **Reference Level** and "Mech Atten" on page 1750 command descriptions
Preset	20 dB
State Saved	Saved in instrument state
Min	0 dB
Max	Only valid values are 0, 6, 14, 20 dB
Annotation	When the Input is RF, and the Input Port is RF Input 2, and the Full Range Attenuator is installed: On the Meas Bar, the field “Atten” displays as follows:

- If the sweep is entirely < 50 GHz, the value shown after “Atten:” is equal to Mech Atten + Elec Atten + Full Range Atten
- If the sweep is entirely > 50 GHz, the value shown after “Atten:” is equal to Full Range Atten
- If the sweep straddles 50 GHz, the value shown after “Atten:” is preceded by the symbol “>=” and is equal to Full Range Atten

In the **Amplitude**, "Attenuation" on page 1747 menu, and the Atten Meas Bar dropdown menu panel, a summary is displayed as follows:

“Total Atten below 50 GHz” followed by the value of Full Range Atten + Mech Atten + Elec Atten

“Total Atten above 50 GHz” followed by the value of Full Range Atten

For example, if Mech Atten = 6 dB, Elec Atten = 4 dB, and Full Range Atten = 20 dB, the summary below is shown:

- Attenuator summary:
- Total Atten below 50 GHz: 30 dB
- Total Atten above 50 GHz: 20 dB

Mech Atten

This control is labeled **Mech Atten** in Dual-Attenuator models and **Atten** in Single-Attenuator models. In the Dual-Attenuator configuration, this control only affects the mechanical attenuator.

This control lets you modify the attenuation applied to the RF input signal path. This value is normally auto coupled to the Ref Level, the Internal Preamp Gain, any External Gain that is entered, and the Max Mixer Level, as described in the table below.

See "Attenuator Configurations and Auto/Man" on page 302

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation <rel_ampl>`
	`[:SENSe]:POWer[:RF]:ATTenuation?`
	`[:SENSe]:POWer[:RF]:ATTenuation:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:POWer[:RF]:ATTenuation:AUTO?`

Example	`:POW:ATT 20`
	Dual-Attenuator configuration: sets the mechanical attenuator to 20 dB
	Single-Attenuator mode: sets the main attenuation to 20 dB (see below for definition of “main” attenuation)
	In either case, if the attenuator was in Auto, it is set to Manual
	`:POW:ATT:AUTO ON`
	Turn Auto Mech Atten ON

Dependencies	Some measurements do not support the Auto setting of "Mech Atten" on page 300. In these measurements, the Auto/Man selection is not available, and the Auto/Man toggle function is not

	available In Dual-Attenuator configurations, when the electronic attenuator is enabled, the mechanical attenuator has no auto setting and the Auto/Man toggle function is not available. The state of Auto/Man is remembered and restored when the electronic attenuator is once again disabled. This is described in more detail in "Elec Atten" on page 1753 See "Attenuator Configurations and Auto/Man" on page 302 for more information on the Auto/Man functionality `:POW:ATT:AUTO` is only available in measurements that support Mech Atten Auto, such as Swept SA
Couplings	If the RF Input Port is the RF Input: – If the USB Preamp is connected to USB, use 0 dB for Mech Atten – Otherwise compute the auto-selected value of Mech Atten based on **Reference Level**, Int Preamp, External Gain, Ref Level Offset, Max Mixer Level, µW Path Control and IF Gain settings. Limit this value to be no less than 6 dB (total attenuation below 6 dB can never be chosen by Auto) – In the N9041B, if the RF Input Port is RF Input 2, use the formula above and subtract the Full Range Atten value from the result to determine the Mech Atten. Limit the value so that it is never lower than 0 dB and so that total attenuation, including Full Range Atten, is never less than 6 dB (total attenuation, including Full Range Atten below 6 dB, can never be chosen by Auto) In External Mixingand BBIQ, where the Attenuator is not in the signal path, the Attenuator setting changes as described above when "Mech Atten" on page 300 is in Auto, but no changes are made to the actual attenuator hardware setting until the input is changed back to the RF Input For CXA-m with option FSA (Fine-Step Attenuator or 2 dB steps), the FSA-like behavior is only available when the frequency setting is <= 7.5GHz. So, when the frequency is changed from below 7.5GHz to above 7.5GHz, the attenuation setting will be changed to a multiple of 10dB which will be no smaller than the previous setting. For example, 4dB attenuation will be changed to 10dB
Preset	The preset for Mech Attenuation is "Auto" The Auto value of attenuation is 10 dB ON
State Saved	Saved in instrument state
Min	0 dB The attenuation set by this control cannot be decreased below 6 dB with the knob or step keys. Values below 6 dB must be directly entered from the keypad or via SCPI. This protects against setting a dangerously small attenuation value, which can put the instrument at risk of damage to input circuitry. If the current mechanical attenuation is below 6 dB, it can be increased with the knob and step keys, but not decreased
Max	CXA Option 503 or 507: 50 dB EXA: 60 dB All other models: 70 dB Note that in the Single-Attenuator configuration, the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB.
Annotation	The current value for Total Atten is displayed in the Measurement Bar at the top of the display. A value appears for Electronic Attenuation only if the Electronic Attenuator is enabled. The annotation appears as Atten: <total> dB (e<elec>)

The e letter is in amber in Single-Attenuator configurations

For example:

Dual-Attenuator configuration:

Atten: 24 dB (e14)

Indicating the total attenuation is at 24 dB and the electronic attenuation is at 14 dB

Single-Attenuator configuration:

A: 24 dB (e14)

Indicating the total attenuation is at 24 dB and the “soft” attenuation is at 14 dB (see below for definition of “soft” attenuation)

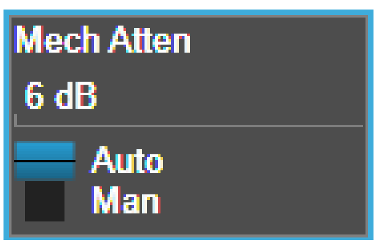
When in Manual, a # sign appears in front of Atten in the annotation

Attenuator Configurations and Auto/Man

As described in "Attenuation" on page 1747 , there are two distinct attenuator configurations available in the X-Series, the single attenuator and Dual-Attenuator configurations. In Dual-Attenuator configurations, we have the mechanical attenuation and the electronic attenuation, and the current total attenuation is the sum of the electronic + mechanical attenuation. In Single-Attenuator configurations, we refer to the attenuation set using "Mech Atten" on page 300 (or `:POW:ATT`) as the “main” attenuation; and the attenuation that is set by `:POW:EATT` as the “soft” attenuation (`:POW:EATT` is honored even in the Single-Attenuator configuration, for compatibility purposes). Then the current total attenuation is the sum of the main + soft attenuation. See "Elec Atten" on page 1753 for more on “soft” attenuation.

NOTE

In some measurements, the **Mech Atten** control has an Auto/Man function. In these measurements, an Auto/Man switch is shown on the **Mech Atten** control:



Note that in configurations that include an Electronic Attenuator, this switch is only shown when the Electronic Attenuator is disabled.

In other measurements, **Mech Atten** has no Auto/Man function. In these measurements, no switch is shown on the **Mech Atten** control:

Mech Atten also appears with no switch, as above, in configurations that include an Electronic Attenuator but when the Electronic Attenuator is enabled.

Elec Atten

Controls the Electronic Attenuator in Dual-Attenuator configurations. This control does not appear in Single-Attenuator configurations, as the control of both the mechanical and electronic stages of the Single-Attenuator is integrated into the single **Atten** control.

This control includes an Enable/Disable toggle switch; it is only possible to enter a value for the Electronic Attenuator when this switch is in the “Enable” position.

See "More Information" on page 304

Remote Command	`[:SENSe]:POWer[:RF]:EATTenuation <rel_ampl>`
	`[:SENSe]:POWer[:RF]:EATTenuation?`
	`[:SENSe]:POWer[:RF]:EATTenuation:STATe OFF | ON | 0 | 1`
	`[:SENSe]:POWer[:RF]:EATTenuation:STATe?`

Example	`:POW:EATT 10`
	`:POW:EATT?`
	`:POW:EATT:STAT ON`
	`:POW:EATT:STAT?`

Notes	Electronic Attenuation’s specification is defined only when Mechanical Attenuation is 6 dB
Dependencies	This control only appears in Dual-Attenuator models with an Electronic Attenuator installed and licensed. It does not appear in models with the Single-Attenuator configuration, as in the Single-Attenuator configuration there is no “electronic attenuator” there is only a single integrated attenuator (which has both a mechanical and electronic stage). However, in the Single-Attenuator configuration, EATT SCPI commands are accepted for compatibility with other X-series instruments and set a “soft” attenuation as described in . The “soft” attenuation is treated as an addition to the “main” attenuation value set by the Atten control or the POW:ATT SCPI command and affects the total attenuation displayed on the Atten control and the Meas Bar The electronic attenuator (and the “soft” attenuation function provided in Single-Attenuator configurations) is unavailable above the low band (0-3.6 GHz, 0-3.4 GHz 0-3GHz, depending on the model). If the low band ranges from 0-3.6GHz, and Stop Frequency of the instrument is > 3.6 GHz, then the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed out If the Internal Preamp is on, meaning it is set to Low Band or Full, the electronic attenuator (and the “soft” attenuation function provided in Single-Attenuator configurations) is unavailable. In this case the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed out If either of the above is true, if the SCPI command is sent, an error indicating that the electronic attenuator is unavailable will be sent If both of the above are true, pressing the control will generate error message -221, in other words, the frequency range lockout takes precedence If the electronic/soft Attenuator is enabled, then the Stop Freq of the instrument is limited to 3.6 GHz and the Internal Preamp is unavailable The SCPI-only “soft” electronic attenuation for the single-attenuator configuration is not available in all measurements; in particular, it is not available in the Swept SA measurement

Couplings	Enabling and disabling the Electronic Attenuator affects the setting of the Mechanical Attenuator (in Dual-Attenuator configurations). This is described in more detail below and in the section "Attenuator Configurations and Auto/Man" on page 1752
Preset	OFF (Disabled) for Swept SA measurement ON (Enabled) for all other measurements that support the electronic attenuator
State Saved	Saved in instrument state
Min	0 dB
Max	Dual-Attenuator configuration: 24 dB Single-Attenuator configuration: the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB
Annotation	See Annotation under the **Mech Atten** control description

More Information

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear. These advantages primarily aid in remote operation and are negligible for front panel use. See "Using the Electronic Attenuator: Pros and Cons" on page 305 for a detailed discussion of the pros and cons of using the electronic attenuator.

For the Single-Attenuator configuration, for SCPI backwards compatibility, the “soft” attenuation feature replaces the Dual-Attenuator configuration’s electronic attenuator. All the same couplings and limitations apply. See "Attenuator Configurations and Auto/Man" on page 1752

Mechanical Attenuator Transition Rules

When the Electronic Attenuator is enabled, the Mechanical Attenuator transitions to a state that has no Auto function. Below are the rules for transitioning the Mechanical Attenuator. Note that the information below ONLY applies to the Dual-Attenuator configurations, and ONLY when the Electronic Attenuator is installed:

When the Electronic Attenuation is enabled from a disabled state:

The Mechanical Attenuator is initialized to 10 dB (this is its optimal performance setting). You can then set it as desired with SCPI, numeric keypad, step keys, or knob, and it behaves as it normally would in manual mode

The Auto/Man state of (Mech) Atten is saved

The Auto/Man toggle on the (Mech) Atten control disappears and the auto rules are disabled

The Electronic Attenuator is set to 10 dB less than the previous value of the Mechanical Attenuator, within the limitation that it must stay within the range of 0 to 24 dB of attenuation

Examples in the Dual-Attenuator configuration:

Mech Atten at 20 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 10 dB. New total attenuation equals the value before Elec Atten enabled

Mech Atten at 0 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 0 dB. New total attenuation does not equal the value before Elec Atten enabled

Mech Atten at 40 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 24 dB. New total attenuation does not equal the value before Elec Atten enabled

When the Electronic Attenuation is disabled from an enabled state:

The Elec Atten control is grayed out

- The Auto/Man state of (Mech) Atten is restored

If now in Auto, (Mech) Atten recouples

If now in Man, (Mech) Atten is set to the value of total attenuation that existed before the Elec Atten was disabled. The resulting value is rounded up to the smallest value possible given the (Mech) Atten Step setting - (That is, 57 dB changes to 58 dB when (Mech) Atten Step is 2 dB)

Using the Electronic Attenuator: Pros and Cons

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear.

The “finer steps” advantage of the electronic attenuator is beneficial in optimizing the alignment of the instrument dynamic range to the signal power in the front panel as well as remote use. Thus, you can achieve improved relative signal measurement accuracy. Compared to a mechanical attenuator with 2 dB steps, the 1 dB resolution of the electronic attenuator only gives better resolution when the odd-decibel steps are used. Those odd-decibel steps are less accurately calibrated than the even-decibel steps, so one tradeoff for this superior relative accuracy is reduced absolute amplitude accuracy.

Another disadvantage of the electronic attenuator is that the spectrum analyzer loses its “Auto” setting, making operation less convenient.

Also, the relationship between the dynamic range specifications (TOI, SHI, compression, and noise) and instrument performance are less well-known with the electrical attenuator. With the mechanical attenuator, TOI, SHI, and compression threshold levels increase dB-for-dB with increasing attenuation, and the noise floor does as well. With the electronic attenuator, there is an excess attenuation of about 1 to 3 dB between 0 and 3.6 GHz, making the effective TOI, SHI, and so forth, less well known. Excess attenuation is the actual attenuation relative to stated attenuation. Excess attenuation is accounted for in the instrument calibration

Adjust Atten for Min Clipping

Sets the combination of mechanical and electronic attenuation and gain based on the current measured signal level so that clipping will be at a minimum.

This is an "immediate action" function, that is, it executes once, when the control is pressed.

The algorithms that are used for the adjustment are documented under "Pre-Adjust for Min Clipping" on page 1757.

Remote Command	[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate
Example	:POW:RANG:OPT IMM
Notes	Executing Adjust Atten for Min Clipping initiates the measurement.
Dependencies	Does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum measurements For the Waveform measurement, this control is available only in 5G NR Mode

Adjust Atten

Allows you to select;

- Electric attenuator only
- Combination of Electric attenuator and Mechanical attenuator

when the command [:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate is executed.

Remote Command	[:SENSe]:POWer[:RF]:RANGe:OPTimize:TYPE EONLy | COMBined [:SENSe]:POWer[:RF]:RANGe:OPTimize:TYPE?
Example	:POW:RANG:OPT:TYPE EONL :POW:RANG:OPT:TYPE?
Dependencies	Does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum measurements For the Waveform measurement, this control is available only in 5G NR Mode
Preset	COMBined
State Saved	Saved in instrument state

Pre-Adjust for Min Clipping

If this function is ON, it applies the adjustment described under "Adjust Atten for Min Clipping" on page 1756 each time a measurement restarts. Therefore, in Continuous measurement mode, it only executes before the first measurement.

In Dual-Attenuator models, you can set **Elec+Mech Atten**, in which case both attenuators participate in the autoranging, or **Elec Atten Only**, in which case the mechanical attenuator does not participate in the autoranging. This latter case results in less wear on the mechanical attenuator and is usually faster.

See "Adjustment Algorithm" on page 308

Selection	Example	Note
Off	:POW:RANGe:OPT:ATT OFF	This is the default setting
Elec Atten Only	:POW:RANGe:OPT:ATT ELEC	Selects only the electric attenuator to participate in auto ranging. This offers less wear on the mechanical attenuator and is usually faster
Mech + Elec Atten	:POW:RANGe:OPT:ATT COMB	In Dual-Attenuator models, this selects both attenuators to participate in the autoranging

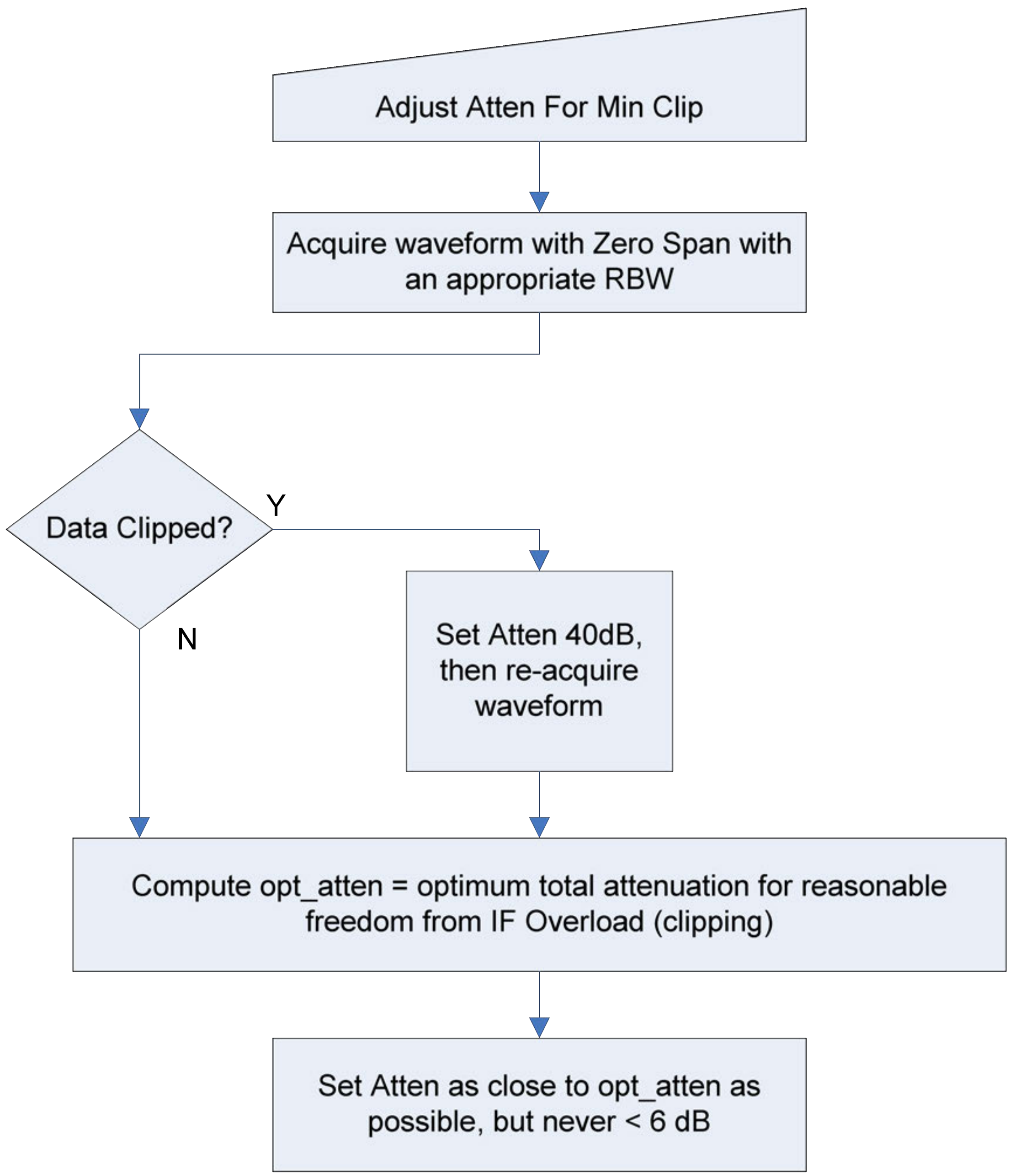
Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation OFF | ON | ELECtrical | COMBined` `[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation?`
Example	`:POW:RANG:OPT:ATT OFF` `:POW:RANG:OPT:ATT?`
Notes	The parameter option ELECtrical sets this function to ON in Single-Attenuator models The parameter option COMBined is mapped to ELECtrical in Single-Attenuator models. If you send COMBined, it sets the function to ON and returns ELEC to a query For SCPI compatibility with models that do not have an input attenuator, the ON parameter is honored and mapped to COMBined
Dependencies	This control only appears in Dual-Attenuator models with an Electronic Attenuator installed In instruments with Dual-Attenuator model, when **Enable** "Elec Atten" on page 1753 is OFF or grayed-out, "Pre-Adjust for Min Clipping" on page 306 is grayed-out This control does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum measurements For the Waveform measurement, this control is available only in 5G NR Mode
Preset	OFF when Elec Atten is Disabled at preset, otherwise ELEC
State Saved	Saved in instrument state
Range	Dual-Attenuator models: Off | Elec Atten Only | Mech + Elec Atten Single-Attenuator models: Off | On

Notes	ON aliases to "Elec Atten Only" (`:POW:RANG:OPT:ATT ELEC`) OFF aliases to "Off" (`:POW:RANG:OPT:ATT OFF`) `:POW:RANG:AUTO?` returns true if `:POW:RANG:OPT:ATT` is not OFF
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:RANGe:AUTO ON | OFF | 1 | 0` `[:SENSe]:POWer[:RF]:RANGe:AUTO?`

Adjustment Algorithm

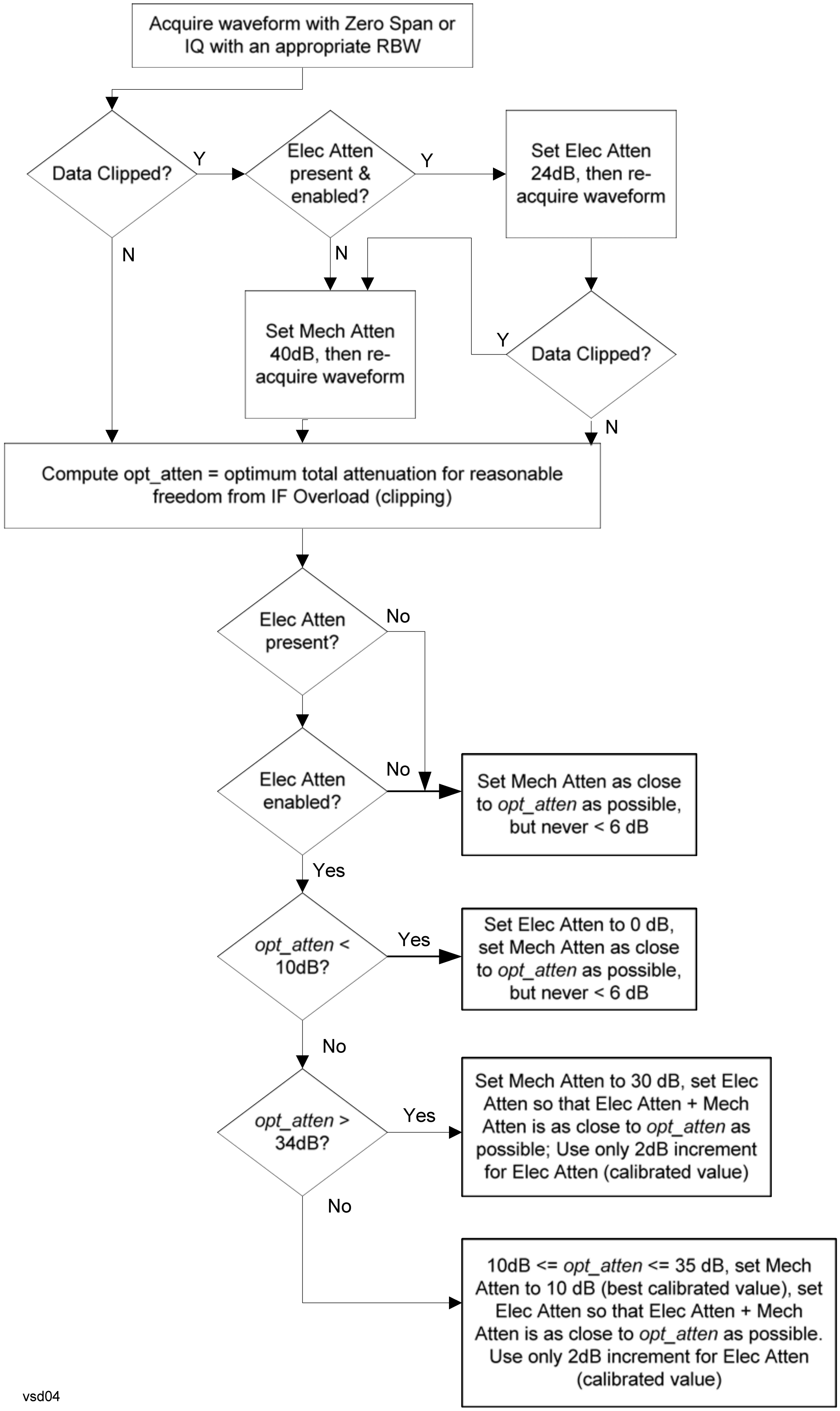
The algorithms for the adjustment are documented below:

Single-Attenuator Models

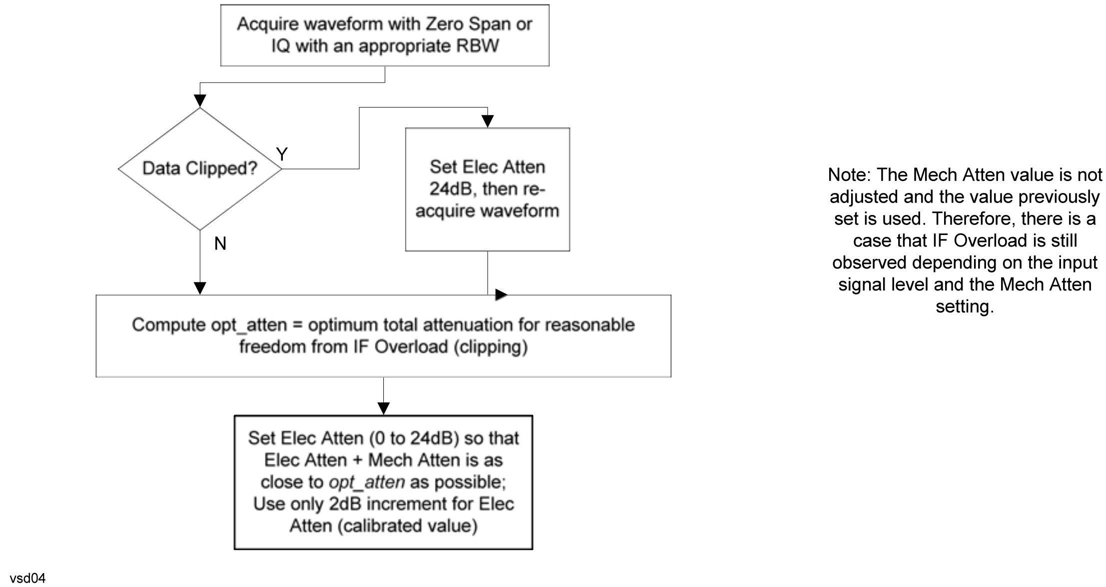


Dual-Attenuator models

"Adjust Atten for Min Clipping" on page 1756 or "Pre-Adjust for Min Clipping" on page 306 selection is Mech + Elec Atten:


Acquire waveform with Zero Span or IQ with an appropriate RBW
Data Clipped?
Y
N
Elec Atten present & enabled?
Y
N
Set Elec Atten 24dB, then re-acquire waveform
Set Mech Atten 40dB, then re-acquire waveform
Y
Data Clipped?
N
Compute opt_atten = optimum total attenuation for reasonable freedom from IF Overload (clipping)
Elec Atten present?
No
Elec Atten enabled?
No
Set Mech Atten as close to opt_atten as possible, but never < 6 dB
Yes
opt_atten < 10dB?
Yes
Set Elec Atten to 0 dB, set Mech Atten as close to opt_atten as possible, but never < 6 dB
No
opt_atten > 34dB?
Yes
Set Mech Atten to 30 dB, set Elec Atten so that Elec Atten + Mech Atten is as close to opt_atten as possible; Use only 2dB increment for Elec Atten (calibrated value)
No
10dB <= opt_atten <= 35 dB, set Mech Atten to 10 dB (best calibrated value), set Elec Atten so that Elec Atten + Mech Atten is as close to opt_atten as possible. Use only 2dB increment for Elec Atten (calibrated value)
vsd04

"Pre-Adjust for Min Clipping" on page 306 selection is Elec Only:



Mech Atten Step

Controls thestep size used when making adjustments to the input attenuation.

This control is labeled **Mech Atten Step** in Dual-Attenuator models and **Atten Step** in Single-Attenuator models. In the Dual-Attenuator configuration, this control only affects the step size of the mechanical attenuator.

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement] 10 dB | 2 dB` `[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement]?`
Example	`:POW:ATT:STEP 2` `:POW:ATT:STEP?`
Notes	This feature has a toggle choice from the front panel, but it takes a specific value (in dB) when used remotely. The only valid values are 2 and 10
Dependencies	Blanked in EXA, CXA and CXA-m if option FSA (2 dB steps) is not present. If blanked, attempts to set it via SCPI yield an error
Couplings	When the attenuation step size changes, the current mechanical attenuation value is adjusted (if necessary) to be quantized to the new step size. That is, if step is set to 10 dB, mech atten is increased if necessary so it is a multiple of 10 dB
Preset	EXA, CXA and CXA-m: 10 dB (2 dB with option FSA) All other models: 2 dB
State Saved	Saved in instrument state

Max Mixer Level

Allows you to set the maximum level to be applied to the mixer for a signal at the top of the screen. By setting this value up or down you can allow more or less signal through the system.

The major impact of changes to **Max Mixer Level** is seen in changes to the value to which **Reference Level** is limited. Max Ref Level depends on Max Mixer Level and Attenuation, and therefore a higher Max Mixer Level may let you set Ref Level higher. However, changing this value can impact your TOI, compression, or dynamic range. The preset value of this function is best for most measurements.

See also "Max Mixer Lvl Rules" on page 1762.

Remote Command	`[:SENSe]:POWer[:RF]:MIXer:RANGe[:UPPer] <real>` `[:SENSe]:POWer[:RF]:MIXer:RANGe[:UPPer]?`
Example	`:POW:MIX:RANG -15 dBm` `:POW:MIX:RANG?`
Dependencies	Only appears in Swept SA and RTSA measurements
Preset	-10 dBm
State Saved	Saved in instrument state
Min	-50 dBm
Max	0 dBm

Max Mixer Lvl Rules

Allows you to optimize the Max Mixer Level setting for certain kinds of measurements.

- `NORMal` – The historical, and thus backwards compatible, setting range (–50 to 0 dBm) and default setting (–10 dBm). The instrument has been designed so that, at the default setting, any signal below the **Reference Level** is extremely unlikely to create ADC overloads. At this mixer level the scale fidelity will be within specifications, thus compression with be negligible.
- `TOI` – Allows a range of settings of the "Max Mixer Level" on page 1762, –50 to –10 dBm, that can be optimum for measurements limited by the instrument third-order dynamic range. The default setting, –25 dBm, is commonly appropriate but RBW affects this. A good setting for Max Mixer Level would be higher than the optimum mixer level by half of the attenuator step size.
- `COMPression` – Allows a range of settings of the Max Mixer Level, –10 to +10 dBm or more, that can be optimum for measurements limited by the tradeoffs between instrument accuracy due to compression, and dynamic range due to the noise floor. The default setting, –3 dBm, is commonly appropriate, representing mixer drive levels that cause 1 dB or less compression at most carrier

frequencies. Typical measurements that would be optimized by this setting are the measurement of low sideband levels, including nulls, in angle-modulated signals (FM and PM). Also pulsed-RF measurements, including finding nulls to estimate pulse width, which are often best done with significant overdrive (compression) of the front end.

Setting Name (readback)	Setting Name (verbose)	Max Mixer Level Preset Value, dBm	Max Mixer Level minimum value, dBm	Max Mixer Level maximum value, dBm
NORMal	Normal – balance TOI, noise, and compression	–10	–50	0
TOI	TOI-limited dynamic range	–25	–50	–10
COMPression	Compression-limited dynamic range	–3	–10	+30

Remote Command	[:SENSe]:POWer[:RF]:MIXer:RULEs NORMal | TOI | COMPression [:SENSe]:POWer[:RF]:MIXer:RULEs?
Example	:POW:MIX:RULE:COMP
Dependencies	Only appears in Swept SA and RTSA
Preset	NORM

3.3.3.3 Range (Non-attenuator models)

This tab is only available for Keysight's modular signal analyzers and certain other Keysight products. Examples include:

– VXT

– E7760

– M9391A

– M9393A

This tab also does not appear in UXM. In UXM, all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

State Saved	No

Range

Represents the amplitude of the largest sinusoidal signal that could be present within the IF without being clipped by the ADC. For signals with high peak-to-average ratios, the range may need to exceed the rms signal power by a significant amount to avoid clipping.

This is a measurement global setting.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe <real>` `[:SENSe]:POWer[:RF]:RANGe?`
Example	`:POW:RANG 10 dBm` `:POW:RANG?`
Notes	The MIN and MAX values are affected by the External Gain parameters, and by the **Center Frequency** The hardware compensates for frequency response and alters the Range setting
Preset	0 dBm
State Saved	Yes
Min	-100
Max	100
Annotation	Meas Bar

Adjust Range for Min Clipping

Sets the combination of attenuation and gain based on the current measured signal level so that clipping will be at a minimum.

This is an "immediate action" function, that is, it executes once, when the key is pressed.

This key does not appear in measurements that do not support this functionality.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate`
Notes	Executing Adjust Range for Min Clipping initiates the measurement
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760

Pre-Adjust for Min Clipping

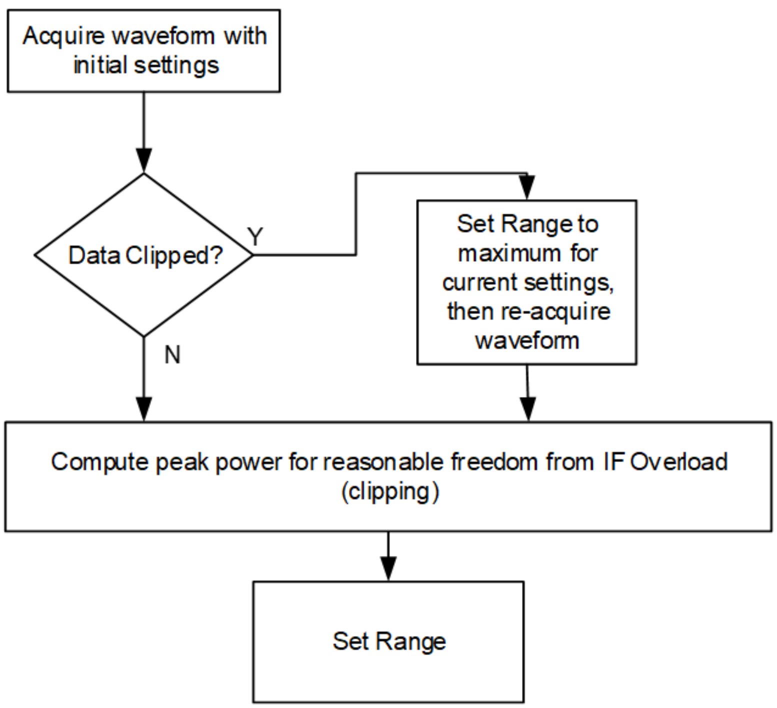
If this function is ON, it applies the adjustment described under Adjust Range For Min Clipping each time a measurement restarts. Therefore, in Continuous measurement mode, it only executes before the first measurement.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation OFF | ON | ELECtrical`

	| COMBined [:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation?
Notes	Because there is no attenuator control available in these models, the control displays only ON and OFF choices. However, for SCPI compatibility with other platforms, all three parameters (ELECtrical, COMBined, and ON) are honored and all are mapped to ELECtrical, so if any of these three parameters is sent, a subsequent query will return ELEC
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760
Preset	OFF for Swept SA measurement; ON for all other measurements that support **Pre-Adjust for Min Clipping**
State Saved	Saved in instrument state

Adjustment Algorithm

The algorithm for the adjustment is documented below:



Peak-to-Average Ratio

Used with "Range (Non-attenuator models)" on page 1864 to optimize the level control in the instrument. The value is the ratio, in dB, of the peak power to the average power of the signal to be measured. A ratio of 0 should be used for sinusoidal signals; for 802.11g OFDM signals use 9 dB.

All Applications (Modes) show the current value of Peak-to-Average ratio on the control. However, some applications do not permit changing the value. In these situations, the control is grayed-out.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:PARatio <real>` `[:SENSe]:POWer[:RF]:RANGe:PARatio?`
Example	`:POW:RANG:PAR 12 dB`
Notes	In some Applications (Modes) this parameter is read-only; meaning the value will appear on the control and query via SCPI, but is not changeable. In such applications the control is grayed-out. Attempting to change the value via SCPI will be ignored but no error message will be generated
Dependencies	This control does not appear in Spectrum Analyzer Mode
Preset	10 dB VXT Models M9410A/11A: 0 dB
State Saved	Saved in instrument state
Min	0 dB
Max	20 dB VXT Models M9410A/11A: 50 dB

Mixer Lvl Offset

This is an advanced setting to adjust target Range at the input mixer, which in turn affects the signal level in the instrument's IF. This setting can be used when additional optimization is needed after setting "Peak-to-Average Ratio" on page 1866. Positive values of offset optimize noise performance over distortion, negative values optimize distortion performance over noise.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet <real>` `[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet?`
Example	`:POW:RANG:MIX:OFFS -5 dB`
Preset	0 dB
State Saved	Saved in instrument state
Min	-35 dB VXT Models M9410A/11A: -34 dB
Max	30 dB

3.3.3.4 Range (Baseband Input models)

This tab is only available when Option BBA is present (I/Q Baseband Inputs), the current measurement supports option BBA, and I/Q is the selected input. It replaces the Attenuation tab in that case.

Each input channel (I and Q) has four internal gain ranges. The maximum allowed voltage in each gain range is slightly more than the nominal value, so the break point between ranges is a few millivolts higher than the nominal (setting a peak voltage of 0.502 mV will still map to the 0.5 V Peak range).

Gain Setting	Volts RMS	Volts Peak	Volts Peak - Peak	dBm (50Ω)	Break Point
0 dB	0.7071	1.0	2.0	10	n/a
6 dB	0.3536	0.5	1.0	4	0.502 V Peak
12 dB	0.1768	0.25	0.5	-2	0.252 V Peak
18 dB	0.0884	0.125	0.25	-8	0.127 V Peak

Dependencies	Available only when the selected input is I/Q. If the current measurement does not support baseband inputs, an error will be displayed: "No result; Meas invalid with I/Q inputs"
State Saved	No

Range Auto/Man

The Auto setting for Range causes the range to be set based on the Y Scale settings. When Range is "Auto", the I & Q Range are set based on the top of the Y Scale when the Y scale is in dB units (for example, power), or to the max(abs(top), abs(bottom)) when the Y scale reference is not at the top of the screen.

Not all measurements support **Range Auto/Man**. If Auto is not supported in the current measurement, this control is grayed-out displaying "Man", and `MAN` is returned to a SCPI query, but this does *not* change the Auto/Man setting for Range. When you switch to a measurement that supports Auto, it goes back to Auto if it was previously in Auto mode.

Remote Command	`[:SENSe]:VOLTage:IQ:RANGe:AUTO OFF | ON | 0 | 1` `[:SENSe]:VOLTage:IQ:RANGe:AUTO?`

Example	Put the I Range and Q Range in manual.
	`:VOLT:IQ:RANG:AUTO OFF`
	`:VOLT:IQ:RANG:AUTO?`

Dependencies	If Auto is not supported, sending the SCPI command generates an error
Couplings	When in Auto, both I Range and Q Range are set to the same value, computed as follows: Maximum absolute value is computed for the Y Scale. The top and bottom of the graph are computed based on Ref Value, Scale/Div, and Ref Position. Formula: Y_{Max} = max(abs(top), abs(bottom)) The I Range and Q Range are then set to Y_{Max}
Preset	ON
State Saved	Saved in instrument state
Annotation	When in Man, the Range annotation is preceded by "#"

This is an alternate form of the command to match the `POWer` form of the I Range and Q Range SCPI.

Remote Command	`[:SENSe]:POWer:IQ:RANGe:AUTO OFF | ON | 0 | 1` `[:SENSe]:POWer:IQ:RANGe:AUTO?`

Example	Put the I Range and Q Range in manual
	`:POW:IQ:RANG:AUTO OFF`
	`:POW:IQ:RANG:AUTO?`

Notes	`:POW:IQ:RANG:AUTO` is an alternate form of `:VOLT:IQ:RANG:AUTO`, to maintain consistency with I Range and Q Range, which support both the `POWer` and `VOLTage` forms of the command
Preset	`ON`
Range	Auto | Man

I Range

The internal gain range for the I channel when the Input Path is I Only or I and I/Q. Used for both the I and Q channels when the Input Path is I+jQ.

Remote Command	`[:SENSe]:VOLTage:IQ[:I]:RANGe[:UPPer] <voltage>` `[:SENSe]:VOLTage:IQ[:I]:RANGe[:UPPer]?`

Example	Set the I Range to 0.5 V Peak
	`:VOLT:IQ:RANG 0.5 V`
	`:VOLT:IQ:RANG?`

Notes	The numeric entries are mapped to the smallest gain range whose break point is greater than or equal to the value, or 1 V Peak if the value is greater than 1 V
Couplings	When "Q Same as I" on page 1580 is On, the **I Range** value will be copied to "Q Range" on page 1578 Changing the value also sets Range = Man
Preset	1 V Peak
State Saved	Saved in instrument state
Range	1 V Peak (10 dBm @ 50 Ω) | 0.5 V Peak (4 dBm @ 50Ω) | 0.25 V Peak (-2 dBm @ 50Ω) | 0.125 V Peak (-8 dBm @ 50Ω)
Min	0.125 V
Max	1 V
Annotation	The Range annotation replaces the RF Input context's "Atten" annotation "Rng: <I Range>". When Range = Man the annotation is preceded by "#" The I Range is not annotated in Input Path Q Only. When I Range and Q Range are the same, the annotation is "Rng: <Range>". When I Range and Q Range are different and the Input Path is Ind I/Q, the annotation is "Rng: <I Range>, <Q Range>" and "Peak" is removed from the text. Examples: "Rng: 1 V Peak" the I Range is 1 V Peak "Rng: 1 V, 0.5 V " the I Range is 1 V Peak and the Q Range is 0.5 V Peak

This is an alternate form of the command to allow entry as a power.

Remote	`[:SENSe]:POWer:IQ[:I]:RANGe[:UPPer] <ampl>`

Command	`[:SENSe]:POWer:IQ[:I]:RANGe[:UPPer]?`

Example	Set the I Range to 0.5 V Peak when Reference Z is 50 Ω, and to 1.0 V Peak when Reference Z is 75 **Ω**
	`:POW:IQ:RANG 4 dBm`
	`:POW:IQ:RANG?`

Notes	The `POWer` form of the command is provided for convenience. It maps to the same underlying gain range parameter as the `VOLTage` form of the command The Reference Z (not the I channel Input Z) is used to convert the power to peak voltage, which is then used to set the I Range as with the `VOLTage` form of the command. The power values of the 4 range states (1V Peak, 0.5V Peak, 0.25V Peak, and 0.125V Peak) will vary with Reference Z. Here are some examples: 50 Ω: 10, 4, -2, -8 75 Ω: 8.2, 2.2, -3.8, -9.8 600 Ω: -0.8, -6.8, -12.8, -18.9
Preset	10.0 dBm
Range	-20 dBm to 10 dBm
Min	-20 dBm
Max	10 dBm

Q Range

The internal gain range for the Q channel.**Q Range** only applies to Input Path Q Only and Ind I/Q. For input I+jQ "I Range" on page 1577 determines both I and Q channel range settings.

Remote Command	`[:SENSe]:VOLTage:IQ:Q:RANGe[:UPPer] <voltage>` `[:SENSe]:VOLTage:IQ:Q:RANGe[:UPPer]?`

Example	Set the Q Range to 0.5 V Peak:
	`:VOLT:IQ:Q:RANG 0.5 V`
	`:VOLT:IQ:Q:RANG?`

Notes	The numeric entries are mapped to the smallest gain range whose break point is greater than or equal to the value, or 1 V Peak if the value is greater than 1 V **Q Range** is only used for Input Path Q Only and Ind I/Q. For input I+jQ, "I Range" on page 1577 determines both I and Q channel range settings
Couplings	When "Q Same as I" on page 1580 is On, the "I Range" on page 1577 value is copied to **Q Range** and the range value keys are disabled Changing the value also sets Range = Man
Preset	1 V Peak
State Saved	Saved in instrument state
Range	1 V Peak (10 dBm @ 50Ω) | 0.5 V Peak (4 dBm @ 50Ω) | 0.25 V Peak (-2 dBm @ 50Ω) | 0.125 V Peak (-8 dBm @ 50Ω)
Min	0.125 V

Max	1 V
Annotation	The Range annotation replaces the RF Input context's "Atten" annotation "Rng: <Q Range>". When Range = Man the annotation is preceded by "#" The Q Range is not annotated in Input Path I Only or I+jQ. When I Range and Q Range are the same, the annotation is "Rng: <Range>". When I Range and Q Range are different and the Input Path is Ind I/Q, the annotation is "Rng: <I Range>, <Q Range>" and "Peak" is removed from the text. Examples: "Rng: 1 V Peak" the Q Range is 1 V Peak "Rng: 1 V, 0.5 V " the I Range is 1 V Peak and the Q Range is 0.5 V Peak

This is an alternate form of the command to allow entry as a power.

Remote Command	`[:SENSe]:POWer:IQ:Q:RANGe[:UPPer] <ampl>` `[:SENSe]:POWer:IQ:Q:RANGe[:UPPer]?`

Example	Sets the Q Range to 0.5 V Peak when Reference Z is 50 Ω, and to 1.0 V Peak when Reference Z is 75 Ω:
	`:POW:IQ:Q:RANG 4 dBm`
	`:POW:IQ:Q:RANG?`

Notes	The `POWer` form of the command is provided for convenience. It maps to the same underlying gain range parameter as the `VOLTage` form of the command The Reference Z (not the Q channel Input Z) is used to convert the power to peak voltage, which is then used to set the Q Range as with the `VOLTage` form of the command. The power values of the 4 range states (1V Peak, 0.5V Peak, 0.25V Peak, and 0.125V Peak) will vary with Reference Z. Here are some examples: 50 Ω: 10, 4, -2, -8 75 Ω: 8.2, 2.2, -3.8, -9.8 600 Ω: -0.8, -6.8, -12.8, -18.9
Preset	10.0 dBm
Range	-20 dBm to 10 dBm
Min	-20 dBm
Max	10 dBm

Q Same as I

Many, but not all, usages require the I and Q channels to have an identical setup. To simplify channel setup, **Q Same as I** causes the Q channel range to be mirrored from the I channel. That way you only need to set up one channel (the I channel). The I channel values are copied to the Q channel, so at the time **Q Same as I** is Off, the I and Q channel setups will be identical.

Remote Command	`[:SENSe]:VOLTage|POWer:IQ:MIRRored OFF | ON | 0 | 1` `[:SENSe]:VOLTage|POWer:IQ:MIRRored?`
Example	Turn off the mirroring of I Range to Q Range. `:VOLT:IQ:MIRR OFF`

	:POW:IQ:MIRR OFF
Couplings	When ON, the "I Range" on page 1577 value is mirrored (copied) to the "Q Range" on page 1578
Preset	ON
State Saved	Saved in instrument state
Range	OFF|ON

3.3.3.5 Signal Path

Contains controls that pertain to the routing of the signal through the frontend of the instrument.

In general, this tab only appears in instruments whose hardware supports this signal routing. For example, this tab does not appear in many of the modular instrument products, including VXT Models M9420/21A. It also does not appear in UXM.

This tab *does* appear in VXT Models M9410A/11A because the Software Preselection control is in this tab, and VXT Models M9410A/11A implement a version of Software Preselection.

Presel Center

Pressing this control adjusts the centering of the preselector filter to optimize the amplitude accuracy at the frequency of the selected marker. If the selected marker is not on when **Presel Center** is pressed, the instrument turns on the selected marker, performs a peak search, and then performs centering on the marker's center frequency. If the selected marker is already on and between the start and stop frequencies of the instrument, the instrument performs the preselector calibration on that marker's frequency. If the selected marker is already on, but outside the frequency range between Start Freq and Stop Freq, the instrument first performs a peak search, and then performs centering on the marker's center frequency.

The value displayed on "Preselector Adjust" on page 1869 will change to reflect the new preselector tuning.

A number of considerations should be observed to ensure proper operation. See "Proper Preselector Operation" on page 322.

Remote Command	[:SENSe]:POWer[:RF]:PCENter
Example	:POW:PCEN
Notes	Note that the rules outlined above under the control description apply for the remote command as well as the key. The result of the command is dependent on marker position, etc. Any message shown by the control press is also shown in response to the remote command
Dependencies	Does not appear in CXA-m Does not appear in VXT Models M9410A/11A Grayed-out if the microwave preselector is off – If the selected marker's frequency is below Band 1, an advisory message is generated "Preselector

	not used in this frequency range" and no action is taken – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz – Blank in models that do not include a preselector, such as option 503. If the remote command is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View
Couplings	The active marker position determines where the centering will be attempted If the instrument is in a measurement such as averaging when centering is initiated, the act of centering the preselector restarts averaging, but the first average trace will not be taken until the centering is completed The offset applied to do the centering reads out on the "Preselector Adjust" on page 1869 control
Status Bits/OPC dependencies	When centering the preselector, `*OPC` will not return true until the process is complete and a subsequent measurement has completed, nor will results be returned to `:READ` or `:MEASure` queries The Measuring bit should remain set while this command is operating and should not go false until the subsequent sweep/measurement has completed

Proper Preselector Operation

A number of considerations should be observed to ensure proper operation:

1 If the selected marker is off, the instrument turns on a marker, performs a peak search, and adjusts the preselector using the selected marker's frequency. It uses the "highest peak" peak search method unqualified by threshold or excursion, so that there is no chance of a 'no peak found' error. It continues with that peak, even if it is the peak of just noise. Therefore, for this operation to work properly, there should be a signal on screen in a preselected range for the peak search to find

2 If the selected marker is already on, the instrument attempts the centering at that marker's frequency. There is no preselector for signals below about 3.6 GHz, so if the marker is on a signal below 3.6 GHz, no centering will be attempted and an advisory message generated

3 In some models, the preselector can be bypassed. If it is bypassed, no centering will be attempted in that range and a message will be generated

Preselector Adjust

Allows you to manually adjust the preselector filter frequency to optimize its response to the signal of interest. This function is only available when "Presel Center" on page 1868is available.

For general purpose signal analysis, using **Presel Center** is recommended. Centering the filter minimizes the impact of long-term preselector drift. **Preselector Adjust** can be used instead to manually optimize the preselector. One application of manual optimization would be to peak the preselector response, which both optimizes the signal-to-noise ratio and minimizes amplitude variations due to small (short-term) preselector drifting.

When **Presel Center** is performed, the offset applied to do the centering becomes the new value of **Preselector Adjust**.

Remote Command	`[:SENSe]:POWer[:RF]:PADJust <freq>` `[:SENSe]:POWer[:RF]:PADJust?`
Example	`:POW:PADJ 100KHz` `:POW:PADJ?`
Notes	The value on the control reads out to 0.1 MHz resolution
Dependencies	– Does not appear in CXA-m – Does not appear in VXT Models M9410A/11A – Grayed-out if microwave preselector is off – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz – Blank in models that do not include a preselector, such as option 503. If the SCPI is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View
Preset	0 MHz
State Saved	The **Preselector Adjust** value set by "Presel Center" on page 1868, or by manually adjusting **Preselector Adjust** It is not saved in instrument state, and does not survive a Preset or power cycle
Min	-500 MHz
Max	500 MHz
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PADJust` `[:SENSe]:POWer[:RF]:MMW:PADJust`

Notes	PSA had multiple preselectors, and you could select which preselector to adjust. Since the X-Series has only one mm/uW preselector, the preselector selection control is no longer available. However, to provide backward compatibility, we accept the legacy remote commands The command form has no effect, the query always returns `MWAVe`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:PADJust:PRESelector MWAVe | MMWave | EXTernal` `[:SENSe]:POWer[:RF]:PADJust:PRESelector?`

Internal Preamp

Accesses a menu of controls for the internal preamps. Turning on the preamp gives a better noise figure, but a poorer inter-modulation distortion (TOI) to noise floor dynamic range. You can optimize this setting for your particular measurement.

The instrument takes the preamp gain into account as it sweeps. If you sweep outside of the range of the preamp, the instrument will also account for that. The displayed result always reflects the correct gain.

For some measurements, when the preamp is on and any part of the displayed frequency range is below the lowest frequency for which the preamp has specifications, a warning condition message appears in the status line. For example, for a preamp with a 9 kHz lowest specified frequency: "Preamp: Accy unspec'd below 9 kHz".

Selection	Example	Note
Off	`:POW:GAIN OFF`	
Low Band	`:POW:GAIN ON` `:POW:GAIN:BAND LOW`	Sets the internal preamp to use only the low band. The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Low Band selection in the dropdown
Full Range	`:POW:GAIN ON` `:POW:GAIN:BAND FULL`	Sets the internal preamp to use its full range. The low band (0-3.6 GHz, 0-3.4 GHz, 0-3GHz, depending on the model) is supplied by the low band preamp and the frequencies above low band are supplied by the high band preamp The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Full Range selection in the dropdown. If the high band option is not installed the Full Range selection does not appear

Remote Command	`[:SENSe]:POWer[:RF]:GAIN:BAND LOW | FULL`
	`[:SENSe]:POWer[:RF]:GAIN:BAND?`
	`[:SENSe]:POWer[:RF]:GAIN[:STATe] OFF | ON | 0 | 1`
	`[:SENSe]:POWer[:RF]:GAIN[:STATe]?`

Example	`:POW:GAIN:BAND LOW`
	`:POW:GAIN:BAND?`
	`:POW:GAIN OFF`
	`:POW:GAIN?`

Dependencies	Preamp is not available on all hardware platforms. If the preamp is not present or is unlicensed, the control is not shown

	Does not appear in VXT Models M9410A/11A/15A If `:POW:GAIN:BAND FULL` is sent when a low band preamp is available, the preamp band parameter is set to `LOW` instead of `FULL`, and an "Option not installed" message is generated The preamp is not available when the electronic/soft attenuator is enabled
Preset	`LOW` `OFF`
State Saved	Saved in instrument state
Annotation	When the USB Preamp is not connected to USB, the Preamp annotation in the Meas Bar says "Off" if the preamp is off and displays the frequency range of the low band or full range preamp depending on the setting. For example, if the Preamp is set to Low Band and the Low Band is 3.6 GHz the annotation says "3.6 GHz". If it is a 13.6 GHz preamp and it is set to Full Range the annotation says "13.6 GHz" When the USB Preamp is connected to USB, the Preamp annotation says "Preamp: USB" if the internal preamp is off or "Preamp: USB, Int" if the internal preamp is on (only for measurements that support the USB preamp)

LNA

Lets you turn the Low Noise Amplifier (**LNA**) on or off.

The LNA is an additional preamplifier that provides superior DANL and frequency range compared to the Internal Preamp. The LNA provides lower system noise figure, especially at frequencies above 100 MHz, and can be operated up to the full range of 50 GHz instruments.

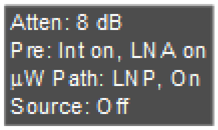
For best possible sensitivity, the LNA can be turned on together with the "Internal Preamp" on page 1870, although if you operate both preamps together, note that the TOI (distortion) specifications are impacted. The sensitivity improvement of this combination is substantial when operating in high band (frequencies above 3.6 GHz).

See "More Information" on page 326

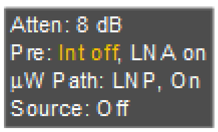
Remote Command	`[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe] OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe]?`
Example	`:POW:GAIN:LNA ON`
Dependencies	Requires option LNA Option LNA is not required by VXT model M9415A Does not appear in VXT models M9420A/21A/10A/11A May not appear in some measurements
Preset	`OFF`
State Saved	Saved in State

More Information

When the LNA is installed, the preamp annotation changes to show the state of both the LNA and the Internal Preamp. Below is an example:



Note that when operating entirely in the low band (below about 3.6 GHz), if the LNA is on, the Internal Preamp is switched off (even if you have its switch set to ON). This is because the noise performance is actually degraded in low band if both preamps are on. In this case, the annotation reflects the actual state of the two preamps, but the Internal Preamp annotation displays in amber, to warn you that the actual state of the Internal Preamp does not match the **Internal Preamp** switch control display:



µW Path Control

Options for this control include **µW Preselector Bypass** (Option MPB), **Low Noise Path** (Option LNP) and **Full Bypass Enable** in the High Band path circuits.

When the µW Preselector is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. When **Low Noise Path Enable** is selected, the instrument automatically bypasses certain circuitry in the high frequency bands that can contribute to noise, when it is appropriate based on other instrument settings.

For most applications, the preset state is **Standard Path**, which provides the best remote-control throughput, minimizes acoustic noise from switching and minimizes the risk of wear in the hardware switches, particularly in remote test scenarios where both low band and high band setups will follow in rapid succession. In this path, the bypass of the low band/high band switch and microwave preamp is never activated, which can cause some noise degradation but preserves the life of the bypass switch.

For applications that utilize the wideband IF paths, the preset state is **µW Preselector Bypas**s, if option MPB is present. This is because, when using a wideband IF such as the 140 MHz IF, the µW Preselector's bandwidth can be narrower than the available IF bandwidth, causing degraded amplitude flatness and phase linearity, so it is desirable to bypass the preselector in the default case.

You may choose **Low Noise Path Enable** for a lower noise floor, especially in the 21-26.5 GHz region, though without improving many measures of dynamic range, and without giving the best possible noise floor. The preamp, if purchased and used, gives better noise floor than does **Low Noise Path Enable**, but the preamp's compression threshold and third-order intercept are much poorer than that of **Low Noise Path Enable**.

A fourth choice is **Full Bypass Enable**, which combines **µW Preselector Bypass** and **Low Noise Path Enable**. Because this can bypass most of the circuitry between the input and the first mixer, care should be taken when using this setting to avoid damaging the mixer. **Full Bypass Enable** is only available if both options LNP and MPB are present, as well as option FBP.

Path	Example	Note
Standard Path	`:POW:MW:PATH STD`	Normal setting for most measurements. µW Preselector in circuit, Low Noise Path disabled
Low Noise Path Enable	`:POW:MW:PATH LNP`	See "Low Noise Path Enable" on page 330
µW Preselector Bypass	`:POW:MW:PATH MPB`	See "µW Preselector Bypass" on page 332
Full Bypass Enable	`:POW:MW:PATH FULL`	See "Full Bypass Enable" on page 333

Remote Command	`[:SENSe]:POWer[:RF]:MW:PATH STD | LNPath | MPBypass | FULL` `[:SENSe]:POWer[:RF]:MW:PATH?`

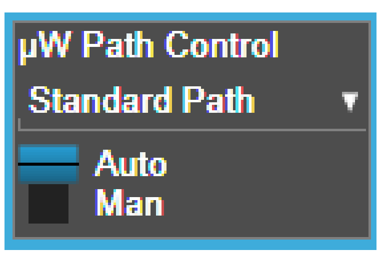
Example	`:POW:MW:PATH LNP`
	Enables the Low Noise path
	`:POW:MW:PATH?`

Notes	If "Presel Center" on page 1868 is performed, the instrument will momentarily switch to the Standard Path, regardless of the setting of **µW Path Control** The DC Block will always be switched in when the low noise path is switched in, to protect succeeding circuitry from DC. Note that this does not mean "when the low noise path is enabled" but when, based on the Low Noise Path rules, the path is actually switched in. This can happen when the selection is **Low Noise Path Enable** or **Full Bypass Enable**. In the case where the DC Block is switched in the instrument is now AC coupled. However, if you selected DC coupling, the UI would still behave as though it were DC coupled, including all annunciation, warnings, status bits, and responses to SCPI queries. This is because, based on other settings, the instrument could switch out the low noise path at any time and hence go back to being DC coupled Alignment switching ignores the settings in this menu, and restores them when finished
Dependencies	Does not appear in CXA-m Does not appear in VXT Models M9410A/11A Does not appear in BBIQ and External Mixing The **Low Noise Path Enable** selection does not appear unless Option LNP is present and licensed The **µW Preselector Bypass** selection does not appear unless Option MPB is present and licensed The **Full Bypass Enable** selection does not appear unless options LNP and MPB are both present as well as option FBP In any of these cases, if the required options are not present and the SCPI command is sent, error -241, "Hardware missing; Option not installed" is generated

	Low Noise Path Enable and **Full Bypass Enable** are grayed-out if the current measurement does not support them **Low Noise Path Enable** and **Full Bypass Enable** are not supported in Avionics and MMR Modes. In any of these cases (that is, the feature is not supported in either measurement or mode), if the SCPI command is sent, the following error is generated: -221, “Setting Conflict; Feature not supported for this measurement”
Preset	All except modes specified below: `STD` IQ Analyzer, VXA, Pulse and Avionics mode: – MPB option present and licensed: `MPB` – MPB option not present and licensed: `STD`
State Saved	Save in instrument state
Range	Standard Path|Low Noise Path Enable|µW Presel Bypass|Full Bypass Enable
Annotation	In the Meas Bar, if the Standard path is chosen, it says: µW Path: Standard If Low Noise Path is enabled but the LNP switch is not thrown, it shows: µW Path: LNP,Off If the Low Noise Path is enabled and the LNP switch IS thrown, it shows: µW Path: LNP,On If the preselctor is bypassed, it says: µW Path: Bypass If Full Bypass Enable is selected but the LNP switch is not thrown, it shows: µW Path: FByp,Off If Full Bypass Enable is selected and the LNP switch IS thrown, it shows: µW Path: FByp,On

µW Path Control Auto [Mode: VMA, WLAN, NR5G, CQM]

In VMA, WLAN, 5G NR, CQM modes, an Auto/Man switch is added to **µW Path Control**:



This allows the function to automatically switch based on certain Auto Rules as shown below:

VMA Mode

Measurement	When µW Path Control is in Auto:
Digital Demod	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Custom OFDM	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Presel Bypass
SEM	Always Presel Bypass
Spurious Emissions	Always Standard Path

WLAN Mode

Measurement	When µW Path Control is in Auto:
Modulation Analysis	Always Presel Bypass
Spectral Flatness	Always Presel Bypasss
Power vs Time	Always Presel Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Always Presel Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Always Presel Bypass
SEM	1. For 11be 320M, when 'Enabled Wideband IF for FFT' is OFF or 'Sweep Type Rule' is Best Dynamic Range, auto µW path is standard. 2. For other cases, auto µW path is presel bypass if presel bypass is enabled, auto µW path is standard if presel bypass is not enabled.
Spurious Emissions	Always Standard Path

5G NR Mode

Measurement	When µW Path Control is in Auto:
Modulation Analysis	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and "Allow Full Bypass in Auto" is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in

Measurement	When µW Path Control is in Auto:
	which case choose Full Bypass if conditions warrant(FBP Option is available and "Allow Full Bypass in Auto" is On), otherwise choose Preselector Bypass
Channel Power	Always Standard Path
Occupied BW	Always Standard Path
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Standard Path
SEM	Always Standard Path
Spurious Emissions	Always Standard Path
Transmit On|Off Power	Use Standard Path unless tuned frequency > 3.6 GHz and Info BW > 15 MHz, in which case choose Preselector Bypass

Channel Quality Mode

Measurement	When µW Path Control is in Auto:
Group Delay	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and "Allow Full Bypass in Auto" is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass

Remote Command	`[:SENSe]:POWer[:RF]:MW:PATH:AUTO ON | OFF | 1 | 0` `[:SENSe]:POWer[:RF]:MW:PATH:AUTO?`
Example	`:POW:MW:PATH:AUTO ON` `:POW:MW:PATH:AUTO?`
Dependencies	Only appears in VMA, WLAN, 5G NR and CQM modes
Couplings	See the tables above
Preset	ON
Range	ON|OFF

Low Noise Path Enable

You may select **Low Noise Path Enable**, which gives a lower noise floor under some circumstances, particularly when operating in the 21–26.5 GHz region. With the Low Noise Path enabled, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

- The instrument is not in the Low Band, meaning:
- the start frequency is above 3.5 GHz and
- the stop frequency is above 3.6 GHz
- the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Low Noise Path Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Low Noise Path Enable** is selected in the user interface. The only time the Low Noise Path is used is when **Low Noise Path Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

For measurements that use IQ acquisition, the low noise path is used when **Center Frequency** is in High Band (> 3.6 GHz) and no preamp is in use. In other words, the rules above are modified to use only the center frequency to qualify which path to switch in. This is not the case for FFTs in the Swept SA measurement; they use the same rules as swept measurements.

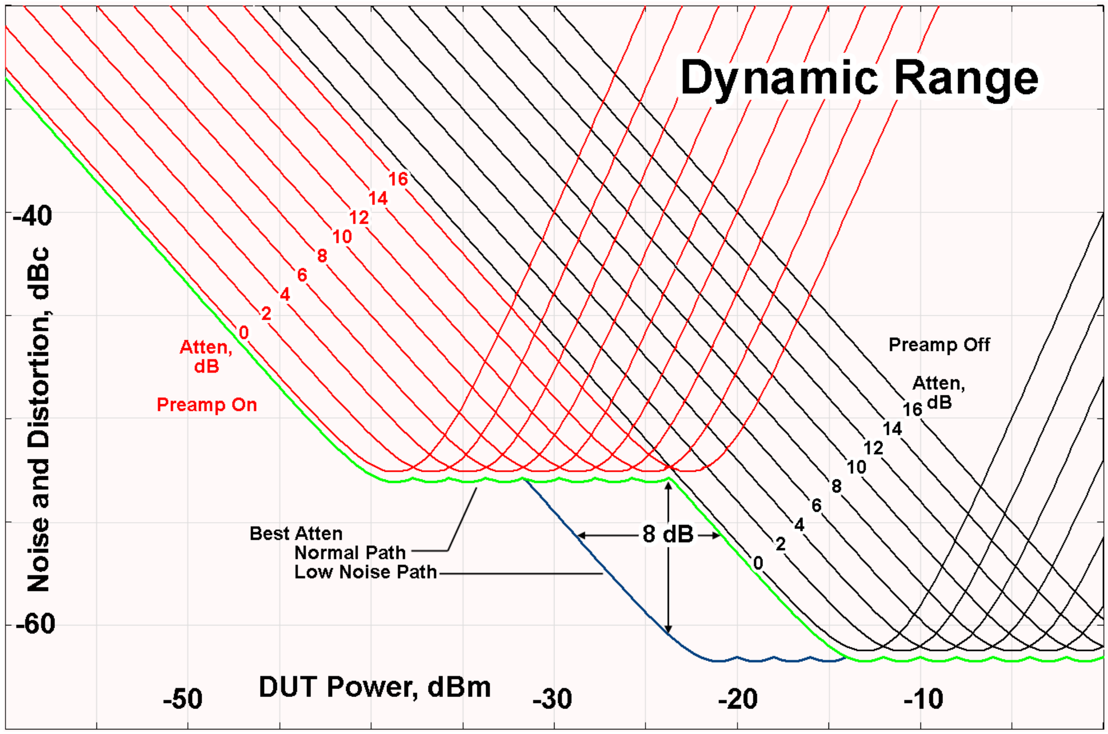
Note that the Low Noise Path, while giving improved DANL, has the disadvantage of decreased TOI performance and decreased gain compression performance relative to the standard path.

Note also that the bypass switch is a mechanical switch and has finite life, so if the **Low Noise Path Enable** is selected, it is possible to cause frequent cycling of this switch by frequently changing instrument settings such that the above conditions hold true only some of the time. A user making tests of this nature should consider opting for the **Standard Path**, which will never throw the bypass switch, at the expense of some degraded noise performance.

The low noise path is useful for situations where the signal level is so low that the instrument performance is dominated by noise even with 0 dB attenuation, but still high enough that the preamp option would have excessive third-order intermodulation or compression. The preamp, if purchased and used, gives better noise floor than does the “Low Noise Path.” However, its compression threshold and third-order intercept are much poorer than that of the non-preamp path.

There are some applications, typically for signals around –30 dBm, for which the third-order dynamic range of the standard path is good enough, but the noise floor is not low enough even with 0 dB input attenuation. When the third-order dynamic range of the preamp path is too little and the noise floor of the standard path is too high, the Low Noise Path can provide the best dynamic range

The graph below illustrates the concept. It shows, in red, the performance of an instrument at different attenuation settings, both with the preamp on and off, in a measurement that is affected by both instrument noise and instrument TOI. The green shows the best available dynamic range, offset by 0.5 dB for clarity. The blue shows how the best available dynamic range improves for moderate signal levels with the low noise path switched in. In this illustration, the preamp improves the noise floor by 15 dB while degrading the third-order intercept by 30 dB, and the low noise path reduces loss by 8 dB. The attenuator step size is 2 dB.



There are other times where selecting the low noise path improves performance, too. Compression-limited measurements such as finding the nulls in a pulsed-RF spectrum can profit from the low noise path in a way similar to the TOI-limited measurement illustrated. Accuracy can be improved when the low noise path allows the optimum attenuation to increase from a small amount like 0, 2 or 4 dB to a larger amount, giving better return loss at the instrument input. Harmonic measurements, such as second and third harmonic levels, are much improved using the low noise path because of the superiority of that path for harmonic (though not intermodulation) distortion performance.

µW Preselector Bypass

Toggles the preselector bypass switch for band 1 and higher. When the microwave presel is on, the signal path is preselected. When the microwave preselector is off, the signal path is not preselected. The preselected path is the normal path for the instrument.

The preselector is a tunable bandpass filter which prevents signals away from the frequency of interest from combining in the mixer to generate in-band spurious signals (images). The consequences of using a preselector filter are its limited bandwidth, the amplitude and phase ripple in its passband, and any amplitude and phase instability due to center frequency drift.

Option MPB or pre-selector bypass provides an unpreselected input mixer path for certain X-Series signal analyzers with frequency ranges above 3.6 GHz. This signal path allows a wider bandwidth and less amplitude variability, which is an advantage when doing modulation analysis and broadband signal analysis. The disadvantage is that, without the preselector, image signals will be displayed. Another disadvantage of bypassing the preselector is increased LO emission levels at the front panel input port.

Image responses are separated from the real signal by twice the 1st IF. For IF Paths of 10 MHz and 25 MHz, the 1st IF is 322.5 MHz, so the image response and the real signal will be separated by 645 MHz. The 1st IF will be different for other IF Path settings. When viewing a real signal and its corresponding image response in internal mixing, the image response will be to the left of the real signal.

Also, the image response and the real signal typically have the same amplitude and exhibit the same shape factor.

However, if Option FS1, Fast Sweep Capability, is enabled, the image response in the Swept SA measurement appears lower in amplitude and has a much wider shape factor compared to the real signal.

Full Bypass Enable

With **Full Bypass Enable** selected, the microwave preselector is bypassed. In addition, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

- The instrument is not in the Low Band, meaning:
- the start frequency is above 3.5 GHz and
- the stop frequency is above 3.6 GHz.
- the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. The only time the Low Noise Path is used is when **Full Bypass Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

CAUTION

When **Full Bypass Enable** is selected, and "Attenuation" on page 1747 is set to 0 dB, there will be a direct AC connection between the input and the first converter when the Low Noise Path switches in (when Start Freq >3.6 GHz and the Preamp is either not licensed, set to Low Band, or Off). This puts the first converter at high risk to be damaged by high AC power. Consequently, whenever **Full Bypass Enable** is selected, a warning message appears in the status bar:

Full Bypass Enabled, maximum safe input power reduced

Microwave Preselector Bypass Backwards Compatibility

Example	:POW:MW:PRES OFF Bypasses the microwave preselector
Notes	Included for Microwave Preselector Bypass backwards compatibility The ON parameter sets the STD path (:POW:MW:PATH STD) The OFF parameter sets path MPB (:POW:MW:PATH MPB)
Preset	ON
Backwards Compatibility SCPI	[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe] ON | OFF | 0 | 1 [:SENSe]:POWer[:RF]:MW:PRESelector[:STATe]?

Frequency Extender Preselection Bypass

Frequency Extender Preselection Bypass only applies to the high frequency path of the Frequency Extender and only if the Frequency Extender allows it. For example, the V3050A high frequency path is 50 – 110 GHz and does allow control of the preselector bypass.

When the Frequency Extender's preselection is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. For bandwidths greater than 2.5 [GHz], it is recommended that the signal bypass the Frequency Extender Preselector since the max bandwidth of the Preselector can be as narrow as 2.5 [GHz].

For most applications, the preset state is OFF, which gives the best remote-control throughput, minimizes acoustic noise from switching, minimizes out of band spurs, and minimizes the risk of wear in the hardware switches.

Coupling with Microwave Preselector Control

The control of whether to apply or bypass the Frequency Extender's preselection is dependent on the Microwave Path Control setting.

The coupling between the Microwave Path Control and Frequency Extender Preselector Bypass is described below.

UW PATH CTRL	UW PRESELECTOR	VIKING PRESELECTOR
Standard Path	On	**On**
Low Noise Path Enable	On	**On**
uW Presel Bypass	Off	**Off**
Full Bypass Enable	Off	**Off**

In other words…

uW Path Ctrl == Standard
uW Path Ctrl == Low Noise
Viking PreselBypass == Off

uW Path Ctrl == Bypass
uW Path Ctrl == Full Bypass
Viking PreselBypass == On

For the Frequency Extender Preselector Bypass to take effect, it requires a Frequency Extender device (such as V3050A) be connected and External RF (ERFIN) selected as the input.

The Frequency Extender Preselector is applied or bypassed depending on the Microwave Path Control setting only when the acquisition is above 50 [GHz]. Hence, it will be bypassed only when the acquisition is above 50 [GHz].

Preselector and Bandwidth Conflict

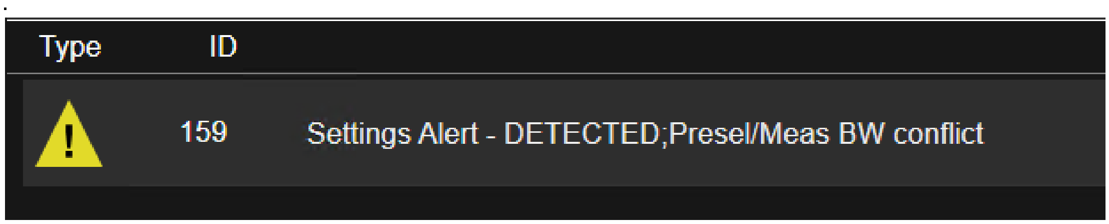
When the Frequency Extender Preselector is applied and the signal bandwidth is greater than 2.5 [GHz], then a settings alert message will show to warn the user that the signal may be distorted due to the limitation of the Frequency Extender Preselector bandwidth.

An example of the settings alert message is shown below.

Settings Alert message in the Status Bar at the bottom of the display.

Settings Alert message in the error queue

.



Software Preselection

Software Preselection is provided in some instruments, either to compensate for issues with provided hardware preselection or to provide the preselection function when there is no hardware preselector.

N9041B

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 50 GHz, software preselection must be used to suppress and separate images above 50 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

In the N9041B, Software Preselection only applies for frequencies above 50 GHz, therefore it is only used for RF Input 2. Even if it is turned on, it will not be used for other inputs and never for frequencies below 50 GHz. This is why the label of this control contains the parenthetical note “(>~50 GHz)”.

Note that in the N9041B, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

N9042B+V3050A

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 88 GHz, software preselection must be used to suppress and separate images above 88 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

For N9042B+V3050A, Software Preselection only applies for frequencies above 88 GHz, therefore it is only used for External RF. Even if it is turned on, it will not be used for other inputs and never for frequencies below 88 GHz. This is why the label of this control contains the parenthetical note “(>~88 GHz)”.

Note that for N9042B+V3050A, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

VXT models M9410A/11A

Software Preselection is used to provide the preselection function, as there is no hardware preselector in these models. Two background traces are taken and compared point by point, and the point with the lowest amplitude from the two traces is used. This provides a method to reduce spurs that are internally generated within the VXT, but the user should note the following when using Software

Preselection:

– There is some speed cost due to the need to take multiple captures

– Taking the point with the lowest amplitude in each trace will make the average noise level lower at all points that do not have a spur. This can reduce the accuracy of the measurement of noise and noise-like signals.

Because of the difficulty in identifying spurs manually, you are encouraged to leave Software Preselection ON at all times in VXT models M9410A/11A. If you turn it off in order to speed up your measurement or improve noise accuracy, be aware of unwanted onscreen spurs.

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel:STATe 0 | 1 | ON | OFF` `[:SENSe]:POWer[:RF]:SWPresel:STAT?`
Example	`:POW:SWPR:STAT 1` `:POW:SWPR:STAT?`
Dependencies	Only appears in N9041B, N9042B+V2050A, and VXT models M9410A/11A. Does not appear in all measurements
Couplings	Sweep Time is affected by SW Preselection. Also Auto Tune supports SW Preselection, so set SW Preselection state and then do Auto Tune
Preset	N9041B: OFF N9042B+V3050A: ON M9410A/11A: ON
State Saved	Saved in instrument state

SW Preselection Type

Specifies the algorithm used for software preselection.

Two hidden sweeps are taken in succession. The second sweep is offset in LO frequency by 2*IF/N. For each point in each trace, the smaller amplitude from the two traces is taken and placed in that point in the selected trace. The Peak detector is auto-selected to improve the image suppression effectiveness. Responses of each trace that lie on top of one another will remain and are valid signals. Other signals are images and are suppressed. The action of taking the smaller of the two traces will make the average noise level lower in all points that do not have an image, thus reducing the accuracy of the measurement of noise and noise-like signals.

– `NORMal` - mathematically removes all image and multiple responses of signals present at the input

– `ADVanced` - any trace processing (such as “max hold” or trace averaging) is performed on the points of both candidate traces before the “select minimum” operation occurs. This form of processing works better for non-stationary signals, such as pulsed-RF signals

Remote Command	[:SENSe]:POWer[:RF]:SWPResel NORMal | ADVanced [:SENSe]:POWer[:RF]:SWPResel?
Example	:POW:SWPR NORM :POW:SWPR?
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed-out. Its grayout message is “Unavailable unless SW Presel enabled”
Preset	N9041B: ADVanced N9042B+V3050A: NORMal
State Saved	Saved in instrument state

SW Preselection BW

Specifies the effective bandwidth to be used for Software Preselection.

The choices are:

– NORMal – when making Swept measurements, a software preselection algorithm is used which takes up to 4 background acquisitions, then post-processes the result. This algorithm can remove images from signals with an occupied bandwidth up to around 3 GHz. (Default/Preset setting). When making FFT measurements, this algorithm is not used, instead the same algorithm is used as for NARRow (below)

– NARRow– a software preselection algorithm is used which takes two background acquisitions, then post-processes the result to detect and remove images from wideband signals with occupied bandwidths up to 2 GHz. This increases the risk of images failing to be rejected, but improves the measurement speed

Remote Command	[:SENSe]:POWer[:RF]:SWPResel:BW NORMal | NARRow [:SENSe]:POWer[:RF]:SWPResel:BW?
Example	:POW:SWPR:BW NARR
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed out. Its grayout message is “Unavailable unless SW Presel enabled” For N9042B+V3050A the parameter is SCPI only and always set to NARRow when Software Preselection is enabled
Preset	N9041B: NORMal N9042B+V3050A: NARRow
State Saved	Saved in instrument state

High Freq Prefilter

Lets you set the state of Prefilter for Center Frequencies above 1310 MHz.

In VXT Models M9410A/11A, the Receiver RF path has a bank of filters that come after the RF Attenuator in the signal path. Since this bank of filters precedes the mixer they are known as the “Prefilter” bank. Their purpose is to eliminate unwanted in-band mixing products by filtering out all but the desired frequencies before the signals get to the mixer. There are 13 prefilter bands to cover the frequencies between 9 kHz and 6000 MHz. The Prefilter provides the necessary rejection of the unwanted signal.

Remote Command	`[:SENSe]:<measurement>:PFILter[:STATe] ON | OFF | 1 | 0` `[:SENSe]:<measurement>:PFILter[:STATe]?`

Example	For example, to enable High Freq Prefilter in IQ Analyzer Mode:
	For the Complex Spectrum Measurement:
	`:SPEC:PFIL ON`
	For the IQ Waveform Measurement:
	`:WAV:PFIL ON`
	`:`

Dependencies	This control only appears in VXT models M9410A/11A with center frequency above 1310 MHz
Preset	See “Prefilter Presets” below
State Saved	Saved in instrument state

Prefilter Presets

Meas	Mode	Preset
SPEC	BASIC	OFF
WAV	BASIC, WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
MON	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
RHO	WCDMA	OFF
CDP	WCDMA	OFF
PCON	WCDMA	OFF
EVMQ	WCDMA	OFF
CHP	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
OBW	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
ACP	WCDMA, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
SEM	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PST	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PVT	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF
EVM	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF

Meas	Mode	Preset
FLAT	WLAN	OFF
EVMM	WLAN	OFF
CEVM	LTEAFDD, LTEATDD	OFF
PAVT	5GNR, VMA	OFF
DDEM	VMA	OFF
OFDM	VMA	OFF
SAN	SA	ON
HARM	SA	ON

3.3.4 BW

BW is not supported in the WCDMA Mod Accuracy Measurement.

3.3.5 Display

The Display key opens the Display Menu, which lets you configure display items for the current Mode, Measurement View or Window.

3.3.5.1 Meas Display

The Meas Display tab contains controls for setting up the display for the current Measurement, View or Window.

I/Q Polar Vec/Constln

Selects the format of the Polar Vector graph display as one of the following:

- Vec Constln (Vector and Constellation)
- Vector (Vector only)
- Constellation (Constellation only)

Remote Command	`:DISPlay:RHO:WINDow2:TRACe:POLar VC | VECTor | CONStln` `:DISPlay:RHO:WINDow2:TRACe:POLar?`
Example	`:DISP:RHO:WIND2:TRAC:POL CONS` `:DISP:RHO:WIND2:TRAC:POL?`
Preset	VC
State Saved	Yes
Range	Vec & Constln|Vector|Constellation

Backwards Compatibility SCPI	`:DISPlay:RHO:VIEW[1]:WINDow2:TRACe:POLar`

Chip Offset

Specifies the number of chips offset from the first chip in a captured slot.

Remote Command	`:DISPlay:RHO:WINDow2:TRACe:COFFset <integer>` `:DISPlay:RHO:WINDow2:TRACe:COFFset?`
Example	`:DISP:RHO:WIND2:TRAC:COFF 100` `:DISP:RHO:WIND2:TRAC:COFF?`
Preset	0
State Saved	Yes
Min/Max	0/2560 – I/Q chips
Backwards Compatibility SCPI	`:DISPlay:RHO:VIEW[1]:WINDow2:TRACe:COFFset`

I/Q Chips

Specifies the number of I/Q chips displayed for the I/Q waveforms.

Remote Command	`:DISPlay:RHO:WINDow2:TRACe:IQCHips <integer>` `:DISPlay:RHO:WINDow2:TRACe:IQCHips?`
Example	`:DISP:RHO:WIND2:TRAC:IQCH 10` `:DISP:RHO:WIND2:TRAC:IQCH?`
Preset	2560
State Saved	Yes
Min/Max	1/2560
Backwards Compatibility SCPI	`:DISPlay:RHO:VIEW[1]:WINDow2:TRACe:IQCHips`

+45° Rotation

Toggles the display rotation function between On and Off. When set to On, the I/Q polar vector or I/Q polar constellation graph is rotated by +45 degrees to provide a rectangular display.

Remote Command	`:DISPlay:RHO:WINDow2:TRACe:ROTQpi[:STATe] 0 | 1 | OFF | ON` `:DISPlay:RHO:WINDow2:TRACe:ROTQpi[:STATe]?`
Example	`:DISP:RHO:WIND2:TRAC:ROTQ ON`

	:DISP:RHO:WIND2:TRAC:ROTQ?
Preset	OFF
State Saved	Yes
Range	On|Off
Backwards Compatibility SCPI	:DISPlay:RHO:VIEW[1]:WINDow2:TRACe:ROTQpi[:STATe]

Full Vector

Toggles the full vector display function between On and Off. When set to On, the full vector traces in gray are displayed in the background of the polar vector solid traces in yellow.

Remote Command	:DISPlay:RHO:WINDow2:TRACe:FVECtor[:STATe] 0 | 1 | OFF | ON :DISPlay:RHO:WINDow2:TRACe:FVECtor[:STATe]?
Example	:DISP:RHO:WIND2:TRAC:FVEC ON :DISP:RHO:WIND2:TRAC:FVEC?
Dependencies	This parameter is not available when the selected view is I/Q Measured Polar Graph and the selected I/Q Polar Vec/Constln is Constellation
Preset	OFF
State Saved	Yes
Range	OFF|ON
Backwards Compatibility SCPI	:DISPlay:RHO:VIEW[1]:WINDow2:TRACe:FVECtor[:STATe]

Time Offset Unit

Toggles the unit of Time Offset result between Chip and Second.

Remote Command	:DISPlay:RHO:TEXT:TFUNit CHIP | SECond :DISPlay:RHO:TEXT:TFUNit?
Example	:DISP:RHO:TEXT:TFUN SEC :DISP:RHO:TEXT:TFUN?
Notes	This command only affects the display result. Results returned by remote commands are always expressed in units of "CHIPs"
Preset	CHIP
State Saved	Yes
Range	CHIP|SECond
Backwards	:DISPlay:RHO:VIEW[1]:WINDow[1]:TEXT:TFUNit

Compatibility	
SCPI	

3.3.5.2 View

Contains controls for selecting the current **View**, and for editing User Views.

Views

The table below shows the Views and Windows used for this measurement.

Some of these Views are multiple-window Views. When in a multiple window View, you select a window by touching it. The menu controls may sometimes change depending on which window is selected.

Whenever the View changes, the default menu is Frequency, unless otherwise specified in the View description.

View	Result
"I/Q Measured Polar Graph" on page 344	I/Q Measured Polar Vector Graph
	Metrics
"I/Q Error" on page 345	EVM Graph
	Mag Error Graph
	Phase Error Graph
"Code Domain Power" on page 345	Code Domain Power Graph
	Metrics
"Peak/Avg Metrics" on page 345	Peak/Average Metrics
"Capture Time Summary" on page 345	Capture Time Summary
"Slot CDE/EVM" on page 346	EVM Graph
	Peak CDE Graph
	Frequency Error Graph

View Selection Remote Commands

Allows you to select the desired measurement view:

- The Enumerated ID is used with the SCPI Command `:DISP:RHO:VIEW[:SEL]` ("View Selection by Name" on page 344)
- The Numeric ID is used with the SCPI Command `:DISP:RHO:VIEW:NSEL` ("View Selection by Name" on page 344)

Enumerated ID	Numeric ID	View Name & Details
`POLar`	1	I/Q Measured Polar Graph - Provides a combination view of an I/Q measured polar vector graph and the summary data
`ERRor`	2	I/Q Error (Tri View) - Provides a combination view of the EVM, magnitude error, and phase error graphs
`PGRaph`	3	Code Domain Power - Provides a graph of Modulation Accuracy (Rho) channels individual power in dB. A table of summary data for the Modulation Accuracy (Rho) channels is provided in the text window

Enumerated ID	Numeric ID	View Name & Details
TABLe	4	Peak/Average Metrics - Provides a table of magnitude error, phase error, EVM, and the modulation accuracy summary data such as rho, peak and rms EVM, peak Modulation Accuracy (Rho) error, magnitude error, phase error, in a text window, in terms of averaged and detected peak/maximum value in the average cycle
SUMMary	5	Capture Time Summary – Provides a table that summarizes measurement results through the Capture Interval. Highlights the peak/worst result through the Capture Interval slot-by-slot
CDError	6	Slot CDE/EVM(Tri View) – Provides a combination view of Frequency Error, Peak CDE, and EVM graphs

View Selection by Name

Allows you to specify the view via its enumerated ID string.

Remote Command	`:DISPlay:RHO:VIEW[:SELect] POLar | ERRor | PGRaph | TABLe | SUMMary | CDError` `:DISPlay:RHO:VIEW[:SELect]?`
Example	`:DISP:RHO:VIEW:SEL CDE` `:DISP:RHO:VIEW:SEL?`
Preset	POLar
State Saved	Yes
Range	I/Q Measured Polar Graph|I/Q Error|Code Domain Power|Peak/Avg Metrics|Capture Time Summary|Slot CDE/EVM

View Selection by Number

Allows you to specify the view via its numeric ID value.

Remote Command	`:DISPlay:RHO:VIEW:NSELect <integer>` `:DISPlay:RHO:VIEW:NSELect?`
Example	`:DISP:RHO:VIEW:NSEL 1` `:DISP:RHO:VIEW:NSEL?`
Preset	1
State Saved	Yes
Min/Max	1/6

I/Q Measured Polar Graph

Windows: "I/Q Measured Polar Vector Graph" on page 280,"Result Summary" on page 281

The traces and results of this view are only for the slot specified by the measurement offset. The traces are not averaged, even if the average is on. The parameters displayed in these windows differ depending on the setting of Radio Device.

Example	`:DISP:RHO:VIEW POL`

I/Q Error

Windows:"EVM Graph" on page 283, "Mag Error Graph" on page 283, "Phase Error Graph" on page 283

The traces of this view are not averaged, even if the average function is on. The parameters displayed in these windows differ depending on the setting of Radio Device.

Example	`:DISP:RHO:VIEW ERR`

Code Domain Power

Windows: "Code Domain Power Graph" on page 283, "CDP Metrics" on page 284

The traces and results of this view are only for the slot specified by the measurement offset. The results are not averaged, even if the average function is on.

The parameters displayed in these windows differ depending on the setting of Radio Device.

Example	`:DISP:RHO:VIEW PGR`

Peak/Avg Metrics

Windows: "Peak/Average Metrics" on page 285

This view has one window, the Peak/Average Metrics window, which displays two sets of data as follows:

Average	The value averaged in average-cycle
Peak Hold	The value detected and held as the Peak/Maximum in the average cycle

NOTE **The average cycle is updated when restarted, and is equal to the average count. In each average cycle, through the capture interval, the data is also averaged and detects the peak/worst values. Therefore, the metrics of this view are actually averaged by the data, which is the value of:**

Average Count x Capture Interval

The parameters displayed in these windows differ depending on the setting of Radio Device.

Example	`:DISP:RHO:VIEW TABL`

Capture Time Summary

Windows:"Capture Time Summary" on page 288

The summary table displays the measurement results for multiple slots (for example 15 slots). It shows data sets slot-by-slot through the Capture Interval, and highlights the peak (or worst) slot value, and average value through the Capture Interval at the bottom of the table.

The results in this view are not averaged when restarted, even if the average is on. The parameters displayed in this window differ depending on the setting of Radio Device.

Example	`:DISP:RHO:VIEW SUMM`

Slot CDE/EVM

Windows: "Slot EVM Graph" on page 290,"Slot EVM Graph" on page 290"Slot EVM Graph" on page 290"Slot EVM Graph" on page 290"Slot Peak CDE Graph" on page 290, "Slot Frequency Error Graph" on page 290

The trace of this view is not averaged when restarted, even if the average function is on.

The parameters displayed in the windows differ depending on the setting of Radio Device in the Mode Setup.

In the graph:

- Yellow lines are the slot-by-slot results
- Blue (Cyan) lines are the test limits

Example	`:DISP:RHO:VIEW CDE`

User View

Lets you choose a View from the saved User Views for the current measurement. This panel only appears if a User View exists for the current measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:SELect <alphanumeric>` `:DISPlay:VIEW:ADVanced:SELect?`
Example	Select Baseband as the current View `:DISP:VIEW:ADV:SEL “Baseband”`
Notes	You must be in the measurement whose View you are trying to set to send the command. You can only set Views for the current measurement using this command For predefined views, the parameter is derived from the view name that is shown in the View list in the user interface. For example, if you are trying to select the Trace Zoom view in the Swept SA measurement, you send: `:DISP:VIEW:ADV:SEL "Trace Zoom"` because “Trace Zoom” is the name of the View as seen in the Mode/Meas dialog or in the Display, View menu

	You *cannot* use the legacy View parameter (which in this case would be `TZOom`) with `:DISP:VIEW:ADV:SEL`
	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case. Thus, both of the following forms work:
	`:DISP:VIEW:ADV:SEL "Trace Zoom"`
	`:DISP:VIEW:ADV:SEL "TRACE ZOOM"`
	If the specified view is not a valid View, the query returns the error message "-224, Illegal parameter value; View with the name <alphanumeric> does not exist"
	If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Backwards Compatibility SCPI	The legacy node `:DISPlay:VIEW[:SELect]` is retained for backwards compatibility, but it only supports predefined views

Restore Layout to Default

Restores the Layout to the default for Basic.

Modified Views are very temporary; if you exit the current measurement they are discarded, and they are not saved in State. To retain this View for later use, and to be able to return easily to your original Basic View, you can save your edited View as a "User View".

Save Layout as New View

Saves your new View as a User View. An alpha keyboard appears, which lets you name your new View; the default is the old View name plus a number.

Remote Command	`:DISPlay:VIEW:ADVanced:NAME <alphanumeric>`
Example	`:DISP:VIEW:ADV:NAME "Baseband"` Creates a new View named `Baseband` from the current View, and selects it as the current View
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If `<alphanumeric>` name already exists as a View, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; User View SCPI cannot be used while Display is disabled" is generated

Re-Save User View

You can re-edit a User View; if you make changes, then an asterisk will appear next to the User View's name. You can then tap **Re-Save User View** to save it back to its existing name, or **Save Layout as New View** to add another, new User View.

This is a front panel function only, there is no remote command available to perform this function. To do this remotely, you must first perform **Save Layout as New View**, then delete the old User View and rename the new one with the name of the View you just deleted.

Rename User View

You can rename the current View by giving it a new unique name. Only User Views can be renamed, if the current View is a Predefined View, an error occurs.

Remote Command	`:DISPlay:VIEW:ADVanced:REName <alphanumeric>`
Example	`:DISP:VIEW:ADV:REN "Baseband"`
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the `<alphanumeric>` specifying the new name is already present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot rename a Predefined View" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete User View

You can delete the current View if it is a User View. The default view becomes the current view for the Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:DELete`
Example	`:DISP:VIEW:ADV:DEL`
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the `<alphanumeric>` is not present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> does not exist" is generated If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot delete a Predefined View" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete All User Views

Deletes all previously saved User Views. The default view becomes the current view for the Measurement if a User View was the current view when this command was executed.

Remote Command	`:DISPlay:VIEW:ADVanced:DELete:ALL`
Example	`:DISP:VIEW:ADV:DEL:ALL`
Notes	Disabled if there are no User Views

View Editor Remote Commands

The following remote commands help you manage Views and User Views. Note that the SCPI node for User Views handles both Predefined and User Views. The legacy nodes, `:DISPlay:VIEW[:SELect]` and `:DISPlay:VIEW:NSEL`, are retained for backwards compatibility, but they only support predefined views.

View Listing Query

Returns a string containing a comma-separated list of names for *all* the Views, including User Views, available for the current Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:CATalog?`
Example	`:DISP:VIEW:ADV:CAT?`
Notes	Returns a quoted string of the available Views for the current measurement, separated by commas. The list includes names for *all* the Views, including User Views, available for the current Measurement Example: `"Normal,Trace Zoom,Spectrogram,Baseband,myView1,yourView1"` No distinction is made between Predefined and User Views If you switch measurements with the display disabled (via `:DISP:ENAB OFF`), then query the list of available Views, the result is undefined

User View Listing Query

Returns a string containing a comma-separated list of names for *only* the User Views available for the current Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:USER:CATalog?`
Example	`:DISP:VIEW:ADV:USER:CAT?`
Notes	Returns a quoted string of the available User Views for the current measurement, separated by commas. Example: `"Baseband,myView1,yourView1"` If you switch measurements with the display disabled (see "Display Enable (Remote Command Only)" on page 1894), then query the list of available Views, the result is undefined

3.3.5.3 Annotation

Contains controls for setting up the annotation for the current Mode or Measurement.

Graticule

Turns the display graticule On or Off for all windows with graticules in all measurements in the current Mode. Also turns the graticule Y-Axis annotation on and off.

Remote Command	:DISPlay:GRATicule[:STATe] OFF | ON | 0 | 1 :DISPlay:GRATicule[:STATe]?
Example	:DISP:GRAT OFF
Notes	The graticule is the set of horizontal and vertical lines that make up the grid/divisions for the X-Axis and Y-Axis
Preset	ON
State Saved	Saved in instrument state
Backwards Compatibility SCPI	:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe] OFF | ON | 0 | 1 :DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe]? This command is accepted for backwards compatibility with older instruments, but the WINDow, TRACe and GRID parameters are ignored

Screen Annotation

Controls the display of the annunciation and annotation around the graticule, including any annotation on lines (such as the display line, the threshold line, etc.) and the Y-Axis annotation, for all windows with screen annotation in all measurements in the current Mode.

This does *not* include marker annotation (or the N dB result). When OFF, the graticule expands to fill the entire graticule area, leaving only the 1.5% gap above the graticule, as described in the **Trace** section.

Remote Command	:DISPlay:ANNotation:SCReen[:STATe] OFF | ON | 0 | 1 :DISPlay:ANNotation:SCReen[:STATe]?
Example	:DISP:ANN:SCR OFF
Dependencies	Grayed-out and forced to OFF when **System Display Settings**, **Annotation** is OFF
Preset	ON This remains OFF through a Preset when **System Display Settings**, **Annotation** is set to OFF
State Saved	Saved in instrument state

Trace Annotation

Turns on and off the labels on the traces, showing their detector (or their Math Mode) as described in the **Trace** section, for all windows in all measurements in the current Mode for which Trace Annotation on/off is supported.

If Trace Math is being performed on a trace, then the Trace Math annotation replaces the detector annotation.

For measurements that support limit lines, this key also turns on and off the labels on the Limit Lines. The label is the Limit number annotation and Limit Comment displayed on the graph. If the length of the comment is greater than 20 characters, the first 8 characters and the last 8 characters are displayed, joined with ….

Remote Command	`:DISPlay:ANNotation:TRACe[:STATe] ON | OFF | 1 | 0` `:DISPlay:ANNotation:TRACe[:STATe]?`
Example	`:DISP:ANN:TRAC OFF`
Preset	`OFF`
State Saved	Saved in instrument state

Control Annotation

Turns on and off the display of values on the Active Function controls for all measurements in the current Mode. This is a security feature.

Remote Command	`:DISPlay:ACTivefunc[:STATe] ON | OFF | 1 | 0` `:DISPlay:ACTivefunc[:STATe]?`
Example	`:DISP:ACT OFF`
Dependencies	Grayed out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Meas Bar

Turns the Measurement Bar at the top of the screen on and off for all measurements in the current Mode. When `OFF`, the graticule area expands to fill the area formerly occupied by the Measurement Bar.

Remote Command	`:DISPlay:ANNotation:MBAR[:STATe] OFF | ON | 0 | 1` `:DISPlay:ANNotation:MBAR[:STATe]?`
Example	`:DISP:ANN:MBAR OFF`
Dependencies	Grayed out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`

Preset	ON This remains OFF through a Preset when **System Display Settings**, **Annotation** is set to OFF
State Saved	Saved in instrument state

Display Enable (Remote Command Only)

Turns the display on/off, including the display drive circuitry. The backlight stays lit to confirm that the instrument is on. The display enable setting is mode global. Theare three reasons for turning the display off:

1. To increase speed as much as possible by freeing the instrument from having to update the display
2. To reduce emissions from the display, drive circuitry
3. For security purposes

If you have turned off the display:

– and you are in local operation, the display can be turned back on by pressing any key or by sending `:SYSTem:DEFaults MISC` or `:DISPlay:ENABle ON` (neither `*RST` nor :SYSTem:PRESet enable the display)

– and you are in remote operation, the display can be turned back on by pressing the **Local** or **Esc** keys, or by sending `:SYSTem:DEFaults MISC` or `:DISPlay:ENABle ON` (neither `*RST` nor `:SYSTem:PRESet` enable the display)

– and you are using either the `:SYSTem:KLOCk` command or GPIB local lockout, then *no* front-panel key press will turn the display back on. You must turn it back on remotely.

If the display is `OFF`, many SCPI commands related to User Views and Multiscreen functionality do not work, and return the error messages “-221, Settings conflict; Screen SCPI cannot be used when Display is disabled” or “221, Settings conflict; View SCPI cannot be used while Display is disabled”. These commands include:

Name	Command
Select User View	:DISPlay:VIEW:ADVanced:SELect
Rename User View	:DISPlay:VIEW:ADVanced:REName
Delete User View	:DISPlay:VIEW:ADVanced:DELete
Create User View	:DISPlay:VIEW:ADVanced:NAME
Select Screen	:INSTrument:SCReen:SELect
Delete Screen	:INSTrument:SCReen:DELete
Delete All But This Screen	:INSTrument:SCReen:DELete:ALL
Add Screen	:INSTrument:SCReen:CREate
Rename Screen	:INSTrument:SCReen:REName
Sequencer On/Off	:SYSTem:SEQuencer

Remote Command	`:DISPlay:ENABle OFF | ON | 0 | 1` `:DISPlay:ENABle?`
Example	`:DISP:ENAB OFF`
Couplings	`:DISP:ENAB OFF` turns Backlight `OFF` and `:DISP:ENAB ON` turns Backlight `ON`, but changing Backlight settings does *not* change the state of `:DISP:ENAB`
Preset	`ON` Set by `:SYST:DEF MISC`, but not affected by `*RST` or `:SYSTem:PRESet`
State Saved	Not saved in instrument state
Backwards Compatibility Notes	`:SYST:PRES` no longer turns on `:DISPlay:ENABle` as it did in legacy analyzers

3.3.6 Freq

The Freq key opens the Frequency menu, which contains controls that allow you to control the Frequency and Channel parameters of the instrument.

Some features in the Frequency menu are the same for all measurements in the current Mode – they do not change as you change measurements. Settings like these are called "Meas Global" and are unaffected by Meas Preset. For example, the Center Freq setting is the same for all measurements - it does not change as you change measurements.

3.3.6.1 Settings

The Settings Tab contains controls that pertain to the X axis parameters of the measurement. These parameters control how data on the vertical (X) axis is displayed and control instrument settings that affect the horizontal axis.

Center Frequency

Sets the frequency that corresponds to the horizontal center of the graticule. While adjusting the Center Frequency the Span is held constant.

The center frequency setting is the same for all measurements within a mode, that is, it is Meas Global. Some modes are also able to share a Mode Global center frequency value. If this is the case, the Mode will have a **Global** tab in its **Meas Setup** menu.

The **Center Freq** function sets (and queries) the Center Frequency for the currently selected input. If your instrument has multiple inputs, and you select another input, the Center Freq changes to the value for that input. SCPI commands are available to directly set the Center Freq for a specific input.

Center Freq is remembered as you go from input to input. Thus you can set a Center Freq of 10 GHz with the RF Input selected, change to BBIQ and set a Center Freq of

20 MHz, then switch to External Mixing and set a Center Freq of 60 GHz, and when you go back to the RF Input the Center Freq will go back to 10 GHz; back to BBIQ and it is 20 MHz; back to External Mixing and it is 60 GHz.

– See "RF Center Freq" on page 356

– See "Ext Mix Center Freq" on page 357

– See "I/Q Center Freq" on page 358

– See "Center Frequency Presets" on page 354

Remote Command	`[:SENSe]:FREQuency:CENTer <freq>` `[:SENSe]:FREQuency:CENTer?`

Example	Sets the Center Frequency to 50 MHz
	`:FREQ:CENT 50 MHz`
	Increments the Center Frequency by the value of CF Step
	`:FREQ:CENT UP`
	Returns the current value of Center Frequency
	`:FREQ:CENT?`

Notes	This command sets the RF, External Mixing or I/Q Center Frequency depending on the selected input For RF input it is equivalent to `:FREQ:RF:CENT` For I/Q input it is equivalent to `:FREQ:IQ:CENT` For External Mixer it is equivalent to `:FREQ:EMIX:CENT` Preset and Max values are dependent on Hardware Options (5xx) If no terminator (e.g. MHz) is sent the terminator Hz is used. If a terminator with unit other than Frequency is used, an invalid suffix error message is generated
Preset	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 354 and "RF Center Freq" on page 356 and "Ext Mix Center Freq" on page 357 and "I/Q Center Freq" on page 358
State Saved	Saved in instrument state
Min	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 354 and "RF Center Freq" on page 356 and "Ext Mix Center Freq" on page 357 and "I/Q Center Freq" on page 358
Max	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 354 and "RF Center Freq" on page 356 and "Ext Mix Center Freq" on page 357 and "I/Q Center Freq" on page 358
Status Bits/OPC dependencies	Non-overlapped

Center Frequency Presets

The following table provides the Center Frequency Presets for the Spectrum Analyzer mode, and the Max Freq, for the various frequency options:

Freq Option	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
503 (all but CXA)	1.805 GHz	3.6 GHz	3.7 GHz
503 (CXA)	1.505 GHz	3.0 GHz	3.08 GHz
507 (all but CXA)	3.505 GHz	7.0 GHz	7.1 GHz
507 (CXA)	3.755 GHz	7.5 GHz	7.58 GHz
508 (all but MXE)	1.805 GHz	3.6 GHz	8.5 GHz
508 (MXE)	4.205 GHz	8.4 GHz	8.5 GHz
513	6.805 GHz	13.6 GHz	13.8 GHz
526 (except CXA and MXE)	13.255 GHz	26.5 GHz	27.0 GHz*
526 (CXA)	13.255 GHz	26.5 GHz	26.55 GHz
526 (MXE)	1.805 GHz	3.6 GHz	27.0 GHz
532	16.005 GHz	32.0 GHz	32.5 GHz
540	20.005 GHz	40.0 GHz	40.5 GHz
543	21.505 GHz	43.0 GHz	43.0 GHz
544	22.005 GHz	44.0 GHz	45.0 GHz
550	25.005 GHz	50.0 GHz	52 GHz
F03 (CXA-m)	1.505 GHz	3.0 GHz	3.08 GHz
F07 (CXA-m)	3.755 GHz	7.5 GHz	7.575 GHz
F13 (CXA-m)	6.805 GHz	13.6 GHz	13.8 GHz
F26 (CXA-m)	13.255 GHz	26.5 GHz	26.55 GHz
504 (M9420A/21A, M8920A)	2.145 GHz	3.88GHz	3.88 GHz
506 (M9420A/21A, M8920A)	3.245 GHz	6.08GHz	6.08 GHz
F06 (M9410A/11A)	1.0 GHz	6.08 GHz	6.08 GHz
F06 (M9415A)	1 GHz	1.08 GHz	6.6 GHz
F08 (M9415A)	1 GHz	1.08 GHz	8.6 GHz
F12 (M9415A)	1 GHz	1.08 GHz	12.9 GHz

*For option 526, the Max CF in RTSA is 26.999999995 GHz.

N9041B Center Freq Presets

Input	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
Input 1, all models	25.005 GHz	50.0 GHz	52 GHz
Input 2, opt 585	42.505 GHz	85.0 GHz	86 GHz
Input 2, opt 590	45.005 GHz	90.0 GHz	92 GHz
Input 2, opt 5CX	55.005 GHz	110.0 GHz	110 GHz

Input 2, CXA and MXE

Model	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
CXA opt C75	0.7505 GHz	1.5 GHz	1.58 GHz
MXE	505 MHz	1 GHz	1.000025 GHz

Tracking Generator Frequency Limits (CXA only)

Tracking Generator Option	Min Freq (clips to this freq when turn TG on and can't tune below while TG on)	If above this Freq, Stop Freq clipped to this Freq when TG turned on	Max Freq (can't tune above) while TG on
T03	9 kHz	3.0 GHz	3.08 GHz
T06	9 kHz	6.0 GHz	6.05 GHz

Tracking Generator Frequency Limits(CXA-m only)

Tracking Generator Option	Min Freq (clips to this freq when turn TG on and can't tune below while TG on)	If above this Freq, Stop Freq clipped to this Freq when TG turned on	Max Freq (can't tune above) while TG on
T03	2 MHz	3.08 GHz	3.08 GHz
T07	2 MHz	7.575 GHz	7.575 GHz
T13	2 MHz	13.8 GHz	13.8 GHz
T26	2 MHz	26.55 GHz	26.55 GHz

RF Center Freq

SCPI command for specifying the RF Center Frequency. This command will set the Center Frequency to be used when the RF input is selected, even if the RF input is not the input that is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:RF:CENTer <freq>` `[:SENSe]:FREQuency:RF:CENTer?`
Example	`:FREQ:RF:CENT 30 MHz` `:FREQ:RF:CENT?`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode
Dependencies	If the electronic/soft attenuator is enabled, any attempt to set Center Frequency such that the Stop Frequency would be >3.6 GHz fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning
Preset	See the table above

State Saved	Saved in instrument state
Min	-79.999995 MHz
Max	See the table above. Basically instrument maximum frequency - 5 Hz

Ext Mix Center Freq

SCPI command for specifying the External Mixer Center Frequency. This command will set the Center Frequency to be used when the External Mixer is selected, even if the External Mixer input is not the input which is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:EMIXer:CENTer <freq>` `[:SENSe]:FREQuency:EMIXer:CENTer?`
Example	`:FREQ:EMIX:CENT 60 GHz` `:FREQ:EMIX:CENT?`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode
Couplings	When returning to External Mixing after having been switched to one of the other inputs (e.g., RF), you will come back into the settings that you had when you left External Mixing. So you will come back to the band you were in with the Center Frequency that you had. However, Span is not an input-dependent parameter, therefore you will bring the span over from the other input. Therefore, the instrument comes back with the span from the previous input, limited as necessary by the current mixer setup
Preset	When a Mode Preset is performed while in External Mixing, the Start frequency of the current Mode is set to the nominal Min Freq of the lowest harmonic range in the Harmonic Table for the current mixer setup. Similarly, the Stop frequency of the current Mode is set to the nominal Max Freq of the highest harmonic range in the Harmonic Table. The Center Freq thus presets to the point arithmetically equidistant from these two frequencies Note that if the current measurement has a limited Span available to it, and cannot achieve the Span shown in the table (Span=Stop Freq – Start Freq), the instrument uses the maximum Span the measurement allows, and still sets the Center Freq to the midpoint of the Start and Stop Freq values in the Harmonic Table When Restore Input/Output Defaults is performed, the mixer presets to the 11970A, whose Start and Stop frequencies are 26.5 and 40 GHz respectively. The center of these two frequencies is 33.25 GHz Therefore, after a Restore Input/Output Defaults, if you go into External Mixing and do a Mode Preset while in the Spectrum Analyzer Mode, the resulting Center Freq is 33.25 GHz
State Saved	Yes
Min	The minimum frequency in the currently selected mixer band + 5 Hz
Max	The maximum frequency in the currently selected mixer band - 5 Hz

I/Q Center Freq

SCPI command for specifying the I/Q Center Frequency. This command will set the Center Frequency to be used when the I/Q input is selected, even if the I/Q input is not the input which is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:IQ:CENTer <freq>` `[:SENSe]:FREQuency:IQ:CENTer?`
Example	`:FREQ:IQ:CENT 30 MHz`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode
Preset	0 Hz
State Saved	Saved in instrument state
Min	-40.049995 MHz
Max	40.049995 MHz

CF Step

Changes the step size for the center frequency and start and stop frequency functions. Once a step size has been selected and the center frequency function is active, the step keys (and the UP|DOWN parameters for Center Frequency from remote commands) change the center frequency by the step-size value. The step size function is useful for finding harmonics and sidebands beyond the current frequency span of the instrument.

Note that the start and stop frequencies also step by the CF Step value.

Remote Command	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement] <freq>`
	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement]?`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO?`

Example	`:FREQ:CENT:STEP 500 MHz`
	Increase the current center frequency value by 500 MHz
	`:FREQ:CENT UP`
	`:FREQ:CENT:STEP?`
	`:FREQ:CENT:STEP:AUTO ON`
	`:FREQ:CENT:STEP:AUTO?`

Notes	Preset and Max values are dependent on Hardware Options (5xx)

Dependencies	Span, RBW, Center frequency If the electronic/soft attenuator is enabled, any attempt to change the value of the center frequency >3.6 GHz by pressing the Up-arrow key, fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning
Couplings	When auto-coupled in a non-zero span, the center frequency step size is set to 10% of the span. When auto-coupled in zero span, the center frequency step size is set to the equivalent -3 dB RBW value
Preset	Auto ON
State Saved	Saved in instrument state
Min	– (the maximum frequency of the instrument). That is, 27 GHz max freq instrument has a CF step range of +/- 27 GHz. Note that this is the maximum frequency given the current settings of the instrument, so in External Mixing, for example, it is the maximum frequency of the current mixer band
Max	The maximum frequency of the instrument. That is, 27 GHz max freq instrument has a CF step range of +/- 27 GHz. Note that this is the maximum frequency given the current settings of the instrument, so in External Mixing, for example, it is the maximum frequency of the current mixer band
Status Bits/OPC dependencies	non-overlapped

3.3.7 Marker

Accesses a menu that enables you to select, set up and control the markers for the current measurement. If there are no active markers, Marker selects marker 1, sets it to Normal and places it at the center of the display. If the selected marker is Off, it is set to Normal and placed it at the center of the screen on the trace determined by the Marker Trace rules.

3.3.7.1 Select Marker

Specifies the selected marker. The term "selected marker" is used throughout this document to specify which marker will be affected when you change marker settings, perform a Peak Search, etc.

The Select Marker control appears above the menu panel, indicating that it applies to all controls in the Marker menu panels. Select Marker is blanked if you select a tab whose controls do NOT depend on the selected marker (e.g., Counter).

On any menu tab for which **Select Marker** displays, the first control is always **Marker Frequency|Time**.

Notes	The selected marker is remembered even when not in the Marker menu and is used if a Search is done or a Band Function is turned on or for Signal Track or Continuous Peak
Preset	Marker 1
State Saved	The number of the selected marker is saved in instrument state
Annunciation	Appears in the marker results block label for **Normal** and **Delta** markers

3.3.7.2 Settings

The controls on the Settings tab include the Marker active function and a radio button selection of the marker control mode (Normal, Delta, or Off) for the selected marker, as well as additional functions that help you use markers.

Marker Chip Time

Sets the marker Chip value in the current marker for the I/Q Polar trace. It has no effect if the control mode is **Off**, but if the control mode is Normal, this is the SCPI equivalent of entering a Chip value.

This command is valid only when Marker Trace 'POLar'(I/Q Polar) is active. For any other Marker Trace, the command is ignored.

Remote Command	`:CALCulate:RHO:MARKer[1]|2|...|12:CHIP <real>` `:CALCulate:RHO:MARKer[1]|2|...|12:CHIP?`
Example	`:CALC:RHO:MARK:CHIP 0` `:CALC:RHO:MARK:CHIP?`
Notes	If no suffix is sent, 'chips' is used. If a suffix is sent that does not match 'chips', an error "Invalid suffix" is generated The query returns the marker's 'chips' value in the trace if the control mode is Normal. The query is returned in 'chips'. If the marker is Off the response is not a number (NAN)
Preset	Start point of the trace in the display window
State Saved	No
Min	-9.9E+37
Max	9.9E+37
Annotation	Mkr # <Chip Value>, <X value> and <Y value> upper right on graph

Marker X Axis Value

Sets the marker X Axis value in the current marker X Axis Scale unit. It has no effect if the control mode is **Off,** but is the SCPI equivalent of entering an X value if the control mode is **Normal** or **Delta**.

NOTE	This command is not valid when Marker Trace is `POLar` and ignored. Marker Chip Time is supported instead.

Remote Command	`:CALCulate:RHO:MARKer[1]|2|...|12:X <real>` `:CALCulate:RHO:MARKer[1]|2|...|12:X?`
Example	`:CALC:RHO:MARK3:X 0.0`

	`:CALC:RHO:MARK3:X?`
Notes	If no suffix is sent, uses the fundamental units for the current marker X Axis Scale. If a suffix is sent that does not match the current marker X Axis Scale unit, an error "Invalid suffix" is generated The query returns the marker's absolute X Axis value if the control mode is Normal, or the offset from the marker's reference marker if the control mode is Delta. The query is returned in the fundamental units for the current marker X Axis scale: Hz for Frequency and Inverse Time, seconds for Period and Time. If the marker is Off the response is not a number
Preset	After a preset, all Markers are turned OFF, so Marker X Axis Value query returns a Not A Number (NAN)
State Saved	No
Min	–9.9E+37
Max	9.9E+37
Annotation	Mkr # <X value> and <Marker value> upper right on graph

Marker X Axis Position (Remote Command only)

Sets the marker X position in trace points. It has no effect if the control mode is **Off,** but is the SCPI equivalent of entering a value if the control mode is **Normal** or **Delta** – except in trace points rather than X Axis Scale units. The entered value is immediately translated into the current X Axis Scale units for setting the value of the marker.

Remote Command	`:CALCulate:RHO:MARKer[1]|2|...|12:X:POSition <real>` `:CALCulate:RHO:MARKer[1]|2|...|12:X:POSition?`
Example	`:CALC:RHO:MARK10:X:POS 0.0` `:CALC:RHO:MARK10:X:POS?`
Notes	The query returns the marker's absolute X Axis value in trace points if the control mode is Normal, or the offset from the marker's reference marker in trace points if the control mode is Delta. The value is returned as a real number, not an integer, corresponding to the translation from X Axis Scale units to trace points. If the marker is Off the response is *Not A Number (NAN)* This command is not available when Marker Trace of the selected marker (`:CALCulate:RHO:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:TRACe?`) is set to `POLar`. In this case, this command is ignored
Preset	After a preset, all Markers are turned OFF, so Marker X Axis Value query returns a Not A Number (NAN)
State Saved	No
Min	-9.9E+37
Max	9.9E+37

Marker Y Axis Value (Remote Command only)

Queries the marker Y Axis value in the current marker Y Axis unit.

Remote	`:CALCulate:RHO:MARKer[1]|2|...|12:Y?`

Command	
Example	:CALC:RHO:MARK11:Y?
Notes	The query returns the marker Y-axis result if the control mode is Normal or Delta. If the marker is Off, the response is not a number (NAN)
Preset	Result dependent on markers setup and signal source
State Saved	No
Backwards Compatibility SCPI	:CALCulate:RHO:MARKer[1]|2|...|12:FUNCtion:RESult?

Marker Mode

Sets the marker control mode to Normal, Delta, or Off. All interactions and dependencies detailed under the control description are enforced when the remote command is sent. If the selected marker is Off, pressing Marker sets it to Normal and places it at the center of the screen on the trace determined by the Marker Trace rules. At the same time, Marker X Axis Value appears on the Active Function area.

The default active function is the active function for the currently selected marker control mode. If the current control mode is Off, there is no active function and the active function is turned off.

Remote Command	:CALCulate:RHO:MARKer[1]|2|...|12:MODE POSition | DELTa | OFF :CALCulate:RHO:MARKer[1]|2|...|12:MODE?
Example	:CALC:RHO:MARK3:MODE POS :CALC:RHO:MARK3:MODE?
Preset	OFF
State Saved	Saved in instrument state
Range	POSition|DELTa|OFF
Annotation	Mkr # <X value> and <Marker value> upper right on graph When Marker Trace is Polar in WCDMA mode: Mkr # <Chip Value (RHO & QPSKEVM)/Symbol Value (CDP)>, <X value> and <Y value> upper right on graph

Backward Compatibility SCPI Commands

Sets or queries the state of a marker. Setting a marker which is OFF to state ON or 1 puts it in Normal mode and places it at the center of the screen.

Remote Command	:CALCulate:RHO:MARKer[1]|2|...|12:STATe OFF | ON | 0 | 1 :CALCulate:RHO:MARKer[1]|2|...|12:STATe?
Example	:CALC:RHO:MARK3:STAT ON

	:CALC:RHO:MARK3:STAT?
Preset	OFF
State Saved	Saved in instrument state
Range	OFF|ON

Delta Marker (Reset Delta)

Pressing this button is exactly the same as pressing the “Delta” selection on the Marker Mode radio button. The selected marker becomes a Delta Marker. If the selected marker is already a Delta marker, the reference marker is moved to the current position of the selected marker, thus resetting the Delta to zero.

Marker Settings Diagram

The Marker Settings Diagram lets you configure the Marker system using a visual utility.

All Markers Off

Turns off all markers.

Remote Command	:CALCulate:RHO:MARKer:AOFF
Example	:CALC:RHO:MARK:AOFF

Couple Markers

When this function is On, moving any marker causes an equal X Axis movement of every other marker which is not Fixed or Off. By “equal X Axis movement” we mean that we preserve the difference between each marker’s X Axis value (in the fundamental x-axis units of the trace that marker is on) and the X Axis value of the marker being moved (in the same fundamental x-axis units).

When the marker is assigned to the Polar graph, a chip value is coupled instead of an X axis value.

This may result in markers going off screen.

Remote Command	:CALCulate:RHO:MARKer:COUPle[:STATe] ON | OFF | 1 | 0 :CALCulate:RHO:MARKer:COUPle[:STATe]?
Example	:CALC:RHO:MARK:COUP ON :CALC:RHO:MARK:COUP?
Preset	OFF Presets on Mode Preset and All Markers Off

State Saved	Saved in instrument state

3.3.7.3 Peak Search

The controls on the Peak Search tab allow you to move the marker to selected peaks of the signal, giving you enormous analysis capabilities, particularly when combined with the Delta Marker function.

NOTE

Pressing the **Peak Search** hardkey automatically moves you to the **Peak Search** page of the **Marker** menu *and* performs a Peak Search.

Pressing the **Peak Search** tab once you are already *in* the **Marker** menu does *not* perform a Peak Search.

Marker Chip Time

Sets the marker Chip value in the current marker for the I/Q Polar trace. It has no effect if the control mode is Off, but if the control mode is Normal, this is the SCPI equivalent of entering a Chip value.

This command is valid only when Marker Trace 'POLar'(I/Q Polar) is active. For any other Marker Trace, the command is ignored.

Remote Command	`:CALCulate:RHO:MARKer[1]|2|...|12:CHIP <real>` `:CALCulate:RHO:MARKer[1]|2|...|12:CHIP?`
Example	`:CALC:RHO:MARK:CHIP 0` `:CALC:RHO:MARK:CHIP?`
Notes	If no suffix is sent, 'chips' is used. If a suffix is sent that does not match 'chips', an error "Invalid suffix" is generated The query returns the marker's 'chips' value in the trace if the control mode is Normal. The query is returned in 'chips'. If the marker is Off the response is not a number (NAN)
Preset	Start point of the trace in the display window
State Saved	No
Min	-9.9E+37
Max	9.9E+37
Annotation	Mkr # <Chip Value>, <X value> and <Y value> upper right on graph

Marker X Axis Value

Sets the marker X Axis value in the current marker X Axis Scale unit. It has no effect if the control mode is Off, but is the SCPI equivalent of entering an X value if the control mode is Normal or Delta.

NOTE This command is not valid when Marker Trace is `POLar` and ignored. Marker Chip Time is supported instead.

Remote Command	`:CALCulate:RHO:MARKer[1]|2|...|12:X <real>` `:CALCulate:RHO:MARKer[1]|2|...|12:X?`
Example	`:CALC:RHO:MARK3:X 0.0` `:CALC:RHO:MARK3:X?`
Notes	If no suffix is sent, uses the fundamental units for the current marker X Axis Scale. If a suffix is sent that does not match the current marker X Axis Scale unit, an error “Invalid suffix” is generated The query returns the marker’s absolute X Axis value if the control mode is Normal, or the offset from the marker’s reference marker if the control mode is Delta. The query is returned in the fundamental units for the current marker X Axis scale: Hz for Frequency and Inverse Time, seconds for Period and Time. If the marker is Off the response is not a number
Preset	After a preset, all Markers are turned OFF, so Marker X Axis Value query returns a Not A Number (NAN)
State Saved	No
Min	–9.9E+37
Max	9.9E+37
Annotation	Mkr # <X value> and <Marker value> upper right on graph

Marker X Axis Position (Remote Command only)

Sets the marker X position in trace points. It has no effect if the control mode is **Off**, but is the SCPI equivalent of entering a value if the control mode is **Normal** or **Delta** - except in trace points rather than X Axis Scale units. The entered value is immediately translated into the current X Axis Scale units for setting the value of the marker.

Remote Command	`:CALCulate:RHO:MARKer[1]|2|...|12:X:POSition <real>` `:CALCulate:RHO:MARKer[1]|2|...|12:X:POSition?`
Example	`:CALC:RHO:MARK10:X:POS 0.0` `:CALC:RHO:MARK10:X:POS?`
Notes	The query returns the marker’s absolute X Axis value in trace points if the control mode is Normal, or the offset from the marker’s reference marker in trace points if the control mode is Delta. The value is returned as a real number, not an integer, corresponding to the translation from X Axis Scale units to trace points. If the marker is Off the response is *Not A Number (NAN)* This command is not available when Marker Trace of the selected marker (`:CALCulate:RHO:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:TRACe?`) is set to `POLar`. In this case, this command is ignored
Preset	After a preset, all Markers are turned OFF, so Marker X Axis Value query returns a Not A Number (NAN)
State Saved	No
Min	-9.9E+37
Max	9.9E+37

Marker Y Axis Value (Remote Command only)

Queries the marker Y Axis value in the current marker Y Axis unit.

Remote Command	`:CALCulate:RHO:MARKer[1]|2|...|12:Y?`
Example	`:CALC:RHO:MARK11:Y?`
Notes	The query returns the marker Y-axis result if the control mode is Normal or Delta. If the marker is Off, the response is not a number (NAN)
Preset	Result dependent on markers setup and signal source
State Saved	No
Backwards Compatibility SCPI	`:CALCulate:RHO:MARKer[1]|2|...|12:FUNCtion:RESult?`

Peak Search

Pressing the Peak Search control moves the selected marker to the trace point which has the maximum y-axis value for that marker's trace.

NOTE: Pressing the **Peak Search** hardkey automatically moves you to the **Peak Search** page of the **Marker** menu *and* performs a Peak Search.

Remote Command	`:CALCulate:RHO:MARKer[1]|2|...|12:MAXimum`

Example	`:CALC:RHO:MARK2:MAX`
	`:SYST:ERR?`
	can be used to query the errors to determine if a peak is found. The message "No peak found" will be returned after an unsuccessful search

Notes	Sending this command selects the subopcoded marker This command does not work when the selected marker is located on the polar trace. In this case, the command is ignored

Next Peak

Pressing Next Peak moves the selected marker to the peak that is next lower in amplitude than the current marker value. Only peaks which meet all enabled peak criteria are considered. If there is no valid peak lower than the current marker position, a "No peak found" message is generated and the marker is not moved.

If the selected marker was off, then it is turned on as a normal marker and a peak search is performed.

Remote Command	`:CALCulate:RHO:MARKer[1]|2|...|12:MAXimum:NEXT`
Example	`:CALC:RHO:MARK2:MAX:NEXT`
Notes	Sending this command selects the subopcoded marker
State Saved	Not part of saved state

Next Peak Right

Pressing Next Pk Right moves the selected marker to the nearest peak right of the current marker that meets all enabled peak criteria. If there is no valid peak to the right of the current marker position, a “No peak found” message is generated and the marker is not moved.

If the selected marker was off, then it is turned on as a normal marker and a peak search is performed.

Pressing this control moves the selected marker to the nearest active channel right of the current marker when Marker Trace is Code Domain Power. In other cases, pressing this control moves the selected marker to the highest peak right of the current marker.

Remote Command	`:CALCulate:RHO:MARKer[1]|2|...|12:MAXimum:RIGHt`
Example	`:CALC:RHO:MARK2:MAX:RIGH`
Notes	Sending this command selects the subopcoded marker
State Saved	Not part of saved state

Next Peak Left

Pressing Next Pk Left moves the selected marker to the nearest peak left of the current marker that meets all enabled peak criteria. If there is no valid peak to the left of the current marker position, a “No peak found” message is generated and the marker is not moved.

If the selected marker was off, then it is turned on as a normal marker and a peak search is performed.

Pressing this control moves the selected marker to the nearest active channel left of the current marker when Marker Trace is Code Domain Power. In other cases, moves the selected marker to the highest peak left of the current marker.

Remote Command	`:CALCulate:RHO:MARKer[1]|2|...|12:MAXimum:LEFT`
Example	`:CALC:RHO:MARK2:MAX:LEFT`
State Saved	Not part of saved state

Minimum Peak

Moves the selected marker to the minimum y-axis value on the current trace. Minimum (negative) peak searches do not have to meet the peak search criteria. It just looks for the lowest y-axis value. If the selected marker is Off, it is turned on before the minimum search is performed.

Remote Command	`:CALCulate:RHO:MARKer[1]|2|...|12:MINimum`
Example	`:CALC:RHO:MARK:MIN`
Notes	Sending this command selects the subopcoded marker
State Saved	Not part of saved state

Pk-Pk Search

Finds and displays the amplitude and frequency (or time, if in zero span) differences between the highest and lowest y-axis value. It places the selected marker on the minimum value on its selected trace. And it places that marker's reference marker on the peak of its selected trace.

This function turns on the reference marker and sets its mode to Normal if it is not already on. (These markers may be on two different traces.)

The rules for finding the maximum peak are exactly the same as for Peak Search, including the use of the peak criteria rules. However, the minimum trace value is not required to meet any criteria other than being the minimum y-axis value in the trace.

If the selected marker is off, a delta type marker is turned on and the peak-to-peak search is done. If the selected marker is on, but it is not a delta marker, then it is changed to delta which turns on the reference marker if needed, and then it performs the peak-to-peak function.

Remote Command	`:CALCulate:RHO:MARKer[1]|2|...|12:PTPeak`
Example	`:CALC:RHO:MARK:PTP`
Notes	Turns on the Marker D active function Sending this command selects the subopcoded marker
Dependencies	Pk-Pk Search is not available when Coupled Markers is on
Couplings	The selected marker becomes a delta marker if not already in delta mode
State Saved	Not part of saved state

Marker Delta

Pressing this button is exactly the same as pressing the “Delta” selection on the Marker Mode radio button on the Settings tab. The selected marker becomes a Delta Marker. If the selected marker is already a Delta marker, the reference marker is moved to the current position of the selected marker, thus resetting the Delta to zero.

The control is duplicated here in the Peak Search Menu to allow you to conveniently perform a peak search and change the marker's control mode to Delta without having to access two separate menus.

3.3.7.4 Properties

The controls on the Properties tab are used to set certain properties of the selected marker.

Marker Chip Time

Sets the marker Chip value in the current marker for the I/Q Polar trace. It has no effect if the control mode is **Off**, but if the control mode is Normal, this is the SCPI equivalent of entering a Chip value.

This command is valid only when Marker Trace 'POLar'(I/Q Polar) is active. For any other Marker Trace, the command is ignored.

Remote Command	`:CALCulate:RHO:MARKer[1]|2|...|12:CHIP <real>` `:CALCulate:RHO:MARKer[1]|2|...|12:CHIP?`
Example	`:CALC:RHO:MARK:CHIP 0` `:CALC:RHO:MARK:CHIP?`
Notes	If no suffix is sent, 'chips' is used. If a suffix is sent that does not match 'chips', an error "Invalid suffix" is generated The query returns the marker's 'chips' value in the trace if the control mode is Normal. The query is returned in 'chips'. If the marker is Off the response is not a number (NAN)
Preset	Start point of the trace in the display window
State Saved	No
Min	-9.9E+37
Max	9.9E+37
Annotation	Mkr # <Chip Value>, <X value> and <Y value> upper right on graph

Marker X Axis Value

Sets the marker X Axis value in the current marker X Axis Scale unit. It has no effect if the control mode is **Off,** but is the SCPI equivalent of entering an X value if the control mode is **Normal** or **Delta**.

NOTE **This command is not valid when Marker Trace is `POLar` and ignored. Marker Chip Time is supported instead.**

Remote Command	`:CALCulate:RHO:MARKer[1]|2|...|12:X <real>` `:CALCulate:RHO:MARKer[1]|2|...|12:X?`
Example	`:CALC:RHO:MARK3:X 0.0` `:CALC:RHO:MARK3:X?`
Notes	If no suffix is sent, uses the fundamental units for the current marker X Axis Scale. If a suffix is sent that does not match the current marker X Axis Scale unit, an error “Invalid suffix” is generated The query returns the marker’s absolute X Axis value if the control mode is Normal, or the offset from the marker’s reference marker if the control mode is Delta. The query is returned in the fundamental units for the current marker X Axis scale: Hz for Frequency and Inverse Time, seconds for Period and Time. If the marker is Off the response is not a number
Preset	After a preset, all Markers are turned OFF, so Marker X Axis Value query returns a Not A Number (NAN)
State Saved	No
Min	–9.9E+37
Max	9.9E+37
Annotation	Mkr # <X value> and <Marker value> upper right on graph

Marker X Axis Position (Remote Command only)

Sets the marker X position in trace points. It has no effect if the control mode is **Off,** but is the SCPI equivalent of entering a value if the control mode is **Normal** or **Delta** - except in trace points rather than X Axis Scale units. The entered value is immediately translated into the current X Axis Scale units for setting the value of the marker.

Remote Command	`:CALCulate:RHO:MARKer[1]|2|...|12:X:POSition <real>` `:CALCulate:RHO:MARKer[1]|2|...|12:X:POSition?`
Example	`:CALC:RHO:MARK10:X:POS 0.0` `:CALC:RHO:MARK10:X:POS?`
Notes	The query returns the marker’s absolute X Axis value in trace points if the control mode is Normal, or the offset from the marker’s reference marker in trace points if the control mode is Delta. The value is returned as a real number, not an integer, corresponding to the translation from X Axis Scale units to trace points. If the marker is Off the response is *Not A Number (NAN)* This command is not available when Marker Trace of the selected marker (`:CALCulate:RHO:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:TRACe?`) is set to `POLar`. In this case, this command is ignored
Preset	After a preset, all Markers are turned OFF, so Marker X Axis Value query returns a Not A Number (NAN)
State Saved	No
Min	-9.9E+37
Max	9.9E+37

Marker Y Axis Value (Remote Command only)

Queries the marker Y Axis value in the current marker Y Axis unit.

Remote Command	`:CALCulate:RHO:MARKer[1]|2|...|12:Y?`
Example	`:CALC:RHO:MARK11:Y?`
Notes	The query returns the marker Y-axis result if the control mode is Normal or Delta. If the marker is Off, the response is not a number (NAN)
Preset	Result dependent on markers setup and signal source
State Saved	No
Backwards Compatibility SCPI	`:CALCulate:RHO:MARKer[1]|2|...|12:FUNCtion:RESult?`

Relative To

Selects the marker to which the selected marker is relative (its reference marker).

Every marker has another marker to which it is relative. This marker is referred to as the “reference marker” for that marker. This attribute is set by the **Marker, Properties, Relative To** key. The marker must be a **Delta** marker to make this attribute relevant. If it is a **Delta** marker, the reference marker determines how the marker is controlled and how its value is displayed. A marker cannot be relative to itself.

Remote Command	`:CALCulate:RHO:MARKer[1]|2|...|12:REFerence <integer>` `:CALCulate:RHO:MARKer[1]|2|...|12:REFerence?`
Example	`:CALC:RHO:MARK:REF 5` `:CALC:RHO:MARK:REF?`
Notes	This command causes the marker specified with the subopcode to become selected Range (for SCPI command): 1 to 12. If the range is exceeded, the value is clipped A marker cannot be relative to itself so that choice is not available, and if sent from SCPI generates error -221: “Settings conflict; marker cannot be relative to itself” When queried a single value is returned (the specified marker numbers relative marker)
Couplings	The act of specifying the selected marker’s reference marker makes the selected marker a Delta marker If the reference marker is off it is turned on in Normal mode at the delta marker location
Preset	The preset default “Relative To” marker (reference marker) is the next higher numbered marker (current marker +1). For example, if marker 2 is selected, then it’s default reference marker is marker 3. The exception is marker 12, which has a default reference of marker 1 Set to the defaults by using Restore Mode Defaults. This is not reset by Marker Off, All Markers Off, or Preset
State Saved	Saved in instrument state. Not affected by Marker Off and hence not affected by Preset or power cycle
Min	1

Max	12
Annunciation	Appears in the marker label of a Delta marker

Marker Trace

Assigns the specified marker to the designated trace.

Remote Command	`:CALCulate:RHO:MARKer[1]|2|...|12:TRACe CDPower | EVM | MERRor | PERRor | FERRor | EVMSlot | PCDE | POLar` `:CALCulate:RHO:MARKer[1]|2|...|12:TRACe?`
Example	`:CALC:RHO:MARK2:TRAC EVM` `:CALC:RHO:MARK:TRACE?`
Preset	`EVM`
State Saved	Yes
Range	`CDPower|EVM|MERRor|PERRor|FERRor|EVMSlot|PCDE|POLar`

Marker Settings Diagram

The Marker Settings Diagram lets you configure the Marker system using a visual utility. This is the same as the "Marker Settings Diagram" on page 363control on the Settings tab.

3.3.8 Meas Setup

The Meas Setup menu panel contains functions for setting up the measurement parameters and also contains functions for setting up parameters global to all measurements in the mode.

3.3.8.1 Settings

This tab enables you to set measurement parameters.

Avg|Hold Number

Sets the number of data acquisitions that are averaged. After the specified number of average counts is reached, the averaging mode (termination control) setting determines the averaging action.

Remote Command	`[:SENSe]:RHO:AVERage:COUNt <integer>` `[:SENSe]:RHO:AVERage:COUNt?`
Example	`:RHO:AVER:COUN 100`

	:RHO:AVER:COUN?
Preset	10
State Saved	Yes
Min/Max	1/10000

Averaging On/Off

Turns averaging on or off.

Remote Command	[:SENSe]:RHO:AVERage[:STATe] OFF | ON | 0 | 1 [:SENSe]:RHO:AVERage[:STATe]?
Example	:RHO:AVER OFF :RHO:AVER?
Preset	ON
State Saved	Yes
Range	OFF|ON

Averaging Mode

Selects the type of termination control used for the averaging function. This determines the averaging action after the specified number of data acquisitions (average count) is reached. You can select between the Exp (exponential) and Repeat averaging modes. This selection only affects the averaging result after the number of N averages is reached. You can use the Avg|Hold Number to set N.

Key	SCPI	Description
Exponential averaging	EXPonential	When Measure is set at Cont, data acquisitions continue indefinitely. After N averages, exponential averaging is used with a weighting factor of N (the displayed average count stops at N). Exponential averaging weights new data more than old data, which allows tracking of slow-changing signals
Repeat averaging	REPeat	When Measure is set at Cont, data acquisitions continue indefinitely. After N averages is reached, all previous result data is cleared and the average count is set back to 1. This is equivalent to being in Measure Single and pressing the Restart key when the Single measurement finishes

Remote Command	[:SENSe]:RHO:AVERage:TCONtrol EXPonential | REPeat [:SENSe]:RHO:AVERage:TCONtrol?
Example	:RHO:AVER:TCON EXP

	:RHO:AVER:TCON?
Preset	REPeat
State Saved	Yes
Range	EXPonential|REPeat

IF Gain

Enables you to control an internally switched IF amplifier with approximately 10 dB of gain. This amplifier takes full advantage of the RF dynamic range of the instrument. When it can be turned on without an overload, the dynamic range is always better when the amplifier is set to On, than when it is set to Off. The control “IF Gain” can be used to set the IF Gain function to Auto, or to On (the extra 10 dB) or Off. These settings affect sensitivity and IF overloads.

Remote Command	[:SENSe]:RHO:IF:GAIN[:STATe] ON | OFF | 1 | 0 [:SENSe]:RHO:IF:GAIN[:STATe]? [:SENSe]:RHO:IF:GAIN:AUTO[:STATe] OFF | ON | 0 | 1 [:SENSe]:RHO:IF:GAIN:AUTO[:STATe]?
Example	:RHO:IF:GAIN OFF :RHO:IF:GAIN? :RHO:IF:GAIN:AUTO OFF :RHO:IF:GAIN:AUTO?
Notes	Where: – ON = high gain – OFF = low gain This only applies to the RF input. It does not apply to baseband I/Q input
Dependencies	This control does not appear in VXT, M9393A, M9391A, or UXM
Couplings	Auto sets IF Gain to High Gain under any of the following conditions: the input attenuator is set to 0 dB, the preamp is turned on, or the Max Mixer Level is –20 dBm or lower. For other settings, Auto sets IF Gain to Low Gain
Preset	OFF OFF
State Saved	Yes
Range	Low Gain | High Gain

Spur Avoidance

Because the VXT models M9410A/11A/15A are direct-conversion (zero-IF) receivers, feedthrough leakage from the local oscillator appears as a spurious signal (spur) at the center frequency. The Spur Avoidance function is provided to eliminate this spur, at the expense of some measurement speed.

When Spur Avoidance is enabled (the default), the instrument uses a software algorithm to remove this spur from the displayed measurement data.

You can disable this function to speed up your measurement by setting Spur Avoidance to “Disabled.” When Spur Avoidance is disabled, the following warning message will appear in the status bar: “Settings Alert; Spur Avoidance Off”. This is to alert you that measurement accuracy might be impacted by the fact that Spur Avoidance is not in effect.

Remote Command	`[:SENSe]:RHO:SAVoid[:STATe] ON | OFF | 0 | 1` `[:SENSe]:RHO:SAVoid[:STATe]?`
Example	`:RHO:SAVoid ON` `:RHO:SAVoid?`
Dependencies	This control only appears in VXT models M9410A/11A/15A
Preset	ON
State Saved	Saved in instrument state
Range	ON|OFF

Auto Couple

Immediately puts all Auto/Man functions into Auto. The **Auto Couple** action is confined to the current measurement only. It does not affect other measurements in the mode.

In the Auto state, Auto/Man functions are said to be “coupled”, meaning their values change as you make changes to other values in the measurement. This helps ensure accurate measurements and optimum dynamic range. Auto Couple is an immediate action function, and when it is executed, all the Auto/Man controls for the current measurement are set to Auto, and all measurement settings coupled to the Auto/Man parameters are automatically set to their optimal value.

For further details of measurement-specific settings (if any), see "Measurement-Specific Details" on page 376 below.

Remote Command	`:COUPle ALL`
Example	`:COUP ALL`
Backwards Compatibility SCPI	`:COUPLE ALL | NONE`
Backwards Compatibility Notes	`:COUP:NONE` puts all Auto/Man parameters in manual mode, decoupling all the coupled instrument parameters. It is retained for backwards compatibility and is *not* recommended for making measurements or new designs

All Auto/Man parameter couplings in the measurement are set to Auto. This includes couplings that may be unavailable or grayed-out due to the current state. For example, in the Swept SA measurement, there is no Auto/Man coupling for RBW while in Zero Span. Nonetheless, if **Auto Couple** were executed while in Zero Span it would set RBW to Auto "behind the scenes" so that, on exit from Zero Span, it would be in Auto.

Any Auto/Man selection specific (local) to the other measurements in the current Mode will not be affected by **Auto Couple**. Any functions that are *not* coupled with other instrument parameters, such as ranging or leveling variables, such as "AutoRange" or "AutoScale", will not be affected.

Executing the **Auto Couple** command generates the informational message, "All Auto/Man functions have been set to Auto".

Each parameter, upon being set to Auto, selects and sets the appropriate auto-coupled value based on that parameter's coupling rules. The Dependency Resolver orchestrates the couplings for parameters that are dependent on one or more other parameters. The coupling and dependency rules for each parameter are defined in the chapter describing that parameter.

Executing the **Auto Couple** command *does not* affect markers, marker functions, trace or display attributes, or any other instrument setting other than those specifically mentioned above.

Measurement-Specific Details

TOI

Parameters affected by Auto Couple are:

- Center Frequency Step
- Resolution Bandwidth
- Span/RBW Ratio
- Sweep Time
- Video BandwidthVBW/RBW ratio
- Upper and Lower Tone (set to Sense
-)Zero span measurement Resolution Bandwidth
- Zero span measurement Dwell Time

Harmonics

For Harmonics, these parameters are:

- Resolution Bandwidth
- Fundamental Frequency
- Dwell Time
- Range Table Resolution Bandwidths
- Range Table Dwell Times

Meas Preset

Restores all the measurement parameters to their default values.

Remote Command	:CONFigure:RHO
Example	:CONF:RHO
Couplings	Selecting Meas Preset restores all measurement parameters to these default values

3.3.8.2 Radio

The Radio tab contains controls to select the Radio Device, and enable or disable HSPA/HSPA+ options.

Radio Device

Allows you to specify the device to be used.

Remote Command	[:SENSe]:RADio:STANdard:DEVice BTS | MS [:SENSe]:RADio:STANdard:DEVice?
Example	:RAD:STAN:DEV MS :RAD:STAN:DEV?
Preset	BTS
State Saved	Saved in instrument state.
Range	BTS | MS
Backwards Compatibility SCPI	[:SENSe]:RADio:DEVice

HSPA Enable

Allows you to turn on or off the HSDPA/HSUPA option enable. This selection is necessary because some of the auto detection functions that expect an HSPA signal are less tolerant when the signal is noisy or distorted. When the HSPA signal is not expected, turn HSPA Enable off.

Remote Command	`[:SENSe]:RADio:CONFigure:HSDPa[:STATe] 0 | 1 | OFF | ON` `[:SENSe]:RADio:CONFigure:HSDPa[:STATe]?`
Example	`:RAD:CONF:HSDP 0` `:RAD:CONF:HSDP?`
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

HSPA+ Enable

Allows you to turn on or off the HSPA+ option enable. This selection is necessary because some of the auto detection functions that expect an HSPA+ signal are less tolerant when the signal is noisy or distorted. When the HSPA+ signal is not expected, turn HSPA+ Enable off.

Remote Command	`[:SENSe]:RADio:CONFigure:EHSPa[:STATe] OFF | ON | 0 | 1` `[:SENSe]:RADio:CONFigure:EHSPa[:STATe]?`
Example	`:RAD:CONF:EHSP 0` `:RAD:CONF:EHSP?`
Notes	When HSPA enable is OFF, HSPA+ function is disabled too.
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

3.3.8.3 Sync

This tab enables you to set sync parameters.

Sync Type (BTS)

Accesses the menu that enables you to select the channel to synchronize with, and to set features, such as Symbol Rate, that may affect synchronization. You can select from the following types of channels and features listed in the menu:

- **CPICH** - Synchronize with the common pilot channel (CPICH)
- **Pilot-aided Timing Est(imator)** - Enables additional symbol timing estimation to each detected code channel through the demod calculation process by referring to the pilot channel (CPICH) timing correlation
- **SCH** - Synchronize with the synchronization channel (SCH)
- **Symbol Based** - Allows you to access the menu that allows you to select the code symbol to synchronize with
- **Symbol Rate** - Allows you to set the symbol rate, ranging from 7.5 to 960 ksps. The parameter automatically sets the maximum value for Code Number when appropriate
- **Code Number** - Allows you to set the code number. The range is 0 to 511, depending on the Symbol Rate setting

Antenna-2 CPICH - Allows you to synchronize with the STTD Antenna-2 common pilot channel

- **Pilot-aided Timing Est(imator)** - Enables additional symbol timing estimation to each detected code channel through the demod calculation process by referring to the pilot channel (Antenna-2 CPICH) timing correlation

STTD Diff - Allows you to synchronize to the common pilot channel at STTD antenna-1 and antenna-2 to make Diversity Time Error measurements

TSTD SCH Antenna1 – Allows you to synchronize the antenna1 of TSTD SCH

TSTD SCH Antenna2 – Allows you to synchronize the antenna2 of TSTD SCH

Remote Command	`[:SENSe]:RHO:SYNC[:BTS] CPICh | SCH | SYMBol | STTD | A2Cpich | A1SCh | A2SCh` `[:SENSe]:RHO:SYNC[:BTS]?`
Example	`:RHO:SYNC SCH` `:RHO:SYNC?`
Notes	This command is effective when `[:SENSe]:RADio:DEVice` is set to BTS
Couplings	SYMBol synchronizes to the code symbol specified by `[:SENSe]:RHO:SYNC:SYMBol:SRATe` and the `[:SENSe]:RHO:SYNC:SYMBol:SPRead` commands
Preset	`CPICh`
State Saved	Yes
Range	CPICH | SCH | Symbol Based | STTD Diff | Antenna-2 CPICH | Antenna-1 TSTD SCH | Antenna-2 TSTD SCH

Sync Type (MS)

Selects the channel to synchronize with. You can select from the following types:

- DPCCh - Synchronizes to DPCCH and the Slot Format, which is specified by [:SENSe]:RHO:SFORmat:MS
- PMESsage - Synchronizes to PRACH Message and the Slot Format, which is specified by [:SENSe]:RHO:PRACh:SIGNature and [:SENSe]:RHO:SFORmat:MS
- EDPCch - Synchronizes to E-DPCCH(C8(1):I, the spreading factor is 256, and the code index is 1 on I-branch)
- PRACh Preamble - Synchronizes to PRACH Preamble and the Signature, which is specified by [:SENSe]:RHO:PRACh:SIGNature

Remote Command	[:SENSe]:RHO:SYNC:MS DPCCh | EDPCch | PMESsage | PPReamble [:SENSe]:RHO:SYNC:MS?
Example	:RHO:SYNC:MS DPCC :RHO:SYNC:MS?
Notes	This command is effective when [:SENSe]:RADio:DEVice is set to MS
Preset	DPCCh
State Saved	Saved in instrument state
Range	DPCCH|E-DPCCH C8(1):I|PRACH Message|PRACH Preamble

Pilot-aided Timing Estimator

Enables additional symbol timing estimation to each detected code channel through the demod calculation process by referring to the pilot channel (i.e. CPICH or Ant2 CPICH, accordingly) timing correlation. It is expected to improve symbol reference vector estimation robustness for some specific impairment conditions: for example, the signal under test is assumed to have asymmetric filter response. Note that this function would not always be effective to any signal condition; on the contrary, turning the control “on” may decrease the estimation robustness and measurement speed for some different cases. A typical example it is worth to try this out is when you find that the peak EVM result is unexpectedly high compared to the RMS EVM result.

Remote Command	[:SENSe]:RHO:SYNC:CPICh:ESTimator OFF | ON | 0 | 1 [:SENSe]:RHO:SYNC:CPICh:ESTimator?
Example	:RHO:SYNC:CPIC:EST 0 :RHO:SYNC:CPIC:EST?
Dependencies	This command is effective when [:SENSe]:RADio:DEVice is set to BTS and [:SENSe]:RHO:SYNC[:BTS] is set to CPICh or A2CPich
Preset	OFF
State Saved	Saved in instrument state
Range	ON|OFF

Synchronization Symbol Rate (BTS only)

Sets the symbol rate of the code symbol to synchronize with. The parameter automatically sets the maximum value for the Code Number when appropriate. This command is currently available only for BTS.

Remote Command	`[:SENSe]:RHO:SYNC:SYMBol:SRATe <integer>` `[:SENSe]:RHO:SYNC:SYMBol:SRATe?`
Example	`:RHO:SYNC:SYMB:SRAT 15000` `:RHO:SYNC:SYMB:SRAT?`
Notes	This command is effective when `[:SENSe]:RADio:DEVice` is set to BTS, and `[:SENSe]:RHO:SYNC[:BTS]` is set to SYMBol
Preset	7500
State Saved	Saved in instrument state
Range	7500|15000|30000|60000|120000|240000|480000|960000

Synchronization Code Number (BTS only)

Sets the spread code number of the code symbol to synchronize with. The range depends on the Symbol Rate setting. This command is available only for BTS.

Remote Command	`[:SENSe]:RHO:SYNC:SYMBol:SPRead <integer>` `[:SENSe]:RHO:SYNC:SYMBol:SPRead?`
Example	`:RHO:SYNC:SYMB:SPR 3` `:RHO:SYNC:SYMB:SPR?`
Notes	This command is effective when `[:SENSe]:RADio:DEVice` is set to BTS, and `[:SENSe]:RHO:SYNC[:BTS]` is set to SYMBol
Preset	1
State Saved	Saved in instrument state
Min/Max	Min: 0 Max: Dependent on Synchronization Symbol Rate

[:SENSe]:RHO:SYNC:SYMBol:SRATe	Value
7500	511
15000	255
30000	127
60000	63
120000	31
240000	15

[:SENSe]:RHO:SYNC:SYMBol:SRATe	Value
480000	7
960000	3

Slot Format (MS only)

Defines the uplink DPCCH pilot pattern to synchronize with. This control is available when **DPCCH** is selected under **Sync Type**. The command is effective when the [:SENSe]:RHO:SYNC:MS command is set to DPCCh.

Formats 0A, 0B, 2A, 2B, 5A and 5B are not supported, because the compressed mode is not supported. For details of the fields for each available slot format, see "DPCCH fields information (TS25.211 V.3.9.0)" on page 382.

Remote Command	`[:SENSe]:RHO:SFORmat:MS SF0 | SF1 | SF2 | SF3 | SF4 | SF5 | AUTO` `[:SENSe]:RHO:SFORmat:MS?`
Example	`:RHO:SFOR:MS SF0` `:RHO:SFOR:MS?`
Dependencies	This command is effective when `[:SENSe]:RADio:DEVice` is set to MS, and `[:SENSe]:RHO:SYNC:MS` is set to DPCCh
Preset	`SF0`
State Saved	Yes
Range	`SF0|SF1|SF2|SF3|SF4|SF5|AUTO`

DPCCH fields information (TS25.211 V.3.9.0)

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/Frame	Bits/Slot	Npilot	NTPC	NTFCI	NFBI	Transmitted slots per radio frame
0	15	15	256	150	10	6	2	2	0	15
0A	15	15	256	150	10	5	2	3	0	10-14
0B	15	15	256	150	10	4	2	4	0	8-9
1	15	15	256	150	10	8	2	0	0	8-15
2	15	15	256	150	10	5	2	2	1	15

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/Frame	Bits/Slot	Npilot	NTPC	NTFCI	NFBI	Transmitted slots per radio frame
2A	15	15	256	150	10	4	2	3	1	10-14
2B	15	15	256	150	10	3	2	4	1	8-9
3	15	15	256	150	10	7	2	0	1	8-15
4	15	15	256	150	10	6	2	0	2	8-15
5	15	15	256	150	10	5	1	2	2	15
5A	15	15	256	150	10	4	1	3	2	10-14
5B	15	15	256	150	10	3	1	4	2	8-9

Preamble Signature (MS only)

Sets the PRACH Preamble Signature number for PRACH Message detection. Based on this value, the code allocation of the PRACH message control part is calculated. This command is effective when the [:SENSe]:RHO:SYNC:MS command is set to PMESsage (PRACH Message) or PPReamble (PRACH Preamble).

PRACH message (Control) has only Slot Format #0. The field lengths are defined in the table below. Demod attribute information is colored according to the given Slot Format parameter. Using input parameter Slot Format #i, bit data is colored accordingly (for example, Npilot and NTFCI).

PRACH message Control field Information (TS25.211 V.3.9.0)

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/Frame	Bits/Slot	Npilot	NTFCI
0	15	15	256	150	10	8	2

Select Auto or Man (Manual). Auto corresponds to “ON” for the `[:SENSe]:RHO:PRACh:SIGNature:AUTO` command. When Auto is selected, it searches and synchronizes the PRACH Message control part automatically. The code for the control part is assigned according to the PRACH Preamble Signature number. It can find the code number for the control part from 16 possible cases. But it takes more time than manual setting. “---“ is shown initially. When Man is selected, it synchronizes with the code specified by the Preamble Signature.

The value is set at its auto number and "---" is replaced with the detected number, if PRACH Search is set to Auto and PRACH Preamble or Message sync is done successfully. Otherwise the value is not changed.

NOTE: When PRACH Message is selected for Sync Type, this function does not check the Preamble Signature itself. Instead, it identifies the code location for the PRACH Message control part. The relationship between "Preamble Signature" and "code location for PRACH Message control part" is a one-to-one correspondence.

Remote Command	`[:SENSe]:RHO:PRACh:SIGNature <integer>`
	`[:SENSe]:RHO:PRACh:SIGNature?`
	`[:SENSe]:RHO:PRACh:SIGNature:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:RHO:PRACh:SIGNature:AUTO?`

Example	`:RHO:PRAC:SIGN 3`
	`:RHO:PRAC:SIGN?`
	`:RHO:PRAC:SIGN:AUTO OFF`
	`:RHO:PRAC:SIGN:AUTO?`

Notes	This command is effective when `[:SENSe]:RADio:DEVice` is set to MS, and `[:SENSe]:RHO:SYNC:MS` is set to PMESsage or PPReamble (PRACH Preamble) Set Signature Auto mode ON for PRACH Preamble detection
Preset	0 ON
State Saved	Yes Yes
Range	Auto|Man
Min/Max	0/15

Sync Start Slt

Specifies the slot number to measure as the first slot. You can then use any trigger, even **Free Run**, to get the measurement result beginning with the specified slot number. For example, if the Sync Start Slot state is set to On and the start slot number is 0, then the synchronization always starts from slot number 0 regardless of the trigger type and its delay.

If Sync Start Slot state is set to Off, the measurement performs synchronization at any slot found immediately after the trigger timing.

Remote Command	`[:SENSe]:RHO:SSLot:NUMBer <integer>`
	`[:SENSe]:RHO:SSLot:NUMBer?`
	`[:SENSe]:RHO:SSLot[:STATe] OFF | ON | 0 | 1`

	[:SENSe]:RHO:SSLot[:STATe]?
Example	:RHO:SSL:NUMB 5 :RHO:SSL:NUMB? :RHO:SSL:STAT ON :RHO:SSL:STAT?
Notes	Turn first slot number detection mode on or off
Dependencies	This command has no effect when Device is MS and Sync Type is PRACH Preamble
Preset	0 OFF
State Saved	Yes Yes
Range	0 to 14 OFF|ON
Min/Max	0/14

Freq Error Tol Range

Selects the frequency error tolerance range from either Normal or Wide.

- NORMal- provides a more stringent range of frequency tolerance, which is useful when you want to accurately demodulate signals of higher complexity. For example, when composite channels are modulated on the same signal, the modulation is complex, and frequency error is critical to correct demodulate. In the case of demodulating complex signals, set to 'Normal'
- WIDE- provides a wider, and less stringent range of frequency error tolerance

This parameter is valid only when the device type is MS (Uplink). When BTS (Downlink), the menu is disabled.

Remote Command	[:SENSe]:RHO:FERRor:TRANge WIDE | NORMal [:SENSe]:RHO:FERRor:TRANge?
Example	:RHO:FERR:TRAN WIDE :RHO:FERR:TRAN?
Preset	NORMal
State Saved	Yes
Range	WIDE|NORMal

P-Scramble Code (BTS only)

Sets a numeric value for the primary scramble code for synchronization:

– **Autodetect** - The instrument autodetects the primary scramble code. The result is also available using SCPI command, READ/FETCh:RHO19? Available only when Sync Type for BTS is set to SCH or CPICH and Capture Interval is set to 1 frame

  When Autodetect is not available, the result as detected primary scramble code is not valid

– **Manual** – You can specify the value for the primary scramble code. The range is 0 to 511

If the Device is set to MS, this label changes to Slot Format to define the DPCCH pilot pattern to synchronize with. It allows you to enter either 0 or 2 slot formats

The BTS scramble code number (Downlink) is determined by the “Primary Scramble Code”, “Scramble Code Offset” and “Scramble Code Type”.

The following information is an excerpt from TS25.213 Section 5.2.2 Scramble Code.

A total of 2^{18}-1 = 262,143 scrambling codes, numbered 0...262,142, can be generated. However, not all the scrambling codes are used. The scrambling codes are divided into 512 sets, each consisting of a primary scrambling code and 15 secondary scrambling codes.

The primary scrambling codes consist of scrambling codes n = 16*i where i = 0...511. The i:th set of secondary scrambling codes consists of scrambling codes 16*i + k, where k = 1...15.

There is a one-to-one mapping between each primary scrambling code and the 15 secondary scrambling codes in a set such that i:th primary scrambling code corresponds to i:th set of secondary scrambling codes.

Hence, according to the above, scrambling codes k = 0, 1, ..., 8191 are used. Each of these codes is associated with a left alternative scrambling code and a right alternative scrambling code that may be used for compressed frames. The left alternative scrambling code corresponding to scrambling code k is scrambling code number k + 8192, while the right alternative scrambling code corresponding to scrambling code k is scrambling code number k + 16384. The alternative scrambling codes can be used for compressed frames. In this case, the left alternative scrambling code is used if n < SF/2, and the right alternative scrambling code is used if n ¤ SF/2, where cch,SF,n is the channelization code used for non-compressed frames. The usage of an alternative scrambling code for compressed frames is signaled by higher layers for each physical channel respectively.

The Primary Scramble Code corresponds to i (i = 0 ... 511), the Scramble Code Offset corresponds to k (k = 1 ... 15: Secondary Scramble Code, 0: Primary Scramble Code) and the Scramble Code Type Left and Right correspond to+8192 and +16384 offsets respectively.

Remote Command

```
[:SENSe]:RHO:SYNC:SCRamble[:BTS] <integer>
[:SENSe]:RHO:SYNC:SCRamble[:BTS]?
[:SENSe]:RHO:SYNC:SCRamble[:BTS]:AUTO OFF | ON | 0 | 1
```

	[:SENSe]:RHO:SYNC:SCRamble[:BTS]:AUTO?
Example	:RHO:SYNC:SCR 100 :RHO:SYNC:SCR? :RHO:SYNC:SCR:AUTO 1 :RHO:SYNC:SCR:AUTO?
Notes	This command is effective when [:SENSe]:RADio:DEVice is set to BTS Autodetect is available when the following conditions are met – Option N/W9073A-AFP (auto scramble code detection) is installed – [:SENSe]:RADio:DEVice is set to BTS – Sync Type for BTS is set to SCH or CPICH – Capture Interval is set to 1 Frame
Preset	0 OFF
State Saved	Yes
Range	Auto Detect|Manual
Min/Max	0/511

Scramble Code (MS only)

Sets the MS scramble code for synchronization. When this control is selected, the “Hex Input” menu appears.

Remote Command	[:SENSe]:RHO:SYNC:SCRamble:MS <integer> [:SENSe]:RHO:SYNC:SCRamble:MS?
Example	:RHO:SYNC:SCR:MS 10000000 :RHO:SYNC:SCR:MS?
Notes	This command is effective when [:SENSe]:RADio:DEVice is set to MS
Preset	0 (0x0
State Saved	Yes
Range	0 to 16777215 (0x0 to 0xFFFFFF; 24 bits)
Min/Max	0/16777215

Scramble Code Offset (BTS only)

Sets the number of scramble code offsets needed to make the modulation accuracy measurement. This control is not available if Device is set to MS.

Remote	[:SENSe]:RHO:SYNC:SCRamble[:BTS]:OFFSet <integer>

Command	[:SENSe]:RHO:SYNC:SCRamble[:BTS]:OFFSet?
Example	:RHO:SYNC:SCR:OFFS 5 :RHO:SYNC:SCR:OFFS?
Notes	This command is effective when [:SENSe]:RADio:DEVice is set to BTS This command is not effective when [:SENSe]:RHO:SYNC:SCRamble[:BTS]:AUTO is set to ON
Preset	0
State Saved	Yes
Range	0 to 15 (0 for the primary scramble code; 1 to 15 for the secondary scramble code)
Min/Max	0/15

Scramble Code Type (BTS only)

Sets the BTS primary scramble code type for synchronization.

Enables you to set the scramble code type to Std (standard), Left, or Right to make the modulation accuracy measurement. This control is not available if Device is set to MS.

- LEFT – the left alternative scrambling code, whose number is the primary scramble code number + 8192, is used
- RIGHt – the right alternative scrambling code, whose number is the primary scrambling code number + 16384, is used
- STANdard – the standard scrambling code, whose number is the primary scrambling code number, is used

Remote Command	[:SENSe]:RHO:SYNC:SCRamble[:BTS]:TYPE LEFT | RIGHt | STANdard [:SENSe]:RHO:SYNC:SCRamble[:BTS]:TYPE?
Example	:RHO:SYNC:SCR:TYPE LEFT :RHO:SYNC:SCR:TYPE?
Notes	This command is effective when [:SENSe]:RADio:DEVice is set to BTS. This command is not effective when [:SENSe]:RHO:SYNC:SCRamble[:BTS]:AUTO is set to ON
Preset	STANdard
State Saved	Yes
Range	LEFT|RIGHt|STANdard

Advanced Sync Setup

The Advanced Sync Setup enables you to access advanced sync parameters in the Meas Setup menus on one screen.

Chip Rate

Sets the chip rate.

Remote Command	`[:SENSe]:RHO:CRATe <freq>` `[:SENSe]:RHO:CRATe?`
Example	`:RHO:CRAT 3900000` `:RHO:CRAT?`
Preset	3.84 MHz
State Saved	Yes
Min/Max	3.456 MHz/4.224 MHz

RRC Filter Control

Specifies the alpha value of the Root Raised Cosine (RRC) filter and changes its status (ON/OFF). This ON/OFF state change involves measurement restart.

Remote Command	`[:SENSe]:RHO:FILTer[:RRC]:ALPHa <real>`
	`[:SENSe]:RHO:FILTer[:RRC]:ALPHa?`
	`[:SENSe]:RHO:FILTer[:RRC][:STATe] OFF | ON | 0 | 1`
	`[:SENSe]:RHO:FILTer[:RRC][:STATe]?`

Example	`:RHO:FILT:ALPH 0.3`
	`:RHO:FILT:ALPH?`
	`:RHO:FILT ON`
	`:RHO:FILT?`

Preset	0.22 ON
State Saved	Yes
Min/Max	0.01/0.50
Backwards Compatibility SCPI	`[:SENSe]:RHO:ALPHa`

Spectrum

Sets a spectrum to either normal or inverted for demodulation related measurements. If set to INVert, the upper and lower spectrums are swapped.

The Invert function conjugates the spectrum, which is equivalent to taking the negative of the quadrature component in demodulation. The correct setting (Normal or Invert) depends on whether the signal at the input of the instrument has a high or low side mix.

Remote Command	`[:SENSe]:RHO:SPECtrum INVert | NORMal` `[:SENSe]:RHO:SPECtrum?`
Example	`:RHO:SPEC INV` `:RHO:SPEC?`
Preset	`NORMal`
State Saved	Yes
Range	`INVert|NORMal`

EVM Result I/Q Offset

Toggles the I/Q origin offset function between Std (standard) and Exclude.

- Std (ON): The measurement results for EVM, Rho, and Modulation Accuracy (Rho) error take into account the I/Q origin offset
- Exclude (OFF): The measurement results for EVM, Rho, and Modulation Accuracy (Rho) error do not take into account the I/Q origin offset

Remote Command	`:CALCulate:RHO:IQOFfset:INCLude OFF | ON | 0 | 1` `:CALCulate:RHO:IQOFfset:INCLude?`
Example	`:CALC:RHO:IQOF:INCL ON` `:CALC:RHO:IQOF:INCL?`
Preset	`ON`
State Saved	Yes
Range	Standard|Exclude

EVM Minimization by IQ Imbalance

Toggles the I/Q Imbalance Compensation between ON and OFF.

- ON: The measurement results for EVM, Rho, and Modulation Accuracy (Rho) error are compensated for I/Q imbalance
- OFF: The measurement results for EVM, Rho, and Modulation Accuracy (Rho) error are not compensated for I/Q imbalance

Remote Command	`[:SENSe]:RHO:EVMMinimize:IQIMbalance OFF | ON | 0 | 1` `[:SENSe]:RHO:EVMMinimize:IQIMbalance?`
Example	`:RHO:EVMM:IQIM ON` `:RHO:EVMM:IQIM?`

Notes	This parameter is available only when N/W9073A-CFP license is installed
Preset	OFF
State Saved	Yes
Range	OFF|ON

IQ Imbalance Frequency Compensation

Toggles Frequency Compensation for IQ Imbalance measurement results (IQ Gain Imbalance, IQ Quadrature Error) for Receiver Device Under Test (DUT) between on and off. The Compensation is not valid for Transmitter DUT.

- ON: IQ Imbalance measurement results are compensated by taking account of Frequency Offset which is added before IQ Imbalance addition on DUT
- OFF: IQ Imbalance measurement results are not compensated for the Frequency Offset

Remote Command	[:SENSe]:RHO:IQIMbalance:FCOMpen ON | OFF [:SENSe]:RHO:IQIMbalance:FCOMpen?
Example	:RHO:IQIM:FCOM ON :RHO:IQIM:FCOM?
Notes	This parameter is available only when N/W9073A-DFP license is installed
Preset	OFF
State Saved	Yes
Range	ON|OFF

MEQ (Equalizer Mode)

Sets the Equalizer mode as follows.

- OFF: Equalizer is not active
- NORMal: Equalizer is active (Mirror Frequency Spectrum is Off)
- INVert: Equalizer is active (Mirror Frequency Spectrum is On)

Remote Command	[:SENSe]:RHO:MEQ OFF | NORMal | INVert [:SENSe]:RHO:MEQ?
Example	:RHO:MEQ OFF :RHO:MEQ?
Dependencies	Available when Option BBA or N9073C-DP2 (or both), and N9073C-DFP are installed
Preset	OFF

State Saved	Yes
Range	OFF|NORMal|INVert

3.3.8.4 Time

This tab enables you to set time parameters.

Capture Interval

Sets the data capture length in frames (1 frame equals 10 ms)that is used in the acquisition.

For details of the functionality, see "Capture Interval Enum" on page 392.

Frame Capture Interval (Remote Command only)

Sets the frame capture interval time.

Remote Command	[:SENSe]:RHO:CAPTure:TIME[:FRAMe] <real> [:SENSe]:RHO:CAPTure:TIME[:FRAMe]?
Example	:RHO:CAPT:TIME 1.0 :RHO:CAPT:TIME?
Preset	1.0
State Saved	Yes
Range	0.067, 0.2, 1.0 frame (0.67 to 80 ms; 1/15 frame equals 1 slot)
Min/Max	0.067/1.0

Capture Interval Enum

Sets the data capture length in frames to be used in the acquisition. Please note that 1 frame equals 10 ms.

Couplings	Changing this parameter forces a change to :RHO:CAPT:TIME – 1 slot: 0.067 – 3 slots: 0.2 – 1 frame: 1.0
Preset	1 frame
State Saved	Yes
Range	1 Slot|3 Slots|1 Frame

Meas Offset

Sets the timing offset of the capture interval in slots, where 1 slot = 666.6 us. If the Capture Interval is set to 1 slot (Fast Mode), the Meas Offset is fixed at “0”.

Remote Command	`:CALCulate:RHO:SWEep:OFFSet <integer>` `:CALCulate:RHO:SWEep:OFFSet?`
Example	`:CALC:RHO:SWE:OFFS 0` `:CALC:RHO:SWE:OFFS?`
Couplings	Max value is limited by Capture Interval in slot
Preset	0
State Saved	Yes
Min/Max	0/Capture Interval in Slot - 1

Transient Period Exclude (MS only)

Selects either to include or to exclude the transient period. The transient period is specified in the 3GPP standard TS 34.121, as 25 µs before each slot boundary and 25 µs after each slot boundary. The 3GPP standard requires that the transient period is not included for the power measurement.

This command is available only when the device is MS.

Remote Command	`[:SENSe]:RHO:SWEep:TIME:TRANsient INCLude | EXCLude` `[:SENSe]:RHO:SWEep:TIME:TRANsient?`
Example	`:RHO:SWE:TIME:TRAN INCL` `:RHO:SWE:TIME:TRAN?`
Notes	This command is available only when the device is MS
Preset	`INCLude`
State Saved	Yes
Range	`INCLude|EXCLude`

Capture Time Diagram

Accesses a menu that enables you to set up time parameters.

Capture Buffer Offset

Sets the timing offset in Capture Buffer, and the unit is slot, where 1 slot = 666.6 µs.

Remote	`[:SENSe]:RHO:CBUFfer:OFFSet <integer>`

Command	`[:SENSe]:RHO:CBUFfer:OFFSet?`
Example	`:RHO:CBUF:OFFS 25` `:RHO:CBUF:OFFS?`
Notes	This parameter is valid only when Data Source is Capture Buffer
Preset	0
State Saved	Yes
Min/Max	0/239

3.3.8.5 Channel/Layer

This tab enables you to set channel/layer parameters.

The Advanced Can Setup dialog contains the following parameters:

– "Active Set Threshold" on page 420
– "Multi Channel Estimator" on page 421
– "Timing Estimation" on page 422
– "PICH Code Number (BTS only)" on page 422
– "MICH Code Number (BTS only)" on page 422
– "S-CCPCH Symbol Rate (BTS only)" on page 423
– "S-CCPCH Code Number (BTS only)" on page 424

Symbol Boundary (BTS only)

Accesses the menu for the symbol boundary detection modes that are used to make the modulation accuracy measurement.

Available selections are as follows:

Auto Detect

Auto Detect [SCPI Enum: AUTO] - Sets symbol boundary detection to the automatic mode. Various code channels are measured and the most appropriate code channel is selected as the reference channel.

Lower level menus enable further selection of various numbers of DPCH channels to make the Modulation Accuracy Measurement.

Test Model 1

Test Model 1 – Accesses a menu with further selections of Test Model 1 with 4, 8, 16, 32 or 64 DPCH channels and with S-CCPCH.

- Test Model 1 w/4DPCH w/ S-CCPCH [SCPI Enum: TM1D4] – Select this to set the Modulation Accuracy Measurement to the Test Model 1 with 4 DPCH channels and 1 S-CCPCH channel
- Test Model 1 w/8DPCH w/ S-CCPCH [SCPI Enum: TM1D8] – Select this to set the Modulation Accuracy Measurement to Test Model 1 with 8 DPCH channels and 1 S-CCPCH channel
- Test Model 1 w/16 DPCH w/ S-CCPCH [SCPI Enum: TM1D16] – Select this to set the Modulation Accuracy Measurement to the Test Model 1 with 16 DPCH channels and 1 S-CCPCH channel
- Test Model 1 w/32 DPCH w/ S-CCPCH [SCPI Enum: TM1D32] – Select this to set the Modulation Accuracy Measurement to Test Model 1 with 32 DPCH channels and 1 S-CCPCH channel
- Test Model 1 w/64 DPCH w/ S-CCPCH [SCPI Enum: TM1D64] – Select this to set the Modulation Accuracy Measurement to Test Model 1 with 64 DPCH channels and 1 S-CCPCH channel

3GPP TS25.141 Table 6.1: Test Model 1 (2009-12 version) (S-CCPCH included)

Type	Number of Channels	Fraction of Power (%)	Level setting (dB)	Channelization Code	Timing offset (x256Tchip)
P-CCPCH+SCH	1	10	-10	1	0
Primary CPICH	1	10	-10	0	0
PICH	1	1.6	-18	16	120
S-CCPCH containing PCH (SF=256)	1	1.6	-18	3	0
DPCH (SF=128)	4*/8*/16/32/64	76.8 in total	See 3GPP TS25.141 table 6.2	See 3GPP TS25.141 table 6.2	See 3GPP TS25.141 table 6.2

Table Note *: Only applicable to Home BS

Test Model 2

Test Model 2 – Accesses a menu with selections of Test Model 2 with S-CCPCH.

- Test Model 2 w/S-CCPCH [SCPI Enum: TM2SC] – Select this to set the Modulation Accuracy Measurement to Test Model 2 with 1 S-CCPCH channel

3GPP TS25.141 Table 6.3: Test Model 2 (2002-09 version) (S-CCPCH included)

Type	Number of Channels	Fraction of Power (%)	Level setting (dB)	Channelization Code	Timing offset (x256Tchip)
P-CCPCH+SCH	1	10	-10	1	0
Primary CPICH	1	10	-10	0	0
PICH	1	5	-13	16	120
S-CCPCH containing PCH (SF=256)	1	5	-13	3	0
DPCH (SF=128)	3	2 x 10, 1 x 50	2 x –10, 1 x –3	24, 72, 120	1, 7, 2

Test Model 3

Test Model 3 - Accesses a menu with further selections from Test Model 3 with 4, 8, 16 or 32 DPCH channels and with S-CCPCH.

- Test Model 3 w/4 DPCH w/ S-CCPCH [SCPI Enum: TM3D4SC] - Select this to set the Modulation Accuracy Measurement to Test Model 3 with 4 DPCH channels and 1 S-CCPCH channel
- Test Model 3 w/8 DPCH w/ S-CCPCH [SCPI Enum: TM3D8SC] - Select this to set the Modulation Accuracy Measurement to Test Model 3 with 8 DPCH channels and 1 S-CCPCH channel
- Test Model 3 w/16 DPCH w/ S-CCPCH [SCPI Enum: TM3D16SC] - Select this to set the Modulation Accuracy Measurement to Test Model 3 with 16 DPCH channels and 1 S-CCPCH channel
- Test Model 3 w/32 DPCH w/ S-CCPCH [SCPI Enum: TM3D32SC] - Select this to set the Modulation Accuracy Measurement to Test Model 3 with 32 DPCH channels and 1 S-CCPCH channel

3GPP TS25.141 Table 6.4: Test Model 3 (2009-12 version)

Type	Number of Channels	Fraction of Power (%) 16/32	Level settings (dB) 16/32	Channelization Code	Timing offset (x256Tchip)
P-CCPCH+SCH	1	15,8/15,8/12,6/7,9	-8/ -8 / -9 / -11	1	0
Primary CPICH	1	15.8/15.8/12,6/7,9	-8/ -8 / -9 / -11	0	0
PICH	1	2.5/2.5/5/1.6	-16/ -16/ -13/ -18	16	120
S-CCPCH	1	2.5/2.5/5/1.6	-16/ -16/	3	0

Type	Number of Channels	Fraction of Power (%) 16/32	Level settings (dB) 16/32	Channelization Code	Timing offset (x256Tchip)
containing PCH (SF=256)			-13/ -18		
DPCH (SF=256)	4*/8*/16/32	63,4/63,4/63,7/80,4 in total	See 3GPP TS25.141 table 6.5	See 3GPP TS25.141 table 6.5	See 3GPP TS25.141 table 6.5

Table Note *: Only applicable to Home BS

Test Model 4

Test Model 4 – Accesses a menu with further selections of Test Model 4.

– Test Model 4 w/P-CPICH [SCPI Enum: TM4CP] – Select this to set the Modulation Accuracy Measurement to Test Model 4 with 1 CPICH channel

– Test Model 4 [SCPI Enum: TM4] – Select this to set the Modulation Accuracy Measurement to Test Model 4 (no CPICH channel)

3GPP TS25.141, Table 6.6: Test Model 4 Active Channels (2001-09 version)

Type	Number of Channels	Fraction of Power (%)	Level setting (dB)	Channelization Code	Timing offset	Type
PCCPCH+SCH	1	50 to 1.6	-3 to -18	1	0	PCCPCH+SCH
Primary CPICH1	1	10	-10	0	0	Primary CPICH1

Note 1: The CPICH channel is optional

Test Model 5

Test Model 5 – Accesses a menu with further selections of Test Model 5. This feature is available when 'HSPA Enable' is on.

– Test Model 5 w/2 HS-PDSCH w/6 DPCH [SCPI Enum: TM5H2] – Select this to set the Modulation Accuracy Measurement to Test Model 5 with 2 HS-PDSCH channels and 6 DPCH channels

– Test Model 5 w/4 HS-PDSCH w/14 DPCH [SCPI Enum: TM5H4] – Select this to set the Modulation Accuracy Measurement to Test Model 5 with 4 HS-PDSCH channels and 14 DPCH channels

- **Test Model 5 w/8 HS-PDSCH w/30 DPCH** [SCPI Enum: TM5H8] - Select this to set the Modulation Accuracy Measurement to Test Model 5 with 8 HS-PDSCH channels and 30 DPCH channels
- **Test Model 5 w/4 HS-PDSCH w/4 DPCH** [SCPI Enum: TM5D4] - Select this to set the Modulation Accuracy Measurement to Test Model 5 with 4 HS-PDSCH channels and 4 DPCH channels

3GPP TS25.141 Table 6.6A: Test Model 5 Active Channels (2009-12 version)

Type	Number of Channels	Fraction of Power (%)	Level setting (dB)	Channelization Code	Timing offset (x256Tchip)
P-CCPCH+SCH	1	7.9	-11	1	0
Primary CPICH	1	7.9	-11	0	0
PICH	1	1.3	-19	16	120
S-CCPCH containing PCH (SF=256)	1	1.3	-19	3	0
DPCH (SF=128)	30/14/6/4*	14/14.2/14.4/14.2 in total	See 3GPP TS25.141 table 6.6.B	See 3GPP TS25.141 table 6.6B	See 3GPP TS25.141 table 6.6.B
HS-SCCH	2	4 in total	See 3GPP TS25.141 table 6.6C	See 3GPP TS25.141 table 6.6C	See 3GPP TS25.141 table 6.6C
HS-PDSCH (16QAM)	8/4/2*	63.6/63.4/63.2 in total	See 3GPP TS25.141 table 6.6D	See 3GPP TS25.141 table 6.6D	See 3GPP TS25.141 table 6.6D

Table Note *: 2 HS-PDSCH shall be taken together with 6 DPCH, 4 HS-PDSCH shall be taken with 14 DPCH or (for Home BS only) 4 DPCH, and 8 HS-PDSCH shall be taken together with 30 DPCH

Test Model 6

Test Model 6 - Accesses a menu to allow further selections of Test Model 6. This feature is available when both ‘HSPA Enable’ and ‘HSPA+ Enable’ are on.

- **Test Model 6 w/8 HS-PDSCH w/30 DPCH** [SCPI Enum: TM6H8] - Select this to set the Modulation Accuracy Measurement to Test Model 6 with 8 HS-PDSCH channels and 30 DPCH channels
- **Test Model 6 w/4 HS-PDSCH w/4 DPCH** [SCPI Enum: TM6D4] - Select this to set the Modulation Accuracy Measurement to Test Model 6 with 4HS-PDSCH channels and 4 DPCH channels

3GPP TS25.141 Table 6.6E: Test Model 6 Active Channels

This feature is available when both ‘HSPA Enable’ and ‘HSPA+ Enable’ are on

Type	Number of Channels	Fraction of Power (%)	Level setting (dB)	Channelization Code	Timing offset (x256Tchip)
P-CCPCH+SCH	1	7.9	-11	1	0
Primary CPICH	1	7.9	-11	0	0
PICH	1	1.3	-19	16	120
S-CCPCH containing PCH (SF=256)	1	1.3	-19	3	0
DPCH (SF=128)	30/4*	27.1 in total	See 3GPP TS25.141 table 6.6F	See 3GPP TS25.141 table 6.6F	See 3GPP TS25.141 table 6.6F
HS-SCCH	2	4 in total	See 3GPP TS25.141 table 6.6G	See 3GPP TS25.141 table 6.6G	See 3GPP TS25.141 table 6.6G
HS-PDSCH (64QAM)	8/4*	50.5 in total	See 3GPP TS25.141 table 6.6H	See 3GPP TS25.141 table 6.6H	See 3GPP TS25.141 table 6.6H

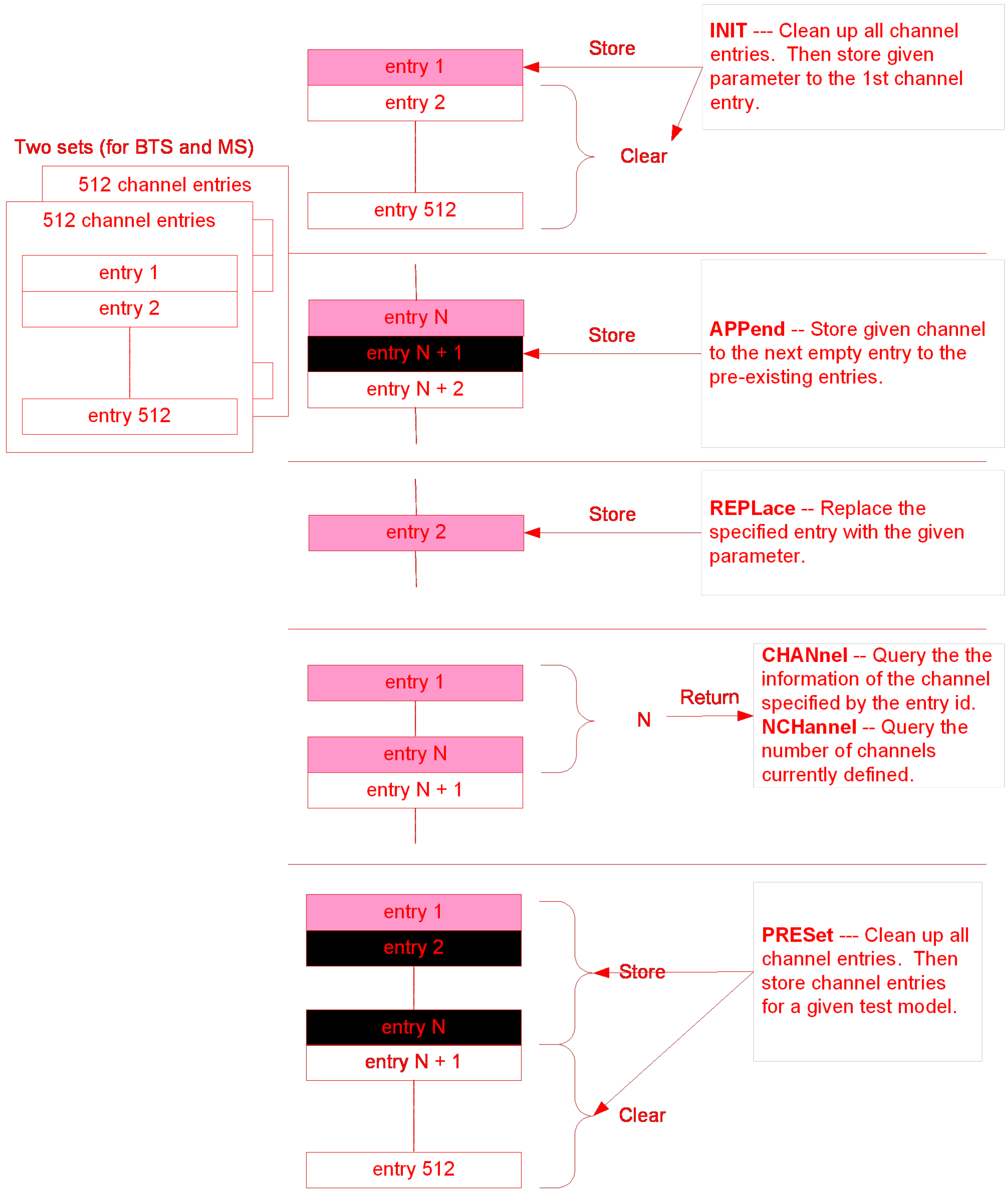
Table Note *: 8 HS-PDSCH shall be taken together with 30 DPCH, and (for Home BS only) 4 HS-PDSCH shall be taken with 4 DPCH

Custom

Custom [SCPI Enum: CUSTom] – Provides a flexible way to specify predefined active channels. By choosing it, you can specify a customized list of active channels using the following remote commands: Initialize List, Append List, Replace List, Query List.

The following commands handle the list of custom active channel list for BTS.

Mnemonic	Function	See Section
`INIT`	Cleans up all channel entries. Then stores given parameter to the 1st channel entry	"Initialize List (Remote Command only)" on page 400
`APPend`	Stores given channel to the next empty entry to the pre-existing entries	"Append List (Remote Command only)" on page 403
`REPLace`	Replaces the specified entry with the given parameter	"Replace List (Remote Command only)" on page 405
`CHANnel`	Queries the information of the channel specified by the entry id	"Query List (Remote Command only)" on page 408
`NCHannel`	Queries the number of channels currently defined	"Query List (Remote Command only)" on page 408
`PRESet`	Cleans up all channel entries. Then stores channel entries for a given test model	"Load Preset Setting BTS (Remote Command Only) (BTS only)" on page 410



Initialize List (Remote Command only)

Initializes the current custom active channel list. This creates a new entry with the specified parameters.

Parameter	Name/Value	Description
1	`<symbol_rate>`	Specifies symbol rate of the channel

Parameter	Name/Value	Description
2	<code_num>	Specifies code number of the channel
3	`QPSK`	Specifies the channel's modulation scheme is QPSK
	`QAM16`	Specifies the channel's modulation scheme is QAM16 This choice is available only for channels with a symbol rate of 240000 Only when 'HSPA' functionality is operative, 'QAM16' parameter is allowed
	`QAM64`	Specifies the channel's modulation scheme is QAM64 This choice is available only for channels with symbol rate 240000 Only when both 'HSPA' functionality and 'HSPA+' functionality are operative, 'QAM64' parameter is allowed

Remote Command	[:SENSe]:RHO:SBOundary:LIST[:BTS]:INIT <symbol_rate>, <code_num>, QPSK | QAM16 | QAM64

Example

In order to predefine the following channels:

- CPICH (C8(0))
- P-CCPCH (C8(1))
- S-CCPCH(C8(3))
- PICH(C8(16))
- HS-DPCCH (C4(15)) 16QAM modulated

```
:RHO:SBO:LIST:INIT 15000,0, QPSK
:RHO:SBO:LIST:APP 15000,1, QPSK
:RHO:SBO:LIST:APP 15000,3, QPSK
:RHO:SBO:LIST:APP 15000,16, QPSK
:RHO:SBO:LIST:APP 240000,15, QAM16
:RHO:SBO:LIST:BTS:NCH?
```

5

```
:RHO:SBO:LIST:CHAN? 1
```

15000,0, QPSK

```
:RHO:SBO:LIST:CHAN? 2
```

15000,1, QPSK

```
:RHO:SBO:LIST:CHAN? 3
```

15000,3, QPSK

```
:RHO:SBO:LIST:CHAN? 4
```

415000,16, QPSK

```
:RHO:SBO:LIST:CHAN? 5
```

	240000,15, QAM16
Notes	This command is effective when `[:SENSe]:RADio:DEVice` is set to BTS and `[:SENSe]:RHO:SBOundary[:BTS]` is set to `CUSTom` QAM16 for the 3rd parameter is available only when HSPA Enable is On QAM64 for the 3rd parameter is available only when both HSPA Enable and HSPA+ Enable are on See also "Initialize List Error Messages" on page 402 below
State Saved	Yes
Range	Dependent on Symbol Rate; see "Range & Symbol Rate" on page 407 below QAM16 and QAM64 for the 3rd parameter available only for channels with a symbol rate of 240000. For other channels, specify QPSK

Initialize List Error Messages

One of the following error messages is logged if the given parameter is invalid. If an error is reported, the SCPI command is rejected and the instrument's settings do not change.

#	Message	Details
1	Missing Parameter	This error is reported if the number of parameters is less than 3 For example, `:SENSe:RHO:SBOundary:LIST:BTS:INIT, 15000, 0` 3rd parameter is missing.

2	Illegal parameter value	This error is reported if parameter type is invalid or if enum value is invalid
		For example,
		`:SENSe:RHO:SBOundary:LIST:BTS:INIT, 15000, ON, QPSK`
		2nd parameter must be integer
		`:SENSe:RHO:SBOundary:LIST:BTS:INIT 15001, 8, QPSK`
		1st parameter value (Symbol Rate) is not allowed
		Only the values given in the Range field are valid for the Symbol Rate. You may specify these in numeric form, but they are interpreted as an enumeration and the error results if the value does not translate to one in the list

3	Data out of range	This error is reported if parameter value is out of range For example, `:SENSe:RHO:SBOundary:LIST:BTS:INIT 15000, 256, QPSK` 2nd parameter is out of range
4	Setting Conflict	This error is reported if the given code channel overlaps another code channel in modulation accuracy For example, if a user sends the following two commands, the second command causes the error message because C7(0) overlaps C8(0) `:SENSe:RHO:SBOundary:LIST:BTS:INIT 15000, 0, QPSK` OK

`:SENSe:RHO:SBOundary:LIST:BTS:APPend 30000, 0, QPSK`

C7(0) overlaps C8(0)

Append List (Remote Command only)

Appends the entry on the list of custom active channel list for BTS.

Parameter	Name/Value	Description
1	`<symbol_rate>`	Specifies symbol rate of the channel
2	`<code_num>`	Specifies code number of the channel
3	`QPSK`	Specifies the channel's modulation scheme is QPSK
	`QAM16`	Specifies the channel's modulation scheme is QAM16 This choice is available only for channels with a symbol rate of 240000 Only when 'HSPA' functionality is operative, 'QAM16' parameter is allowed
	`QAM64`	Specifies the channel's modulation scheme is QAM64 This choice is available only for channels with symbol rate 240000. Only when both 'HSPA' functionality and 'HSPA+' functionality are operative, 'QAM64' is valid to select

Remote Command	`[:SENSe]:RHO:SBOundary:LIST[:BTS]:APPend <symbol_rate>, <code_num>, QPSK | QAM16 | QAM64`

Example	In order to predefine the following channels:
	- CPICH (C8(0))
	P-CCPCH (C8(1))
	- S-CCPCH(C8(3))
	- PICH(C8(16))
	- HS-DPCCH (C4(15)) 16QAM modulated
	`:RHO:SBO:LIST:INIT 15000,0, QPSK`
	`:RHO:SBO:LIST:APP 15000,1, QPSK`
	`:RHO:SBO:LIST:APP 15000,3, QPSK`
	`:RHO:SBO:LIST:APP 15000,16, QPSK`
	`:RHO:SBO:LIST:APP 240000,15, QAM16`
	`:RHO:SBO:LIST:BTS:NCH?`
	5
	`:RHO:SBO:LIST:BTS:CHAN? 1`
	15000,0, QPSK
	`:RHO:SBO:LIST:BTS:CHAN? 2`

	15000,1, QPSK
	`:RHO:SBO:LIST:BTS:CHAN? 3`
	15000,3, QPSK
	`:RHO:SBO:LIST:BTS:CHAN? 4`
	15000,16, QPSK
	`:RHO:SBO:LIST:BTS:CHAN? 5`
	240000,15, QAM16

Notes	This command is effective when [:SENSe]:RADio:DEVice is set to BTS and [:SENSe]:RHO:SBOundary [:BTS] is set to CUSTom QAM16 for the 3rd parameter is available only when HSPA Enable is On QAM64 for the 3rd parameter is available only when both HSPA Enable and HSPA+ Enable are on The maximum number of entries is 512 See also "Append List Error Messages" on page 404 below
State Saved	Yes
Range	Dependent on Symbol Rate; see "Range & Symbol Rate" on page 407 below QAM16 and QAM64 for the 3rd parameter available only for channels with a symbol rate of 240000. For other channels, specify QPSK

Append List Error Messages

One of the following error messages is logged if the given parameter is invalid. If an error is reported, the SCPI command is rejected and the instrument's settings do not change.

#	Message	Details
1	Missing Parameter	This error is reported if the number of parameters is less than 4 For example, `:SENSe:RHO:SBOundary:LIST:BTS:APPend, 15000, 0` 3rd parameter is missing.

2	Illegal parameter value	This error is reported if parameter type is invalid or if enum value is invalid
		For example,
		`:SENSe:RHO:SBOundary:LIST:BTS:APPend 15000, ON, QPSK`
		2nd parameter must be integer
		`:SENSe:RHO:SBOundary:LIST:BTS:APPend, 15001, 8, QPSK`
		1st parameter value (Symbol Rate) is not allowed
		Only the values given in the Range field are valid for the Symbol Rate. You may specify these in numeric form, but they are interpreted as an enumeration and the error results if the value does not translate to one in the list

3	Data out of range	This error is reported if parameter value is out of range For example,

#	Message	Details
		`:SENSe:RHO:SBOundary:LIST:BTS:APPend 15000, 256, QPSK`
		2nd parameter is out of range
4	Setting Conflict	This error is reported if the given code channel overlaps another code channel in Modulation Accuracy (Rho)
		For example, if a user sends the following two commands, the second command causes the error message because C7(0) overlaps C8(0)
		`:SENSe:RHO:SBOundary:LIST:BTS:INIT, 15000, 0, QPSK`
		OK
		`:SENSe:RHO:SBOundary:LIST:BTS:APPend 30000, 0, QPSK`
		C7(0) overlaps C8(0)

Replace List (Remote Command only)

Replaces the entry of the custom active channel list for BTS.

Parameter	Name/Value	Description
1	`<entry_id>`	Specifies entry ID of the channel to replace
2	`<symbol_rate>`	Specifies symbol rate of the channel
3	`<code_num>`	Specifies code number of the channel
4	`QPSK`	Specifies the channel's modulation scheme is QPSK
	`QAM16`	Specifies the channel's modulation scheme is QAM16
		This choice is available only for channels with a symbol rate of 240000
		Only when 'HSPA' functionality is operative, 'QAM16' parameter is allowed
	`QAM64`	Specifies the channel's modulation scheme is QAM64
		This choice is available only for channels with symbol rate 240000
		Only when both 'HSPA' and 'HSPA+' functionalities are operative, 'QAM64' is valid to select

Remote Command	`[:SENSe]:RHO:SBOundary:LIST[:BTS]:REPLace <entry_id>, <symbol_rate>, <code_num>, QPSK | QAM16 | QAM64`
Example	In order to predefine the following channels: - CPICH (C8(0)) - P-CCPCH (C8(1)) - S-CCPCH(C8(3)) - PICH(C8(16)) - HS-DPCCH (C4(15)) 16QAM modulated `:RHO:SBO:LIST:INIT 15000,0, QPSK`

	`:RHO:SBO:LIST:APP 15000,1, QPSK`
	`:RHO:SBO:LIST:APP 15000,3, QPSK`
	`:RHO:SBO:LIST:APP 15000,16, QPSK`
	`:RHO:SBO:LIST:APP 240000,15, QAM16`
	And, P-CCPCH(C8(3)) is replaced as follows:
	`:RHO:SBO:LIST:REPL 3,15000,5,QPSK`
	`:RHO:SBO:LIST:BTS:NCH?`
	5
	`:RHO:SBO:LIST:CHAN? 1`
	15000,0, QPSK
	`:RHO:SBO:LIST:CHAN? 2`
	15000,1, QPSK
	`:RHO:SBO:LIST:CHAN? 3`
	15000,5, QPSK
	`:RHO:SBO:LIST:CHAN? 4`
	15000,16, QPSK
	`:RHO:SBO:LIST:CHAN? 5`
	240000,15, QAM16

Notes	This command is effective when [:SENSe]:RADio:DEVice is set to BTS and [:SENSe]:RHO:SBOundary [:BTS] is set to CUSTom QAM16 for the 4th parameter is available only when HSPA Enable is On. QAM64 for the 4th parameter is available only when both HSPA Enable and HSPA+ Enable are on The maximum number of entries is 512 See also "Replace List Error Messages" on page 406 below
State Saved	Yes
Range	The entry ID must be: 1 <= entry_id <= The number of entries that are currently appended Dependent on Symbol Rate; see "Range & Symbol Rate" on page 407 below QAM16 and QAM64 for the 4th parameter available only for channels with a symbol rate of 240000. For other channels, specify QPSK

Replace List Error Messages

One of the following error messages is logged if the given parameter is invalid. If an error is reported, the SCPI command is rejected and the instrument's settings do not change.

#	Message	Details
1	Missing	This error is reported if the number of parameters is less than 4

#	Message	Details
	Parameter	For example, `:SENSe:RHO:SBOundary:LIST:BTS:REPLace 1,15000, 0` 4th parameter is missing.

2	Illegal parameter value	This error is reported if parameter type is invalid or if enum value is invalid
		For example,
		`:SENSe:RHO:SBOundary:LIST:BTS:REPLace 1,15000, ON, QPSK`
		3rd parameter must be integer
		`:SENSe:RHO:SBOundary:LIST:BTS:REPLace 1,15001, 8, QPSK`
		2nd parameter value (Symbol Rate) is not allowed
		Only the values given in the Range field are valid for the Symbol Rate. You may specify these in numeric form, but they are interpreted as an enumeration and the error results if the value does not translate to one in the list

3	Data out of range	This error is reported if parameter value is out of range For example, `:SENSe:RHO:SBOundary:LIST:BTS:REPLace 1,15000, 256, QPSK` 3rd parameter is out of range

4	Setting Conflict	This error is reported if the given code channel overlaps another code channel in Modulation Accuracy (Rho)
		For example, if a user sends the following two commands, the second command causes the error message because C7(0) overlaps C8(0)
		`:SENSe:RHO:SBOundary:LIST:BTS:INIT 15000, 0, QPSK`
		OK
		`:SENSe:RHO:SBOundary:LIST:BTS:REPLace 1,30000, 0, QPSK`
		C7(0) overlaps C8(0)

5	The entry ID is out of range	1 <= entry_id <= The number of entries that are currently appended See Symbol Boundary Custom Active Channel List – The Number Of Entries BTS (BTS only)

Range & Symbol Rate

Symbol Rate	Range
7500	0<= code_num <= 511
15000	0<= code_num <= 255
30000	0<= code_num <= 127
60000	0<= code_num <= 63
120000	0<= code_num <= 31
240000	0<= code_num <= 15
480000	0<= code_num <= 7
960000	0<= code_num <= 3

Query List (Remote Command only)

This command returns the entry of the custom active channel list for BTS.

See also "Number of Entries (Remote Command only) (BTS only)" on page 409 below.

Parameter	Name/Value	Description
1	<entry_id>	Specifies entry ID of the channel to query

Remote Command	`[:SENSe]:RHO:SBOundary:LIST[:BTS]:CHANnel? <entry_id>`

Example	In order to predefine the following channels:
	- CPICH (C8(0))
	- P-CCPCH (C8(1))
	- S-CCPCH(C8(3))
	- PICH(C8(16))
	- HS-DPCCH (C4(15)) 16QAM modulated
	`:RHO:SBO:LIST:INIT 15000,0, QPSK`
	`:RHO:SBO:LIST:APP 15000,1, QPSK`
	`:RHO:SBO:LIST:APP 15000,3, QPSK`
	`:RHO:SBO:LIST:APP 15000,16, QPSK`
	`:RHO:SBO:LIST:APP 240000,15, QAM16`
	`:RHO:SBO:LIST:BTS:NCH?`
	5
	`:RHO:SBO:LIST:CHAN? 1`
	15000,0, QPSK
	`:RHO:SBO:LIST:CHAN? 2`
	15000,1, QPSK
	`:RHO:SBO:LIST:CHAN? 3`
	15000,3, QPSK
	`:RHO:SBO:LIST:CHAN? 4`
	15000,16, QPSK
	`:RHO:SBO:LIST:CHAN? 5`
	240000,15, QAM16

Notes	This command is effective when `[:SENSe]:RADio:DEVice` is set to BTS and [:SENSe]:RHO:SBOundary[:BTS] is set to CUSTom QAM16 for the 4th parameter is available only when HSPA Enable is On. QAM64 for the 4th parameter is available only when both HSPA Enable and HSPA+ Enable are on

	The maximum number of entries is 512
	Default value of the parameter
	By default, one channel is defined. (CPICH C8(0))
	In order to query the default entry, specify 1 for <entry_id>:
	`:SENSe:RHO:SBOundary:LIST:BTS:CHANnel? 1`
	The instrument returns an array of three values:
	`15000, 0, QPSK`
	Query command needs <entry_id> parameter
	The <entry_id> parameter is always required for a query command.
	The range of the parameter is from 1 to the total number of channels you have defined
	For example, if you have defined two channels, you can query them as follows:
	`:SENSe:RHO:SBOundary:LIST:BTS:CHANnel? 1`
	`:SENSe:RHO:SBOundary:LIST:BTS:CHANnel? 2`
	If you want to know the number of channels you have defined, send the following query command:
	`:SENSe:RHO:SBOundary:LIST:BTS:NCHannels?`
	Error messages associated with this parameter. The following error message is logged if the given parameter is invalid. If an error is reported, the SCPI command is rejected and the instrument's settings do not change:
	<entry_id> out of range
	The entry ID must be:
	1 <= entry_id <= The number of entries that are currently appended

Preset	15000, 0, QPSK
State Saved	Yes
Range	1 <= entry_id <= the number of channels defined <= 512 (<entry_id> is an integer ranging from 1 to 512)

Number of Entries (Remote Command only) (BTS only)

Returns the number of entries in the custom predefined active channel list BTS. This is a query only command.

Remote Command	`[:SENSe]:RHO:SBOundary:LIST[:BTS]:NCHannels?`
Example	`:SENS:RHO:SBO:LIST:BTS:NCH?`
Notes	This command is effective when `[:SENSe]:RADio:DEVice` is set to BTS and `[:SENSe]:RHO:SBOundary[:BTS]` is set to `CUSTom` This is a query-only command
Preset	1
Force Restart	No
State Saved	No

Load Preset Setting BTS (Remote Command Only) (BTS only)

Loads preset setting to the custom active channel list BTS. This is a command-only command; it does not support a query.

Remote Command	[:SENSe]:RHO:SBOundary:LIST[:BTS]:PRESet TM1D16 | TM1D32 | TM1D64 | TM1D16SC | TM1D32SC | TM1D64SC | TM2 | TM2SC | TM3D16 | TM3D32 | TM3D16SC | TM3D32SC | TM4 | TM4CP | TM5H2 | TM5H4 | TM5H8 | TM6H8
Example	:SENSe:RHO:SBOundary:LIST:BTS:PRESet TM1D64
Notes	(1) This command is effective when [:SENSe]:RADio:DEVice is set to BTS and [:SENSe]:RHO:SBOundary[:BTS] is set to CUSTom (2) TM5H2, TM5H4, TM5H8 parameters are allowed if HSPA Enable is On This is a command only; it does not support a query (3)TM6H8 parameter is allowed when HSPA+Enable is On
Force Restart	No
State Saved	No
Range	TM1D16|TM1D32|TM1D64|TM1D16SC|TM1D32SC|TM1D64SC| TM2 | TM2SC | TM3D16 | TM3D32 | TM3D16SC | TM3D32SC | TM4 | TM4CP | TM5H2 | TM5H4 | TM5H8 | TM6H8

Remote Command	[:SENSe]:RHO:SBOundary[:BTS] AUTO | TM1D4SC | TM1D8SC | TM1D16SC | TM1D32SC | TM1D64SC | TM2 | TM2SC | TM3D4SC | TM3D8SC | TM3D16SC | TM3D32SC | TM4 | TM4CP | TM5H2 | TM5H4 | TM5H8 | TM5D4 | TM6H8 | TM6D4 | CUSTom [:SENSe]:RHO:SBOundary[:BTS]?
Example	:RHO:SBO:BTS TM1D16 :RHO:SBO:BTS?

Notes	The reason that TM5H2, TM5H4 and TM5H8 have been selected is to align the enumerations with those of ESG
	For Test Model 5, W-CDMA HSPA option (N9073C-2FP) license needs to be installed and enabled. Otherwise, Test Model 5 menu is inactive (grayed out) and SCPI commands for Test Model 5 do not have effect
	For Test Model 6, both W-CDMA HSPA+ option (N9073C-3FP) license and W-CDMA HSPA option (N9073C-2FP) license need to be installed and enabled. Otherwise Test Model 6 is inactive (grayed out) and SCPI command for Test Model 6 do not have effect
	For the following selections of Home BS settings of Test Model 1 and Test Model 3, W-CDMA HSPA option license needs to be installed and enabled:
	– <TM1>
	  – Test Model 1 w/4DPCH w/ S-CCPCH
	  – Test Model 1 w/8DPCH w/ S-CCPCH
	– <TM3>
	  – Test Model 3 w/4 DPCH w/ S-CCPCH

– Test Model 3 w/8 DPCH w/ S-CCPCH

	Otherwise these are unavailable and the SCPI commands have no effect
Couplings	This command is effective when `[:SENSe]:RADio:DEVice` is set to `BTS`
Preset	`AUTO`
Force Restart	Yes
State Saved	Yes
Range	Auto Detect| Test Model 1 w/ 4 DPCH w/ S-CCPCH | Test Model 1 w/ 8 DPCH w/ S-CCPCH | Test Model 1 w/ 16 DPCH w/ S-CCPCH | Test Model 1 w/ 32 DPCH w/ S-CCPCH | Test Model 1 w/ 64 DPCH w/ S-CCPCH | Test Model 2 w/ S_CCPCH | Test Model 3 w/ 4 DPCH w/ S-CCPCH | Test Model 3 w/ 8 DPCH w/ S-CCPCH | Test Model 3 w/ 16 DPCH w/ S-CCPCH | Test Model 3 w/ 32 DPCH w/ S-CCPCH | Test Model 4 w/ P-CPICH | Test Model 4 | Test Model 5 w/ 2 HS-PDSCH w/ 6 DPCH | Test Model 5 w/ 4 HS-PDSCH w/ 14 DPCH | Test Model 5 w/ 8 HS-PDSCH w/ 30 DPCH | Test Model 5 w/ 4 HS-PDSCH w/ 4 DPCH | Test Model 6 w/ 8 HS-PDSCH w/ 30 DPCH | Test Model 6 w/ 4 HS-PDSCH w/ 4 DPCH | Custom

Symbol Boundary (MS only)

Selects the symbol boundary detection mode for MS and allows you to access the selection menu for the symbol boundary detection modes that allow you to specify the active channel detection scheme for the uplink.

Auto Detect

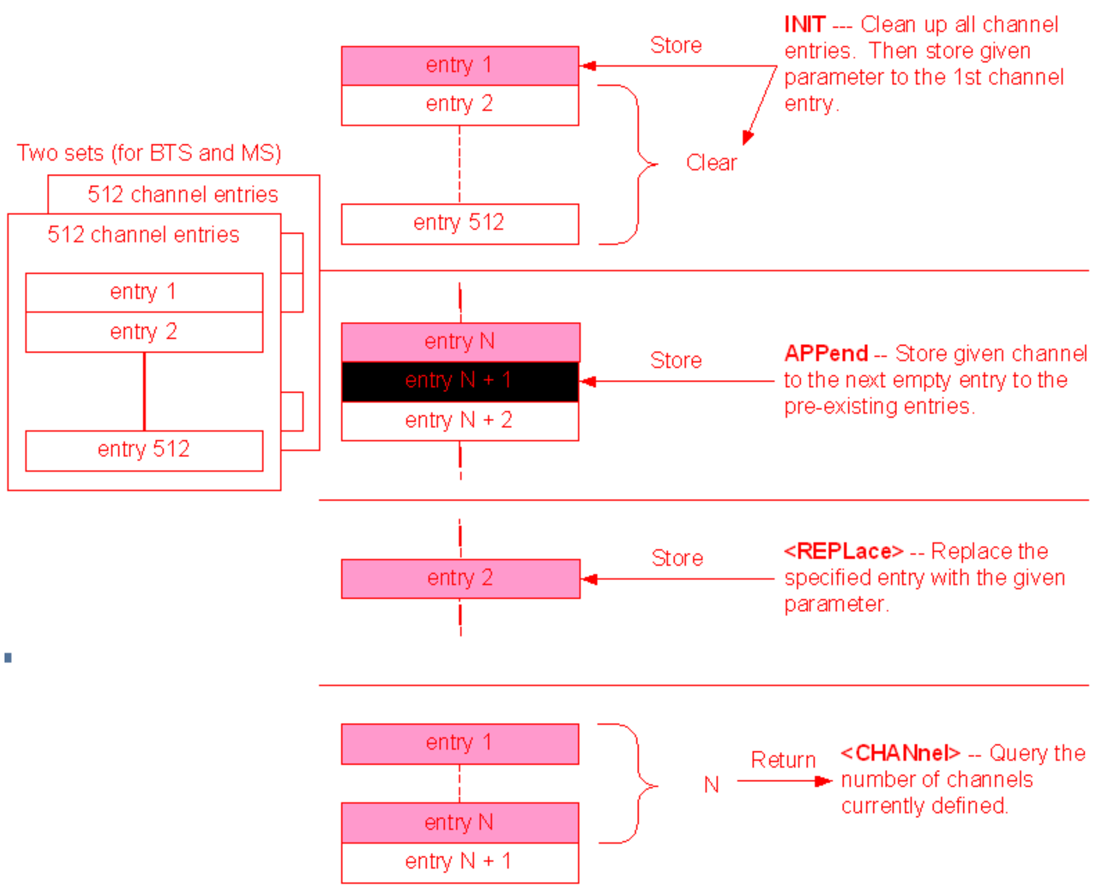
Auto Detect [SCPI Enum: `AUTO`] – Select this feature to set the symbol boundary detection to the automatic mode. Various code channels are measured and the most appropriate code channel is selected as the reference channel.

Custom

Custom [SCPI Enum: `CUSTom`] – Select this feature to specify a customized list of active channels using remote commands. All specified channels are considered as active. (There is no corresponding control.)

The following commands handle the list of custom predefined channels for MS.

Mnemonic	Function	See Section
`INIT`	Cleans up all channel entries. Then stores given parameter to the 1st channel entry	"Initialize List (Remote Command only)" on page 413
`APPend`	Stores given channel to the next empty entry to the pre-existing entries	"Append List (Remote Command only)" on page 414
`REPLace`	Replaces the specified entry with the given parameter	"Replace List (Remote Command only)" on page 416
`CHANnel`	Queries the information of the channel specified by the entry id	"Query List (Remote Command only)" on page 418
`NCHannel`	Queries the number of channels currently defined	"Query List (Remote Command only)" on page 418



Initialize List (Remote Command only)

Initializes the current custom active channel list. This creates a new entry with the given parameter.

Parameter	Name/Value	Description
1	<symbol_rate>	Specifies symbol rate of the channel
2	<code_num>	Specifies spreading code of the channel
3	IPH	Specifies the channel is on the I-axis
	QPH	Specifies the channel Is on the Q-axis

Remote Command	`[:SENSe]:RHO:SBOundary:LIST:MS:INIT <symbol_rate>, <code_num>, IPH | QPH`

Example	In order to predefine the following channels:
	- DPCCH (C8(0):Q)
	- DPDCH (C6(16):I)
	`:RHO:SBO:LIST:MS:INIT 15000, 0, QPH`
	`:RHO:SBO:LIST:MS:APP 60000, 16, IPH`
	`:RHO:SBO:LIST:MS:NCH?`
	2
	`:RHO:SBO:LIST:MS:CHAN? 1`
	15000, 0, QPH
	`:RHO:SBO:LIST:MS:CHAN? 2`
	60000, 16, IPH

Notes	This command is effective when `[:SENSe]:RADio:DEVice` is set to MS and `[:SENSe]:RHO:SBOundary:MS` is set to CUSTom symbol_rate = 1920000 is available if HSPA Enable is On The maximum number of entries is 512 See also "Initialize List Error Messages" on page 413 below
State Saved	Yes
Range	Dependent on Symbol Rate; see "Range & Symbol Rate" on page 418 below

Initialize List Error Messages

One of the following error messages is logged if the given parameter is invalid. If an error is reported, the SCPI command is rejected and the instrument’s settings do not change

#	Message	Details
1	Missing Parameter	This error is reported if the number of parameters is less than 3 For example, `:SENSe:RHO:SBOundary:LIST:MS:INIT 15000, 0`

#	Message	Details
		3rd parameter is missing.

2	Illegal parameter value	This error is reported if parameter type is invalid or if enum value is invalid
		For example,
		`:SENSe:RHO:SBOundary:LIST:MS:INIT 15000, ON, QPH`
		2nd parameter must be integer
		`:SENSe:RHO:SBOundary:LIST:MS:INIT 15001, 0, QPH`
		1st parameter value (Symbol Rate) is not allowed
		Only the values given in the Range field are valid for the Symbol Rate. You may specify these in numeric form, but they are interpreted as an enumeration and the error results if the value does not translate to one in the list

3	Data out of range	This error is reported if parameter value is out of range For example, `:SENSe:RHO:SBOundary:LIST:MS:INIT 15000, 256, QPH` 2nd parameter is out of range

4	Setting Conflict	This error is reported if the given code channel overlaps another code channel in modulation Accuracy
		For example, if a user sends the following two commands, the second command causes the error message because C7(0):Q overlaps C8(0):Q
		`:SENSe:RHO:SBOundary:LIST:MS:INIT 15000, 0, QPH`
		OK
		`:SENSe:RHO:SBOundary:LIST:MS:APPend 30000, 0, QPH`
		C7(0):Q overlaps C8(0):Q

Append List (Remote Command only)

Appends the entry to the custom active channel list.

Parameter	Name/Value	Description
1	`<symbol_rate>`	Specifies symbol rate of the channel
2	`<code_num>`	Specifies spreading code of the channel
3	`IPH`	Specifies the channel is on the I-axis
	`QPH`	Specifies the channel Is on the Q-axis

Remote Command	`[:SENSe]:RHO:SBOundary:LIST:MS:APPend <symbol_rate>, <code_num>, IPH | QPH`
Example	In order to predefine the following channels: - DPCCH (C8(0):Q) - DPDCH (C6(16):I)

	`:RHO:SBO:LIST:MS:INIT 15000, 0, QPH`
	`:RHO:SBO:LIST:MS:APP 60000, 16, IPH`
	`:RHO:SBO:LIST:MS:NCH?`
	2
	`:RHO:SBO:LIST:MS:CHAN? 1`
	15000, 0, QPH
	`:RHO:SBO:LIST:MS:CHAN? 2`
	60000, 16, IPH

Notes	This command is effective when `[:SENSe]:RADio:DEVice` is set to MS and `[:SENSe]:RHO:SBOundary:MS` is set to CUSTom symbol_rate = 1920000 is available if HSPA Enable is On The maximum number of entries is 512 See also "Append List Error Messages" on page 415 below
State Saved	Yes
Range	Dependent on Symbol Rate; see "Range & Symbol Rate" on page 418 below

Append List Error Messages

One of the following error messages is logged if the given parameter is invalid. If an error is reported, the SCPI command is rejected and the instrument's settings do not change.

#	Message	Details
1	Missing Parameter	This error is reported if the number of parameters is less than 3 For example, `:SENSe:RHO:SBOundary:LIST:MS:APPend 15000, 0` 3rd parameter is missing.

2	Illegal parameter value	This error is reported if parameter type is invalid or if enum value is invalid
		For example,
		`:SENSe:RHO:SBOundary:LIST:MS:APPend 15000, ON, QPH`
		2nd parameter must be integer
		`:SENSe:RHO:SBOundary:LIST:MS:APPend 15001, 0, QPH`
		1st parameter value (Symbol Rate) is not allowed
		Only the values given in the Range field are valid for the Symbol Rate. You may specify these in numeric form, but they are interpreted as an enumeration and the error results if the value does not translate to one in the list

3	Data out of range	This error is reported if parameter value is out of range For example, `:SENSe:RHO:SBOundary:LIST:MS:APPend 15000, 256, QPH` 2nd parameter is out of range

#	Message	Details

4	Setting Conflict	This error is reported if the given code channel overlaps another code channel in modulation accuracy
		For example, if a user sends the following two commands, the second command causes the error message because C7(0):Q overlaps C8(0):Q
		`:SENSe:RHO:SBOundary:LIST:MS:INIT 15000, 0, QPH`
		OK
		`:SENSe:RHO:SBOundary:LIST:MS:APPend 30000, 0, QPH`
		C7(0):Q overlaps C8(0):Q

Replace List (Remote Command only)

Replaces an entry in the custom active channel list.

Parameter	Name/Value	Description
1	`<entry_id>`	Specifies entry ID of the channel to replace
2	`<symbol_rate>`	Specifies symbol rate of the channel
3	`<code_num>`	Specifies spreading code of the channel
4	IPH	Specifies the channel is on the I-axis
	QPH	Specifies the channel Is on the Q-axis

Remote Command	`[:SENSe]:RHO:SBOundary:LIST:MS:REPLace <entry_id>,<symbol_rate>, <code_num>, IPH | QPH`

Example	In order to predefine the following channels:
	- DPCCH (C8(0):Q)
	- DPDCH (C6(16):I)
	`:RHO:SBO:LIST:MS:INIT 15000, 0, QPH`
	`:RHO:SBO:LIST:MS:APP 60000, 16, IPH`
	`:RHO:SBO:LIST:MS:NCH?`
	2
	And, replace 2nd entry:
	`:RHO:SBO:LIST:MS:REPL 2, 60000,17,QPH`
	`:RHO:SBO:LIST:MS:CHAN? 1`
	15000, 0, QPH
	`:RHO:SBO:LIST:MS:CHAN? 2`
	60000, 17, IPH

Notes	This command is effective when `[:SENSe]:RADio:DEVice` is set to MS and `[:SENSe]:RHO:SBOundary:MS` is set to CUSTom symbol_rate = 1920000 is available if HSPA Enable is On

	The maximum number of entries is 512 See also "Replace List Error Messages" on page 417 below
State Saved	Yes
Range	The entry ID must be: 1 <= entry_id <= The number of entries that are currently appended. Dependent on Symbol Rate; see "Range & Symbol Rate" on page 418 below

Replace List Error Messages

One of the following error messages is logged if the given parameter is invalid. If an error is reported, the SCPI command is rejected and the instrument's settings do not change

#	Message	Details
1	Missing Parameter	This error is reported if the number of parameters is less than 4 For example, `:SENSe:RHO:SBOundary:LIST:MS:REPLace 1,15000, 0` 4th parameter is missing.

2	Illegal parameter value	This error is reported if parameter type is invalid or if enum value is invalid
		For example,
		`:SENSe:RHO:SBOundary:LIST:MS: REPLace 1,15000, ON, QPH`
		3rd parameter must be integer
		`:SENSe:RHO:SBOundary:LIST:MS:REPLace 1,15001, 0, QPH`
		2nd parameter value (Symbol Rate) is not allowed
		Only the values given in the Range field are valid for the Symbol Rate. You may specify these in numeric form, but they are interpreted as an enumeration and the error results if the value does not translate to one in the list

3	Data out of range	This error is reported if parameter value is out of range For example, `:SENSe:RHO:SBOundary:LIST:MS:APPend 15000, 256, QPH` 3rd parameter is out of range

4	Setting Conflict	This error is reported if the given code channel overlaps another code channel in modulation accuracy
		For example, if a user sends the following two commands, the second command causes the error message because C7(0):Q overlaps C8(0):Q
		`:SENSe:RHO:SBOundary:LIST:MS:INIT 15000, 0, QPH`
		OK
		`:SENSe:RHO:SBOundary:LIST:MS: REPLace 1,30000, 0, QPH`
		C7(0):Q overlaps C8(0):Q

5	The entry ID out of range	1 <= entry_id <= The number of entries that are currently appended

Range & Symbol Rate

Symbol Rate	Range
15000	0<= code_num <= 255
30000	0<= code_num <= 127
60000	0<= code_num <= 63
120000	0<= code_num <= 31
240000	0<= code_num <= 15
480000	0<= code_num <= 7
960000	0<= code_num <= 3
1920000	0<= code_num <= 1

Query List (Remote Command only)

This command returns the entry of the custom active channel list.

See also "Number of Entries (Remote Command only) (MS only)" on page 419 below.

Parameter	Name/Value	Description
1	<entry_id>	Specifies entry ID of the channel to query

Remote Command	`[:SENSe]:RHO:SBOundary:LIST:MS:CHANnel? <entry_id>`

Example	In order to predefine the following channels:
	- DPCCH (C8(0):Q)
	- DPDCH (C6(16):I)
	`:RHO:SBO:LIST:MS:INIT 15000, 0, QPH`
	`:RHO:SBO:LIST:MS:APP 60000, 16, IPH`
	`:RHO:SBO:LIST:MS:NCH?`
	2
	`:RHO:SBO:LIST:MS:CHAN? 1`
	15000, 0, QPH
	`:RHO:SBO:LIST:MS:CHAN? 2`
	60000, 16, IPH

Notes	This command is effective when `[:SENSe]:RADio:DEVice` is set to MS and `[:SENSe]:RHO:SBOundary:MS` is set to `CUSTom` symbol_rate = 1920000 is available if HSPA Enable is On The maximum number of entries is 512 Default value of the parameter By default, one channel is defined. (DPCCH C8(0):Q) In order to query the default entry, specify 1 for <entry_id>:

	`:SENSe:RHO:SBOundary:LIST:MS:CHANnel? 1`
	The instrument returns an array of three values:
	`15000, 0, QPH`
	Query command needs <entry_id> parameter
	The <entry_id> parameter is always required for the query command
	The range of the parameter is from 1 to the total number of channels you have defined. For example, if you have defined two channels, you can query them as follows:
	`:SENSe:RHO:SBOundary:LIST:MS:CHANnel? 1`
	`:SENSe:RHO:SBOundary:LIST:MS:CHANnel? 2`
	If you want to know the number of channels you have defined, send the following query command:
	`:SENSe:RHO:SBOundary:LIST:NCHannels:MS?`
	Error Messages. The following error message is logged if the given parameter is invalid. If an error is reported, the SCPI command is rejected and the instrument's settings do not change

<entry_id> out of range
The entry ID must be: 1 <= entry_id <= The number of entries that are currently appended

Preset	15000, 0, QPH
State Saved	Yes
Range	The entry ID must be: 1 <= entry_id <= The number of entries that are currently appended

Number of Entries (Remote Command only) (MS only)

Returns the number of entries in the custom predefined active channel list MS. This command is query only.

Remote Command	`[:SENSe]:RHO:SBOundary:LIST:MS:NCHannels?`
Example	`:RHO:SBO:LIST:MS:NCH?`
Notes	This command is effective when `[:SENSe]:RADio:DEVice` is set to MS and `[:SENSe]:RHO:SBOundary:MS` is set to `CUSTom` This command is a query-only command
Preset	1
Force Restart	No
State Saved	No

Remote Command	`[:SENSe]:RHO:SBOundary:MS AUTO | CUSTom`

	[:SENSe]:RHO:SBOundary:MS?
Example	:SENS:RHO:SBO:MS CUST :SENS:RHO:SBO:MS?
Notes	This parameter is effective when [:SENSe]:RADio:DEVice is set to MS
Couplings	If the "Radio Device" selection is "BTS", a different control (Symbol Boundary BTS) appears instead of this control
Preset	AUTO
Force Restart	No
State Saved	Yes
Range	AUTO|CUSTom

DTX/Burst Detect

For downlink signals, detects the power burst for either "CM" (Compressed Mode) or "DTX". In the case of "Compressed Mode," both I and Q symbol power are set to Off. In the case of "DTX", either I or Q symbol power, or both, can be set to Off.

For uplink signals, this function detects the HS-DPCCH burst, the subframe of which does not align with the DPCCH slot boundary.

Remote Command	:CALCulate:RHO:DTXBurst 0 | 1 | OFF | ON :CALCulate:RHO:DTXBurst?
Example	:CALC:RHO:DTXB ON :CALC:RHO:DTXB?
Notes	When the HSPA option is enabled, this parameter is active and effective for both uplink and downlink. When disabled, this parameter is active and effective only for downlink
Preset	OFF
State Saved	Yes

Advanced Chan Setup

The Advanced Chan Setup enables you to access advanced channel/layer parameters in the Meas Setup menus on one screen.

Active Set Threshold

Toggles the active channel identification function between Auto and Man. If set to Auto, the active channels are determined automatically by the internal algorithm. If set to Man, the active channel identification is determined by a user definable threshold ranging from 0.00 to -100.00 dB.

Remote Command	`:CALCulate:RHO:ASET:THReshold <rel_ampl>`
	`:CALCulate:RHO:ASET:THReshold?`
	`:CALCulate:RHO:ASET:THReshold:AUTO OFF | ON | 0 | 1`
	`:CALCulate:RHO:ASET:THReshold:AUTO?`

Example	`:CALC:RHO:ASET:THR -20.0`
	`:CALC:RHO:ASET:THR?`
	`:CALC:RHO:ASET:THR:AUTO ON`
	`:CALC:RHO:ASET:THR:AUTO?`

Notes	This command is effective when `[:SENSe]:RHO:SBOundary[:BTS]` is set to `AUTO` For MS, this command is always effective Turn the automatic mode On or Off, for the active channel identification function – OFF – The active channel identification for each code channel is determined by a value set by `:CALCulate:RHO:ASET:THReshold` – ON – The active channels are determined automatically by the internal algorithm
Preset	0.0 `ON`
State Saved	Yes Yes
Min/Max	-100.0/0.0

Multi Channel Estimator

Allows you to toggle the multi-channel estimator function for MMSE between On and Off.

- `ON` (1): The individual code channels are aligned to the pilot channel to improve the phase error (whether each code phase is aligned or not). This requires a longer time
- `OFF` (0): The phase information is computed from one coded signal only. (The phase of each code channel needs to be aligned to the pilot channel.) This requires less time

Remote Command	`[:SENSe]:RHO:MCEStimator OFF | ON | 0 | 1` `[:SENSe]:RHO:MCEStimator?`
Example	`:RHO:MCES ON` `:RHO:MCES?`
Preset	`OFF`
State Saved	Yes
Range	`OFF|ON`

Timing Estimation

Selects between channel-by-channel and global timing estimation functions for MMSE.

- CHANnel-by-Channel: The code channels are estimated using individual timing. This requires longer time
- GLOBal: The individual code channels are estimated using global timing. This requires less time

Remote Command	[:SENSe]:RHO:MCEStimator:TIMing CHANnel | GLOBal [:SENSe]:RHO:MCEStimator:TIMing?
Example	:RHO:MCES:TIM CHAN :RHO:MCES:TIM?
Preset	GLOBal
State Saved	Yes
Range	Channel by Channel|Global

PICH Code Number (BTS only)

Specifies the code number for PICH, which contains the DTX (no transmission) part. PICH has 300 bits in 1 radio frame, but the last 12 bits are not transmitted. Then, PICH needs special handling to measure code domain power. The PICH Code Number enables you to specify which code channel should be set as PICH.

Remote Command	[:SENSe]:RHO:PICH:SPRead <integer> [:SENSe]:RHO:PICH:SPRead?
Example	:RHO:PICH:SPR 16 :RHO:PICH:SPR?
Notes	If PICH Code Number and MICH Code Number are the same, the channel is considered as PICH This parameter is meaningful only when the Symbol Boundary setting is Auto
Dependencies	This parameter is available only when Direction is BTS
Preset	16
State Saved	Yes
Min/Max	0/255

MICH Code Number (BTS only)

Specifies the code number for MICH (MBMS Indicator channel), which contains the DTX (no transmission) part. MICH has 300 bits in 1 radio frame, but the last 6 symbols (12 bits) are not transmitted. Therefore, MICH needs special handling to measure code domain power. The MICH Code Number specifies which code channel should be considered as MICH.

Since MICH is an optional channel, the parameter has a BAF setting (On|Off).

Active ID auto-detection is performed. However, the result can be 7.5ksps channel if MICH's two consecutive demod bits are the same. If this occurs, these 7.5ksps channels are automatically set to be 15ksps channels.

Remote Command	`[:SENSe]:RHO:MICH:SPRead <integer>`
	`[:SENSe]:RHO:MICH:SPRead?`
	`[:SENSe]:RHO:MICH:STATe OFF | ON | 0 | 1`
	`[:SENSe]:RHO:MICH:STATe?`

Example	`:RHO:MICH:SPR 4`
	`:RHO:MICH:SPR?`
	`:RHO:MICH:STAT ON`
	`:RHO:MICH:STAT?`

Notes	If the PICH Code Number and MICH Code Number are the same, the channel is considered as PICH This parameter is meaningful only when Symbol Boundary setting is Auto This parameter enables or disables MICH code number setting.
Dependencies	This parameter is available only when Direction is BTS
Preset	2 `OFF`
State Saved	Yes Yes
Min/Max	2/255

S-CCPCH Symbol Rate (BTS only)

To calculate the EVM value correctly, specifies the symbol rate for S-CCPCH (Secondary Common Control Physical Channel), which might be modulated with 64QAM, and is hard to detect as correct channelization code.

Remote Command	`[:SENSe]:RHO:SCCPch:SRATe <integer>` `[:SENSe]:RHO:SCCPch:SRATe?`
Example	`:RHO:SCCP:SRAT 15000` `:RHO:SCCP:SRAT?`
Notes	This command is effective when `[:SENSe]:RADio:DEVice` is set to `BTS` This parameter is available only when both W-CDMA HSPA+ option (N9073C-3FP) and HSPA option (N9073C-2FP) licenses are installed, and HSPA+ option is enabled. Otherwise this control and the SCPI command are unavailable

Preset	15000
State Saved	Yes
Range	15000|30000|60000|120000|240000|480000|960000

S-CCPCH Code Number (BTS only)

To calculate the EVM value correctly, specifies the code number for S-CCPCH (Secondary Common Control Physical Channel), which might be modulated with 64QAM, and is hard to detect as correct channelization code.

Remote Command	`[:SENSe]:RHO:SCCPch:SPRead <integer>` `[:SENSe]:RHO:SCCPch:SPRead?`
Example	`:RHO:SCCP:SPR 255` `:RHO:SCCP:SPR?`
Notes	This command is effective when [:SENSe]:RADio:DEVice is set to BTS This parameter is available only when both W-CDMA HSPA+ option (N9073C-3FP) and HSPA option (N9073C-2FP) licenses are installed, and HSPA+ option is enabled. Otherwise this control and the SCPI command are unavailable
Preset	3
State Saved	Yes
Min/Max	Min: 0 Max: Dependent on S-CCPCH Symbol Rate:

`[:SENSe]:RHO:SCCPch:SRATe`	Value
15000	255
30000	127
60000	63
120000	31
240000	15
480000	7
960000	3

3.3.8.6 Limits

Accesses a menu that allows you to set the following limits:

1. RMS EVM (Composite)
2. Peak EVM (Composite)
3. Rho (Composite)

4. Peak Code Domain
5. Frequency Error
6. CPICH Reference
7. CPICH Tolerance

RMS EVM (Composite)

Sets the limit for the composite RMS EVM measurement pass/fail test.

Remote Command	`:CALCulate:RHO:LIMit:RMS <real>` `:CALCulate:RHO:LIMit:RMS?`
Example	`:CALC:RHO:LIM:RMS 10.0` `:CALC:RHO:LIM:RMS?`
Preset	17.5
State Saved	Yes
Min/Max	0.00/100.00

Peak EVM (Composite)

Sets the limit for the composite peak EVM measurement pass/fail test.

Remote Command	`:CALCulate:RHO:LIMit:PEAK <real>` `:CALCulate:RHO:LIMit:PEAK?`
Example	`:CALC:RHO:LIM:PEAK 50.0` `:CALC:RHO:LIM:PEAK?`
Preset	200.0
State Saved	Yes
Min/Max	0.0/200.0

Rho (Composite)

Sets the limit for the composite Rho measurement pass/fail test.

Remote Command	`:CALCulate:RHO:LIMit:RHO <real>` `:CALCulate:RHO:LIMit:RHO?`
Example	`:CALC:RHO:LIM:RHO 0.9` `:CALC:RHO:LIM:RHO?`
Preset	0.50000

State Saved	Yes
Min/Max	0/1

Peak Code Domain Error

Sets the limit in dB for the composite Peak Code Domain Error measurement pass/fail test.

Remote Command	`:CALCulate:RHO:LIMit:CDERror <real>` `:CALCulate:RHO:LIMit:CDERror?`
Example	`:CALC:RHO:LIM:CDER -50.0` `:CALC:RHO:LIM:CDER?`
Preset	-32.0
State Saved	Yes
Min/Max	-100/0

Frequency Error

Sets the limit for the frequency error measurement pass/fail test.

Remote Command	`:CALCulate:RHO:LIMit:FERRor <freq>` `:CALCulate:RHO:LIMit:FERRor?`
Example	`:CALC:RHO:LIM:FERR 200` `:CALC:RHO:LIM:FERR?`
Preset	100.0 Hz
State Saved	Yes
Min/Max	0 Hz/500 Hz

CPICH Reference

Sets the limit for CPICH Reference Power (relative power to total carrier power) in dB.

Remote Command	`:CALCulate:RHO:LIMit:CPICh[:BTS]:POWer <real>` `:CALCulate:RHO:LIMit:CPICh[:BTS]:POWer?`
Example	`:CALC:RHO:LIM:CPIC:POW -30.0` `:CALC:RHO:LIM:CPIC:POW?`
Dependencies	The limit value set by this command is used only when `[:SENSe]:RADio:DEVice` is set to BTS
Preset	-10.0

State Saved	Yes
Min/Max	-100/0

CPICH Tolerance

Sets the limit, in dB, for the CPICH Tolerance measurement pass/fail test.

Remote Command	`:CALCulate:RHO:LIMit:CPICh[:BTS] <real>` `:CALCulate:RHO:LIMit:CPICh[:BTS]?`
Example	`:CALC:RHO:LIM:CPIC 30.0` `:CALC:RHO:LIM:CPIC?`
Dependencies	The limit value set by this command is used only when `[:SENSe]:RADio:DEVice` is set to `BTS`
Preset	100.0
State Saved	Yes
Range	0.0 to 100.0
Min/Max	0/100

3.3.9 Sweep

The Sweep key contains controls that allow you to control the sweep and measurement functions of the instrument, such as the sweep or measurement time and whether in Single sweep/measure or Continuous sweep/measure mode.

3.3.9.1 Sweep/Control

Contains controls for the Sweep and Control functions of the instrument, such as Sweep Time and Continuous/Single.

Sweep/Measure

Allows you to toggle between Continuous and Single sweep or measurement operation. The Single/Continuous state is Meas Global, so the setting affects *all* measurements.

The front-panel key **Single/Cont** performs exactly the same function

NOTE In the `WAVeform` measurement, this control only appears in the Meas Bar, and not in the **Sweep/Control** tab.

See "More Information" on page 428

Remote	`:INITiate:CONTinuous OFF | ON | 0 | 1`

Command	`:INITiate:CONTinuous?`

Example	`:INIT:CONT 0`
	`:INIT:CONT OFF`
	puts instrument into Single measurement operation
	`:INIT:CONT 1`
	`:INIT:CONT ON`
	puts instrument into Continuous measurement operation

Preset	ON Note that `:SYST:PRES` sets `:INIT:CONT` to `ON` but `*RST` sets `:INIT:CONT` to `OFF`
State Saved	Saved in instrument state
Annunciation	The **Single/Continuous** icon in the Meas Bar changes depending on the setting: – A line with an arrow is Single – A loop with an arrow is Continuous

More Information

With **Avg/Hold Num** (in the **Meas Setup** menu) set to **Off** or set to **On** with a value of 1, a sweep is taken after the trigger condition is met; and the instrument continues to take new sweeps after the current sweep has completed and the trigger condition is again met. However, with **Avg/Hold Num** set to On with a value >1, multiple sweeps (data acquisitions) are taken for the measurement. The trigger condition must be met prior to each sweep. The sweep is not stopped when the average count k equals the number N set for Avg/Hold Num is reached, but the number k stops incrementing. A measurement average usually applies to all traces, marker results, and numeric results, but sometimes only applies to the numeric results.

If the instrument is in Single measurement, pressing the **Cont/Single** toggle control does not change k and does not cause the sweep to be reset; the only action is to put the instrument into Continuous measurement operation.

If it is already in Continuous sweep:

- the `:INIT:CONT 1` command has no effect
- the `:INIT:CONT 0` command will place the instrument in Single Sweep but will have no effect on the current sequence until k = N, at which point the current sequence will stop and the instrument will go to the idle state.

See "Restart" on page 1738 control description for details on the `:INIT:IMM` (Restart) function.

If you are already in Single sweep, the `:INIT:CONT OFF` command has no effect.

If you are already in Single Sweep, then pressing the **Cont/Single** toggle control in the middle of a sweep does not restart the sweep or sequence. Similarly, pressing the **Cont/Single** toggle control does not restart the sweep or sequence if the sweep is not in the idle state (for example, if you are taking a very slow sweep, or the instrument is waiting for a trigger). Even though pressing the **Cont/Single** toggle control in the middle of a sweep does *not* restart the sweep, sending `:INIT:IMM` *does* reset it.

Restart

The **Restart** function restarts the current sweep, or measurement, or set of averaged/held sweeps or measurements. In measurements that support pausing, if you are Paused, pressing **Restart** performs a **Resume**.

The Restart function is accessed in several ways:

– Pressing the **Restart** key

– Sending the remote command `:INIT:IMM`

– Sending the remote command `:INIT:REST`

See "More Information" on page 430

Remote Command	`:INITiate[:IMMediate]` `:INITiate:RESTart`
Example	`:INIT:IMM` `:INIT:REST`
Notes	`:INIT:REST` and `:INIT:IMM` and the front-panel **Restart** key perform exactly the same function
Couplings	Resets average/hold count k For the first sweep, overwrites all active (update=on) traces with new current data For application modes, resets other parameters as required by the measurement
Status Bits/OPC dependencies	This is an Overlapped command The `:STATus:OPERation` register bits 0 through 8 are cleared The `:STATus:QUEStionable` register bit 9 (INTegrity sum) is cleared The `SWEEPING` bit is set The `MEASURING` bit is set
Backwards Compatibility Notes	For Spectrum Analysis mode in ESA and PSA, the **Restart** hardkey and the `:INIT:REST` command restart trace averages (displayed average count reset to 1) for a trace in **Clear Write**, but did not restart **Max Hold** and **Min Hold** In the X-Series, the **Restart** hardkey and the `:INIT:REST` command restart not only **Trace Average**, but **Max Hold** and **Min Hold** traces as well For wireless comms modes in ESA and PSA, the **Restart** hardkey and the `:INIT:REST` command restarted every measurement, including all traces and numeric results. There is no change to this operation

More Information

The **Restart** function first aborts the current sweep or measurement as quickly as possible. It then resets the sweep and trigger systems, sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is in the process of aligning when a Restart is executed, the alignment finishes before the restart function is performed.

Even when set for Single operation, multiple sweeps may be taken when **Restart** is pressed (for example, when averaging/holding is on). Thus when we say that Restart "restarts a measurement," depending on the current settings, we may mean:

- It restarts the current sweep
- It restarts the current measurement
- It restarts the current set of sweeps if any trace is in Trace Average, Max Hold or Min Hold
- It restarts the current set of measurements if Averaging, or Max Hold, or Min Hold is on for the measurement

With Average/Hold Number (in Meas Setup menu) set to 1, or Averaging off, or no trace in Trace Average or Hold, a single sweep is equivalent to a single measurement. A single sweep is taken after the trigger condition is met; and the instrument stops sweeping once that sweep has completed. However, with Average/Hold Number >1 and at least one trace set to Trace Average, Max Hold, or Min Hold (SA Measurement) or Averaging on (most other measurements), multiple sweeps/data acquisitions are taken for a single measurement. The trigger condition must be met prior to each sweep. The sweep is stopped when the average count k equals the number N set for Average/Hold Number. A measurement average usually applies to all traces, marker results, and numeric results, but sometimes only applies to the numeric results.

Once the full set of sweeps has been taken, the instrument will go to the idle state. To take one more sweep without resetting the average count, increment the average count by 1, by pressing the step up key while Average/Hold Number is the active function, or by sending the remote command `:CALC:AVER:TCON UP`.

Pause/Resume

Pauses a measurement after the current data acquisition is complete.

When a measurement is paused:

– The label on this control changes to **Resume**. Pressing **Resume** un-pauses the measurement.

– Pressing **Restart** also performs a **Resume**.

Remote Command	:INITiate:PAUSe :INITiate:RESume
Example	:INIT:PAUS :INIT:RES
Dependencies	Not displayed in Modes that do not support pausing
Couplings	When Averaging is On, if the measurement is paused no more updates will occur until either a Resume or Restart occurs If the measurement is resumed, the averaging continues to use the traces from before the Pause occurred and continues to use the traces from the point where the Resume occurred. This still provides real-time traces, but they will no longer be gap free In a view with a Waterfall window, when the measurement is paused, the Waterfall stops updating. When Resume is selected, the Waterfall will retain the existing traces and continue updating using traces from the point at which Resume was selected. The time stamp of the individual Waterfall traces will show the time from the beginning of the measurement the trace relates to, showing there was a gap in the Waterfall capture In Density view, when the measurement is paused, the Density Display stops updating. When the measurement is resumed, if Persistence is ON, the persistence fading will continue from the point when the measurement was paused If a Restart occurs, the average counter is reset and all results are discarded. The measurement begins again, using traces after the Restart occurred

Abort (Remote Command Only)

This command stops the current measurement. It aborts the current measurement as quickly as possible, resets the sweep and trigger systems, and puts the measurement into an "idle" state. If the instrument is in the process of aligning when :ABORt is sent, the alignment finishes before the abort function is performed, so :ABORt does *not* abort an alignment.

If the instrument is set for Continuous measurement, it sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is set for Single measurement, it remains in the "idle" state until an :INIT:IMM command is received.

Remote Command	:ABORt
Example	:ABOR
Notes	If :INIT:CONT is ON, then a new continuous measurement will start immediately, with sweep (data acquisition) occurring once the trigger condition has been met If :INIT:CONT is OFF, then :INIT:IMM is used to start a single measurement, with sweep (data

	acquisition) occurring once the trigger condition has been met
Dependencies	For continuous measurement, `:ABORt` is equivalent to the **Restart** key Not all measurements support the abort command
Status Bits/OPC dependencies	The `:STATus:OPERation` register bits 0 through 8 are cleared The `:STATus:QUEStionable` register bit 9 (INTegrity sum) is cleared Since all the bits that feed into OPC are cleared by `:ABORt`, the `:ABORt` will cause the *OPC query to return true

3.3.9.2 X Scale

This tab accesses controls that enable you to set the horizontal scale parameters.

Ref Value

Sets the chip reference value on the horizontal axis. The default setting is 0.000 chips. When Auto Scaling is set to On, the displayed graphs use a Scale/Div value determined by the instrument, based on the measurement result.

Remote Command	`:DISPlay:RHO:WINDow3|4|5:TRACe:X[:SCALe]:RLEVel <amptd>`
	`:DISPlay:RHO:WINDow3|4|5:TRACe:X[:SCALe]:RLEVel?`
	Window numbers are as follows:
	– EVM : 3
	– Mag Error: 4
	– Phase Error: 5

Example	3-EVM window
	`:DISP:RHO:WIND3:TRAC:X:RLEV 0.0`
	4-Mag Error window
	`:DISP:RHO:WIND4:TRAC:X:RLEV 0.0`
	5-Phase Error Window
	`:DISP:RHO:WIND5:TRAC:X:RLEV 0.0`

Couplings	When Auto Scaling is On (default), this value is automatically determined by the measurement result. When you set a value manually, Auto Scaling changes to Off
Preset	0.0
State Saved	Yes
Min/Max	0.0/5000000.0

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now only Window number is sent. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command
EVM	DISP:RHO:VIEW2:WIND:TRAC:X:RLEV 0.0	DISP:RHO:WIND3:TRAC:X:RLEV 0.0
Mag Error	DISP:RHO:VIEW2:WIND2:TRAC:X:RLEV 0.0	DISP:RHO:WIND4:TRAC:X:RLEV 0.0
Phase Error	DISP:RHO:VIEW2:WIND3:TRAC:X:RLEV 0.0	DISP:RHO:WIND5:TRAC:X:RLEV 0.0

Scale/Div

Sets the horizontal scale by changing a chip value per division. When the Scale Coupling default setting On is active, the displayed plots use a Scale/Div value determined by the instrument, which is based on the measurement result.

Remote Command	`:DISPlay:RHO:WINDow3|4|5:TRACe:X[:SCALe]:PDIVision <real>`
	`:DISPlay:RHO:WINDow3|4|5:TRACe:X[:SCALe]:PDIVision?`
	Window numbers are as follows:
	– EVM : 3
	– Mag Error: 4
	– Phase Error: 5

Example	3-EVM window
	`:DISP:RHO:WIND3:TRAC:X:PDIV 100.0`
	4-Mag Error window
	`:DISP:RHO:WIND4:TRAC:X:PDIV 100.0`
	5-Phase Error Window
	`:DISP:RHO:WIND5:TRAC:X:PDIV 100.0`

Couplings	If Auto Scaling is set to On, this value is automatically determined by the measurement result. When you set this value manually, Auto Scaling is automatically set to Off
Preset	3840.0
State Saved	Yes
Min/Max	64/38400.0

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now only Window number is sent. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command
EVM	DISP:RHO:VIEW2:WIND:TRAC:X:PDIV 100.0	DISP:RHO:WIND3:TRAC:X:PDIV 100.0
Mag Error	DISP:RHO:VIEW2:WIND2:TRAC:X:PDIV 100.0	DISP:RHO:WIND4:TRAC:X:PDIV 100.0
Phase Error	DISP:RHO:VIEW2:WIND3:TRAC:X:PDIV 100.0	DISP:RHO:WIND5:TRAC:X:PDIV 100.0

Ref Position

Sets the reference position for the X axis to the left, center, or right of the display.

Remote Command	:DISPlay:RHO:WINDow3|4|5:TRACe:X[:SCALe]:RPOSition LEFT | CENTer | RIGHt :DISPlay:RHO:WINDow3|4|5:TRACe:X[:SCALe]:RPOSition? Window numbers are as follows: – EVM: 3 – Mag Error: 4 – Phase Error: 5
Example	3-EVM window :DISP:RHO:WIND3:TRAC:X:RPOS LEFT 4-Mag Error window :DISP:RHO:WIND4:TRAC:X:RPOS LEFT 5-Phase Error Window :DISP:RHO:WIND5:TRAC:X:RPOS LEFT
Preset	LEFT
State Saved	Yes
Range	LEFT|CENTer|RIGHt

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now only Window number is sent. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command
EVM	DISP:RHO:VIEW2:WIND:TRAC:X:RPOS	DISP:RHO:WIND3:TRAC:X:RPOS

Window	Old SCPI Command	New SCPI Command
	LEFT	LEFT
Mag Error	DISP:RHO:VIEW2:WIND2:TRAC:X:RPOS LEFT	DISP:RHO:WIND4:TRAC:X:RPOS LEFT
Phase Error	DISP:RHO:VIEW2:WIND3:TRAC:X:RPOS LEFT	DISP:RHO:WIND5:TRAC:X:RPOS LEFT

Auto Scaling

Toggles the Auto Scaling function between On and Off. When Auto Scaling is On, and the Restart front-panel key is pressed, this function automatically determines the scale per division and reference values based on the measurement results.

Remote Command	`:DISPlay:RHO:WINDow3|4|5:TRACe:X[:SCALe]:COUPle 0	1	OFF	ON` `:DISPlay:RHO:WINDow3|4|5:TRACe:X[:SCALe]:COUPle?` Window numbers are as follows: – EVM: 3 – Mag Error: 4 – Phase Error: 5

Example	3-EVM window
	`:DISP:RHO:WIND3:TRAC:X:COUP ON`
	4-Mag Error window
	`:DISP:RHO:WIND4:TRAC:X:COUP ON`
	5-Phase Error Window
	`:DISP:RHO:WIND5:TRAC:X:COUP ON`

Couplings	When this parameter is set to On, pressing the front-panel Restart key activates the scale coupling function, that automatically determines scale per division and reference values based on the measurement results. When you set a value to either Scale/Div or Ref Value manually, Auto Scaling is automatically set to Off
Preset	ON
State Saved	Yes
Range	OFF|ON

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now only Window number is sent. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command
EVM	DISP:RHO:VIEW2:WIND:TRAC:X:COUP ON	DISP:RHO:WIND3:TRAC:X:COUP ON

Window	Old SCPI Command	New SCPI Command
Mag Error	DISP:RHO:VIEW2:WIND2:TRAC:X:COUP ON	DISP:RHO:WIND4:TRAC:X:COUP ON
Phase Error	DISP:RHO:VIEW2:WIND3:TRAC:X:COUP ON	DISP:RHO:WIND5:TRAC:X:COUP ON

Start Code Number

Sets the start value of the code range for the code domain power graph (CDP).

Remote Command	:DISPlay:RHO:CDOMain:SPAN:STARt <integer> :DISPlay:RHO:CDOMain:SPAN:STARt?
Example	:DISP:RHO:CDOM:SPAN:STAR 10 :DISP:RHO:CDOM:SPAN:STAR?
Notes	The max value is device sensitive: BTS: 448 MS: 192
Couplings	Start Code Number and Stop Code Number are coupled to each other, according to the following condition: Stop Code Number > Start Code Number If changing Start Code Number does not satisfy this condition, Stop Code Number is changed to satisfy the following condition Stop Code Number – Start Code Number = 63
Preset	0
State Saved	Yes
Min	0
Max	448

Stop Code Number

Sets the stop value of the code range for the code domain power graph (CDP).

Remote Command	:DISPlay:RHO:CDOMain:SPAN:STOP <integer> :DISPlay:RHO:CDOMain:SPAN:STOP?
Example	:DISP:RHO:CDOM:SPAN:STOP 200 :DISP:RHO:CDOM:SPAN:STOP?
Notes	The max value is device sensitive: BTS: 511 MS: 255
Couplings	Start CodeNumber and Stop Code Number are coupled to each other, according to:

	Stop Code Number > Start Code Number If changing Stop Code Number does not satisfy this condition, Start Code Number is changed to satisfy the following condition Stop Code Number – Start Code Number = 63
Preset	511
State Saved	Yes
Min	63
Max	511

Expand

Toggles the expanding function of the code domain power graph between On and Off. If set to On, the CDP graph is expanded horizontally to show 64 spread codes centered at the scale or the marker position. If toggled back to Off, the spread code range returns to the previous setting.

Notes	This control is valid only for Power Bar Graph window
Preset	Off
State Saved	Yes
Range	On|Off

3.3.10 Trace

Trace is not supported in the WCDMA Mod Accuracy Measurement.

3.4 Code Domain

The Code Domain Measurement provides the code domain analysis functions. It is an analysis-oriented measurement rather than a conformance test. Therefore, it doesn't provide pass/fail type of results.

The modulation schemes for downlink and uplink are quite different. Even though some key parameters and mnemonics are shared by downlink and uplink, the measurement functions are context sensitive depending on the Radio Device selection.

Code Domain Measurement Commands

The following commands and queries are used to retrieve the measurement results:

`:CONFigure:CDPower`

`:CONFigure:CDPower:NDEFault`

`:INITiate:CDPower`

`:FETCh:CDPower[n]?`

`:READ:CDPower[n]?`

`:MEASure:CDPower[n]?`

Remote Command Results for Code Domain

The following table describes the results returned by the queries listed above, according to the index value `n`.

Some results in the table are limited by an option license.

When both W-CDMA HSPA and HSPA+ option licenses are enabled,

– 64QAM

– 16QAM

– QPSK

– 4PAM

– BPSK

are returned.

When W-CDMA HSPA option license is enabled, but HSPA+ option is not enabled,

- 16QAM
- QPSK
- BPSK

are returned, but

- 64QAM
- 4PAM

are not returned. Therefore 64QAM channel is measured and returned as either 16QAM or QPSK, and 4PAM channel is measured and returned as BPSK.

When W-CDMA HSPA option license is not enabled,

- QPSK
- BPSK

are returned, but

- 64QAM
- 16QAM
- 4PAM

are not returned. Therefore either 64QAM or 16QAM channel is measured and returned as QPSK, and 4PAM channel is measured and returned as BPSK.

Index: n <Mnemonic>	Results Returned
0	Returns unprocessed I/Q trace data, as a series of comma-separated trace points, in volts. The I values are listed first in each pair, using the 0 through even-indexed values. The Q values are the odd-indexed values
not specified, or 1	Returns 44 comma-separated scalar results. For details, see "Results Data Format (n = 1)" on page 449 below
2 <CDPower>	**Code Domain Power** Returns a series of floating point numbers (in either dB or dBm, depending on Meas Type) that represents all the code domain powers In BTS mode, there are 512 numbers. If the active channel occupies more than the max spreading factor (7.5 ksps) the power is duplicated (active symbol rate / 7.5 ksps) times (N=512) – 1st number = 1st code power over one slot specified by Meas Offset including SCH period. – 2nd number = 2nd code power over one slot specified by Meas Offset including SCH period – ... – Nth number = Nth code power over one slot specified by Meas Offset including SCH period In MS mode, there are 256 I/Q pairs. If the active channel occupies more than the max spreading factor (15 ksps) the power is duplicated (active symbol rate / 15 ksps) times (N=256) – 1st number = 1st in-phase code power over one slot specified by Meas Offset – 2nd number = 1st quad-phase code power over one slot specified by Meas Offset

Index: n <Mnemonic>	Results Returned
	– ... – (2N – 1)th number = N th in-phase code power over one slot specified by Meas Offset – (2N)th number = N th quad-phase code power over one slot specified by Meas Offset
3	**Symbol Rate** Returns a series of floating point numbers (in sps) that represents all the code domain symbol rate In BTS mode, there are 512 numbers. If the active channel occupies more than the max spreading factor (7.5 ksps) the symbol rate is duplicated (active symbol rate / 7.5 ksps) times (N=512) – 1st number = 1st code symbol rate over one slot specified by Meas Offset including SCH period – 2nd number = 2nd code symbol rate over one slot specified by Meas Offset including SCH period – ... – N th number = N th code symbol rate over one slot specified by Meas Offset including SCH period In MS mode, there are 256 I/Q pairs. If the active channel occupies more than the max spreading factor (15 ksps) the symbol rate is duplicated (active symbol rate / 15 ksps) times (N=256) – 1st number = 1st in-phase code symbol rate over one slot specified by Meas Offset including SCH period – 2nd number = 1st quad-phase code symbol rate over one slot specified by Meas Offset including SCH period – ... – (2N – 1)th number = Nth in-phase code symbol rate over one slot specified by Meas Offset including SCH period – (2N)th number = Nth quad-phase code symbol rate over one slot specified by Meas Offset including SCH period
4	**Active Status** Returns series of floating point numbers that show either active or inactive of each code returned in n=2 and 3. When the code is inactive, the result is 0.0, otherwise more than 0.0 In BTS mode, there are 512 numbers (N=512) – 1st number = Active or inactive flag of the 1st code – 2nd number = Active or inactive flag of the 2nd code – ... – Nth number = Active or inactive flag of the N th code In MS mode, there are 256 I/Q pairs (N=256) – 1st number = 1st In Phase code active flag – 2nd number = 1st Quad Phase code active flag – ... – (2N – 1)th number = Nth In Phase code active flag – (2N)th number = Nth Quad Phase code active flag
5 <EVM>	**Symbol EVM** Returns series of floating point numbers (in percent) that represent EVM of symbols of the selected code channel

Index: n <Mnemonic>	Results Returned
	The length of the trace depends on the measurement period specified by Meas Offset, Meas Interval and tDPCH[BTS] / tHS-DPCCH[MS]
6 <MERRor>	**Symbol Magnitude Error** Returns series of floating point numbers (in percent) that represent magnitude error of symbols of the selected code channel The length of the trace depends on the measurement period specified by Meas Offset, Meas Interval and tDPCH[BTS] / tHS-DPCCH[MS]
7 <PERRor>	**Symbol Phase Error** Returns series of floating point numbers (in degrees) that represent phase error of symbols of the selected code channel The length of the trace depends on the measurement period specified by Meas Offset, Meas Interval and tDPCH[BTS] / tHS-DPCCH[MS]
8	**I/Q Corrected Measured Trace** Returns series of floating point numbers that alternately represent I and Q pairs of the corrected measured trace of the selected code channel The magnitude of each I and Q pair is normalized to 1.0 The length of the trace depends on the measurement period specified by Meas Offset, Meas Interval and tDPCH[BTS] / tHS-DPCCH[MS] – 1st number = I of the 1st symbol decision point – 2nd number = Q of the 1st symbol decision point – 3rd number = I of the 2nd symbol decision point – 4th number = Q of the 2nd symbol decision point – ... – (2N – 1)th number = I of the Nth symbol decision point – (2N)th number = Q of the Nth symbol decision point IQ Corrected Measured Trace is scaled as follows: [QPSK] The values of "I" and "Q" in the measured trace are normalized by the maximum value of the magnitude (= SQRT(I*I + Q*Q)) of the reference trace, which is scaled to SQRT(2.0) [16QAM] The values of "I" and "Q" in the measured trace are normalized as the maximum value of the magnitude (= SQRT(I*I + Q*Q)) of the reference trace, which is scaled to SQRT(1.3416*1.3416 + 1.3416*1.3416) In the 3GPP standard "TS 25.213 v6.4.0 (2005-09)", symbol values for each modulation format (QPSK, 16QAM) and DTX in the section "5.1.1 Modulation mapper" are specified
9 <SPOWer>	**Symbol Power vs. Time** Returns series of floating point numbers (in dBm) that represent the entire trace data of Symbol Power vs. Time of the selected code channel
10 <CPOWer>	**Chip Power vs. Time** Returns series of floating point numbers (in dBm) that represent the entire trace data of Chip Power vs. Time
11	**Demod Bits** Returns a series of floating point numbers of symbol values for the selected code channel for the entire capture length – If :CALCulate:CDPower:DBITs[:FORMat] is set to BINary, each value in the trace is either 0.0 or 1.0 – If :CALCulate:CDPower:DBITs[:FORMat] is set to TRIState, each value in the trace is one of 0.0, 1.0 and –1.0 where "–1.0" represents DTX (Discontinuous Transmission) bit or burst-off bit If a channel's spreading has been done on only I or Q branch, queried data represents the sequence of corresponding I or Q data If a channel's spreading has been done on both I and Q branch and its modulation scheme is QPSK, queried data represents alternating I and Q sequences as follows: – 1st number = in-phase bit of the 1st I/Q pair – 2nd number = quad-phase bit of the 1st I/Q pair – 3rd number = in-phase bit of the 2nd I/Q pair

Index: n <Mnemonic>	Results Returned
	– 4th number = quad-phase bit of the 2nd I/Q pair – ... – (2N – 1)th number = in-phase bit of the Nth I/Q pair – (2N)th number = quad-phase bit of the Nth I/Q pair where N is the number of the symbols in the entire capture length If a channel's modulation scheme is 16QAM, queried data represents alternating i1, q1, i2 and q2 sequences as follows: – 1st number = i1 bit of the 1st symbol – 2nd number = q1 bit of the 1st symbol – 3rd number = i2 bit of the 1st symbol – 4th number = q2 bit of the 1st symbol – 5th number = i1 bit of the 2nd symbol – 6th number = q1 bit of the 2nd symbol – 7th number = i2 bit of the 2nd symbol – 8th number = q2 bit of the 2nd symbol – ... – (4N – 3)th number = i1 bit of the Nth symbol – (4N – 2)th number = q1 bit of the Nth symbol – (4N – 1)th number = i2 bit of the Nth symbol – (4N)th number = q2 bit of the Nth symbol If a channel's modulation scheme is 64QAM, queried data represents alternating i1, q1, i2, q2, i3 and q3 sequences as follows: – 1st number = i1 bit of the 1st symbol – 2nd number = q1 bit of the 1st symbol – 3rd number = i2 bit of the 1st symbol – 4th number = q2 bit of the 1st symbol – 5th number = i3 bit of the 1st symbol – 6th number = q3 bit of the 1st symbol – ...... – (6N – 5) th number = i1 bit of the Nth symbol – (6N – 4) th number = q1 bit of the Nth symbol

Index: n <Mnemonic>	Results Returned
	– (6N – 3) th number = i2 bit of the Nth symbol – (6N –2) th number = q2 bit of the Nth symbol – (6N –1) th number = i3 bit of the Nth symbol – (6N) th number = q3 bit of the Nth symbol If a channel's modulation scheme is 4PAM for only either I or Q branch, queried data represents alternating x1 and x2 sequences as follows: – 1st number = x_1 bit of the 1st symbol – 2nd number = x_2 bit of the 1st symbol – 3rd number = x_1 bit of the 2nd symbol – 4th number = x_2 bit of the 2nd symbol – ... – (2N – 1)th number = x_1 bit of the Nth symbol – (2N)th number = x_2 bit of the Nth symbol Where, – x1: Either i_1 or q_1 – x2: Either i_2 or q_2 If a channel's modulation scheme is 4PAM for I branch and BPSK for Q branch, queried data represents alternating i1,i2 and q(quad-phase bit) sequences as follows: – 1st number = i1 bit of the 1st symbol for 4PAM on I branch – 2nd number = i2 bit of the 1st symbol for 4PAM on I branch – 3rd number = q bit of the 1st symbol for BPSK on Q branch – 4th number = i1 bit of the 2nd symbol for 4PAM on I branch – 5th number = i2 bit of the 2nd symbol for 4PAM on I branch – 6th number = q bit of the 2nd symbol for BPSK on Q branch – ... – (3N – 2)th number = i1 bit of the Nth symbol for 4PAM on I branch – (3N – 1)th number = i2 bit of the Nth symbol for 4PAM on I branch – (3N)th number = q bit of the Nth symbol for BPSK on Q branch If a channel's modulation scheme is BPSK for I branch and 4PAM for Q branch, queried data represents alternating i(in-phase bit) and q1,q2 sequences as follows: – 1st number = i bit of the 1st symbol for BPSK on I branch

Index: n <Mnemonic>	Results Returned
	– 2nd number = q1 bit of the 1st symbol for 4PAM on Q branch – 3rd number = q2 bit of the 1st symbol for 4PAM on Q branch – 4th number = i bit of the 2nd symbol for BPSK on I branch – 5th number = q1 bit of the 2nd symbol for 4PAM on Q branch – 6th number = q2 bit of the 2nd symbol for 4PAM on Q branch – ... – (3N – 2)th number = i bit of the Nth symbol for BPSK on I branch – (3N – 1)th number = q_1 bit of the Nth symbol for 4PAM on Q branch – (3N)th number = q_2 bit of the Nth symbol for 4PAM on Q branch If a channel's modulation scheme is 4PAM for both I and Q branches, queried data represents alternating i1, i2 and q1, q2 sequences as follows: – 1st number = i_1 bit of the 1st symbol for 4PAM on I branch – 2nd number = i_2 bit of the 1st symbol for 4PAM on I branch – 3rd number = q_1 bit of the 1st symbol for 4PAM on Q branch – 4th number = q_2 bit of the 1st symbol for 4PAM on Q branch – 5th number = i_1 bit of the 2nd symbol for 4PAM on I branch – 6th number = i_2 bit of the 2nd symbol for 4PAM on I branch – 7th number = q_1 bit of the 2nd symbol for 4PAM on Q branch – 8th number = q_2 bit of the 2nd symbol for 4PAM on Q branch – ... – (4N – 3)th number = i_1 bit of the Nth symbol for 4PAM on I branch – (4N – 2)th number = i_2 bit of the Nth symbol for 4PAM on I branch – (4N – 1)th number = q_1 bit of the Nth symbol for 4PAM on Q branch – (4N)th number = q_2 bit of the Nth symbol for 4PAM on Q branch where N is the number of the symbols in the entire capture length
12	**Demod Bits For Selected Measurement Period** Returns series of floating point numbers of symbol values for the selected code channel for the measurement period selected by Meas Offset, Meas Interval and tDPCH[BTS] / tHS-DPCCH[MS] – If `:CALCulate:CDPower:DBITs[:FORMat]` is set to BINary and `:CALCulate:CDPower:PCKM` is set to OFF, each value in the trace is either 0.0 or 1.0 – If `:CALCulate:CDPower:DBITs[:FORMat]` is set to TRIState and `:CALCulate:CDPower:PCKM` is set to OFF, each value in the trace is one of 0.0, 1.0 and –1.0 where "–1.0" represents DTX (Discontinuous Transmission) bit or burst-off bit

Index: n <Mnemonic>	Results Returned
	If a channel's spreading has been done on only I or Q branch, queried data represents the sequence of corresponding I or Q data If a channel's spreading has been done on both I and Q branch and its modulation scheme is QPSK, queried data represents alternating I and Q sequences as follows: – 1st number = in-phase bit of the 1st I/Q pair – 2nd number = quad-phase bit of the 1st I/Q pair – 3rd number = in-phase bit of the 2nd I/Q pair – 4th number = quad-phase bit of the 2nd I/Q pair – ... – (2N – 1)th number = in-phase bit of the Nth I/Q pair – (2N)th number = quad-phase bit of the Nth I/Q pair where N is the number of the symbols in the measurement period selected by Meas Offset, Meas Interval and tDPCH[BTS] / tHS-DPCCH[MS] If a channel's modulation scheme is 16QAM, queried data represents alternating i1, q1, i2 and q2 sequences as follows: – 1st number = i1 bit of the 1st symbol – 2nd number = q1 bit of the 1st symbol – 3rd number = i2 bit of the 1st symbol – 4th number = q2 bit of the 1st symbol – 5th number = i1 bit of the 2nd symbol – 6th number = q1 bit of the 2nd symbol – 7th number = i2 bit of the 2nd symbol – 8th number = q2 bit of the 2nd symbol – ... – (4N – 3)th number = i1 bit of the Nth symbol – (4N – 2)th number = q1 bit of the Nth symbol – (4N – 1)th number = i2 bit of the Nth symbol – (4N)th number = q2 bit of the Nth symbol If a channel's modulation scheme is 64QAM, queried data represents alternating i1, q1, i2, q2, i3 and q3 sequences as follows: – 1st number = i1 bit of the 1st symbol – 2nd number = q1 bit of the 1st symbol – 3rd number = i2 bit of the 1st symbol – 4th number = q2 bit of the 1st symbol – 5th number = i3 bit of the 1st symbol

Index: n <Mnemonic>	Results Returned
	– 6th number = q3 bit of the 1st symbol – ...... – (6N – 5)th number = i1 bit of the Nth symbol – (6N – 4)th number = q1 bit of the Nth symbol – (6N – 3)th number = i2 bit of the Nth symbol – (6N – 2)th number = q2 bit of the Nth symbol – (6N – 1)th number = i3 bit of the Nth symbol – (6N) th number = q3 bit of the Nth symbol If a channel's modulation scheme is 4PAM for only either I or Q branch, queried data represents alternating x1 and x2 sequences as follows: – 1st number = x1 bit of the 1st symbol – 2nd number = x2 bit of the 1st symbol – 3rd number = x1 bit of the 2nd symbol – 4th number = x2 bit of the 2nd symbol – ... – (2N – 1)th number = x1 bit of the Nth symbol – (2N)th number = x2 bit of the Nth symbol Where, – x1: Either i1 or q1 – x2: Either i2 or q2 If a channel's modulation scheme is 4PAM for I branch and BPSK for Q branch, queried data represents alternating i1,i2 and q(quad-phase bit) sequences as follows: – 1st number = i1 bit of the 1st symbol for 4PAM on I branch – 2nd number = i2 bit of the 1st symbol for 4PAM on I branch – 3rd number = q bit of the 1st symbol for BPSK on Q branch – 4th number = i1 bit of the 2nd symbol for 4PAM on I branch – 5th number = i2 bit of the 2nd symbol for 4PAM on I branch – 6th number = q bit of the 2nd symbol for BPSK on Q branch – ... – (3N – 2)th number = i1 bit of the Nth symbol for 4PAM on I branch

Index: n <Mnemonic>	Results Returned
	– (3N – 1)th number = i_2 bit of the Nth symbol for 4PAM on I branch – (3N)th number = q bit of the Nth symbol for BPSK on Q branch If a channel's modulation scheme is BPSK for I branch and 4PAM for Q branch, queried data represents alternating i(in-phase bit) and q1,q2 sequences as follows: – 1st number = i bit of the 1st symbol for BPSK on I branch – 2nd number = q1 bit of the 1st symbol for 4PAM on Q branch – 3rd number = q2 bit of the 1st symbol for 4PAM on Q branch – 4th number = i bit of the 2nd symbol for BPSK on I branch – 5th number = q1 bit of the 2nd symbol for 4PAM on Q branch – 6th number = q_2 bit of the 2nd symbol for 4PAM on Q branch – ... – (3N – 2)th number = i bit of the Nth symbol for BPSK on I branch – (3N – 1)th number = q_1 bit of the Nth symbol for 4PAM on Q branch – (3N)th number = q_2 bit of the Nth symbol for 4PAM on Q branch If a channel's modulation scheme is 4PAM for both I and Q branches, queried data represents alternating i1, i2 and q1, q2 sequences as follows: – 1st number = i_1 bit of the 1st symbol for 4PAM on I branch – 2nd number = i_2 bit of the 1st symbol for 4PAM on I branch – 3rd number = q_1 bit of the 1st symbol for 4PAM on Q branch – 4th number = q_2 bit of the 1st symbol for 4PAM on Q branch – 5th number = i_1 bit of the 2nd symbol for 4PAM on I branch – 6th number = i_2 bit of the 2nd symbol for 4PAM on I branch – 7th number = q_1 bit of the 2nd symbol for 4PAM on Q branch – 8th number = q_2 bit of the 2nd symbol for 4PAM on Q branch – ... – (4N – 3)th number = i_1 bit of the Nth symbol for 4PAM on I branch – (4N – 2)th number = i_2 bit of the Nth symbol for 4PAM on I branch – (4N – 1)th number = q_1 bit of the Nth symbol for 4PAM on Q branch – (4N)th number = q2 bit of the Nth symbol for 4PAM on Q branch where N is the number of the symbols in the measurement period selected by Meas Offset, Meas Interval and tDPCH[BTS] / tHS-DPCCH[MS] If `:CALCulate:CDPower:PCKM` is set to PKM1(=Mode1), demod bits per symbol are packed into one float value in bit-slice manner as follows:

Index: n <Mnemonic>	Results Returned
	- For 64QAM channels: 64QAM (No DTX):Float value 00……0X5X4X3X2X1X0, where: X5:I1, X4:Q1, X3:I2, X2:Q2, X1:I3, X0:Q3 - For 16QAM channels: 16QAM (No DTX):Float value 00……0X3X2X1X0, where: X3:I1, X2:Q1, X1:I2, X0:Q2 - For QPSK channels: QPSK (With DTX): Float value 00……0M1M0B1B0, where: M1: Mask for B1 (1:DTX, 0:Normal), M0: Mask for B0 (1:DTX, 0:Normal), B1:I, B0:Q - For 4PAM channels: 4PAM (No DTX):Float value 00……0 I1 I2 Q1 Q2 - For 4PAM on I branch channels and BPSK on Q branch channels: 4PAM (No DTX):Float value 00……0 I1 I2 0 Q - For BPSK on I branch channels and 4PAM on Q branch channels: 4PAM (No DTX):Float value 00……0 0 I Q1 Q2 The returned data is a sequence of float numbers as follows: – 1st number = Packed Demod bits of 1st symbol – 2nd number = Packed Demod bits of 2nd symbol – 3rd number = Packed Demod bits of 3rd symbol – … – Nth number = Packed Demod bits of Nth symbol where N is the number of the symbols in the measurement period selected by Meas Offset, Meas Interval and tDPCH[BTS] / tHS-DPCCH[MS] To identify whether the Demod bits of each symbol is either QPSK or 16QAM, query the Modulation Scheme returned by 14th trace (Modulation Scheme)
13 <CDError>	**Code Domain Error** Returns a series of floating point numbers (in dB or dBm) that represents all the code domain errors In BTS mode, there are 512 numbers. If the active channel occupies more than the max spreading factor (7.5 ksps) the error is duplicated (active symbol rate / 7.5 ksps) times (N=512) – 1st number = 1st code domain error over one slot specified by Meas Offset including SCH period – 2nd number = 2nd code domain error over one slot specified by Meas Offset including SCH period – … – Nth number = Nth code domain error over one slot specified by Meas Offset including SCH period In MS mode, there are 256 I/Q pairs. If the active channel occupies more than the max spreading factor (15 ksps) the power is duplicated (active symbol rate / 15 ksps) times (N=256) – 1st number = 1st in-phase code domain error over one slot specified by Meas Offset including SCH period – 2nd number = 1st quad-phase code domain error over one slot specified by Meas Offset including SCH period – … – (2N – 1)th number = Nth in-phase code domain error over one slot specified by Meas Offset including SCH period – (2N)th number = Nth quad-phase code domain error over one slot specified by Meas Offset including SCH period
14	**Modulation Scheme**

Index: n <Mnemonic>	Results Returned
Modulation Scheme	Returns a series of floating point numbers that represents the modulation scheme slot-by-slot for measurement period selected by Meas Offset, Meas Interval and tDPCH[BTS] / tHS-DPCCH[MS] The meaning of the number is : 0.0 QPSK (Quadrature Phase Shift Keying) 2.0 16QAM (16Quadrature Amplified Modulation) 4.0 64QAM (64Quadrature Amplified Modulation) 10.0 BPSK (Binary Phase Shift Keying) on I branch only 11.0 BPSK (Binary Phase Shift Keying) on Q branch only 12.0 4PAM(Pulse Amplitude Modulation) on I branch only 13.0 4PAM(Pulse Amplitude Modulation) on Q branch only 14.0 BPSK on I branch and BPSK on Q branch 15.0 4PAM on I branch and BPSK on Q branch 16.0 BPSK on I branch and 4PAM on Q branch 17.0 4PAM on I branch and 4PAM on Q branch – 1st number = Modulation Scheme of the slot specified by Meas Offset – 2nd number = Modulation Scheme of the slot specified by Meas Offset + 1 – 3rd number = Modulation Scheme of the slot specified by Meas Offset + 2 – ... – Nth number = Modulation Scheme of the slot specified by Meas Offset + N, where N is Meas Interval
15	1. Returns a detected scramble code. The value returned is 0~511 Available only when Radio Device is set to BTS and P-Scramble Code is set to Autodetect. Otherwise NaN is returned 2. (Reserved) NaN returned 3. (Reserved) NaN returned 4. (Reserved) NaN returned 5. (Reserved) NaN returned 6. (Reserved) NaN returned 7. (Reserved) NaN returned 8. (Reserved) NaN returned 9. (Reserved) NaN returned 10. (Reserved) NaN returned

Results Data Format (n = 1)

Queries using this parameter value return the following 44 comma-separated scalar results:

#	**Result Name: (type of number) [unit]** **<explanation>**
1	**RMS Symbol EVM**: (floating) [percent] The despreading (Symbol) RMS EVM of the selected code (OVSF level and number) over the selected measurement period by Meas Offset, Meas Interval and tDPCH [BTS] / tHS-DPCCH [MS]
2	**Peak Symbol EVM**: (floating) [percent] The despreading (Symbol) peak EVM of the selected code over the selected measurement period by Meas Offset, Meas Interval and tDPCH [BTS] / tHS-DPCCH[MS]
3	**RMS Symbol Magnitude Error**: (floating) [percent] The RMS-averaged magnitude error of Symbol I/Q Polar Vector of the selected code over the selected measurement period by Meas Offset, Meas Interval and tDPCH [BTS] / tHS-DPCCH[MS]
4	**RMS Symbol Phase Error**: (floating) [degrees] The RMS-averaged phase error of Symbol I/Q Polar Vector of the selected code over the selected measurement period by Meas Offset, Meas Interval and tDPCH [BTS] / tHS-DPCCH [MS]
5	**Total Power**: (floating) [dBm] – The total RF power over the selected measurement period by Meas Offset, Meas Interval and tDPCH[BTS] / tHS-DPCCH[MS] – (See item 8. for Total Power over one slot specified by Meas Offset)
6	**Channel Power**: (floating) [dBc or dBm] The absolute or relative (relative to Total Power) power of the selected code over the measurement period selected by Meas Offset, Meas Interval and tDPCH[BTS] / tHS-DPCCH [MS]
7	**tDPCH, tHS-DPCCH**: (floating) [x256 chips] BTS mode: – In tDPCH auto-detection mode, the offset delay time for the selected code (DPCH) from the reference (CPICH slot #0 start point) is returned for valid DPCH. It returns 0 for other channels – In tDPCH manual setting mode, the returned value is the same as “tDPCH” parameter setting MS mode: – There is no tHS-DPCCH auto-detection function – Returns the given “tHS-DPCCH” parameter setting
8	**Total Power**: (floating) [dBm] Total RF power over one slot specified by Meas Offset. SCH period is included in its calculation (See item 5 above for Total Power over the measurement period selected by Meas Offset and Meas Interval)
9	**Total Active Power**: (floating) [dBc or dBm]

#	Result Name: (type of number) [unit] <explanation>
	The sum of the active code channel powers over one slot specified by Meas Offset. SCH period is included in its calculation
10	**Common Pilot (CPICH) Power**: (floating) [dBc or dBm]
	The average power of the CPICH code (absolute or relative to the Total Power) over one slot specified by Meas Offset. SCH period is included in its calculation
	In MS mode, the value returned is –999.0
11	**Maximum Active Code Power**: (floating) [dBc or dBm]
	The maximum average power of active code channels (absolute or relative to the Total Power) over one slot specified by Meas Offset. SCH period is included in its calculation
	If no active code is detected, the value returned is –999.0
	In MS mode, the value returned is –999.0
12	**Average Active Code Power**: (floating) [dBc or dBm]
	The average power of active code channels (absolute or relative to the Total Power) over one slot specified by Meas Offset. SCH period is included in its calculation
	If no active code is detected the value returned is –999.0
	In MS mode, the value returned is –999.0
13	**Maximum Inactive Code Power**: (floating) [dBc or dBm]
	The maximum average power of inactive code channels (absolute or relative to the Total Power) over one slot specified by Meas Offset. SCH period is included in its calculation
	In MS mode, the value returned is –999.0
14	**Average Inactive Code Power**: (floating) [dBc or dBm]
	The average power of inactive code channels (absolute or relative to the Total Power) over one slot specified by Meas Offset. SCH period is included in its calculation
	In MS mode, the value returned is –999.0
15	**Number of active channel**: (floating) [no unit]
	The number of active channel for one slot specified by Meas Offset
16	**P-SCH (Primary SCH) Power**: (floating) [dBm]
	The P-SCH power over one slot specified by Meas Offset
	In MS mode, the value returned is –999.0
17	**S-SCH (Secondary SCH) Power**: (floating) [dBm]
	The S-SCH power over one slot specified by Meas Offset
	In MS mode, the value returned is –999.0
18	**DPCCH Power, PRACH Message Control Part Power**: (floating) [dBc or dBm]
	If Sync Type is DPCCH, dedicated physical control channel (DPCCH) power over one slot specified by Meas Offset
	If Sync Type is PRACH Message, PRACH message control part power over one slot specified by Meas Offset
	In BTS mode, the value returned is –999.0
19	**DPCCH Beta Nominal, PRACH Message Control Part Beta Nominal**: (floating) [no unit]
	If Sync Type is DPCCH, the nominal value of DPCCH beta factor over one slot specified by

#	Result Name: (type of number) [unit] <explanation>
	Meas Offset If Sync Type is PRACH Message, PRACH message control part beta nominal over one slot specified by Meas Offset The value is one of 0.0, 0.067 (=1/15), 0.133 (=2/15), ... or 1.0 (=15/15) In BTS mode, the value returned is –999.0
20	**DPCCH Beta Measured**: (floating) [no unit] If Sync Type is DPCCH, the measured value of DPCCH beta factor over one slot specified by Meas Offset If Sync Type is PRACH Message, the measured value of PRACH message control part beta factor over one slot specified by Meas Offset In BTS mode, the value returned is –999.0
21	**DPDCH 1 Beta Nominal**: (floating) [no unit] If Sync Type is DPCCH, the nominal value of DPDCH #1 beta factor over one slot specified by Meas Offset If Sync Type is PRACH Message, the nominal value of PRACH message data part beta factor over one slot specified by Meas Offset The value is one of 0.0, 0.067 (=1/15), 0.133 (=2/15), ... or 1.0 (=15/15) If DPCH/E-DPCH is Config 2 w/o DPDCH or Config 3, the value returned is –999.0 In BTS mode, the value returned is –999.0
22	**DPDCH 1 Beta Measured**: (floating) [no unit] If Sync Type is DPCCH, the measured value of the DPDCH #1 beta factor over one slot specified by Meas Offset If Sync Type is PRACH Message, the measured value of PRACH message data part beta factor over one slot specified by Meas Offset If DPCH/E-DPCH is Config 2 w/o DPDCH or Config 3, the value returned is –999.0 In BTS mode, the value returned is –999.0
23	**DPDCH 2 Beta Measured**: (floating) [no unit] If Sync Type is DPCCH, the measured value of the DPDCH #2 beta factor over one slot specified by Meas Offset If DPCH/E-DPCH not Config 1, the value returned is –999.0 If Sync Type is PRACH Message, the value returned is –999.0 In BTS mode, the value returned is –999.0
24	**DPDCH 3 Beta Measured**: (floating) [no unit] If Sync Type is DPCCH, the measured value of the DPDCH #3 beta factor over one slot specified by Meas Offset If DPCH/E-DPCH not Config 1, the value returned is –999.0 If Sync Type is PRACH Message, the value returned is –999.0 In BTS mode, the value returned is –999.0
25	**DPDCH 4 Beta Measured**: (floating) [no unit] If Sync Type is DPCCH, the measured value of the DPDCH #4 beta factor over one slot

#	Result Name: (type of number) [unit] <explanation>
	specified by Meas Offset If DPCH/E-DPCH not Config 1, the value returned is –999.0 If Sync Type is PRACH Message, the value returned is –999.0 In BTS mode, the value returned is –999.0
26	**DPDCH 5 Beta Measured**: (floating) [no unit] If Sync Type is DPCCH, the measured value of the DPDCH #5 beta factor over one slot specified by Meas Offset If DPCH/E-DPCH not Config 1, the value returned is –999.0 If Sync Type is PRACH Message, the value returned is –999.0 In BTS mode, the value returned is –999.0
27	**DPDCH 6 Beta Measured**: (floating) [no unit] If Sync Type is DPCCH, the measured value of the DPDCH #6 beta factor over one slot specified by Meas Offset If DPCH/E-DPCH not Config 1, the value returned is –999.0 If Sync Type is PRACH Message, the value returned is –999.0 In BTS mode, the value returned is –999.0
28	**I Channel Average Active Power**: (floating) [dBc or dBm] The average power of active I channels over one slot specified by Meas Offset In BTS mode, the value returned is –999.0
29	**I Channel Maximum Inactive Power**: (floating) [dBc or dBm] The maximum average power of inactive I channels over one slot specified by Meas Offset In BTS mode, the value returned is –999.0
30	**Q Channel Average Active Power**: (floating) [dBc or dBm] The average power of active Q channels over one slot specified by Meas Offset In BTS mode, the value returned is –999.0
31	**Q Channel Maximum Inactive Power**: (floating) [dBc or dBm] The maximum average power of inactive Q channels over one slot specified by Meas Offset In BTS mode, the value returned is –999.0
32	**Nominal Ratio Between HS-DPCCH And DPCCH**: (floating) If Sync Type is DPCCH, amplitude ratio of the nominal value based on the measured value of HS-DPCCH beta factor and the DPCCH beta factor If Sync Type is PRACH Message, the value returned is –999.0 In BTS mode, the value returned is –999.0
33	**HS-DPCCH Beta Measured**: (floating) If Sync Type is DPCCH, the measured value of HS-DPCCH beta factor If Sync Type is PRACH Message, the value returned is –999.0 In BTS mode, the value returned is –999.0
34	**Modulation scheme**: (floating) Modulation scheme for the specified code channel

#	Result Name: (type of number) [unit] <explanation>
	– 0.0: QPSK – +2.0: 16QAM – +4.0: 64QAM – 10.0 = BPSK (Binary Phase Shift Keying) on I branch only – 11.0 = BPSK (Binary Phase Shift Keying) on Q branch only – 12.0 = 4PAM(Pulse Amplitude Modulation) on I branch only – 13.0 = 4PAM(Pulse Amplitude Modulation) on Q branch only – 14.0 = BPSK on I branch and BPSK on Q branch – 15.0 = 4PAM on I branch and BPSK on Q branch – 16.0 = BPSK on I branch and 4PAM on Q branch – 17.0 = 4PAM on I branch and 4PAM on Q branch (+1 and other values are reserved for different modulation types) – If Mod Scheme is Auto, the modulation scheme is detected based on the measurement time period specified by Meas Offset, Meas Interval and tDPCH[BTS] / tHS-DPCCH[MS] – If Mod Scheme is either QPSK or 16QAM, the given setting is returned. This result has meaning only for downlink SF16 (240ksps) channels
35	**First Slot Number**: (floating) The first slot number of the specified channel by Symbol Rate and Code Number in Capture Interval
36	**Channel CDE**: (floating) [dBc or dBm] The absolute or relative (relative to Total Power) CDE of the selected code over one slot specified by Meas Offset SCH period is included in its calculation [BTS]
37	**DPCCH Slot Format**: (floating) If Sync Type is DPCCH , the DPCCH slot format value used for synchronization is returned – 0.0: Slot Format 0 – 1.0: Slot Format 1 – 2.0: Slot Format 2 – 3.0: Slot Format 3 – 4.0: Slot Format 4 – 5.0: Slot Format

#	Result Name: (type of number) [unit] <explanation>
	If Sync Type is PRACH, the value returned is –999.0 In BTS mode, the value returned is –999.0
38	**Preamble Signature**: (floating) BTS mode: – Always the returned value is –999.0 MS mode: – In Preamble Signature auto-detection mode, the detected signature code number(from 0.0 to 15.0) is returned when Sync Type is PRACH Message – In Preamble Signature manual setting mode, the returned value is the same as the parameter setting. When Sync Type is not PRACH Message, the returned value is –999.0
39	**E-DPCCH Beta Nominal**: (floating) If Sync Type is DPCCH and DPCH/E-DPCH Config is one of Config 2 w/ DPCH, Config 2 w/o DPCH and Config 3, the nominal value of E-DPCCH beta factor The value is one of 0.333 (=5/15), 0.4 (=6/15), 0.533 (=8/15), ... or 2.0 (=30/15) If DPCH/E-DPCH Config is Config 1, the value returned is –999.0 If Sync Type is PRACH Message, the value returned is –999.0 In BTS mode, the value returned is –999.0
40	**E-DPCCH Beta Measured**: (floating) If Sync Type is DPCCH and DPCH/E-DPCH Config is one of Config 2 w/ DPCH, Config 2 w/o DPCH and Config 3, the measured value of E-DPCCH beta factor If DPCH/E-DPCH Config is Config 1, the value returned is –999.0 If Sync Type is PRACH Message, the value returned is –999.0 In BTS mode, the value returned is –999.0
41	**E-DPDCH 1st on I-axis Beta Measured**: (floating) If Sync Type is DPCCH and DPCH/E-DPCH Config is either Config 2 w/o DPCH or Config 3, the measured value of E-DPDCH on I-axis (C8(64), C7(32), C6(16), C5(8), C4(4), C3(2) or C2(1)) beta factor If DPCH/E-DPCH Config is either Config 1 or Config 2 w/ DPCH, the value returned is –999.0 If Sync Type is PRACH Message, the value returned is –999.0 In BTS mode, the value returned is –999.0
42	**E-DPDCH 1st on Q-axis Beta Measured**: (floating) If Sync Type is DPCCH and DPCH/E-DPCH Config is either Config 2 w/o DPCH or Config 3, the measured value of E-DPDCH on Q-axis (C8(64), C7(32), C6(16), C5(8), C4(4), C3(2) or C2(1)) beta factor If DPCH/E-DPCH Config is either Config 1 or Config 2 w/ DPCH, the value returned is –999.0 If Sync Type is PRACH Message, the value returned is –999.0 In BTS mode, the value returned is –999.0

#	Result Name: (type of number) [unit] <explanation>
43	**E-DPDCH 2nd on I-axis Beta Measured**: (floating) If Sync Type is DPCCH and DPCH/E-DPCH Config is one of Config 2 w/ DPCH, Config 2 w/o DPCH and Config 3, the measured value of E-DPDCH on I-axis (C8(128), C7(64), C6(32), C5 (16), C4(8), C3(4), C2(2) or C1(1)) beta factor If DPCH/E-DPCH Config is Config 1, the value returned is –999.0 If Sync Type is PRACH Message, the value returned is –999.0 In BTS mode, the value returned is –999.0
44	**E-DPDCH 2nd on Q-axis Beta Measured**: (floating) If Sync Type is DPCCH and DPCH/E-DPCH Config is one of Config 2 w/ DPCH, Config 2 w/o DPCH and Config 3, the measured value of E-DPDCH on Q-axis (C8(128), C7(64), C6(32), C5 (16), C4(8), C3(4), C2(2) or C1(1)) beta factor If DPCH/E-DPCH Config is Config 1, the value returned is –999.0 If Sync Type is PRACH Message, the value returned is –999.0 In BTS mode, the value returned is –999.0

3.4.1 Views

The Code Domain Power measurement has five views as follows.

Some of these Views are multiple-window Views. When in a multiple window View, you select a window by touching it. The menu controls may sometimes change depending on which window is selected.

Whenever the View changes, the default menu is Frequency, unless otherwise specified in the View description.

View	Result
Power Graph & Metrics	Code Domain Power Graph
	CDP Metrics
CDP Graph & CDE Graph	Code Domain Power Graph
	Code Domain Error Graph
I/Q Error (Quad View)	Mag Error Graph
	Phase Error Graph
	EVM Graph
	Symbol Error Metrics
Code Domain (Quad View)	Code Domain Power Graph
	Symbol Power Graph
	I/Q Symbol Polar Vector Graph
	Symbol Error Metrics

View	Result
Demod Bits	Code Domain Power Graph Symbol Power Graph Demod Bits

View Selection

Selects the desired measurement view from the selections listed in the table below. There are two available commands, allowing you to select the view using either the ID string or a numeric ID value. For more details of the commands, see:

- "View Selection by Name" on page 458
- "View Selection by Number" on page 458

In the following table:

- The Enumerated ID is used with the SCPI Command `:DISP:CDP:VIEW[:SEL]`
- The Numeric ID is used with the SCPI Command `:DISP:CDP:VIEW:NSEL`

Enumerated ID	Numeric ID	View Name & Details
`PGRaph`	1	Power Graph & Metrics Provides a combination view of the code domain power graph and the summary data Not available if the [:SENSe]:CDPower:CAPTure:TIME (Capture Interval) is 4.0 or 8.0 (Long Mode)
`CDE`	2	Power Graph & CDE Graph Provides a combination view of the code domain power graph and the code domain error Not available if the [:SENSe]:CDPower:CAPTure:TIME (Capture Interval) is 4.0 or 8.0 or 16.0 (Long Mode)
`SEVM`	3	I/Q Error (Quad View) Symbol EVM provides a combination view of magnitude error, phase error, Symbol EVM, and the summary data Not available if the [:SENSe]:CDPower:CAPTure:TIME (Capture Interval) is set to 4.0 or 8.0 (Long Mode)
`QUAD`	4	Code Domain (Quad View) Provides a combination view for the code domain power symbol power, I/Q symbol polar vector and the summary data Not available if the [:SENSe]:CDPower:CAPTure:TIME (Capture Interval) is set to 4.0 or 8.0 (Long Mode)
`DBITs`	5	Demod Bits Provides a combination view of the graphs for the code domain power and symbol power, and the I/Q demodulated bit stream data for the symbol power slots selected by the measurement

Enumerated ID	Numeric ID	View Name & Details
		interval and measurement offset
LDEMod	6	Long Demodulation Provides a combination view of the symbol power and demodulation bits stream data for the symbol power slots selected by the measurement interval and measurement offset though long capture (capture interval > 3 frames)

View Selection by Name

Remote Command	:DISPlay:CDPower:VIEW[:SELect] PGRaph | CDE | SEVM | QUAD | DBITs | LDEMod :DISPlay:CDPower:VIEW[:SELect]?
Example	:DISP:CDP:VIEW PGR :DISP:CDP:VIEW?
Preset	PGRaph
State Saved	Yes
Range	Power Graph & Metrics|CDP Graph & CDE Graph|I/Q Error (Quad View)|Code Domain (Quad View)|Demod Bits|Long Demod

View Selection by Number

Displays the numeric values of the measurement results.

For a complete list of Numeric ID values for use with this command, see "View Selection" on page 457 above.

Remote Command	:DISPlay:CDPower:VIEW:NSELect <integer> :DISPlay:CDPower:VIEW:NSELect?
Example	:DISP:CDP:VIEW:NSEL 2 :DISP:CDP:VIEW:NSEL?
Preset	1
State Saved	Yes
Min/Max	1/6

3.4.1.1 Power Graph & Metrics

Windows: "Code Domain Power Graph" on page 461, "Metrics" on page 461

Dual window view of the graph and the metrics. The parameters displayed in these windows differ depending on the setting of Radio Device. When the parameter Capture Interval is set to Long Mode (4, 8 or 16 Frame), this view is not available, and only the "Demod Bits" on page 517 view is available.

Example	`:DISP:CDP:VIEW PGR`

3.4.1.2 CDP Graph & CDE Graph

Windows: "Code Domain Power Graph" on page 461, "Code Domain Error Graph" on page 464

Dual window view of the CDP graph and the CDE graph.

These two windows are coupled in terms of: X/Y Scaling, Composite Symbol Boundary, and Display Symbol Rate.

The parameters displayed in these windows differ depending on the setting of Radio Device. When the parameter Capture Interval is set to Long Mode (4, 8 or 16 Frame), this view is not available, and only the "Demod Bits" on page 517 view is available.

Example	`:DISP:CDP:VIEW CDE`

3.4.1.3 I/Q Error (Quad View)

Windows: "Magnitude Error Graph" on page 464, "Phase Error Graph" on page 464, "EVM Graph" on page 465, "Symbol Error Metrics" on page 465

Combination view of magnitude error, phase error, Symbol EVM, and the summary data using the above four windows.

The parameters displayed in these windows differ depending on the setting of Radio Device. When the parameter Capture Interval is set to Long Mode (4, 8 or 16 Frame), this view is not available, and only "Demod Bits" on page 517 view is available.

Example	`:DISP:CDP:VIEW SEVM`

3.4.1.4 Code Domain (Quad View)

Windows: "Code Domain Power Graph" on page 461, "Symbol Power Graph" on page 467, "I/Q Symbol Polar Graph" on page 468, "Symbol Error Metrics" on page 465

Combination view of the code domain power, symbol power, I/Q symbol polar vector and the summary data using the above 4 windows.

The parameters displayed in these windows differ depending on the setting of Radio Device. When the parameter Capture Interval is set to Long Mode (4, 8 or 16 Frame), this view is not available, and only "Demod Bits" on page 517 view is available.

Example	`:DISP:CDP:VIEW QUAD`

3.4.1.5 Demod Bits

Windows: "Code Domain Power Graph" on page 461, "Symbol Power Graph" on page 467, "Symbol Power Graph (Long Mode)" on page 467, "Demod Bits" on page 468

In this view, the number of windows that are displayed depends on the parameter setting of "Capture Interval" on page 557. See the following table for detailed settings of Capture Interval.

The parameters displayed in each window differ depending on the setting of Radio Device.

Capture Interval Setting	Number & Type of Windows
1 to 14 slots 1 to 3 frames	Three windows: – Power Bar Graph window (upper left) – Symbol/Chip Power vs. Time window (upper right) – Demod Bits text window (lower)
Long Mode (4, 8, 16 frames)	Two windows: – Symbol/Chip Power vs. Time window (upper) – Demod Bits text window (lower)

Example	`:DISP:CDP:VIEW DBIT` `:DISP:CDP:VIEW LDEM`

3.4.2 Windows

This section describes the windows that are available in the Code Domain Measurement.

3.4.2.1 Window Number List

Window	Number
Code Domain Power	1
Metrics	2
Code Domain Error	3
Mag Error	4
Phase Error	5

Window	Number
EVM	6
Symbol Error Metrics	7
Symbol Power	8
I/Q Symbol Polar	9
Demod Bits	10

Code Domain Power Graph

The Code Domain Power Graph window appears in several Views, as follows:

View	Size	Position
Power Graph & Metrics	Half, full width	Top
CDP Graph & CDE Graph	Half, full width	Top
Code Domain (Quad View)	Half, half width	Upper left
Demod Bits	Half, half width	Upper left

Marker Operation	Yes
Corresponding Trace	CDPower (n=2)

Note 1: These traces and scalar results are for the slot specified by the Meas Offset. (Not averaged through Meas Interval.)

Metrics

The Metrics window appears in the following View:

View	Size	Position
Power Graph & Metrics	One thirds, full width	Bottom

Radio Device: BTS

Name	Corresponding Results	Explanation
Total Power	n=1 8th Total Power (Note 1)	-nn.nn dBm
Total Active Ch	n=1 9th Total active power (Note 1)	-nnn.nnn dBc
CPICH	n=1 10th Common Pilot (CPICH) power (Note 1)	-nn.nnn dBc
PSCH	n=1 16th P-SCH (Primary SCH) Power (Note 1, 2)	-nnn.nn dBm
SSCH	n=1 17th	-nnn.nn dBm

Name	Corresponding Results	Explanation
	S-SCH (Secondary SCH) Power (Note 1, 2)	
Max Active Ch	n=1 11th Maximum active code power (Note 1)	-nnn.nnn dBc
Avg Active Ch	n=1 12th Average active code power (Note 1)	-nnn.nnn dBc
Max Inactive Ch	n=1 13th Maximum inactive code power (Note 1)	-nn.nnn dBc
Avg Inactive Ch	n=1 14th Average inactive code power (Note 1)	-nn.nnn dBc
Num of Active Ch	n=1 15th Number of active channels (Note 1)	nnn

Note 1: These traces and scalar results are for the slot specified by the Meas Offset. (Not averaged over Meas Interval.) SCH burst period (the first 10% of each slot) is included in the measurement. SCH's interference is suppressed if “SCH Suppress” setting is “On”.

Note 2: Primary and Secondary SCH power is estimated by MMSE algorithm.

Radio Device: MS

Name	Corresponding Results	Explanation
Total Power	n=1 8th Total Power	-nn.nn dBm
Total Active Ch	n=1 9th Total active power (Note 1)	-nnn.nnn dBc
DPCCH Power	n=1 18th DPCCH power, PRACH Message Control Power (Note 1)	-nn.nnn dBc
DPCCH Beta	n=1 20th DPCCH Beta Measured, PRACH Message Control Part Beta Measured (Note 1)	n.nnn
HS-DPCCH Beta	n=1 33rd HS-DPCCH Beta Measured (Note 1)	n.nnn
E-DPCCH Beta	n=1 38th E-DPCCH Beta Measured (Note 1)	n.nnn
DPDCH Beta #1:	n=1 22nd DPDCH 1 Beta Measured,	n.nnn

Name	Corresponding Results	Explanation
	PRACH Message Data Part Beta Measured (Note 1)	
DPDCH Beta #2:	n=1 23rd DPDCH 2 Beta Measured (Note 1)	n.nnn
DPDCH Beta #3:	n=1 24th DPDCH 3 Beta Measured (Note 1)	n.nnn
DPDCH Beta #4:	n=1 25th DPDCH 4 Beta Measured (Note 1)	n.nnn
DPDCH Beta #5:	n=1 26th DPDCH 5 Beta Measured (Note 1)	n.nnn
DPDCH Beta #6:	n=1 27th DPDCH 6 Beta Measured (Note 1)	n.nnn
E-DPDCH Beta 1st on I	n=1 39th E-DPDCH 1st on I-axis Beta Measured (Note 1)	n.nnn
E-DPDCH Beta 1st on Q	n=1 40th E-DPDCH 1st on Q-axis Beta Measured (Note 1)	n.nnn
E-DPDCH Beta 2nd on I	n=1 41st E-DPDCH 2nd on I-axis Beta Measured This result is used only when there are two E-DPDCHs on I-axis. In this case, beta for E-DPDCH at C1(1):I is returned (Note 1)	n.nnn
E-DPDCH Beta 2nd on Q	n=1 42nd E-DPDCH 2nd on Q-axis Beta Measured This result is used only when there are two E-DPDCHs on Q-axis. In this case, beta for E-DPDCH at C1(1):Q is returned (Note 1)	n.nnn
Control Part Power	n=1 18th DPCCH power, PRACH Message Control Power (Note 1, 2)	
Control Part Beta	n=1 20th DPCCH Beta Measured, PRACH Message Control Part Beta Measured (Note 1, 2)	
Data Part Beta	n=1 22nd DPDCH 1 Beta Measured, PRACH Message Data Part Beta Measured (Note 1, 2)	
I Avg Active Ch	n=1 28th I channel average active power (Note 1)	-nnn.nnn dBc
I Max	n=1 29th	-nnn.nnn dBc

Name	Corresponding Results	Explanation
Inactive Ch	I channel maximum inactive power (Note 1)	
Q Avg Active Ch	n=1 30th Q channel average active power (Note 1)	-nnn.nnn dBc
Q Max Inactive Ch	n=1 31st Q channel maximum inactive power (Note 1)	-nnn.nnn dBc
Num of Active Ch	n=1 15th Number of active channels (Note 1)	nnn

Note 1: These traces and scalar results are for the slot specified by the Meas Offset. (Not averaged over Meas Interval.)

Code Domain Error Graph

The Code Domain Error Graph appears in the following View:

View	Size	Position
CDP Graph & CDE Graph	Half, full width	Bottom

Marker Operation	Yes
Corresponding Trace	CDError (n=13)

Note 1: These traces and scalar results are for the slot specified by the Meas Offset. (Not averaged over Meas Interval.)

Magnitude Error Graph

The Magnitude Error window appears in the following View:

View	Size	Position
I/Q Error (Quad View)	Half, half width	Upper left

Marker Operation	Yes
Corresponding Trace	MERRor (n=6)
Note 1	When I/Q Branch is either I(-BPSK) or Q(-BPSK): EVM of single code Channel is calculated independently between I and Q each other When I/Q Branch is IQC(-Combined): EVM is calculated based on combined symbol vector of I and Q decision point

Phase Error Graph

The Phase Error window appears in the following View:

View	Size	Position
I/Q Error (Quad View)	Half, half width	Upper right

Marker Operation	Yes
Corresponding Trace	PERRor (n=7)
Note 1	When I/Q Branch is either I(-BPSK) or Q(-BPSK): EVM of single code Channel is calculated independently between I and Q each other When I/Q Branch is IQC(-Combined): EVM is calculated based on combined symbol vector of I and Q decision point
Note 2	When I/Q Branch is either I(-BPSK) or Q(-BPSK): IQ Phase error has no meaning When I/Q Branch is IQ(-Combined): IQ Phase error is calculated based on combined symbol vector of I and Q decision point

EVM Graph

The EVM window appears in the following View:

View	Size	Position
I/Q Error (Quad View)	Half, half width	Lower left

Marker Operation	Yes
Corresponding Trace	EVM (n=5)
Note 1	When I/Q Branch is either I(-BPSK) or Q(-BPSK): EVM of single code Channel is calculated independently between I and Q each other When I/Q Branch is IQC(-Combined): EVM is calculated based on combined symbol vector of I and Q decision point

Symbol Error Metrics

The Metrics window appears in the following Views:

View	Size	Position
I/Q Error (Quad View)	Half, half width	Lower right
Code Domain (Quad View)	Half, half width	Lower right

Radio Device: BTS

Name	Corresponding Results	Explanation
Code Number	N/A	CX(Y) N ksps X: OVSF level (2 … 9) 2: 960ksps … 9:7.5ksps Y: OVSF code number (0 … 2^X-1) N: 7.5, 15, 30 …, 960 ksps
RMS EVM	n=1 1st RMS symbol EVM	nn.nn % rms
Pk EVM	n=1 2nd Peak symbol EVM	nn.nn % pk
Magnitude Error	n=1 3rd Symbol magnitude error	nn.nn % rms
Phase Error	n=1 4th Symbol phase error	nn.nn °rms
Total Power	n=1 5th Total power	-nn.nn dBm
Channel Power	n=1 6th Channel Power	-nn.nn dBc
tDPCH	n=1 7th tDPCH	nnn

Note 1: The result metrics window indicates the modulation scheme (“QPSK” or “16QAM”) that was used in the measurement. If modulation scheme setting is “Auto”, the result is auto-detected one. If the setting is manual, either “QPSK” or “16QAM”, the result is the same as the specified one.

Radio Device: MS

Name	Corresponding Results	Explanation
Code Number	N/A	CX(Y) N ksps X: OVSF level (2 … 8) 2: 960ksps … 8:15ksps Y: OVSF code number (0 … 2^X-1) N: 15, 30 …, 960 ksps
RMS EVM	n=1 1st RMS symbol EVM (Note 1)	nn.nn % rms
Pk EVM	n=1 2nd Peak symbol EVM (Note 1)	nn.nn % pk
Magnitude Error	n=1 3rd	nn.nn % rms

Name	Corresponding Results	Explanation
	Symbol magnitude error (Note 1)	
Phase Error	n=1 4th Symbol phase error (Note 2)	nn.nn °rms
Total Power	n=1 5th Total power	-nn.nn dBm
Channel Power	n=1 6th Channel Power	-nn.nn dBc
tHS-DPCCH	n=1 7th tHS-DPCCH	nnn

Note 1	When I/Q Branch is either I(-BPSK) or Q(-BPSK): EVM of single code Channel is calculated independently between I and Q each other When I/Q Branch is IQC(-Combined): EVM is calculated based on combined symbol vector of I and Q decision point
Note 2	When I/Q Branch is either I(-BPSK) or Q(-BPSK): IQ Phase error has no meaning When I/Q Branch is IQ(-Combined): IQ Phase error is calculated based on combined symbol vector of I and Q decision point

Symbol Power Graph

This graph appears in the following Views:

View	Size	Position
Code Domain (Quad View)	Half, half width	Upper right
Demod Bits	Half, half width	Upper right

Marker Operation	Yes
Corresponding Trace	SPOWer (n=9), CPOWer (n=10)

Symbol Power Graph (Long Mode)

This graph appears in the following View:

View	Size	Position
Demod Bits	Half, full width	Top

Marker Operation	Yes
Corresponding Trace	SPOWer (n=9)

I/Q Symbol Polar Graph

This graph appears in the following View:

View	Size	Position
Code Domain (Quad View)	Half, half width	Lower left

Marker Operation	No
Corresponding Trace	IQ Corrected Measured Trace (n=8)
Note 1	When I/Q Branch is either I(-BPSK) or Q(-BPSK): Symbol Vector is independent between I and Q each other When I/Q Branch is IQC(-Combined) Symbol vector is combined between I and Q

Demod Bits

The Demod Bits window appears in the following View:

View	Size	Position
Demod Bits	Half, full width	Bottom

Marker Operation	No
Corresponding Trace	Selected Demod Bits by Meas Offset and Meas Interval (n=12)

Note 1: When Capture Interval is less than 1 frame, the channel type is not shown as the physical channel name. It is simply shown by Code Level and Index:

Cx(y) : x = Code Level, y = Code Index

3.4.3 Amplitude

Activates the **Amplitude** menu and selects **Reference Level** or **Reference Value** as the active function, depending on the measurement.

Some features in this menu apply to multiple measurements. Some other features apply only to specific measurements and their controls are blanked or grayed-out in measurements that do not support the feature.

3.4.3.1 Y Scale

The Y Scale Tab contains controls that pertain to the Y axis parameters of the measurement. These parameters control how data on the vertical (Y) axis is displayed and control instrument settings that affect the vertical axis.

Ref Value

Sets the value for the absolute power reference. The functionality depends on the selected window.

Remote Command	`:DISPlay:CDPower:WINDow[1]|3|4|5|6|8:TRACe:Y[:SCALe]:RLEVel <real>`
	`:DISPlay:CDPower:WINDow[1]|3|4|5|6|8:TRACe:Y[:SCALe]:RLEVel?`
	Window numbers are as follows:
	– CDP: 1
	– CDE: 3
	– Mag Error: 4
	– Phase Error: 5
	– EVM : 6
	– Symb Power: 8

Example	`:DISP:CDP:WIND:TRAC:Y:RLEV 0.0`
	1-CDP Window
	`:DISP:CDP:WIND3:TRAC:Y:RLEV 0.0`
	3-CDE Window
	`:DISP:CDP:WIND4:TRAC:Y:RLEV 0.0`
	4-Mag Error Window
	`:DISP:CDP:WIND5:TRAC:Y:RLEV 0.0`
	5-Phase Error Window
	`:DISP:CDP:WIND6:TRAC:Y:RLEV 0.0`
	6-EVM Window
	`:DISP:CDP:WIND8:TRAC:Y:RLEV 0.0`
	8-Symb Power Window

Couplings	When Auto Scaling is On (default), this value is automatically determined by the measurement result. When you set a value manually, Auto Scaling changes to Off
Preset	0.00
State Saved	Yes
Min/Max	see table below

View	Min/Max
1-CDP | 3-CDE	250.0/250.0
4-Mag Error | 6-EVM	-100/100
5-Phase Error	-360/360

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now the VIEW parameter is not used and defaults to 1. All Windows are referenced through VIEW 1. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command
CDP	!Power Graph & Metrics View DISP:CDP:VIEW:WIND:TRAC:Y:RLEV 0.0 !CDP/CDE View DISP:CDP:VIEW2:WIND:TRAC:Y:RLEV 0.0 !Code Domain View DISP:CDP:VIEW4:WIND:TRAC:Y:RLEV 0.0 !Demod Bits View DISP:CDP:VIEW5:WIND:TRAC:Y:RLEV 0.0	DISP:CDP:WIND:TRAC:Y:RLEV 0.0
CDE	DISP:CDP:VIEW2:WIND2:TRAC:Y:RLEV 0.0	DISP:CDP:WIND3:TRAC:Y:RLEV 0.0
Mag Error	DISP:CDP:VIEW3:WIND:TRAC:Y:RLEV 0.0	DISP:CDP:WIND4:TRAC:Y:RLEV 0.0
Phase Error	DISP:CDP:VIEW3:WIND2:TRAC:Y:RLEV 0.0	DISP:CDP:WIND5:TRAC:Y:RLEV 0.0
EVM	DISP:CDP:VIEW3:WIND3:TRAC:Y:RLEV 0.0	DISP:CDP:WIND6:TRAC:Y:RLEV 0.0
Symb Power	!Code Domain View DISP:CDP:VIEW4:WIND2:TRAC:Y:RLEV 0.0 !Demod Bits View DISP:CDP:VIEW5:WIND2:TRAC:Y:RLEV 0.0 !Demod Bits View (Long Mode) DISP:CDP:VIEW6:WIND:TRAC:Y:RLEV 0.0	DISP:CDP:WIND8:TRAC:Y:RLEV 0.0

Scale/Div

Sets the units per division of vertical scale in the logarithmic display. However, since Auto Scaling defaults to On, this value is automatically determined by the measurement result. When you set a value manually, Auto Scaling automatically changes to Off.

Remote	:DISPlay:CDPower:WINDow[1] | 3 | 4 | 5 | 6 | 8:TRACe:Y

Command	`[:SCALe]:PDIVision <real>`
	`:DISPlay:CDPower:WINDow[1] | 3 | 4 | 5 | 6 | 8:TRACe:Y [:SCALe]:PDIVision?`
	Window numbers are as follows:
	– CDP: 1
	– CDE: 3
	– Mag Error: 4
	– Phase Error: 5
	– EVM : 6
	– Symb Power: 8

Example	1-CDP Window
	`:DISP:CDP:WIND:TRAC:Y:PDIV 5.0`
	3-CDE Window
	`:DISP:CDP:WIND3:TRAC:Y:PDIV 5.0`
	4-Mag Error Window
	`:DISP:CDP:WIND4:TRAC:Y:PDIV 5.0`
	5-Phase Error Window
	`:DISP:CDP:WIND5:TRAC:Y:PDIV 5.0`
	6-EVM Window
	`:DISP:CDP:WIND6:TRAC:Y:PDIV 5.0`
	8-Symb Power Window
	`:DISP:CDP:WIND8:TRAC:Y:PDIV 5.0`

Notes	Target window to control depends on the SubOpCode
Couplings	In the Mag Error, Phase Error, EVM, and Symbol Power window, if Auto Scaling is set to On, this value is automatically determined by the measurement result. When you set this value manually, Auto Scaling automatically changes to Off
Preset	(see table below)
State Saved	Yes
Min/Max	(see table below)

Preset:

Views	Preset
1-CDP | 3-CDE	10.00
4-Mag Error	0.2
5-Phase Error | 6 EVM	0.1
8-Symb Power	5

Min/Max:

Views	Min/Max
1-CDP | 3-CDE | 8-Symb Power	0.10/20.00

Views	Min/Max
4-Mag Error | 6 EVM	0.100/50.0
5-Phase Error	0.01/360

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now the VIEW parameter is not used and defaults to 1. All Windows are referenced through VIEW 1. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command

CDP	!Power Graph & Metrics View
	`DISP:CDP:VIEW:WIND:TRAC:Y:PDIV 5.0`
	! CDP/CDE View
	`DISP:CDP:VIEW2:WIND:TRAC:Y:PDIV 5.0`
	!Code Domain View
	`DISP:CDP:VIEW4:WIND:TRAC:Y:PDIV 5.0`
	!Demod Bits View
	`DISP:CDP:VIEW5:WIND:TRAC:Y:PDIV 5.0`
		`DISP:CDP:WIND:TRAC:Y:PDIV 5.0`

CDE	`DISP:CDP:VIEW2:WIND2:TRAC:Y:PDIV 5.0`	`DISP:CDP:WIND3:TRAC:Y:PDIV 5.0`
Mag Error	`DISP:CDP:VIEW3:WIND:TRAC:Y:PDIV 5.0`	`DISP:CDP:WIND4:TRAC:Y:PDIV 5.0`
Phase Error	`DISP:CDP:VIEW3:WIND2:TRAC:Y:PDIV 5.0`	`DISP:CDP:WIND5:TRAC:Y:PDIV 5.0`
EVM	`DISP:CDP:VIEW3:WIND3:TRAC:Y:PDIV 5.0`	`DISP:CDP:WIND6:TRAC:Y:PDIV 5.0`

Symb Power	!Code Domain View
	`DISP:CDP:VIEW4:WIND2:TRAC:Y:PDIV 5.0`
	!Demod Bits View
	`DISP:CDP:VIEW5:WIND2:TRAC:Y:PDIV 5.0`
	!Demod Bits View (Long Mode)
	`DISP:CDP:VIEW6:WIND:TRAC:Y:PDIV 5.0`
		`DISP:CDP:WIND8:TRAC:Y:PDIV 5.0`

Ref Position

Positions the Y-axis scale reference level at the top, center or bottom of the display. Changing the reference position does not change the reference level value.

Remote Command	`:DISPlay:CDPower:WINDow4|5|6|8:TRACe:Y[:SCALe]:RPOSition TOP | CENTer | BOTTom`
	`:DISPlay:CDPower:WINDow4|5|6|8:TRACe:Y[:SCALe]:RPOSition?`
	Window numbers are as follows:
	– Mag Error: 4
	– Phase Error: 5
	– EVM : 6
	– Symb Power: 8

Example	4-Mag Error Window
	`:DISP:CDP:WIND4:TRAC:Y:RPOS CENT`
	5-Phase Error Window
	`:DISP:CDP:WIND5:TRAC:YRPOS CENT`
	6-EVM Window
	`:DISP:CDP:WIND6:TRAC:Y:RPOS CENT`
	8-Symb Power Window
	`:DISP:CDP:WIND8:TRAC:Y:RPOS CENT`

Notes	Target window to control depends on the SubOpCode
Preset	`CENTer`
State Saved	Yes
Range	`TOP|CENTer|BOTTom`

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now the VIEW parameter is not used and defaults to 1. All Windows are referenced through VIEW 1. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command
Mag Error	`DISP:CDP:VIEW3:WIND:TRAC:Y:RPOS CENT`	`DISP:CDP:WIND4:TRAC:Y:RPOS CENT`
Phase Error	`DISP:CDP:VIEW3:WIND2:TRAC:Y:RPOS CENT`	`DISP:CDP:WIND5:TRAC:Y:RPOS CENT`
EVM	`DISP:CDP:VIEW3:WIND3:TRAC:Y:RPOS CENT`	`DISP:CDP:WIND6:TRAC:Y:RPOS CENT`
Symb	!Demod Bits View	`DISP:CDP:WIND8:TRAC:Y:RPOS`

Window	Old SCPI Command	New SCPI Command
Power	DISP:CDP:VIEW5:WIND2:TRAC:Y:RPOS CENT !Demod Bits View (Long Mode) DISP:CDP:VIEW6:WIND:TRAC:Y:RPOS CENT	CENT

Auto Scaling

Toggles the Auto Scaling function between On and Off.

Remote Command	:DISPlay:CDPower:WINDow4|5|6|8:TRACe:Y[:SCALe]:COUPle 0 | 1 | OFF | ON :DISPlay:CDPower:WINDow4|5|6|8:TRACe:Y[:SCALe]:COUPle? Window numbers are as follows: – Mag Error: 4 – Phase Error: 5 – EVM : 6 – Symb Power: 8
Example	4-Mag Error Window :DISP:CDP:WIND4:TRAC:Y:COUP ON 5-Phase Error Window :DISP:CDP:WIND5:TRAC:YCOUP ON 6-EVM Window :DISP:CDP:WIND6:TRAC:Y:COUP ON 8-Symb Power Window :DISP:CDP:WIND8:TRAC:Y:COUP ON
Notes	Target window to control depends on the SubOpCode
Couplings	Upon pressing the front-panel key Restart, the Auto Scaling function automatically determines the scale per division and reference values based on the measurement results if this parameter is set to On. When you set a value to either Scale/Div or Ref Value manually, Auto Scaling automatically changes to Off
Preset	ON
State Saved	Yes
Range	OFF|ON

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now the VIEW parameter is not used and defaults to 1. All Windows are referenced through VIEW 1. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command
Mag Error	DISP:CDP:VIEW3:WIND:TRAC:Y:COUP ON	DISP:CDP:WIND4:TRAC:Y:COUP ON
Phase Error	DISP:CDP:VIEW3:WIND2:TRAC:Y:COUP ON	DISP:CDP:WIND5:TRAC:Y:COUP ON
EVM	DISP:CDP:VIEW3:WIND3:TRAC:Y:COUP ON	DISP:CDP:WIND6:TRAC:Y:COUP ON
Symb Power	Demod Bits View: DISP:CDP:VIEW5:WIND2:TRAC:Y:COUP ON Demod Bits View (Long Mode): DISP:CDP:VIEW6:WIND:TRAC:Y:COUP ON	DISP:CDP:WIND8:TRAC:Y:COUP ON

3.4.3.2 Attenuation

Controls the attenuator functions and interactions between the attenuation system components.

There are two attenuator configurations in the X-Series. One is a Dual-Attenuator configuration consisting of a mechanical attenuator and an optional electronic attenuator. The other configuration uses a single attenuator with combined mechanical and electronic sections thatcontrols all the attenuation functions. Different models in the X-Series come with different configurations.

– See "Dual-Attenuator Configurations" on page 476

– See "Single-Attenuator Configuration" on page 476

Most attenuation settings are the same for all measurements – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset.

This tab is only available when the hardware set includes an input attenuator, which is typically only the case when using Keysight’s box instruments. For example, this tab does not appear in:

– VXT models M9420A/21A/10A/11A

– E7760

– M9391A

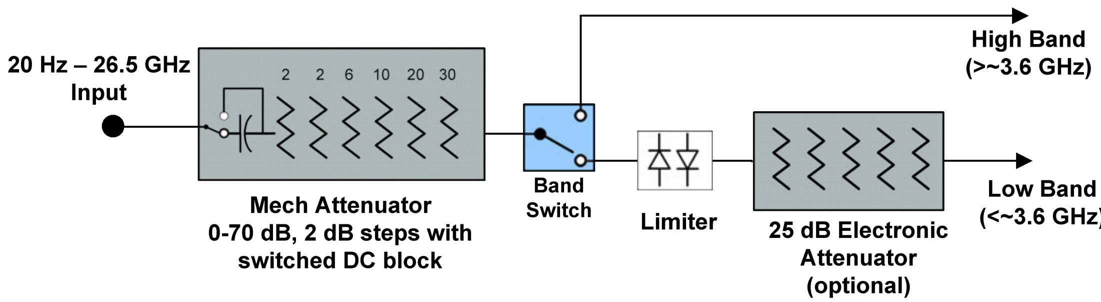
– M9393A

This tab also does not appear in UXM. In UXM all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

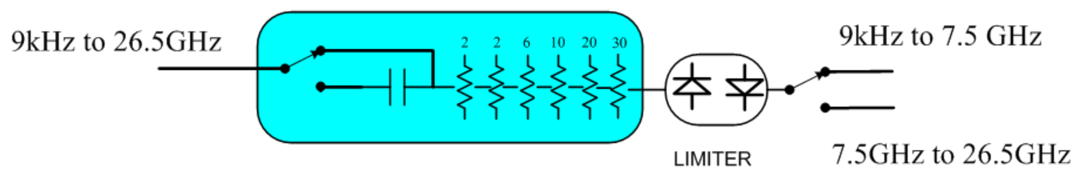
Dependencies	In measurements that support the I/Q inputs, this tab is unavailable when I/Q is the selected input, and is replaced by the Range tab in that case

Dual-Attenuator Configurations

Configuration 1: Mechanical attenuator + optional electronic attenuator

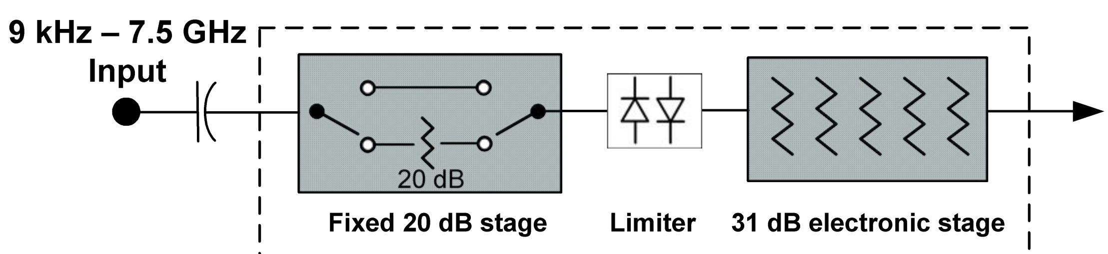


Configuration 2: Mechanical attenuator, no optional electronic attenuator

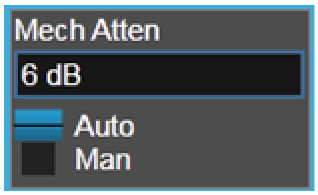


(note that Configuration 2 is not strictly speaking a dual-section attenuator, since there is no electronic section available. However, it behaves exactly like Configuration 1 without the Electronic Attenuator option EA3, therefore for the sake of this document it is grouped into the "Dual-Attenuator" configuration)

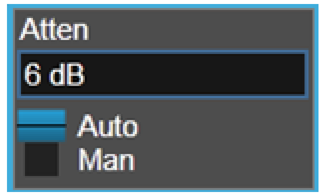
Single-Attenuator Configuration



You can tell which attenuator configuration you have by pressing the Attenuation tab, which (in most Modes) opensthe Attenuation menu. If the first control in the Attenuation menu says **Mech Atten** you have the Dual-Attenuator configuration. If the first control says **Atten** you have the Single-Attenuator configuration.



Dual Attenuator



Single Attenuator

(Note that depending on the measurement, there may be no Auto/Man functionality on the Mech Atten control).

In the Single-Attenuator configuration, youcontrol the attenuation with a single control, as the fixed stage has only two states. In the Dual-Attenuator configuration, both stages have significant range so you are given separate control of the mechanical and electronic attenuator stages.

When you have the Dual-Attenuator configuration, you may still have only a Single-Attenuator, because unless option EA3 (the Electronic Attenuator option) is available, and you purchase it, you will have only the mechanical attenuator.

Full Range Atten

The **Full Range Atten** control and **Attenuator Summary** only appear in N9041B, when the RF input is selected and the RF Input Port is set to RF Input 2, and the Full Range Attenuator is installed. The Full Range Attenuator adds a second input attenuator at the beginning of the RF Input 2, which enhances the protection and optimizes the performance of the extra internal mixers used by RF Input 2.

Remote Command	[:SENSe]:POWer[:RF]:FRATten <rel_ampl> [:SENSe]:POWer[:RF]:FRATten?
Example	:POW:FRAT 14 :POW:FRAT?
Notes	When you enter an amplitude value that falls between valid values, the value will be incremented to the next smallest valid value
Dependencies	Only appears if input RF is selected, and RF Input Port 2 is selected, and the Full Range Attenuator exists
Couplings	This value is never changed by any coupling, however other couplings use this value. See the **Reference Level** and "Mech Atten" on page 1750 command descriptions
Preset	20 dB
State Saved	Saved in instrument state
Min	0 dB
Max	Only valid values are 0, 6, 14, 20 dB
Annotation	When the Input is RF, and the Input Port is RF Input 2, and the Full Range Attenuator is installed: On the Meas Bar, the field "Atten" displays as follows:

- If the sweep is entirely < 50 GHz, the value shown after “Atten:” is equal to Mech Atten + Elec Atten + Full Range Atten
- If the sweep is entirely > 50 GHz, the value shown after “Atten:” is equal to Full Range Atten
- If the sweep straddles 50 GHz, the value shown after “Atten:” is preceded by the symbol “>=” and is equal to Full Range Atten

In the **Amplitude**, "Attenuation" on page 1747 menu, and the Atten Meas Bar dropdown menu panel, a summary is displayed as follows:

“Total Atten below 50 GHz” followed by the value of Full Range Atten + Mech Atten + Elec Atten

“Total Atten above 50 GHz” followed by the value of Full Range Atten

For example, if Mech Atten = 6 dB, Elec Atten = 4 dB, and Full Range Atten = 20 dB, the summary below is shown:

- Attenuator summary:
- Total Atten below 50 GHz: 30 dB
- Total Atten above 50 GHz: 20 dB

Mech Atten

This control is labeled **Mech Atten** in Dual-Attenuator models and **Atten** in Single-Attenuator models. In the Dual-Attenuator configuration, this control only affects the mechanical attenuator.

This control lets you modify the attenuation applied to the RF input signal path. This value is normally auto coupled to the Ref Level, the Internal Preamp Gain, any External Gain that is entered, and the Max Mixer Level, as described in the table below.

See "Attenuator Configurations and Auto/Man" on page 480

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation <rel_ampl>`
	`[:SENSe]:POWer[:RF]:ATTenuation?`
	`[:SENSe]:POWer[:RF]:ATTenuation:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:POWer[:RF]:ATTenuation:AUTO?`

Example	`:POW:ATT 20`
	Dual-Attenuator configuration: sets the mechanical attenuator to 20 dB
	Single-Attenuator mode: sets the main attenuation to 20 dB (see below for definition of “main” attenuation)
	In either case, if the attenuator was in Auto, it is set to Manual
	`:POW:ATT:AUTO ON`
	Turn Auto Mech Atten ON

Dependencies	Some measurements do not support the Auto setting of "Mech Atten" on page 478. In these measurements, the Auto/Man selection is not available, and the Auto/Man toggle function is not

	available In Dual-Attenuator configurations, when the electronic attenuator is enabled, the mechanical attenuator has no auto setting and the Auto/Man toggle function is not available. The state of Auto/Man is remembered and restored when the electronic attenuator is once again disabled. This is described in more detail in "Elec Atten" on page 1753 See "Attenuator Configurations and Auto/Man" on page 480 for more information on the Auto/Man functionality `:POW:ATT:AUTO` is only available in measurements that support Mech Atten Auto, such as Swept SA
Couplings	If the RF Input Port is the RF Input: – If the USB Preamp is connected to USB, use 0 dB for Mech Atten – Otherwise compute the auto-selected value of Mech Atten based on **Reference Level**, Int Preamp, External Gain, Ref Level Offset, Max Mixer Level, µW Path Control and IF Gain settings. Limit this value to be no less than 6 dB (total attenuation below 6 dB can never be chosen by Auto) – In the N9041B, if the RF Input Port is RF Input 2, use the formula above and subtract the Full Range Atten value from the result to determine the Mech Atten. Limit the value so that it is never lower than 0 dB and so that total attenuation, including Full Range Atten, is never less than 6 dB (total attenuation, including Full Range Atten below 6 dB, can never be chosen by Auto) In External Mixingand BBIQ, where the Attenuator is not in the signal path, the Attenuator setting changes as described above when "Mech Atten" on page 478 is in Auto, but no changes are made to the actual attenuator hardware setting until the input is changed back to the RF Input For CXA-m with option FSA (Fine-Step Attenuator or 2 dB steps), the FSA-like behavior is only available when the frequency setting is <= 7.5GHz. So, when the frequency is changed from below 7.5GHz to above 7.5GHz, the attenuation setting will be changed to a multiple of 10dB which will be no smaller than the previous setting. For example, 4dB attenuation will be changed to 10dB
Preset	The preset for Mech Attenuation is "Auto" The Auto value of attenuation is 10 dB `ON`
State Saved	Saved in instrument state
Min	0 dB The attenuation set by this control cannot be decreased below 6 dB with the knob or step keys. Values below 6 dB must be directly entered from the keypad or via SCPI. This protects against setting a dangerously small attenuation value, which can put the instrument at risk of damage to input circuitry. If the current mechanical attenuation is below 6 dB, it can be increased with the knob and step keys, but not decreased
Max	CXA Option 503 or 507: 50 dB EXA: 60 dB All other models: 70 dB Note that in the Single-Attenuator configuration, the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB.
Annotation	The current value for Total Atten is displayed in the Measurement Bar at the top of the display. A value appears for Electronic Attenuation only if the Electronic Attenuator is enabled. The annotation appears as Atten: <total> dB (e<elec>)

The e letter is in amber in Single-Attenuator configurations

For example:

Dual-Attenuator configuration:

Atten: 24 dB (e14)

Indicating the total attenuation is at 24 dB and the electronic attenuation is at 14 dB

Single-Attenuator configuration:

A: 24 dB (e14)

Indicating the total attenuation is at 24 dB and the “soft” attenuation is at 14 dB (see below for definition of “soft” attenuation)

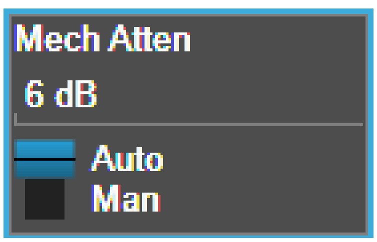
When in Manual, a # sign appears in front of Atten in the annotation

Attenuator Configurations and Auto/Man

As described in "Attenuation" on page 1747 , there are two distinct attenuator configurations available in the X-Series, the single attenuator and Dual-Attenuator configurations. In Dual-Attenuator configurations, we have the mechanical attenuation and the electronic attenuation, and the current total attenuation is the sum of the electronic + mechanical attenuation. In Single-Attenuator configurations, we refer to the attenuation set using "Mech Atten" on page 478 (or `:POW:ATT`) as the “main” attenuation; and the attenuation that is set by `:POW:EATT` as the “soft” attenuation (`:POW:EATT` is honored even in the Single-Attenuator configuration, for compatibility purposes). Then the current total attenuation is the sum of the main + soft attenuation. See "Elec Atten" on page 1753 for more on “soft” attenuation.

NOTE

In some measurements, the **Mech Atten** control has an Auto/Man function. In these measurements, an Auto/Man switch is shown on the **Mech Atten** control:



Note that in configurations that include an Electronic Attenuator, this switch is only shown when the Electronic Attenuator is disabled.

In other measurements, **Mech Atten** has no Auto/Man function. In these measurements, no switch is shown on the **Mech Atten** control:

Mech Atten also appears with no switch, as above, in configurations that include an Electronic Attenuator but when the Electronic Attenuator is enabled.

Elec Atten

Controls the Electronic Attenuator in Dual-Attenuator configurations. This control does not appear in Single-Attenuator configurations, as the control of both the mechanical and electronic stages of the Single-Attenuator is integrated into the single **Atten** control.

This control includes an Enable/Disable toggle switch; it is only possible to enter a value for the Electronic Attenuator when this switch is in the "Enable" position.

See "More Information" on page 482

Remote Command	`[:SENSe]:POWer[:RF]:EATTenuation <rel_ampl>`
	`[:SENSe]:POWer[:RF]:EATTenuation?`
	`[:SENSe]:POWer[:RF]:EATTenuation:STATe OFF | ON | 0 | 1`
	`[:SENSe]:POWer[:RF]:EATTenuation:STATe?`

Example	`:POW:EATT 10`
	`:POW:EATT?`
	`:POW:EATT:STAT ON`
	`:POW:EATT:STAT?`

Notes	Electronic Attenuation's specification is defined only when Mechanical Attenuation is 6 dB
Dependencies	This control only appears in Dual-Attenuator models with an Electronic Attenuator installed and licensed. It does not appear in models with the Single-Attenuator configuration, as in the Single-Attenuator configuration there is no "electronic attenuator" there is only a single integrated attenuator (which has both a mechanical and electronic stage). However, in the Single-Attenuator configuration, EATT SCPI commands are accepted for compatibility with other X-series instruments and set a "soft" attenuation as described in . The "soft" attenuation is treated as an addition to the "main" attenuation value set by the Atten control or the POW:ATT SCPI command and affects the total attenuation displayed on the Atten control and the Meas Bar The electronic attenuator (and the "soft" attenuation function provided in Single-Attenuator configurations) is unavailable above the low band (0-3.6 GHz, 0-3.4 GHz 0-3GHz, depending on the model). If the low band ranges from 0-3.6GHz, and Stop Frequency of the instrument is > 3.6 GHz, then the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed out If the Internal Preamp is on, meaning it is set to Low Band or Full, the electronic attenuator (and the "soft" attenuation function provided in Single-Attenuator configurations) is unavailable. In this case the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed out If either of the above is true, if the SCPI command is sent, an error indicating that the electronic attenuator is unavailable will be sent If both of the above are true, pressing the control will generate error message -221, in other words, the frequency range lockout takes precedence If the electronic/soft Attenuator is enabled, then the Stop Freq of the instrument is limited to 3.6 GHz and the Internal Preamp is unavailable The SCPI-only "soft" electronic attenuation for the single-attenuator configuration is not available in all measurements; in particular, it is not available in the Swept SA measurement

Couplings	Enabling and disabling the Electronic Attenuator affects the setting of the Mechanical Attenuator (in Dual-Attenuator configurations). This is described in more detail below and in the section "Attenuator Configurations and Auto/Man" on page 1752
Preset	OFF (Disabled) for Swept SA measurement ON (Enabled) for all other measurements that support the electronic attenuator
State Saved	Saved in instrument state
Min	0 dB
Max	Dual-Attenuator configuration: 24 dB Single-Attenuator configuration: the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB
Annotation	See Annotation under the **Mech Atten** control description

More Information

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear. These advantages primarily aid in remote operation and are negligible for front panel use. See "Using the Electronic Attenuator: Pros and Cons" on page 483 for a detailed discussion of the pros and cons of using the electronic attenuator.

For the Single-Attenuator configuration, for SCPI backwards compatibility, the “soft” attenuation feature replaces the Dual-Attenuator configuration’s electronic attenuator. All the same couplings and limitations apply. See "Attenuator Configurations and Auto/Man" on page 1752

Mechanical Attenuator Transition Rules

When the Electronic Attenuator is enabled, the Mechanical Attenuator transitions to a state that has no Auto function. Below are the rules for transitioning the Mechanical Attenuator. Note that the information below ONLY applies to the Dual-Attenuator configurations, and ONLY when the Electronic Attenuator is installed:

When the Electronic Attenuation is enabled from a disabled state:

The Mechanical Attenuator is initialized to 10 dB (this is its optimal performance setting). You can then set it as desired with SCPI, numeric keypad, step keys, or knob, and it behaves as it normally would in manual mode

The Auto/Man state of (Mech) Atten is saved

The Auto/Man toggle on the (Mech) Atten control disappears and the auto rules are disabled

The Electronic Attenuator is set to 10 dB less than the previous value of the Mechanical Attenuator, within the limitation that it must stay within the range of 0 to 24 dB of attenuation

Examples in the Dual-Attenuator configuration:

Mech Atten at 20 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 10 dB. New total attenuation equals the value before Elec Atten enabled

Mech Atten at 0 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 0 dB. New total attenuation does not equal the value before Elec Atten enabled

Mech Atten at 40 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 24 dB. New total attenuation does not equal the value before Elec Atten enabled

When the Electronic Attenuation is disabled from an enabled state:

The Elec Atten control is grayed out

- The Auto/Man state of (Mech) Atten is restored

If now in Auto, (Mech) Atten recouples

If now in Man, (Mech) Atten is set to the value of total attenuation that existed before the Elec Atten was disabled. The resulting value is rounded up to the smallest value possible given the (Mech) Atten Step setting - (That is, 57 dB changes to 58 dB when (Mech) Atten Step is 2 dB)

Using the Electronic Attenuator: Pros and Cons

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear.

The “finer steps” advantage of the electronic attenuator is beneficial in optimizing the alignment of the instrument dynamic range to the signal power in the front panel as well as remote use. Thus, you can achieve improved relative signal measurement accuracy. Compared to a mechanical attenuator with 2 dB steps, the 1 dB resolution of the electronic attenuator only gives better resolution when the odd-decibel steps are used. Those odd-decibel steps are less accurately calibrated than the even-decibel steps, so one tradeoff for this superior relative accuracy is reduced absolute amplitude accuracy.

Another disadvantage of the electronic attenuator is that the spectrum analyzer loses its “Auto” setting, making operation less convenient.

Also, the relationship between the dynamic range specifications (TOI, SHI, compression, and noise) and instrument performance are less well-known with the electrical attenuator. With the mechanical attenuator, TOI, SHI, and compression threshold levels increase dB-for-dB with increasing attenuation, and the noise floor does as well. With the electronic attenuator, there is an excess attenuation of about 1 to 3 dB between 0 and 3.6 GHz, making the effective TOI, SHI, and so forth, less well known. Excess attenuation is the actual attenuation relative to stated attenuation. Excess attenuation is accounted for in the instrument calibration

Mech Atten Step

Controls thestep size used when making adjustments to the input attenuation.

This control is labeled **Mech Atten Step** in Dual-Attenuator models and **Atten Step** in Single-Attenuator models. In the Dual-Attenuator configuration, this control only affects the step size of the mechanical attenuator.

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement] 10 dB | 2 dB` `[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement]?`
Example	`:POW:ATT:STEP 2` `:POW:ATT:STEP?`
Notes	This feature has a toggle choice from the front panel, but it takes a specific value (in dB) when used remotely. The only valid values are 2 and 10
Dependencies	Blanked in EXA, CXA and CXA-m if option FSA (2 dB steps) is not present. If blanked, attempts to set it via SCPI yield an error
Couplings	When the attenuation step size changes, the current mechanical attenuation value is adjusted (if necessary) to be quantized to the new step size. That is, if step is set to 10 dB, mech atten is increased if necessary so it is a multiple of 10 dB
Preset	EXA, CXA and CXA-m: 10 dB (2 dB with option FSA) All other models: 2 dB
State Saved	Saved in instrument state

3.4.3.3 Range (Baseband Input models)

This tab is only available when Option BBA is present (I/Q Baseband Inputs), the current measurement supports option BBA, and I/Q is the selected input. It replaces the Attenuation tab in that case.

Each input channel (I and Q) has four internal gain ranges. The maximum allowed voltage in each gain range is slightly more than the nominal value, so the break point between ranges is a few millivolts higher than the nominal (setting a peak voltage of 0.502 mV will still map to the 0.5 V Peak range).

Gain Setting	Volts RMS	Volts Peak	Volts Peak - Peak	dBm (50Ω)	Break Point
0 dB	0.7071	1.0	2.0	10	n/a
6 dB	0.3536	0.5	1.0	4	0.502 V Peak
12 dB	0.1768	0.25	0.5	-2	0.252 V Peak
18 dB	0.0884	0.125	0.25	-8	0.127 V Peak

Dependencies	Available only when the selected input is I/Q. If the current measurement does not support baseband inputs, an error will be displayed: “No result; Meas invalid with I/Q inputs”
State Saved	No

Range Auto/Man

The Auto setting for Range causes the range to be set based on the Y Scale settings. When Range is “Auto”, the I & Q Range are set based on the top of the Y Scale when the Y scale is in dB units (for example, power), or to the max(abs(top), abs(bottom)) when the Y scale reference is not at the top of the screen.

Not all measurements support **Range Auto/Man**. If Auto is not supported in the current measurement, this control is grayed-out displaying “Man”, and `MAN` is returned to a SCPI query, but this does *not* change the Auto/Man setting for Range. When you switch to a measurement that supports Auto, it goes back to Auto if it was previously in Auto mode.

Remote Command	`[:SENSe]:VOLTage:IQ:RANGe:AUTO OFF | ON | 0 | 1` `[:SENSe]:VOLTage:IQ:RANGe:AUTO?`

Example	Put the I Range and Q Range in manual.
	`:VOLT:IQ:RANG:AUTO OFF`
	`:VOLT:IQ:RANG:AUTO?`

Dependencies	If Auto is not supported, sending the SCPI command generates an error
Couplings	When in Auto, both I Range and Q Range are set to the same value, computed as follows: Maximum absolute value is computed for the Y Scale. The top and bottom of the graph are computed based on Ref Value, Scale/Div, and Ref Position. Formula: Y_{Max} = max(abs(top), abs(bottom)) The I Range and Q Range are then set to Y_{Max}
Preset	`ON`
State Saved	Saved in instrument state
Annotation	When in Man, the Range annotation is preceded by "#"

This is an alternate form of the command to match the `POWer` form of the I Range and Q Range SCPI.

Remote Command	`[:SENSe]:POWer:IQ:RANGe:AUTO OFF | ON | 0 | 1` `[:SENSe]:POWer:IQ:RANGe:AUTO?`

Example	Put the I Range and Q Range in manual
	`:POW:IQ:RANG:AUTO OFF`
	`:POW:IQ:RANG:AUTO?`

Notes	`:POW:IQ:RANG:AUTO` is an alternate form of `:VOLT:IQ:RANG:AUTO`, to maintain consistency with I Range and Q Range, which support both the `POWer` and `VOLTage` forms of the command
Preset	`ON`
Range	Auto | Man

I Range

The internal gain range for the I channel when the Input Path is I Only or I and I/Q. Used for both the I and Q channels when the Input Path is I+jQ.

Remote Command	`[:SENSe]:VOLTage:IQ[:I]:RANGe[:UPPer] <voltage>` `[:SENSe]:VOLTage:IQ[:I]:RANGe[:UPPer]?`

Example	Set the I Range to 0.5 V Peak
	`:VOLT:IQ:RANG 0.5 V`
	`:VOLT:IQ:RANG?`

Notes	The numeric entries are mapped to the smallest gain range whose break point is greater than or equal to the value, or 1 V Peak if the value is greater than 1 V
Couplings	When "Q Same as I" on page 1580 is On, the **I Range** value will be copied to "Q Range" on page 1578 Changing the value also sets Range = Man
Preset	1 V Peak
State Saved	Saved in instrument state
Range	1 V Peak (10 dBm @ 50 Ω) | 0.5 V Peak (4 dBm @ 50Ω) | 0.25 V Peak (-2 dBm @ 50Ω) | 0.125 V Peak (-8 dBm @ 50Ω)
Min	0.125 V
Max	1 V
Annotation	The Range annotation replaces the RF Input context's "Atten" annotation "Rng: <I Range>". When Range = Man the annotation is preceded by "#" The I Range is not annotated in Input Path Q Only. When I Range and Q Range are the same, the annotation is "Rng: <Range>". When I Range and Q Range are different and the Input Path is Ind I/Q, the annotation is "Rng: <I Range>, <Q Range>" and "Peak" is removed from the text. Examples: "Rng: 1 V Peak" the I Range is 1 V Peak "Rng: 1 V, 0.5 V " the I Range is 1 V Peak and the Q Range is 0.5 V Peak

This is an alternate form of the command to allow entry as a power.

Remote Command	`[:SENSe]:POWer:IQ[:I]:RANGe[:UPPer] <ampl>` `[:SENSe]:POWer:IQ[:I]:RANGe[:UPPer]?`

Example	Set the I Range to 0.5 V Peak when Reference Z is 50 Ω, and to 1.0 V Peak when Reference Z is 75 **Ω**
	`:POW:IQ:RANG 4 dBm`
	`:POW:IQ:RANG?`

Notes	The `POWer` form of the command is provided for convenience. It maps to the same underlying gain range parameter as the `VOLTage` form of the command The Reference Z (not the I channel Input Z) is used to convert the power to peak voltage, which is then used to set the I Range as with the `VOLTage` form of the command. The power values of the 4 range states (1V Peak, 0.5V Peak, 0.25V Peak, and 0.125V Peak) will vary with Reference Z. Here are some examples:

	50 Ω: 10, 4, -2, -8 75 Ω: 8.2, 2.2, -3.8, -9.8 600 Ω: -0.8, -6.8, -12.8, -18.9
Preset	10.0 dBm
Range	-20 dBm to 10 dBm
Min	-20 dBm
Max	10 dBm

Q Range

The internal gain range for the Q channel.**Q Range** only applies to Input Path Q Only and Ind I/Q. For input I+jQ "I Range" on page 1577 determines both I and Q channel range settings.

Remote Command	`[:SENSe]:VOLTage:IQ:Q:RANGe[:UPPer] <voltage>` `[:SENSe]:VOLTage:IQ:Q:RANGe[:UPPer]?`

Example	Set the Q Range to 0.5 V Peak:
	`:VOLT:IQ:Q:RANG 0.5 V`
	`:VOLT:IQ:Q:RANG?`

Notes	The numeric entries are mapped to the smallest gain range whose break point is greater than or equal to the value, or 1 V Peak if the value is greater than 1 V **Q Range** is only used for Input Path Q Only and Ind I/Q. For input I+jQ, "I Range" on page 1577 determines both I and Q channel range settings
Couplings	When "Q Same as I" on page 1580 is On, the "I Range" on page 1577 value is copied to **Q Range** and the range value keys are disabled Changing the value also sets Range = Man
Preset	1 V Peak
State Saved	Saved in instrument state
Range	1 V Peak (10 dBm @ 50Ω) | 0.5 V Peak (4 dBm @ 50Ω) | 0.25 V Peak (-2 dBm @ 50Ω) | 0.125 V Peak (-8 dBm @ 50Ω)
Min	0.125 V
Max	1 V
Annotation	The Range annotation replaces the RF Input context's "Atten" annotation "Rng: <Q Range>". When Range = Man the annotation is preceded by "#" The Q Range is not annotated in Input Path I Only or I+jQ. When I Range and Q Range are the same, the annotation is "Rng: <Range>". When I Range and Q Range are different and the Input Path is Ind I/Q, the annotation is "Rng: <I Range>, <Q Range>" and "Peak" is removed from the text. Examples: "Rng: 1 V Peak" the Q Range is 1 V Peak "Rng: 1 V, 0.5 V " the I Range is 1 V Peak and the Q Range is 0.5 V Peak

This is an alternate form of the command to allow entry as a power.

Remote Command	[:SENSe]:POWer:IQ:Q:RANGe[:UPPer] <ampl> [:SENSe]:POWer:IQ:Q:RANGe[:UPPer]?
Example	Sets the Q Range to 0.5 V Peak when Reference Z is 50 Ω, and to 1.0 V Peak when Reference Z is 75 Ω: :POW:IQ:Q:RANG 4 dBm :POW:IQ:Q:RANG?
Notes	The POWer form of the command is provided for convenience. It maps to the same underlying gain range parameter as the VOLTage form of the command The Reference Z (not the Q channel Input Z) is used to convert the power to peak voltage, which is then used to set the Q Range as with the VOLTage form of the command. The power values of the 4 range states (1V Peak, 0.5V Peak, 0.25V Peak, and 0.125V Peak) will vary with Reference Z. Here are some examples: 50 Ω: 10, 4, -2, -8 75 Ω: 8.2, 2.2, -3.8, -9.8 600 Ω: -0.8, -6.8, -12.8, -18.9
Preset	10.0 dBm
Range	-20 dBm to 10 dBm
Min	-20 dBm
Max	10 dBm

Q Same as I

Many, but not all, usages require the I and Q channels to have an identical setup. To simplify channel setup, **Q Same as I** causes the Q channel range to be mirrored from the I channel. That way you only need to set up one channel (the I channel). The I channel values are copied to the Q channel, so at the time **Q Same as I** is Off, the I and Q channel setups will be identical.

Remote Command	[:SENSe]:VOLTage|POWer:IQ:MIRRored OFF | ON | 0 | 1 [:SENSe]:VOLTage|POWer:IQ:MIRRored?
Example	Turn off the mirroring of I Range to Q Range. :VOLT:IQ:MIRR OFF :POW:IQ:MIRR OFF
Couplings	When ON, the "I Range" on page 1577 value is mirrored (copied) to the "Q Range" on page 1578
Preset	ON
State Saved	Saved in instrument state
Range	OFF|ON

3.4.3.4 Range (Non-attenuator models)

This tab is only available for Keysight’s modular signal analyzers and certain other Keysight products. Examples include:

- VXT
- E7760
- M9391A
- M9393A

This tab also does not appear in UXM. In UXM, all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

State Saved	No

Range

Represents the amplitude of the largest sinusoidal signal that could be present within the IF without being clipped by the ADC. For signals with high peak-to-average ratios, the range may need to exceed the rms signal power by a significant amount to avoid clipping.

This is a measurement global setting.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe <real>` `[:SENSe]:POWer[:RF]:RANGe?`
Example	`:POW:RANG 10 dBm` `:POW:RANG?`
Notes	The MIN and MAX values are affected by the External Gain parameters, and by the **Center Frequency** The hardware compensates for frequency response and alters the Range setting
Preset	0 dBm
State Saved	Yes
Min	-100
Max	100
Annotation	Meas Bar

Adjust Range for Min Clipping

Sets the combination of attenuation and gain based on the current measured signal level so that clipping will be at a minimum.

This is an "immediate action" function, that is, it executes once, when the key is pressed.

This key does not appear in measurements that do not support this functionality.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate`

Notes	Executing Adjust Range for Min Clipping initiates the measurement
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760

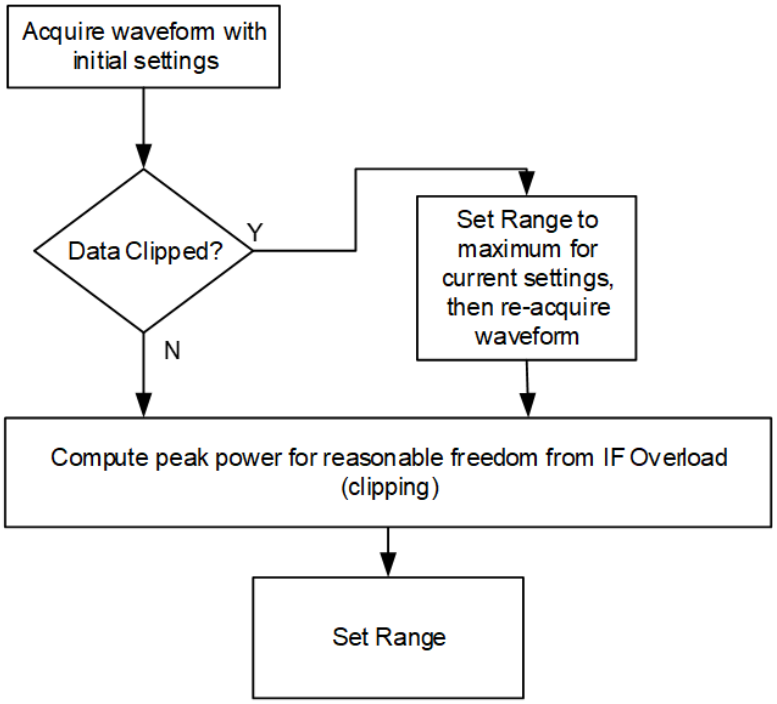
Pre-Adjust for Min Clipping

If this function is ON, it applies the adjustment described under Adjust Range For Min Clipping each time a measurement restarts. Therefore, in Continuous measurement mode, it only executes before the first measurement.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation OFF | ON | ELECtrical | COMBined` `[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation?`
Notes	Because there is no attenuator control available in these models, the control displays only ON and OFF choices. However, for SCPI compatibility with other platforms, all three parameters (ELECtrical, COMBined, and ON) are honored and all are mapped to ELECtrical, so if any of these three parameters is sent, a subsequent query will return ELEC
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760
Preset	OFF for Swept SA measurement; ON for all other measurements that support **Pre-Adjust for Min Clipping**
State Saved	Saved in instrument state

Adjustment Algorithm

The algorithm for the adjustment is documented below:



Peak-to-Average Ratio

Used with "Range (Non-attenuator models)" on page 1864 to optimize the level control in the instrument. The value is the ratio, in dB, of the peak power to the average power of the signal to be measured. A ratio of 0 should be used for sinusoidal signals; for 802.11g OFDM signals use 9 dB.

All Applications (Modes) show the current value of Peak-to-Average ratio on the control. However, some applications do not permit changing the value. In these situations, the control is grayed-out.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:PARatio <real>` `[:SENSe]:POWer[:RF]:RANGe:PARatio?`
Example	`:POW:RANG:PAR 12 dB`
Notes	In some Applications (Modes) this parameter is read-only; meaning the value will appear on the control and query via SCPI, but is not changeable. In such applications the control is grayed-out. Attempting to change the value via SCPI will be ignored but no error message will be generated
Dependencies	This control does not appear in Spectrum Analyzer Mode
Preset	10 dB VXT Models M9410A/11A: 0 dB
State Saved	Saved in instrument state
Min	0 dB
Max	20 dB VXT Models M9410A/11A: 50 dB

Mixer Lvl Offset

This is an advanced setting to adjust target Range at the input mixer, which in turn affects the signal level in the instrument's IF. This setting can be used when additional optimization is needed after setting "Peak-to-Average Ratio" on page 1866. Positive values of offset optimize noise performance over distortion, negative values optimize distortion performance over noise.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet <real>` `[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet?`
Example	`:POW:RANG:MIX:OFFS -5 dB`
Preset	0 dB
State Saved	Saved in instrument state
Min	-35 dB VXT Models M9410A/11A: -34 dB
Max	30 dB

3.4.3.5 Signal Path

Contains controls that pertain to the routing of the signal through the frontend of the instrument.

In general, this tab only appears in instruments whose hardware supports this signal routing. For example, this tab does not appear in many of the modular instrument products, including VXT Models M9420/21A. It also does not appear in UXM.

This tab *does* appear in VXT Models M9410A/11A because the Software Preselection control is in this tab, and VXT Models M9410A/11A implement a version of Software Preselection.

Presel Center

Pressing this control adjusts the centering of the preselector filter to optimize the amplitude accuracy at the frequency of the selected marker. If the selected marker is not on when **Presel Center** is pressed, the instrument turns on the selected marker, performs a peak search, and then performs centering on the marker's center frequency. If the selected marker is already on and between the start and stop frequencies of the instrument, the instrument performs the preselector calibration on that marker's frequency. If the selected marker is already on, but outside the frequency range between Start Freq and Stop Freq, the instrument first performs a peak search, and then performs centering on the marker's center frequency.

The value displayed on "Preselector Adjust" on page 1869 will change to reflect the new preselector tuning.

A number of considerations should be observed to ensure proper operation. See "Proper Preselector Operation" on page 493.

Remote Command	`[:SENSe]:POWer[:RF]:PCENter`
Example	`:POW:PCEN`
Notes	Note that the rules outlined above under the control description apply for the remote command as well as the key. The result of the command is dependent on marker position, etc. Any message shown by the control press is also shown in response to the remote command
Dependencies	Does not appear in CXA-m Does not appear in VXT Models M9410A/11A Grayed-out if the microwave preselector is off – If the selected marker's frequency is below Band 1, an advisory message is generated "Preselector not used in this frequency range" and no action is taken – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz – Blank in models that do not include a preselector, such as option 503. If the remote command is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View
Couplings	The active marker position determines where the centering will be attempted If the instrument is in a measurement such as averaging when centering is initiated, the act of centering the preselector restarts averaging, but the first average trace will not be taken until the centering is completed The offset applied to do the centering reads out on the "Preselector Adjust" on page 1869 control
Status Bits/OPC dependencies	When centering the preselector, `*OPC` will not return true until the process is complete and a subsequent measurement has completed, nor will results be returned to `:READ` or `:MEASure` queries The Measuring bit should remain set while this command is operating and should not go false until the subsequent sweep/measurement has completed

Proper Preselector Operation

A number of considerations should be observed to ensure proper operation:

1 If the selected marker is off, the instrument turns on a marker, performs a peak search, and adjusts the preselector using the selected marker's frequency. It uses the "highest peak" peak search method unqualified by threshold or excursion, so that there is no chance of a 'no peak found' error. It continues with that peak, even if it is the peak of just noise. Therefore, for this operation to work properly, there should be a signal on screen in a preselected range for the peak search to find

2 If the selected marker is already on, the instrument attempts the centering at that marker's frequency. There is no preselector for signals below about 3.6 GHz, so if the marker is on a signal below 3.6 GHz, no centering will be attempted and an advisory message generated

3 In some models, the preselector can be bypassed. If it is bypassed, no centering will be attempted in that range and a message will be generated

Preselector Adjust

Allows you to manually adjust the preselector filter frequency to optimize its response to the signal of interest. This function is only available when "Presel Center" on page 1868is available.

For general purpose signal analysis, using **Presel Center** is recommended. Centering the filter minimizes the impact of long-term preselector drift. **Preselector Adjust** can be used instead to manually optimize the preselector. One application of manual optimization would be to peak the preselector response, which both optimizes the signal-to-noise ratio and minimizes amplitude variations due to small (short-term) preselector drifting.

When **Presel Center** is performed, the offset applied to do the centering becomes the new value of **Preselector Adjust**.

Remote Command	`[:SENSe]:POWer[:RF]:PADJust <freq>` `[:SENSe]:POWer[:RF]:PADJust?`
Example	`:POW:PADJ 100KHz` `:POW:PADJ?`
Notes	The value on the control reads out to 0.1 MHz resolution
Dependencies	– Does not appear in CXA-m – Does not appear in VXT Models M9410A/11A – Grayed-out if microwave preselector is off – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz – Blank in models that do not include a preselector, such as option 503. If the SCPI is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View
Preset	0 MHz
State Saved	The **Preselector Adjust** value set by "Presel Center" on page 1868, or by manually adjusting **Preselector Adjust** It is not saved in instrument state, and does not survive a Preset or power cycle
Min	-500 MHz
Max	500 MHz
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PADJust` `[:SENSe]:POWer[:RF]:MMW:PADJust`

Notes	PSA had multiple preselectors, and you could select which preselector to adjust. Since the X-Series has only one mm/uW preselector, the preselector selection control is no longer available. However, to provide backward compatibility, we accept the legacy remote commands The command form has no effect, the query always returns `MWAVe`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:PADJust:PRESelector MWAVe | MMWave | EXTernal` `[:SENSe]:POWer[:RF]:PADJust:PRESelector?`

Internal Preamp

Accesses a menu of controls for the internal preamps. Turning on the preamp gives a better noise figure, but a poorer inter-modulation distortion (TOI) to noise floor dynamic range. You can optimize this setting for your particular measurement.

The instrument takes the preamp gain into account as it sweeps. If you sweep outside of the range of the preamp, the instrument will also account for that. The displayed result always reflects the correct gain.

For some measurements, when the preamp is on and any part of the displayed frequency range is below the lowest frequency for which the preamp has specifications, a warning condition message appears in the status line. For example, for a preamp with a 9 kHz lowest specified frequency: "Preamp: Accy unspec'd below 9 kHz".

Selection	Example	Note
Off	`:POW:GAIN OFF`	
Low Band	`:POW:GAIN ON` `:POW:GAIN:BAND LOW`	Sets the internal preamp to use only the low band. The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Low Band selection in the dropdown
Full Range	`:POW:GAIN ON` `:POW:GAIN:BAND FULL`	Sets the internal preamp to use its full range. The low band (0-3.6 GHz, 0-3.4 GHz, 0-3GHz, depending on the model) is supplied by the low band preamp and the frequencies above low band are supplied by the high band preamp The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Full Range selection in the dropdown. If the high band option is not installed the Full Range selection does not appear

Remote Command	`[:SENSe]:POWer[:RF]:GAIN:BAND LOW | FULL` `[:SENSe]:POWer[:RF]:GAIN:BAND?`

	[:SENSe]:POWer[:RF]:GAIN[:STATe] OFF | ON | 0 | 1 [:SENSe]:POWer[:RF]:GAIN[:STATe]?
Example	:POW:GAIN:BAND LOW :POW:GAIN:BAND? :POW:GAIN OFF :POW:GAIN?
Dependencies	Preamp is not available on all hardware platforms. If the preamp is not present or is unlicensed, the control is not shown Does not appear in VXT Models M9410A/11A/15A If :POW:GAIN:BAND FULL is sent when a low band preamp is available, the preamp band parameter is set to LOW instead of FULL, and an "Option not installed" message is generated The preamp is not available when the electronic/soft attenuator is enabled
Preset	LOW OFF
State Saved	Saved in instrument state
Annotation	When the USB Preamp is not connected to USB, the Preamp annotation in the Meas Bar says “Off” if the preamp is off and displays the frequency range of the low band or full range preamp depending on the setting. For example, if the Preamp is set to Low Band and the Low Band is 3.6 GHz the annotation says “3.6 GHz”. If it is a 13.6 GHz preamp and it is set to Full Range the annotation says “13.6 GHz” When the USB Preamp is connected to USB, the Preamp annotation says “Preamp: USB” if the internal preamp is off or “Preamp: USB, Int” if the internal preamp is on (only for measurements that support the USB preamp)

LNA

Lets you turn the Low Noise Amplifier (**LNA**) on or off.

The LNA is an additional preamplifier that provides superior DANL and frequency range compared to the Internal Preamp. The LNA provides lower system noise figure, especially at frequencies above 100 MHz, and can be operated up to the full range of 50 GHz instruments.

For best possible sensitivity, the LNA can be turned on together with the "Internal Preamp" on page 1870, although if you operate both preamps together, note that the TOI (distortion) specifications are impacted. The sensitivity improvement of this combination is substantial when operating in high band (frequencies above 3.6 GHz).

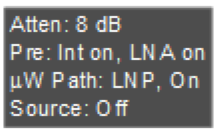
See "More Information" on page 497

Remote Command	[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe] OFF | ON | 0 | 1 [:SENSe]:POWer[:RF]:GAIN:LNA[:STATe]?
Example	:POW:GAIN:LNA ON

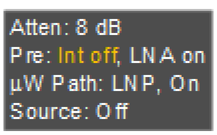
Dependencies	Requires option LNA Option LNA is not required by VXT model M9415A Does not appear in VXT models M9420A/21A/10A/11A May not appear in some measurements
Preset	OFF
State Saved	Saved in State

More Information

When the LNA is installed, the preamp annotation changes to show the state of both the LNA and the Internal Preamp. Below is an example:



Note that when operating entirely in the low band (below about 3.6 GHz), if the LNA is on, the Internal Preamp is switched off (even if you have its switch set to ON). This is because the noise performance is actually degraded in low band if both preamps are on. In this case, the annotation reflects the actual state of the two preamps, but the Internal Preamp annotation displays in amber, to warn you that the actual state of the Internal Preamp does not match the **Internal Preamp** switch control display:



µW Path Control

Options for this control include **µW Preselector Bypass** (Option MPB), **Low Noise Path** (Option LNP) and **Full Bypass Enable** in the High Band path circuits.

When the µW Preselector is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. When **Low Noise Path Enable** is selected, the instrument automatically bypasses certain circuitry in the high frequency bands that can contribute to noise, when it is appropriate based on other instrument settings.

For most applications, the preset state is **Standard Path**, which provides the best remote-control throughput, minimizes acoustic noise from switching and minimizes the risk of wear in the hardware switches, particularly in remote test scenarios where both low band and high band setups will follow in rapid succession. In this path, the bypass of the low band/high band switch and microwave preamp is never activated, which can cause some noise degradation but preserves the life of the bypass switch.

For applications that utilize the wideband IF paths, the preset state is **µW Preselector Bypass**, if option MPB is present. This is because, when using a wideband IF such as the 140 MHz IF, the µW Preselector's bandwidth can be narrower than the available IF bandwidth, causing degraded amplitude flatness and phase linearity, so it is desirable to bypass the preselector in the default case.

You may choose **Low Noise Path Enable** for a lower noise floor, especially in the 21-26.5 GHz region, though without improving many measures of dynamic range, and without giving the best possible noise floor. The preamp, if purchased and used, gives better noise floor than does **Low Noise Path Enable**, but the preamp's compression threshold and third-order intercept are much poorer than that of **Low Noise Path Enable**.

A fourth choice is **Full Bypass Enable**, which combines **µW Preselector Bypass** and **Low Noise Path Enable**. Because this can bypass most of the circuitry between the input and the first mixer, care should be taken when using this setting to avoid damaging the mixer. **Full Bypass Enable** is only available if both options LNP and MPB are present, as well as option FBP.

Path	Example	Note
Standard Path	:POW:MW:PATH STD	Normal setting for most measurements. µW Preselector in circuit, Low Noise Path disabled
Low Noise Path Enable	:POW:MW:PATH LNP	See "Low Noise Path Enable" on page 502
µW Preselector Bypass	:POW:MW:PATH MPB	See "µW Preselector Bypass" on page 504
Full Bypass Enable	:POW:MW:PATH FULL	See "Full Bypass Enable" on page 504

Remote Command	[:SENSe]:POWer[:RF]:MW:PATH STD | LNPath | MPBypass | FULL [:SENSe]:POWer[:RF]:MW:PATH?
Example	:POW:MW:PATH LNP Enables the Low Noise path :POW:MW:PATH?
Notes	If "Presel Center" on page 1868 is performed, the instrument will momentarily switch to the Standard Path, regardless of the setting of **µW Path Control** The DC Block will always be switched in when the low noise path is switched in, to protect succeeding circuitry from DC. Note that this does not mean "when the low noise path is enabled" but when, based on the Low Noise Path rules, the path is actually switched in. This can happen when the selection is **Low Noise Path Enable** or **Full Bypass Enable**. In the case where the DC Block is switched in the instrument is now AC coupled. However, if you selected DC coupling, the UI would still behave as though it were DC coupled, including all annunciation, warnings, status bits, and responses to SCPI queries. This is because, based on other settings, the instrument could switch out the low noise path at any time and hence go back to being DC coupled Alignment switching ignores the settings in this menu, and restores them when finished
Dependencies	Does not appear in CXA-m

	Does not appear in VXT Models M9410A/11A Does not appear in BBIQ and External Mixing The **Low Noise Path Enable** selection does not appear unless Option LNP is present and licensed The **µW Preselector Bypass** selection does not appear unless Option MPB is present and licensed The **Full Bypass Enable** selection does not appear unless options LNP and MPB are both present as well as option FBP In any of these cases, if the required options are not present and the SCPI command is sent, error -241, "Hardware missing; Option not installed" is generated **Low Noise Path Enable** and **Full Bypass Enable** are grayed-out if the current measurement does not support them **Low Noise Path Enable** and **Full Bypass Enable** are not supported in Avionics and MMR Modes. In any of these cases (that is, the feature is not supported in either measurement or mode), if the SCPI command is sent, the following error is generated: -221, “Setting Conflict; Feature not supported for this measurement”
Preset	All except modes specified below: `STD` IQ Analyzer, VXA, Pulse and Avionics mode: – MPB option present and licensed: `MPB` – MPB option not present and licensed: `STD`
State Saved	Save in instrument state
Range	Standard Path|Low Noise Path Enable|µW Presel Bypass|Full Bypass Enable
Annotation	In the Meas Bar, if the Standard path is chosen, it says: µW Path: Standard If Low Noise Path is enabled but the LNP switch is not thrown, it shows: µW Path: LNP,Off If the Low Noise Path is enabled and the LNP switch IS thrown, it shows: µW Path: LNP,On If the preselctor is bypassed, it says: µW Path: Bypass If Full Bypass Enable is selected but the LNP switch is not thrown, it shows: µW Path: FByp,Off If Full Bypass Enable is selected and the LNP switch IS thrown, it shows: µW Path: FByp,On

µW Path Control Auto [Mode: VMA, WLAN, NR5G, CQM]

In VMA, WLAN, 5G NR, CQM modes, an Auto/Man switch is added to **µW Path Control**:

This allows the function to automatically switch based on certain Auto Rules as shown below:

VMA Mode

Measurement	When µW Path Control is in Auto:
Digital Demod	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Custom OFDM	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Presel Bypass
SEM	Always Presel Bypass
Spurious Emissions	Always Standard Path

WLAN Mode

Measurement	When µW Path Control is in Auto:
Modulation Analysis	Always Presel Bypass
Spectral Flatness	Always Presel Bypasss
Power vs Time	Always Presel Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Always Presel Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Always Presel Bypass
SEM	1. For 11be 320M, when 'Enabled Wideband IF for FFT' is OFF or 'Sweep Type Rule' is Best Dynamic Range, auto µW path is standard. 2. For other cases, auto µW path is presel bypass if presel bypass is enabled,

Measurement	When µW Path Control is in Auto:
	auto µW path is standard if presel bypass is not enabled.
Spurious Emissions	Always Standard Path

5G NR Mode

Measurement	When µW Path Control is in Auto:
Modulation Analysis	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and “Allow Full Bypass in Auto” is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and “Allow Full Bypass in Auto” is On), otherwise choose Preselector Bypass
Channel Power	Always Standard Path
Occupied BW	Always Standard Path
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Standard Path
SEM	Always Standard Path
Spurious Emissions	Always Standard Path
Transmit On|Off Power	Use Standard Path unless tuned frequency > 3.6 GHz and Info BW > 15 MHz, in which case choose Preselector Bypass

Channel Quality Mode

Measurement	When µW Path Control is in Auto:
Group Delay	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and “Allow Full Bypass in Auto” is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass

Remote Command	`[:SENSe]:POWer[:RF]:MW:PATH:AUTO ON | OFF | 1 | 0` `[:SENSe]:POWer[:RF]:MW:PATH:AUTO?`
Example	`:POW:MW:PATH:AUTO ON` `:POW:MW:PATH:AUTO?`

Dependencies	Only appears in VMA, WLAN, 5G NR and CQM modes
Couplings	See the tables above
Preset	ON
Range	ON|OFF

Low Noise Path Enable

You may select **Low Noise Path Enable**, which gives a lower noise floor under some circumstances, particularly when operating in the 21-26.5 GHz region. With the Low Noise Path enabled, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

- The instrument is not in the Low Band, meaning:
- the start frequency is above 3.5 GHz and
- the stop frequency is above 3.6 GHz
- the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Low Noise Path Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Low Noise Path Enable** is selected in the user interface. The only time the Low Noise Path is used is when **Low Noise Path Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

For measurements that use IQ acquisition, the low noise path is used when **Center Frequency** is in High Band (> 3.6 GHz) and no preamp is in use. In other words, the rules above are modified to use only the center frequency to qualify which path to switch in. This is not the case for FFTs in the Swept SA measurement; they use the same rules as swept measurements.

Note that the Low Noise Path, while giving improved DANL, has the disadvantage of decreased TOI performance and decreased gain compression performance relative to the standard path.

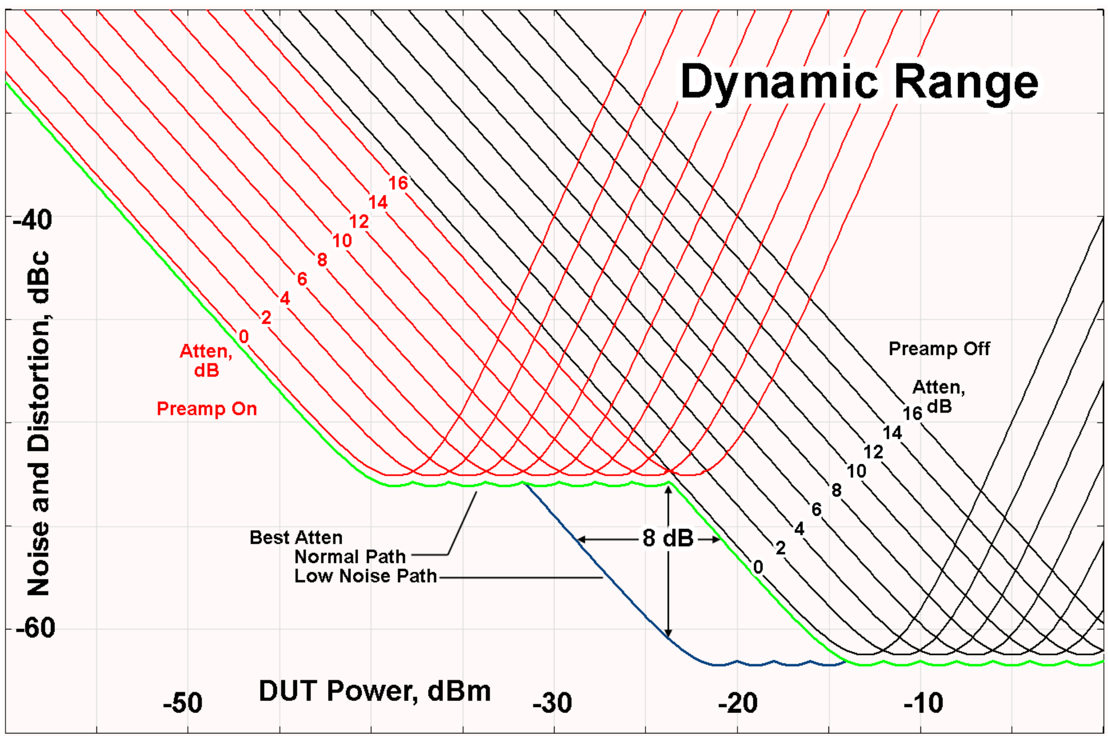
Note also that the bypass switch is a mechanical switch and has finite life, so if the **Low Noise Path Enable** is selected, it is possible to cause frequent cycling of this switch by frequently changing instrument settings such that the above conditions hold true only some of the time. A user making tests of this nature should consider opting for the **Standard Path**, which will never throw the bypass switch, at the expense of some degraded noise performance.

The low noise path is useful for situations where the signal level is so low that the instrument performance is dominated by noise even with 0 dB attenuation, but still high enough that the preamp option would have excessive third-order intermodulation or compression. The preamp, if purchased and used, gives better

noise floor than does the “Low Noise Path.” However, its compression threshold and third-order intercept are much poorer than that of the non-preamp path.

There are some applications, typically for signals around –30 dBm, for which the third-order dynamic range of the standard path is good enough, but the noise floor is not low enough even with 0 dB input attenuation. When the third-order dynamic range of the preamp path is too little and the noise floor of the standard path is too high, the Low Noise Path can provide the best dynamic range

The graph below illustrates the concept. It shows, in red, the performance of an instrument at different attenuation settings, both with the preamp on and off, in a measurement that is affected by both instrument noise and instrument TOI. The green shows the best available dynamic range, offset by 0.5 dB for clarity. The blue shows how the best available dynamic range improves for moderate signal levels with the low noise path switched in. In this illustration, the preamp improves the noise floor by 15 dB while degrading the third-order intercept by 30 dB, and the low noise path reduces loss by 8 dB. The attenuator step size is 2 dB.



There are other times where selecting the low noise path improves performance, too. Compression-limited measurements such as finding the nulls in a pulsed-RF spectrum can profit from the low noise path in a way similar to the TOI-limited measurement illustrated. Accuracy can be improved when the low noise path allows the optimum attenuation to increase from a small amount like 0, 2 or 4 dB to a larger amount, giving better return loss at the instrument input. Harmonic measurements, such as second and third harmonic levels, are much improved using the low noise path because of the superiority of that path for harmonic (though not intermodulation) distortion performance.

µW Preselector Bypass

Toggles the preselector bypass switch for band 1 and higher. When the microwave presel is on, the signal path is preselected. When the microwave preselector is off, the signal path is not preselected. The preselected path is the normal path for the instrument.

The preselector is a tunable bandpass filter which prevents signals away from the frequency of interest from combining in the mixer to generate in-band spurious signals (images). The consequences of using a preselector filter are its limited bandwidth, the amplitude and phase ripple in its passband, and any amplitude and phase instability due to center frequency drift.

Option MPB or pre-selector bypass provides an unpreselected input mixer path for certain X-Series signal analyzers with frequency ranges above 3.6 GHz. This signal path allows a wider bandwidth and less amplitude variability, which is an advantage when doing modulation analysis and broadband signal analysis. The disadvantage is that, without the preselector, image signals will be displayed. Another disadvantage of bypassing the preselector is increased LO emission levels at the front panel input port.

Image responses are separated from the real signal by twice the 1st IF. For IF Paths of 10 MHz and 25 MHz, the 1st IF is 322.5 MHz, so the image response and the real signal will be separated by 645 MHz. The 1st IF will be different for other IF Path settings. When viewing a real signal and its corresponding image response in internal mixing, the image response will be to the left of the real signal.

Also, the image response and the real signal typically have the same amplitude and exhibit the same shape factor.

However, if Option FS1, Fast Sweep Capability, is enabled, the image response in the Swept SA measurement appears lower in amplitude and has a much wider shape factor compared to the real signal.

Full Bypass Enable

With **Full Bypass Enable** selected, the microwave preselector is bypassed. In addition, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

- The instrument is not in the Low Band, meaning:
- the start frequency is above 3.5 GHz and
- the stop frequency is above 3.6 GHz.
- the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. The only time the Low

Noise Path is used is when **Full Bypass Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

CAUTION

When **Full Bypass Enable** is selected, and "Attenuation" on page 1747 is set to 0 dB, there will be a direct AC connection between the input and the first converter when the Low Noise Path switches in (when Start Freq >3.6 GHz and the Preamp is either not licensed, set to Low Band, or Off). This puts the first converter at high risk to be damaged by high AC power. Consequently, whenever **Full Bypass Enable** is selected, a warning message appears in the status bar:

Full Bypass Enabled, maximum safe input power reduced

Microwave Preselector Bypass Backwards Compatibility

Example	`:POW:MW:PRES OFF` Bypasses the microwave preselector
Notes	Included for Microwave Preselector Bypass backwards compatibility The `ON` parameter sets the `STD` path (`:POW:MW:PATH STD`) The `OFF` parameter sets path `MPB` (`:POW:MW:PATH MPB`)
Preset	`ON`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe] ON | OFF | 0 | 1` `[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe]?`

Frequency Extender Preselection Bypass

Frequency Extender Preselection Bypass only applies to the high frequency path of the Frequency Extender and only if the Frequency Extender allows it. For example, the V3050A high frequency path is 50 – 110 GHz and does allow control of the preselector bypass.

When the Frequency Extender's preselection is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. For bandwidths greater than 2.5 [GHz], it is recommended that the signal bypass the Frequency Extender Preselector since the max bandwidth of the Preselector can be as narrow as 2.5 [GHz].

For most applications, the preset state is `OFF`, which gives the best remote-control throughput, minimizes acoustic noise from switching, minimizes out of band spurs, and minimizes the risk of wear in the hardware switches.

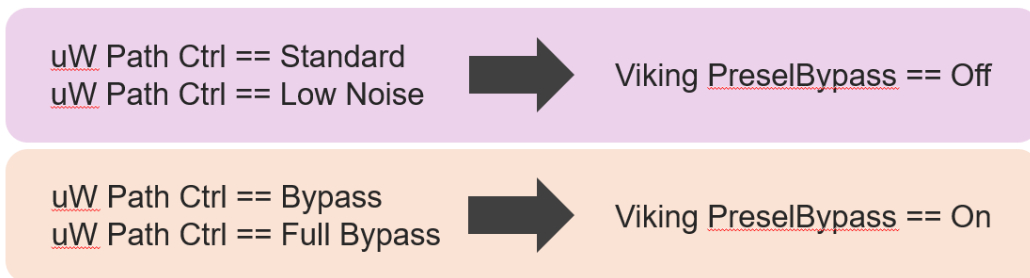
Coupling with Microwave Preselector Control

The control of whether to apply or bypass the Frequency Extender's preselection is dependent on the Microwave Path Control setting.

The coupling between the Microwave Path Control and Frequency Extender Preselector Bypass is described below.

UW PATH CTRL	UW PRESELECTOR	VIKING PRESELECTOR
Standard Path	On	**On**
Low Noise Path Enable	On	**On**
uW Presel Bypass	Off	**Off**
Full Bypass Enable	Off	**Off**

In other words…



For the Frequency Extender Preselector Bypass to take effect, it requires a Frequency Extender device (such as V3050A) be connected and External RF (ERFIN) selected as the input.

The Frequency Extender Preselector is applied or bypassed depending on the Microwave Path Control setting only when the acquisition is above 50 [GHz]. Hence, it will be bypassed only when the acquisition is above 50 [GHz].

Preselector and Bandwidth Conflict

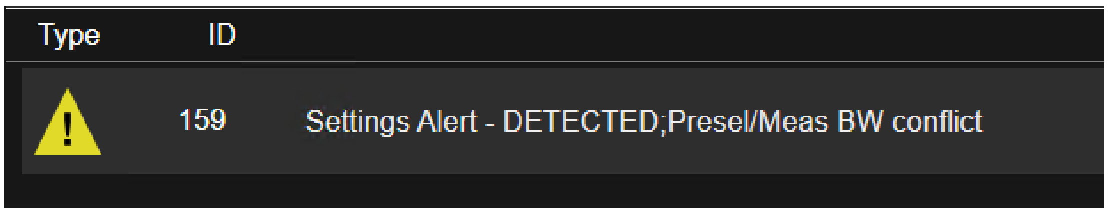
When the Frequency Extender Preselector is applied and the signal bandwidth is greater than 2.5 [GHz], then a settings alert message will show to warn the user that the signal may be distorted due to the limitation of the Frequency Extender Preselector bandwidth.

An example of the settings alert message is shown below.

Settings Alert message in the Status Bar at the bottom of the display.

Settings Alert message in the error queue

.



Software Preselection

Software Preselection is provided in some instruments, either to compensate for issues with provided hardware preselection or to provide the preselection function when there is no hardware preselector.

N9041B

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 50 GHz, software preselection must be used to suppress and separate images above 50 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

In the N9041B, Software Preselection only applies for frequencies above 50 GHz, therefore it is only used for RF Input 2. Even if it is turned on, it will not be used for other inputs and never for frequencies below 50 GHz. This is why the label of this control contains the parenthetical note “(>~50 GHz)”.

Note that in the N9041B, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

N9042B+V3050A

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 88 GHz, software preselection must be used to suppress and separate images above 88 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

For N9042B+V3050A, Software Preselection only applies for frequencies above 88 GHz, therefore it is only used for External RF. Even if it is turned on, it will not be used for other inputs and never for frequencies below 88 GHz. This is why the label of this control contains the parenthetical note “(>~88 GHz)”.

Note that for N9042B+V3050A, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

VXT models M9410A/11A

Software Preselection is used to provide the preselection function, as there is no hardware preselector in these models. Two background traces are taken and compared point by point, and the point with the lowest amplitude from the two traces is used. This provides a method to reduce spurs that are internally generated within the VXT, but the user should note the following when using Software Preselection:

- There is some speed cost due to the need to take multiple captures
- Taking the point with the lowest amplitude in each trace will make the average noise level lower at all points that do not have a spur. This can reduce the accuracy of the measurement of noise and noise-like signals.

Because of the difficulty in identifying spurs manually, you are encouraged to leave Software Preselection ON at all times in VXT models M9410A/11A. If you turn it off in order to speed up your measurement or improve noise accuracy, be aware of unwanted onscreen spurs.

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel:STATe 0 | 1 | ON | OFF` `[:SENSe]:POWer[:RF]:SWPresel:STAT?`
Example	`:POW:SWPR:STAT 1` `:POW:SWPR:STAT?`
Dependencies	Only appears in N9041B, N9042B+V2050A, and VXT models M9410A/11A. Does not appear in all measurements
Couplings	Sweep Time is affected by SW Preselection. Also Auto Tune supports SW Preselection, so set SW Preselection state and then do Auto Tune
Preset	N9041B: OFF N9042B+V3050A: ON M9410A/11A: ON
State Saved	Saved in instrument state

SW Preselection Type

Specifies the algorithm used for software preselection.

Two hidden sweeps are taken in succession. The second sweep is offset in LO frequency by 2*IF/N. For each point in each trace, the smaller amplitude from the two traces is taken and placed in that point in the selected trace. The Peak detector is auto-selected to improve the image suppression effectiveness. Responses of each trace that lie on top of one another will remain and are valid signals. Other signals are images and are suppressed. The action of taking the smaller of the two traces will make the average noise level lower in all points that do not have an image, thus reducing the accuracy of the measurement of noise and noise-like signals.

– NORMal - mathematically removes all image and multiple responses of signals present at the input

– ADVanced - any trace processing (such as “max hold” or trace averaging) is performed on the points of both candidate traces before the “select minimum” operation occurs. This form of processing works better for non-stationary signals, such as pulsed-RF signals

Remote Command	[:SENSe]:POWer[:RF]:SWPResel NORMal | ADVanced [:SENSe]:POWer[:RF]:SWPResel?
Example	:POW:SWPR NORM :POW:SWPR?
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed-out. Its grayout message is “Unavailable unless SW Presel enabled”
Preset	N9041B: ADVanced N9042B+V3050A: NORMal
State Saved	Saved in instrument state

SW Preselection BW

Specifies the effective bandwidth to be used for Software Preselection.

The choices are:

– NORMal – when making Swept measurements, a software preselection algorithm is used which takes up to 4 background acquisitions, then post-processes the result. This algorithm can remove images from signals with an occupied bandwidth up to around 3 GHz. (Default/Preset setting). When making FFT measurements, this algorithm is not used, instead the same algorithm is used as for NARRow (below)

– NARRow– a software preselection algorithm is used which takes two background acquisitions, then post-processes the result to detect and remove images from wideband signals with occupied bandwidths up to 2 GHz. This increases the risk of images failing to be rejected, but improves the measurement speed

Remote Command	[:SENSe]:POWer[:RF]:SWPResel:BW NORMal | NARRow [:SENSe]:POWer[:RF]:SWPResel:BW?
Example	:POW:SWPR:BW NARR
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed out. Its grayout message is “Unavailable unless SW Presel enabled” For N9042B+V3050A the parameter is SCPI only and always set to NARRow when Software

	Preselection is enabled
Preset	N9041B: NORMal N9042B+V3050A: NARRow
State Saved	Saved in instrument state

High Freq Prefilter

Lets you set the state of Prefilter for Center Frequencies above 1310 MHz.

In VXT Models M9410A/11A, the Receiver RF path has a bank of filters that come after the RF Attenuator in the signal path. Since this bank of filters precedes the mixer they are known as the “Prefilter” bank. Their purpose is to eliminate unwanted in-band mixing products by filtering out all but the desired frequencies before the signals get to the mixer. There are 13 prefilter bands to cover the frequencies between 9 kHz and 6000 MHz. The Prefilter provides the necessary rejection of the unwanted signal.

Remote Command	`[:SENSe]:<measurement>:PFILter[:STATe] ON | OFF | 1 | 0` `[:SENSe]:<measurement>:PFILter[:STATe]?`

Example	For example, to enable High Freq Prefilter in IQ Analyzer Mode:
	For the Complex Spectrum Measurement:
	`:SPEC:PFIL ON`
	For the IQ Waveform Measurement:
	`:WAV:PFIL ON`
	`:`

Dependencies	This control only appears in VXT models M9410A/11A with center frequency above 1310 MHz
Preset	See “Prefilter Presets” below
State Saved	Saved in instrument state

Prefilter Presets

Meas	Mode	Preset
SPEC	BASIC	OFF
WAV	BASIC, WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
MON	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
RHO	WCDMA	OFF
CDP	WCDMA	OFF
PCON	WCDMA	OFF
EVMQ	WCDMA	OFF
CHP	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF

Meas	Mode	Preset
OBW	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
ACP	WCDMA, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
SEM	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PST	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PVT	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF
EVM	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF
FLAT	WLAN	OFF
EVMM	WLAN	OFF
CEVM	LTEAFDD, LTEATDD	OFF
PAVT	5GNR, VMA	OFF
DDEM	VMA	OFF
OFDM	VMA	OFF
SAN	SA	ON
HARM	SA	ON

3.4.4 BW

BW is not supported in the WCDMA Code Domain Measurement.

3.4.5 Display

The Display Menu lets you configure display items for the current Mode, Measurement View or Window.

3.4.5.1 Meas Display

The Meas Display tab contains controls for setting up the display for the current Measurement, View or Window.

Composite Symbol Boundary

Turns the composite code channel display function on or off.

The Composite Symbol Boundary for Power Bar Graph and CDE Graph functions are coupled to each other.

Remote Command	`:CALCulate:CDPower:SBOundary:COMPosite OFF | ON | 0 | 1` `:CALCulate:CDPower:SBOundary:COMPosite?`
Example	`:CALC:CDP:SBO:COMP ON` `:CALC:CDP:SBO:COMP?`

Notes	Only valid for CDPower Bar Graph window and CDE Graph window
Dependencies	This command is effective only when the [:SENSe]:CDPOwer:CAPTure:TIME (Capture Interval) is set to 0.067, 1.0, 2.0 and 3.0
Couplings	Setting this parameter to off activates the Symbol Rate control
Preset	ON
State Saved	Yes
Range	OFF|ON

Symbol Rate

Sets the display symbol rate to read the total power level of the combined code channels defined by the :CALCulate:CDPower:SRATe command.

The functions of Display Symbol Rate for Power Bar Graph and CDE Graph are coupled to each other.

Remote Command	:CALCulate:CDPower:SBOundary:SRATe <integer> :CALCulate:CDPower:SBOundary:SRATe?
Example	:CALC:CDP:SBO:SRAT 30000 :CALC:CDP:SBO:SRAT?
Notes	Only valid for CDP Bar Graph window and CDE Graph window 192000 choice for MS is available only when HSPA is enabled
Dependencies	This control is unavailable when Composite is On
Couplings	The functions of Display Symbol Rate for Power Bar Graph and CDE Graph are coupled to each other
Preset	15000
State Saved	Yes
Range	7500|15000|30000|60000|120000|240000|480000|960000 for BTS 15000|30000|60000|120000|240000|480000|960000|1920000 for MS

Composite Chip Pwr

Toggles the composite chip power display function between On and Off.

Remote Command	:DISPlay:CDPower:CPOWer[:STATe] 0 | 1 | OFF | ON :DISPlay:CDPower:CPOWer[:STATe]?
Example	:DISP:CDP:CPOW ON :DISP:CDP:CPOW?
Notes	Only valid for Symbol/Chip Power vs. Time window
Dependencies	This control is grayed out when Capture Intvl is set to Long Mode

Preset	ON
State Saved	Yes
Range	OFF|ON

Demod Bits Format (BTS only)

This control is displayed and active if Radio Device is BTS and Demod Bits window is selected.

- Binary: Demodulated bits are displayed in binary format
- Hex: Demodulated bits are displayed in hexadecimal format

The Demod Bits view changes as the above settings change.

This functionality works only when all the following conditions are met:

1. Radio Device is BTS
2. the Symbol Rate is 240 ksps
3. the modulation scheme on the result metrics window is 16QAM

For QPSK channels, this setting has no effect and the channels are always displayed in binary format.

(1) Binary format

In this format, each symbol appears in a column consisting of 4 index bits:

Sample:

Downlink HS-PDSCH: tDPCH(unknown:0)

```
I1:   1   1   0   0   1   1   0   0   1   1
Q1:   0   0   0   0   0   0   0   0   1   1
I2:   1   0   0   1   1   0   0   1   1   0
Q2:   1   1   1   1   0   0   0   0   0   0
```

(2) Hexadecimal format

In this format, each symbol is shown as a hexadecimal digit.

Sample (using the same data as for the above binary format case):

Downlink HS-PDSCH : tDPCH(unknown:0)

```
0x:   B   9   1   3   A   8   0   2   E   C
```

Remote Command	:DISPlay:CDPower:TEXT:BFORmat BINary | HEX :DISPlay:CDPower:TEXT:BFORmat?

Example	`:DISP:CDP:TEXT:BFOR BIN` `:DISP:CDP:TEXT:BFOR?`
Preset	`BINary`
State Saved	Yes
Range	`BINary|HEX`

3.4.5.2 View

Contains controls for selecting the current **View**, and for editing User Views.

Views

The Code Domain Power measurement has five views as follows.

Some of these Views are multiple-window Views. When in a multiple window View, you select a window by touching it. The menu controls may sometimes change depending on which window is selected.

Whenever the View changes, the default menu is Frequency, unless otherwise specified in the View description.

View	Result
Power Graph & Metrics	Code Domain Power Graph
	CDP Metrics
CDP Graph & CDE Graph	Code Domain Power Graph
	Code Domain Error Graph
I/Q Error (Quad View)	Mag Error Graph
	Phase Error Graph
	EVM Graph
	Symbol Error Metrics
Code Domain (Quad View)	Code Domain Power Graph
	Symbol Power Graph
	I/Q Symbol Polar Vector Graph
	Symbol Error Metrics
Demod Bits	Code Domain Power Graph
	Symbol Power Graph
	Demod Bits

View Selection

Selects the desired measurement view from the selections listed in the table below. There are two available commands, allowing you to select the view using either the ID string or a numeric ID value. For more details of the commands, see:

– "View Selection by Name" on page 516

– "View Selection by Number" on page 516

In the following table:

– The Enumerated ID is used with the SCPI Command `:DISP:CDP:VIEW[:SEL]`

– The Numeric ID is used with the SCPI Command `:DISP:CDP:VIEW:NSEL`

Enumerated ID	Numeric ID	View Name & Details
PGRaph	1	Power Graph & Metrics Provides a combination view of the code domain power graph and the summary data Not available if the [:SENSe]:CDPower:CAPTure:TIME (Capture Interval) is 4.0 or 8.0 (Long Mode)
CDE	2	Power Graph & CDE Graph Provides a combination view of the code domain power graph and the code domain error Not available if the [:SENSe]:CDPower:CAPTure:TIME (Capture Interval) is 4.0 or 8.0 or 16.0 (Long Mode)
SEVM	3	I/Q Error (Quad View) Symbol EVM provides a combination view of magnitude error, phase error, Symbol EVM, and the summary data Not available if the [:SENSe]:CDPower:CAPTure:TIME (Capture Interval) is set to 4.0 or 8.0 (Long Mode)
QUAD	4	Code Domain (Quad View) Provides a combination view for the code domain power symbol power, I/Q symbol polar vector and the summary data Not available if the [:SENSe]:CDPower:CAPTure:TIME (Capture Interval) is set to 4.0 or 8.0 (Long Mode)
DBITs	5	Demod Bits Provides a combination view of the graphs for the code domain power and symbol power, and the I/Q demodulated bit stream data for the symbol power slots selected by the measurement interval and measurement offset
LDEMod	6	Long Demodulation Provides a combination view of the symbol power and demodulation bits stream data for the symbol power slots selected by the measurement interval and measurement offset though long capture (capture interval > 3 frames)

View Selection by Name

Remote Command	`:DISPlay:CDPower:VIEW[:SELect] PGRaph | CDE | SEVM | QUAD | DBITs | LDEMod` `:DISPlay:CDPower:VIEW[:SELect]?`
Example	`:DISP:CDP:VIEW PGR` `:DISP:CDP:VIEW?`
Preset	`PGRaph`
State Saved	Yes
Range	Power Graph & Metrics|CDP Graph & CDE Graph|I/Q Error (Quad View)|Code Domain (Quad View)|Demod Bits|Long Demod

View Selection by Number

Displays the numeric values of the measurement results.

For a complete list of Numeric ID values for use with this command, see "View Selection" on page 515 above.

Remote Command	`:DISPlay:CDPower:VIEW:NSELect <integer>` `:DISPlay:CDPower:VIEW:NSELect?`
Example	`:DISP:CDP:VIEW:NSEL 2` `:DISP:CDP:VIEW:NSEL?`
Preset	1
State Saved	Yes
Min/Max	1/6

Power Graph & Metrics

Windows: "Code Domain Power Graph" on page 461, "Metrics" on page 461

Dual window view of the graph and the metrics. The parameters displayed in these windows differ depending on the setting of Radio Device. When the parameter Capture Interval is set to Long Mode (4, 8 or 16 Frame), this view is not available, and only the "Demod Bits" on page 517 view is available.

Example	`:DISP:CDP:VIEW PGR`

CDP Graph & CDE Graph

Windows: "Code Domain Power Graph" on page 461, "Code Domain Error Graph" on page 464

Dual window view of the CDP graph and the CDE graph.

These two windows are coupled in terms of: X/Y Scaling, Composite Symbol Boundary, and Display Symbol Rate.

The parameters displayed in these windows differ depending on the setting of Radio Device. When the parameter Capture Interval is set to Long Mode (4, 8 or 16 Frame), this view is not available, and only the "Demod Bits" on page 517 view is available.

Example	`:DISP:CDP:VIEW CDE`

I/Q Error (Quad View)

Windows: "Magnitude Error Graph" on page 464, "Phase Error Graph" on page 464, "EVM Graph" on page 465, "Symbol Error Metrics" on page 465

Combination view of magnitude error, phase error, Symbol EVM, and the summary data using the above four windows.

The parameters displayed in these windows differ depending on the setting of Radio Device. When the parameter Capture Interval is set to Long Mode (4, 8 or 16 Frame), this view is not available, and only "Demod Bits" on page 517 view is available.

Example	`:DISP:CDP:VIEW SEVM`

Code Domain (Quad View)

Windows: "Code Domain Power Graph" on page 461, "Symbol Power Graph" on page 467, "I/Q Symbol Polar Graph" on page 468, "Symbol Error Metrics" on page 465

Combination view of the code domain power, symbol power, I/Q symbol polar vector and the summary data using the above 4 windows.

The parameters displayed in these windows differ depending on the setting of Radio Device. When the parameter Capture Interval is set to Long Mode (4, 8 or 16 Frame), this view is not available, and only "Demod Bits" on page 517 view is available.

Example	`:DISP:CDP:VIEW QUAD`

Demod Bits

Windows: "Code Domain Power Graph" on page 461, "Symbol Power Graph" on page 467, "Symbol Power Graph (Long Mode)" on page 467, "Demod Bits" on page 468

In this view, the number of windows that are displayed depends on the parameter setting of "Capture Interval" on page 557. See the following table for detailed settings of Capture Interval.

The parameters displayed in each window differ depending on the setting of Radio Device.

Capture Interval Setting	Number & Type of Windows
1 to 14 slots 1 to 3 frames	Three windows: – Power Bar Graph window (upper left) – Symbol/Chip Power vs. Time window (upper right) – Demod Bits text window (lower)
Long Mode (4, 8, 16 frames)	Two windows: – Symbol/Chip Power vs. Time window (upper) – Demod Bits text window (lower)

Example	`:DISP:CDP:VIEW DBIT` `:DISP:CDP:VIEW LDEM`

User View

Lets you choose a View from the saved User Views for the current measurement. This panel only appears if a User View exists for the current measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:SELect <alphanumeric>` `:DISPlay:VIEW:ADVanced:SELect?`
Example	Select Baseband as the current View `:DISP:VIEW:ADV:SEL “Baseband”`

Notes	You must be in the measurement whose View you are trying to set to send the command. You can only set Views for the current measurement using this command
	For predefined views, the parameter is derived from the view name that is shown in the View list in the user interface. For example, if you are trying to select the Trace Zoom view in the Swept SA measurement, you send:
	`:DISP:VIEW:ADV:SEL "Trace Zoom"`
	because “Trace Zoom” is the name of the View as seen in the Mode/Meas dialog or in the Display, View menu
	You *cannot* use the legacy View parameter (which in this case would be `TZOom`) with `:DISP:VIEW:ADV:SEL`
	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case. Thus, both of the following forms work:
	`:DISP:VIEW:ADV:SEL "Trace Zoom"`
	`:DISP:VIEW:ADV:SEL "TRACE ZOOM"`
	If the specified view is not a valid View, the query returns the error message “-224, Illegal parameter value; View with the name <alphanumeric> does not exist”
	If the display is disabled (via `:DISP:ENAB OFF`) then the error message “-221, Settings conflict; View

	SCPI cannot be used while Display is disabled" is generated
Backwards Compatibility SCPI	The legacy node `:DISPlay:VIEW[:SELect]` is retained for backwards compatibility, but it only supports predefined views

Restore Layout to Default

Restores the Layout to the default for Basic.

Modified Views are very temporary; if you exit the current measurement they are discarded, and they are not saved in State. To retain this View for later use, and to be able to return easily to your original Basic View, you can save your edited View as a "User View".

Save Layout as New View

Saves your new View as a User View. An alpha keyboard appears, which lets you name your new View; the default is the old View name plus a number.

Remote Command	`:DISPlay:VIEW:ADVanced:NAME <alphanumeric>`
Example	`:DISP:VIEW:ADV:NAME "Baseband"` Creates a new View named `Baseband` from the current View, and selects it as the current View
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If `<alphanumeric>` name already exists as a View, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; User View SCPI cannot be used while Display is disabled" is generated

Re-Save User View

You can re-edit a User View; if you make changes, then an asterisk will appear next to the User View's name. You can then tap **Re-Save User View** to save it back to its existing name, or **Save Layout as New View** to add another, new User View.

This is a front panel function only, there is no remote command available to perform this function. To do this remotely, you must first perform **Save Layout as New View**, then delete the old User View and rename the new one with the name of the View you just deleted.

Rename User View

You can rename the current View by giving it a new unique name. Only User Views can be renamed, if the current View is a Predefined View, an error occurs.

Remote Command	`:DISPlay:VIEW:ADVanced:REName <alphanumeric>`
Example	`:DISP:VIEW:ADV:REN "Baseband"`
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the `<alphanumeric>` specifying the new name is already present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot rename a Predefined View" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete User View

You can delete the current View if it is a User View. The default view becomes the current view for the Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:DELete`
Example	`:DISP:VIEW:ADV:DEL`
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the `<alphanumeric>` is not present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> does not exist" is generated If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot delete a Predefined View" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete All User Views

Deletes all previously saved User Views. The default view becomes the current view for the Measurement if a User View was the current view when this command was executed.

Remote Command	`:DISPlay:VIEW:ADVanced:DELete:ALL`
Example	`:DISP:VIEW:ADV:DEL:ALL`
Notes	Disabled if there are no User Views

View Editor Remote Commands

The following remote commands help you manage Views and User Views. Note that the SCPI node for User Views handles both Predefined and User Views. The legacy nodes, `:DISPlay:VIEW[:SELect]` and `:DISPlay:VIEW:NSEL`, are retained for backwards compatibility, but they only support predefined views.

View Listing Query

Returns a string containing a comma-separated list of names for *all* the Views, including User Views, available for the current Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:CATalog?`
Example	`:DISP:VIEW:ADV:CAT?`
Notes	Returns a quoted string of the available Views for the current measurement, separated by commas. The list includes names for *all* the Views, including User Views, available for the current Measurement Example: `"Normal,Trace Zoom,Spectrogram,Baseband,myView1,yourView1"` No distinction is made between Predefined and User Views If you switch measurements with the display disabled (via `:DISP:ENAB OFF`), then query the list of available Views, the result is undefined

User View Listing Query

Returns a string containing a comma-separated list of names for *only* the User Views available for the current Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:USER:CATalog?`
Example	`:DISP:VIEW:ADV:USER:CAT?`
Notes	Returns a quoted string of the available User Views for the current measurement, separated by commas. Example: `"Baseband,myView1,yourView1"` If you switch measurements with the display disabled (see "Display Enable (Remote Command Only)" on page 1894), then query the list of available Views, the result is undefined

3.4.5.3 Annotation

Contains controls for setting up the annotation for the current Mode or Measurement.

Graticule

Turns the display graticule On or Off for all windows with graticules in all measurements in the current Mode. Also turns the graticule Y-Axis annotation on and off.

Remote Command	`:DISPlay:GRATicule[:STATe] OFF | ON | 0 | 1` `:DISPlay:GRATicule[:STATe]?`
Example	`:DISP:GRAT OFF`
Notes	The graticule is the set of horizontal and vertical lines that make up the grid/divisions for the X-Axis and Y-Axis
Preset	`ON`
State Saved	Saved in instrument state

Backwards Compatibility SCPI	`:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe] OFF | ON | 0 | 1`
	`:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe]?`
	This command is accepted for backwards compatibility with older instruments, but the `WINDow`, `TRACe` and `GRID` parameters are ignored

Screen Annotation

Controls the display of the annunciation and annotation around the graticule, including any annotation on lines (such as the display line, the threshold line, etc.) and the Y-Axis annotation, for all windows with screen annotation in all measurements in the current Mode.

This does *not* include marker annotation (or the N dB result). When `OFF`, the graticule expands to fill the entire graticule area, leaving only the 1.5% gap above the graticule, as described in the **Trace** section.

Remote Command	`:DISPlay:ANNotation:SCReen[:STATe] OFF | ON | 0 | 1` `:DISPlay:ANNotation:SCReen[:STATe]?`
Example	`:DISP:ANN:SCR OFF`
Dependencies	Grayed-out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Trace Annotation

Turns on and off the labels on the traces, showing their detector (or their Math Mode) as described in the **Trace** section, for all windows in all measurements in the current

Mode for which Trace Annotation on/off is supported.

If Trace Math is being performed on a trace, then the Trace Math annotation replaces the detector annotation.

For measurements that support limit lines, this key also turns on and off the labels on the Limit Lines. The label is the Limit number annotation and Limit Comment displayed on the graph. If the length of the comment is greater than 20 characters, the first 8 characters and the last 8 characters are displayed, joined with ….

Remote Command	`:DISPlay:ANNotation:TRACe[:STATe] ON | OFF | 1 | 0` `:DISPlay:ANNotation:TRACe[:STATe]?`
Example	`:DISP:ANN:TRAC OFF`
Preset	`OFF`
State Saved	Saved in instrument state

Control Annotation

Turns on and off the display of values on the Active Function controls for all measurements in the current Mode. This is a security feature.

Remote Command	`:DISPlay:ACTivefunc[:STATe] ON | OFF | 1 | 0` `:DISPlay:ACTivefunc[:STATe]?`
Example	`:DISP:ACT OFF`
Dependencies	Grayed out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Meas Bar

Turns the Measurement Bar at the top of the screen on and off for all measurements in the current Mode. When `OFF`, the graticule area expands to fill the area formerly occupied by the Measurement Bar.

Remote Command	`:DISPlay:ANNotation:MBAR[:STATe] OFF | ON | 0 | 1` `:DISPlay:ANNotation:MBAR[:STATe]?`
Example	`:DISP:ANN:MBAR OFF`
Dependencies	Grayed out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Display Enable (Remote Command Only)

Turns the display on/off, including the display drive circuitry. The backlight stays lit to confirm that the instrument is on. The display enable setting is mode global. Theare three reasons for turning the display off:

1. To increase speed as much as possible by freeing the instrument from having to update the display
2. To reduce emissions from the display, drive circuitry
3. For security purposes

If you have turned off the display:

– and you are in local operation, the display can be turned back on by pressing any key or by sending `:SYSTem:DEFaults MISC` or `:DISPlay:ENABle ON` (neither `*RST` nor :SYSTem:PRESet enable the display)

– and you are in remote operation, the display can be turned back on by pressing the **Local** or **Esc** keys, or by sending `:SYSTem:DEFaults MISC` or `:DISPlay:ENABle ON` (neither `*RST` nor `:SYSTem:PRESet` enable the display)

– and you are using either the `:SYSTem:KLOCk` command or GPIB local lockout, then *no* front-panel key press will turn the display back on. You must turn it back on remotely.

If the display is `OFF`, many SCPI commands related to User Views and Multiscreen functionality do not work, and return the error messages "-221, Settings conflict; Screen SCPI cannot be used when Display is disabled" or "221, Settings conflict; View SCPI cannot be used while Display is disabled". These commands include:

Name	Command
Select User View	`:DISPlay:VIEW:ADVanced:SELect`
Rename User View	`:DISPlay:VIEW:ADVanced:REName`
Delete User View	`:DISPlay:VIEW:ADVanced:DELete`
Create User View	`:DISPlay:VIEW:ADVanced:NAME`
Select Screen	`:INSTrument:SCReen:SELect`
Delete Screen	`:INSTrument:SCReen:DELete`
Delete All But This Screen	`:INSTrument:SCReen:DELete:ALL`
Add Screen	`:INSTrument:SCReen:CREate`
Rename Screen	`:INSTrument:SCReen:REName`
Sequencer On/Off	`:SYSTem:SEQuencer`

Remote Command	`:DISPlay:ENABle OFF | ON | 0 | 1`

	:DISPlay:ENABle?
Example	:DISP:ENAB OFF
Couplings	:DISP:ENAB OFF turns Backlight OFF and :DISP:ENAB ON turns Backlight ON, but changing Backlight settings does *not* change the state of :DISP:ENAB
Preset	ON Set by :SYST:DEF MISC, but not affected by *RST or :SYSTem:PRESet
State Saved	Not saved in instrument state
Backwards Compatibility Notes	:SYST:PRES no longer turns on :DISPlay:ENABle as it did in legacy analyzers

3.4.6 Freq

The Freq key opens the Frequency menu, which contains controls that allow you to control the Frequency and Channel parameters of the instrument.

Some features in the Frequency menu are the same for all measurements in the current Mode – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset. For example, the Center Freq setting is the same for all measurements - it does not change as you change measurements.

3.4.6.1 Settings

The Settings Tab contains controls that pertain to the X axis parameters of the measurement. These parameters control how data on the vertical (X) axis is displayed and control instrument settings that affect the horizontal axis.

Center Frequency

Sets the frequency that corresponds to the horizontal center of the graticule. While adjusting the Center Frequency the Span is held constant.

The center frequency setting is the same for all measurements within a mode, that is, it is Meas Global. Some modes are also able to share a Mode Global center frequency value. If this is the case, the Mode will have a Global tab in its Meas Setup menu.

The Center Freq function sets (and queries) the Center Frequency for the currently selected input. If your instrument has multiple inputs, and you select another input, the Center Freq changes to the value for that input. SCPI commands are available to directly set the Center Freq for a specific input.

Center Freq is remembered as you go from input to input. Thus you can set a Center Freq of 10 GHz with the RF Input selected, change to BBIQ and set a Center Freq of 20 MHz, then switch to External Mixing and set a Center Freq of 60 GHz, and when

you go back to the RF Input the Center Freq will go back to 10 GHz; back to BBIQ and it is 20 MHz; back to External Mixing and it is 60 GHz.

– See "RF Center Freq" on page 528

– See "Ext Mix Center Freq" on page 529

– See "I/Q Center Freq" on page 530

– See "Center Frequency Presets" on page 526

Remote Command	`[:SENSe]:FREQuency:CENTer <freq>` `[:SENSe]:FREQuency:CENTer?`

Example	Set Center Frequency to 50 MHz
	`:FREQ:CENT 50 MHz`
	Increment the Center Frequency by the value of CF Step
	`:FREQ:CENT UP`
	Return the current value of Center Frequency
	`:FREQ:CENT?`

Notes	This command sets the RF, External Mixing or I/Q Center Frequency depending on the selected input For RF input it is equivalent to `:FREQ:RF:CENT` For I/Q input it is equivalent to `:FREQ:IQ:CENT` For External Mixer it is equivalent to `:FREQ:EMIX:CENT` Preset and Max values are dependent on Hardware Options (5xx) If no terminator (e.g. MHz) is sent the terminator Hz is used. If a terminator with unit other than Frequency is used, an invalid suffix error message is generated
Preset	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 526 and "RF Center Freq" on page 528 and "Ext Mix Center Freq" on page 529 and "I/Q Center Freq" on page 530
State Saved	Saved in instrument state
Min	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 526 and "RF Center Freq" on page 528 and "Ext Mix Center Freq" on page 529 and "I/Q Center Freq" on page 530
Max	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 526 and "RF Center Freq" on page 528 and "Ext Mix Center Freq" on page 529 and "I/Q Center Freq" on page 530
Status Bits/OPC dependencies	Non-overlapped

Center Frequency Presets

The following table provides the Center Frequency Presets for the Spectrum Analyzer mode, and the Max Freq, for the various frequency options:

Freq Option	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
503 (all but CXA)	1.805 GHz	3.6 GHz	3.7 GHz
503 (CXA)	1.505 GHz	3.0 GHz	3.08 GHz
507 (all but CXA)	3.505 GHz	7.0 GHz	7.1 GHz
507 (CXA)	3.755 GHz	7.5 GHz	7.58 GHz
508 (all but MXE)	1.805 GHz	3.6 GHz	8.5 GHz
508 (MXE)	4.205 GHz	8.4 GHz	8.5 GHz
513	6.805 GHz	13.6 GHz	13.8 GHz
526 (except CXA and MXE)	13.255 GHz	26.5 GHz	27.0 GHz*
526 (CXA)	13.255 GHz	26.5 GHz	26.55 GHz
526 (MXE)	1.805 GHz	3.6 GHz	27.0 GHz
532	16.005 GHz	32.0 GHz	32.5 GHz
540	20.005 GHz	40.0 GHz	40.5 GHz
543	21.505 GHz	43.0 GHz	43.0 GHz
544	22.005 GHz	44.0 GHz	45.0 GHz
550	25.005 GHz	50.0 GHz	52 GHz
F03 (CXA-m)	1.505 GHz	3.0 GHz	3.08 GHz
F07 (CXA-m)	3.755 GHz	7.5 GHz	7.575 GHz
F13 (CXA-m)	6.805 GHz	13.6 GHz	13.8 GHz
F26 (CXA-m)	13.255 GHz	26.5 GHz	26.55 GHz
504 (M9420A/21A, M8920A)	2.145 GHz	3.88GHz	3.88 GHz
506 (M9420A/21A, M8920A)	3.245 GHz	6.08GHz	6.08 GHz
F06 (M9410A/11A)	1.0 GHz	6.08 GHz	6.08 GHz
F06 (M9415A)	1 GHz	1.08 GHz	6.6 GHz
F08 (M9415A)	1 GHz	1.08 GHz	8.6 GHz
F12 (M9415A)	1 GHz	1.08 GHz	12.9 GHz

*For option 526, the Max CF in RTSA is 26.999999995 GHz.

N9041B Center Freq Presets

Input	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
Input 1, all models	25.005 GHz	50.0 GHz	52 GHz
Input 2, opt 585	42.505 GHz	85.0 GHz	86 GHz
Input 2, opt 590	45.005 GHz	90.0 GHz	92 GHz
Input 2, opt 5CX	55.005 GHz	110.0 GHz	110 GHz

Input 2, CXA and MXE

Model	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
CXA opt C75	0.7505 GHz	1.5 GHz	1.58 GHz
MXE	505 MHz	1 GHz	1.000025 GHz

Tracking Generator Frequency Limits (CXA only)

Tracking Generator Option	Min Freq (clips to this freq when turn TG on and can't tune below while TG on)	If above this Freq, Stop Freq clipped to this Freq when TG turned on	Max Freq (can't tune above) while TG on
T03	9 kHz	3.0 GHz	3.08 GHz
T06	9 kHz	6.0 GHz	6.05 GHz

Tracking Generator Frequency Limits(CXA-m only)

Tracking Generator Option	Min Freq (clips to this freq when turn TG on and can't tune below while TG on)	If above this Freq, Stop Freq clipped to this Freq when TG turned on	Max Freq (can't tune above) while TG on
T03	2 MHz	3.08 GHz	3.08 GHz
T07	2 MHz	7.575 GHz	7.575 GHz
T13	2 MHz	13.8 GHz	13.8 GHz
T26	2 MHz	26.55 GHz	26.55 GHz

RF Center Freq

SCPI command for specifying the RF Center Frequency. This command will set the Center Frequency to be used when the RF input is selected, even if the RF input is not the input that is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:RF:CENTer <freq>` `[:SENSe]:FREQuency:RF:CENTer?`
Example	`:FREQ:RF:CENT 30 MHz` `:FREQ:RF:CENT?`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode
Dependencies	If the electronic/soft attenuator is enabled, any attempt to set Center Frequency such that the Stop Frequency would be >3.6 GHz fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning
Preset	See table above

State Saved	Saved in instrument state
Min	-79.999995 MHz
Max	See table above. Basically instrument maximum frequency - 5 Hz

Ext Mix Center Freq

SCPI command for specifying the External Mixer Center Frequency. This command will set the Center Frequency to be used when the External Mixer is selected, even if the External Mixer input is not the input which is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:EMIXer:CENTer <freq>` `[:SENSe]:FREQuency:EMIXer:CENTer?`
Example	`:FREQ:EMIX:CENT 60 GHz` `:FREQ:EMIX:CENT?`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode
Couplings	When returning to External Mixing after having been switched to one of the other inputs (e.g., RF), you will come back into the settings that you had when you left External Mixing. So you will come back to the band you were in with the Center Frequency that you had. However, Span is not an input-dependent parameter, therefore you will bring the span over from the other input. Therefore, the instrument comes back with the span from the previous input, limited as necessary by the current mixer setup
Preset	When a Mode Preset is performed while in External Mixing, the Start frequency of the current Mode is set to the nominal Min Freq of the lowest harmonic range in the Harmonic Table for the current mixer setup. Similarly, the Stop frequency of the current Mode is set to the nominal Max Freq of the highest harmonic range in the Harmonic Table. The Center Freq thus presets to the point arithmetically equidistant from these two frequencies Note that, if the current measurement has a limited Span available to it, and cannot achieve the Span shown in the table (Span=Stop Freq – Start Freq), the instrument uses the maximum Span the measurement allows, and still sets the Center Freq to the midpoint of the Start and Stop Freq values in the Harmonic Table When Restore Input/Output Defaults is performed, the mixer presets to the 11970A, whose Start and Stop frequencies are 26.5 and 40 GHz respectively. The center of these two frequencies is 33.25 GHz Therefore, after a Restore Input/Output Defaults, if you go into External Mixing and do a Mode Preset while in the Spectrum Analyzer Mode, the resulting Center Freq is 33.25 GHz
State Saved	Yes
Min	The minimum frequency in the currently selected mixer band + 5 Hz
Max	The maximum frequency in the currently selected mixer band - 5 Hz

I/Q Center Freq

SCPI command for specifying the I/Q Center Frequency. This command sets the Center Frequency to be used when the I/Q input is selected, even if the I/Q input is not the input that is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:IQ:CENTer <freq>` `[:SENSe]:FREQuency:IQ:CENTer?`
Example	`:FREQ:IQ:CENT 30 MHz`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode
Preset	0 Hz
State Saved	Saved in instrument state
Min	-40.049995 MHz
Max	40.049995 MHz

CF Step

Changes the step size for the center frequency and start and stop frequency functions. Once a step size has been selected and the center frequency function is active, the step keys (and the UP|DOWN parameters for **Center Frequency** from remote commands) change the center frequency by the step-size value. The step size function is useful for finding harmonics and sidebands beyond the current frequency span of the instrument.

Note that the start and stop frequencies also step by the CF Step value.

Remote Command	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement] <freq>`
	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement]?`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO?`

Example	`:FREQ:CENT:STEP 500 MHz`
	Increase the current center frequency value by 500 MHz
	`:FREQ:CENT UP`
	`:FREQ:CENT:STEP?`
	`:FREQ:CENT:STEP:AUTO ON`
	`:FREQ:CENT:STEP:AUTO?`

Notes	Preset and Max values are dependent on Hardware Options (5xx)

Dependencies	Span, RBW, Center frequency If the electronic/soft attenuator is enabled, any attempt to change the value of the center frequency >3.6 GHz by pressing the Up-arrow key, fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning
Couplings	When auto-coupled in a non-zero span, the center frequency step size is set to 10% of the span. When auto-coupled in zero span, the center frequency step size is set to the equivalent -3 dB RBW value
Preset	Auto ON
State Saved	Saved in instrument state
Min	– (the maximum frequency of the instrument). That is, 27 GHz max freq instrument has a CF step range of +/- 27 GHz. Note that this is the maximum frequency given the current settings of the instrument, so in External Mixing, for example, it is the maximum frequency of the current mixer band
Max	The maximum frequency of the instrument. That is, 27 GHz max freq instrument has a CF step range of +/- 27 GHz. Note that this is the maximum frequency given the current settings of the instrument, so in External Mixing, for example, it is the maximum frequency of the current mixer band
Status Bits/OPC dependencies	non-overlapped

3.4.7 Marker

Accesses a menu that enables you to select, set up and control the markers for the current measurement. If there are no active markers, Marker selects marker 1, sets it to Normal and places it at the center of the display. If the selected marker is Off, it is set to Normal and placed it at the center of the screen on the trace determined by the Marker Trace rules.

For more detailed information on the types of Markers and the interaction between Markers, see the Marker section of the Swept SA measurement.

3.4.7.1 Select Marker

Specifies the selected marker. The term "selected marker" is used throughout this document to specify which marker will be affected when you change marker settings, perform a Peak Search, etc.

The **Select Marker** control appears above the menu panel, indicating that it applies to all controls in the **Marker** menu panels. **Select Marker** is blanked if you select a tab whose controls do *not* depend on the selected marker (e.g., Counter).

On any menu tab for which **Select Marker** displays, the first control is always **Marker Frequency|Time**.

Notes	The selected marker is remembered even when not in the Marker menu and is used if a Search is done or a Band Function is turned on or for Signal Track or Continuous Peak
Preset	Marker 1

State Saved	The number of the selected marker is saved in instrument state
Annunciation	Appears in the marker results block label for Normal and Delta markers

3.4.7.2 Settings

The controls on the **Settings** tab include the Marker active function and a radio button selection of the marker control mode (Normal, Delta, or Off) for the selected marker, as well as additional functions that help you use markers.

Marker X Axis Value

Accesses a menu that enables you to select, set up and control the markers for the current measurement.

Marker Symbol Value

Sets the marker symbol value in the current marker for the trace of I/Q symbol polar vector. It has no effect if the control mode is Off, but is the SCPI equivalent of entering an X value if the control mode is Normal.

If no suffix is sent, uses ‘symbols’. If the suffix is not ‘symbols’, an error “Invalid suffix” is generated.

The query returns the marker’s ‘symbol’ value in the trace if the control mode is Normal. The query is returned in ‘symbols’. If the marker is Off the response is Not A Number.

NOTE **This command is only valid when Marker Trace is ‘POLar’ (I/Q symbol polar vector). For other Marker Traces, it is ignored.**

Remote Command	`:CALCulate:CDPower:MARKer[1]|2|...|12:SYMBol <real>` `:CALCulate:CDPower:MARKer[1]|2|...|12:SYMBol?`
Example	`:CALC:CDP:MARK:SYMB 1.0` `:CALC:CDP:MARK:SYMB?`
Notes	If no suffix is sent, uses ‘symbols’. If the suffix is not ‘symbols’, an error “Invalid suffix” is generated
Preset	Start point of the trace on the display window
State Saved	No
Min	-9.9E+37
Max	9.9E+37
Annotation	Mkr # <Symbol Value>, <X value> and <Y value> upper right on graph

Marker X Axis Value

Sets the marker X Axis value in the current marker X Axis Scale unit. It has no effect if the control mode is Off, but is the SCPI equivalent of entering an X value if the control mode is Normal or Delta.

NOTE: This command is not valid when Marker Trace is 'POLar' and ignored. Marker Symbol Value is supported instead.

Remote Command	`:CALCulate:CDPower:MARKer[1]|2|...|12:X <real>` `:CALCulate:CDPower:MARKer[1]|2|...|12:X?`
Example	`:CALC:CDP:MARK3:X 0.0` `:CALC:CDP:MARK3:X?`
Notes	If no suffix is sent, uses the fundamental units for the current marker X Axis Scale. If a suffix is sent that does not match the current marker X Axis Scale unit, an error "Invalid suffix" is generated The query returns the marker's absolute X Axis value if the control mode is Normal, or the offset from the marker's reference marker if the control mode is Delta. The query is returned in the fundamental units for the current marker X Axis scale: Hz for Frequency and Inverse Time, seconds for Period and Time. If the marker is Off the response is not a number
Preset	After a preset, all Markers are turned OFF, so Marker X Axis Value query returns a Not A Number (NAN)
State Saved	No
Min	–9.9E+37
Max	9.9E+37
Annotation	Mkr # <X value> and <Marker value> upper right on graph

Marker X Axis Position (Remote Command only)

Sets the marker X position in trace points. It has no effect if the control mode is Off, but is the SCPI equivalent of entering a value if the control mode is Normal or Delta - except in trace points rather than X Axis Scale units. The entered value is immediately translated into the current X Axis Scale units for setting the value of the marker.

Remote Command	`:CALCulate:CDPower:MARKer[1]|2|...|12:X:POSition <real>` `:CALCulate:CDPower:MARKer[1]|2|...|12:X:POSition?`
Example	`:CALC:CDP:MARK10:X:POS 0.0` `:CALC:CDP:MARK10:X:POS?`
Notes	The query returns the marker's absolute X Axis value in trace points if the control mode is Normal, or the offset from the marker's reference marker in trace points if the control mode is Delta. The value is returned as a real number, not an integer, corresponding to the translation from X Axis Scale units to trace points. If the marker is Off the response is *Not A Number (NAN)*

	This command is not available when Marker Trace of the selected marker (:CALCulate:CDPower:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:TRACe?) is set to POLar. In this case, this command is ignored
Preset	After a preset, all Markers are turned OFF, so Marker X Axis Value query returns a Not A Number (NAN)
State Saved	No
Min	-9.9E+37
Max	9.9E+37

Marker Y Axis Value (Remote Command only)

Queries the marker Y Axis value in the current marker Y Axis unit.

Remote Command	:CALCulate:CDPower:MARKer[1]|2|...|12:Y?
Example	:CALC:CDP:MARK11:Y?
Notes	The query returns the marker Y-axis result if the control mode is Normal or **Delta**. If the marker is Off, the response is not a number (NAN)
Preset	Result dependent on markers setup and signal source
State Saved	No
Backwards Compatibility SCPI	:CALCulate:CDPower:MARKer[1]|2|...|12:FUNCtion:RESult?

Marker Mode

Sets the marker control mode to Normal, Delta, or Off. All interactions and dependencies detailed under the control description are enforced when the remote command is sent. If the selected marker is Off, pressing Marker sets it to Normal and places it at the center of the screen on the trace determined by the Marker Trace rules. At the same time, Marker X Axis Value appears on the Active Function area.

The default active function is the active function for the currently selected marker control mode. If the current control mode is Off, there is no active function and the active function is turned off.

Remote Command	:CALCulate:CDPower:MARKer[1]|2|...|12:MODE POSition | DELTa | OFF :CALCulate:CDPower:MARKer[1]|2|...|12:MODE?
Example	:CALC:CDP:MARK:MODE POS :CALC:CDP:MARK:MODE?
Preset	OFF
State Saved	Saved in instrument state

Range	POSition|DELTa|OFF
Annotation	Mkr # <X value> and <Marker value> upper right on graph When Marker Trace is Polar in WCDMA mode: Mkr # <Symbol Value>, <X value> and <Y value> upper right on graph

Backward Compatibility SCPI Commands

Sets or queries the state of a marker. Setting a marker that is OFF to an ON state or 1, puts it in Normal mode and places it at the center of the screen.

Remote Command	:CALCulate:CDPower:MARKer[1]|2|...|12:STATe OFF | ON | 0 | 1 :CALCulate:CDPower:MARKer[1]|2|...|12:STATe?
Example	:CALC:CDP:MARK3:STAT ON :CALC:CDP:MARK3:STAT?
Preset	OFF
State Saved	Saved in instrument state
Range	OFF|ON

Delta Marker (Reset Delta)

Pressing this button is exactly the same as pressing the “Delta” selection on the Marker Mode radio button. The selected marker becomes a Delta Marker. If the selected marker is already a Delta marker, the reference marker is moved to the current position of the selected marker, thus resetting the Delta to zero.

Marker Settings Diagram

The Marker Settings Diagram lets you configure the Marker system using a visual utility.

All Markers Off

Turns off all markers.

Remote Command	:CALCulate:CDPower:MARKer:AOFF
Example	:CALC:CDP:MARK:AOFF

Couple Markers

When this function is On, moving any marker causes an equal X Axis movement of every other marker which is not Fixed or Off. By “equal X Axis movement” we mean that we preserve the difference between each marker’s X Axis value (in the fundamental x-axis units of the trace that marker is on) and the X Axis value of the marker being moved (in the same fundamental x-axis units).

When the marker is assigned to the Polar graph, a symbol value is coupled instead of an X axis value.

This may result in markers going off screen.

Remote Command	`:CALCulate:CDPower:MARKer:COUPle[:STATe] ON | OFF | 1 | 0` `:CALCulate:CDPower:MARKer:COUPle[:STATe]?`
Example	`:CALC:CDP:MARK:COUP ON` `:CALC:CDP:MARK:COUP?`
Preset	`OFF` Presets on Mode Preset and All Markers Off
State Saved	Saved in instrument state

3.4.7.3 Peak Search

The controls on the Peak Search tab allow you to move the marker to selected peaks of the signal, giving you enormous analysis capabilities, particularly when combined with the Delta Marker function.

NOTE: Pressing the **Peak Search** hardkey automatically moves you to the **Peak Search** page of the **Marker** menu *and* performs a Peak Search.

Pressing the **Peak Search** tab once you are already *in* the **Marker** menu does *not* perform a Peak Search.

Marker X Axis Value

The Marker X-Axis Value control is the fundamental control that you use to move a marker around on the trace. This is the same as the X-Axis Value control on the Settings tab.

Peak Search

Pressing the Peak Search control moves the selected marker to the trace point which has the maximum y-axis value for that marker's trace.

NOTE: Pressing the **Peak Search** hardkey automatically moves you to the **Peak Search** page of the **Marker** menu *and* performs a Peak Search.

Remote Command	`:CALCulate:CDPower:MARKer[1]|2|...|12:MAXimum`

Example	:CALC:CDP:MARK2:MAX :SYST:ERR? can be used to query the errors to determine if a peak is found. The message "No peak found" will be returned after an unsuccessful search
Notes	Sending this command selects the subopcoded marker This command does not work when the selected marker is located on the polar trace. In this case, the command is ignored

Next Peak

Pressing Next Peak moves the selected marker to the peak that is next lower in amplitude than the current marker value. Only peaks which meet all enabled peak criteria are considered. If there is no valid peak lower than the current marker position, a "No peak found" message is generated and the marker is not moved.

If the selected marker was off, then it is turned on as a normal marker and a peak search is performed.

Remote Command	:CALCulate:CDPower:MARKer[1]|2|...|12:MAXimum:NEXT
Example	:CALC:CDP:MARK2:MAX:NEXT
Notes	Sending this command selects the subopcoded marker
State Saved	Not part of saved state

Next Peak Right

Pressing Next Pk Right moves the selected marker to the nearest peak right of the current marker that meets all enabled peak criteria. If there is no valid peak to the right of the current marker position, a "No peak found" message is generated and the marker is not moved.

If the selected marker was off, then it is turned on as a normal marker and a peak search is performed.

Pressing this control moves the selected marker to the nearest active channel right of the current marker when Marker Trace is either Code Domain Power or Code Domain Error. In other cases, pressing this control moves the selected marker to the highest peak right of the current marker.

Remote Command	:CALCulate:CDPower:MARKer[1]|2|...|12:MAXimum:RIGHt
Example	:CALC:CDP:MARK2:MAX:RIGH
Notes	Sending this command selects the subopcoded marker
State Saved	Not part of saved state

Next Peak Left

Pressing Next Pk Left moves the selected marker to the nearest peak left of the current marker that meets all enabled peak criteria. If there is no valid peak to the left of the current marker position, a “No peak found” message is generated and the marker is not moved.

If the selected marker was off, then it is turned on as a normal marker and a peak search is performed.

Pressing this control moves the selected marker to the nearest active channel left of the current marker when Marker Trace is either Code Domain Power or Code Domain Error. In other cases, moves the selected marker to the highest peak left of the current marker.

Remote Command	`:CALCulate:CDPower:MARKer[1]|2|...|12:MAXimum:LEFT`
Example	`:CALC:CDP:MARK2:MAX:LEFT`
State Saved	Not part of saved state

Minimum Peak

Moves the selected marker to the minimum y-axis value on the current trace. Minimum (negative) peak searches do not have to meet the peak search criteria. It just looks for the lowest y-axis value. If the selected marker is Off, it is turned on before the minimum search is performed.

Remote Command	`:CALCulate:CDPower:MARKer[1]|2|...|12:MINimum`
Example	`:CALC:CDP:MARK:MIN`
Notes	Sending this command selects the subopcoded marker
State Saved	Not part of saved state

Pk-Pk Search

Finds and displays the amplitude and frequency (or time, if in zero span) differences between the highest and lowest y-axis value. It places the selected marker on the minimum value on its selected trace. And it places that marker’s reference marker on the peak of its selected trace.

This function turns on the reference marker and sets its mode to Normal if it is not already on. (These markers may be on two different traces.)

The rules for finding the maximum peak are exactly the same as for Peak Search, including the use of the peak criteria rules. However, the minimum trace value is not required to meet any criteria other than being the minimum y-axis value in the trace.

If the selected marker is off, a delta type marker is turned on and the peak-to-peak search is done. If the selected marker is on, but it is not a delta marker, then it is changed to delta which turns on the reference marker if needed, and then it performs the peak-to-peak function.

Remote Command	`:CALCulate:CDPower:MARKer[1]|2|...|12:PTPeak`
Example	`:CALC:CDP:MARK:PTP`
Notes	Turns on the Marker D active function Sending this command selects the subopcoded marker
Dependencies	Pk-Pk Search is not available when Coupled Markers is on
Couplings	The selected marker becomes a delta marker if not already in delta mode
State Saved	Not part of saved state

Marker Delta

Pressing this button is exactly the same as pressing the “Delta” selection on the Marker Mode radio button on the Settings tab. The selected marker becomes a Delta Marker. If the selected marker is already a Delta marker, the reference marker is moved to the current position of the selected marker, thus resetting the Delta to zero.

The control is duplicated here in the Peak Search Menu to allow you to conveniently perform a peak search and change the marker’s control mode to Delta without having to access two separate menus.

3.4.7.4 Properties

The controls on the Properties tab are used to set certain properties of the selected marker.

Marker X Axis Value

The Marker X-Axis Value control is the fundamental control that you use to move a marker around on the trace. This is the same as the X-Axis Value control on the Settings tab.

Relative To

Selects the marker to which the selected marker is relative (its reference marker).

Every marker has another marker to which it is relative. This marker is referred to as the “reference marker” for that marker. This attribute is set by the Marker, Properties, Relative To key. The marker must be a Delta marker to make this attribute relevant. If it is a Delta marker, the reference marker determines how the marker is controlled and how its value is displayed. A marker cannot be relative to itself.

Remote Command	`:CALCulate:CDPower:MARKer[1]|2|...|12:REFerence <integer>` `:CALCulate:CDPower:MARKer[1]|2|...|12:REFerence?`
Example	`:CALC:CDP:MARK:REF 5` `:CALC:CDP:MARK:REF?`
Notes	This command causes the marker specified with the subopcode to become selected Range (for SCPI command): 1 to 12. If the range is exceeded the value is clipped A marker cannot be relative to itself so that choice is not available, and if sent from SCPI generates error -221: "Settings conflict; marker cannot be relative to itself" When queried a single value is returned (the specified marker numbers relative marker)
Couplings	The act of specifying the selected marker's reference marker makes the selected marker a Delta marker If the reference marker is off it is turned on in Normal mode at the delta marker location
Preset	The preset default "Relative To" marker (reference marker) is the next higher numbered marker (current marker +1). For example, if marker 2 is selected, then it's default reference marker is marker 3. The exception is marker 12, which has a default reference of marker 1 Set to the defaults by using Restore Mode Defaults. This is not reset by Marker Off, All Markers Off, or Preset
State Saved	Saved in instrument state. Not affected by Marker Off and hence not affected by Preset or power cycle
Min	1
Max	12
Annunciation	Appears in the marker label of a **Delta** marker

Marker Trace

Assigns the specified marker to the designated trace.

Remote Command	`:CALCulate:CDPower:MARKer[1]|2|...|12:TRACe CDPower	EVM	MERRor	PERRor	SPOWer	CPOWer	CDError	POLar` `:CALCulate:CDPower:MARKer[1]|2|...|12:TRACe?`
Example	`:CALC:CDP:MARK:TRACE POL` `:CALC:CDP:MARK:TRACE?`
Preset	`CDPower`
State Saved	Yes
Range	Code Domain Power|Code Domain Error|Symbol Power|Chip Power|EVM|Phase Error|Mag Error|Polar

Marker Settings Diagram

The Marker Settings Diagram lets you configure the Marker system using a visual utility. This is the same as the"Marker Settings Diagram" on page 535 control on the Settings tab.

3.4.7.5 Marker To

The controls on the Marker -> tab enable you to copy the current marker value into other instrument parameters (for example, Center Freq). The currently selected marker is made the active function on entry to this menu (if the currently selected marker is not on when you press this front panel key, it will be turned on at the center of the screen as a normal type marker and then made the active function).

The Marker -> (or Marker To) feature is used to quickly assign a marker's x- or y-axis value to another parameter. For example, if a marker's x-axis value is 500 MHz and y-axis value is –20 dBm, pressing Mkr -> CF would assign 500 MHz to Center Freq and pressing Mkr - >Ref Lvl would assign –20 dBm to Ref Level.

All Marker To functions executed from the front panel use the selected marker's values, while all Marker To remote commands specify in the command which marker's value to use.

Mkr->Despread

Executes post processing for the selected marker.

Remote Command	`:CALCulate:CDPower:MARKer[1]|2|...|12[:SET]:DESPread`
Example	`:CALC:CDP:MARK4:SET:DESP`
Dependencies	This function is available only when the marker trace is either 'CDPower' or 'CDError'

3.4.8 Meas Setup

The Meas Setup menu panel contains functions for setting up the measurement parameters.

3.4.8.1 Settings

This tab enables you to set measurement parameters.

Meas Type

Sets the code domain power computation type to either the absolute power or the relative value to the mean power.

- ABSolute – Code domain power is computed as the absolute power
- RELative – Code domain power is computed relative to the mean power

Remote Command	`:CALCulate:CDPower:TYPE RELative	ABSolute` `:CALCulate:CDPower:TYPE?`

Example	:CALC:CDP:TYPE REL :CALC:CDP:TYPE?
Preset	RELative
State Saved	Yes
Range	RELative|ABSolute

IF Gain

Enables you to control an internally switched IF amplifier with approximately 10 dB of gain. When it can be turned on without an overload, the dynamic range is always better with the amplifier on than off. The control "**IF Gain**" can be used to set the IF Gain function to Auto, or to On (the extra 10 dB) or Off. These settings affect sensitivity and IF overloads.

Remote Command	[:SENSe]:CDPower:IF:GAIN[:STATe] ON | OFF | 1 | 0 [:SENSe]:CDPower:IF:GAIN[:STATe]? [:SENSe]:CDPower:IF:GAIN:AUTO[:STATe] OFF | ON | 0 | 1 [:SENSe]:CDPower:IF:GAIN:AUTO[:STATe]?
Example	:CDP:IF:GAIN ON :CDP:IF:GAIN? :CDP:IF:GAIN:AUTO ON :CDP:IF:GAIN:AUTO?
Notes	This only applies to the RF input. It does not apply to baseband I/Q input
Dependencies	This control does not appear in VXT, M9393A, M9391A, or UXM
Couplings	Auto sets IF Gain to High Gain under any of the following conditions: 1. The input attenuator is set to 0 dB, *or*, 2. The preamp is turned on, *or*, 3. The Max Mixer Level is –20 dBm or lower. For other settings, 'auto' sets IF Gain to 'Low Gain'
Preset	OFF OFF
State Saved	Yes
Range	Low Gain|High Gain

Auto Couple

Immediately puts all Auto/Man functions into Auto. The **Auto Couple** action is confined to the current measurement only. It does not affect other measurements in the mode.

In the Auto state, Auto/Man functions are said to be “coupled”, meaning their values change as you make changes to other values in the measurement. This helps ensure accurate measurements and optimum dynamic range. Auto Couple is an immediate action function, and when it is executed, all the Auto/Man controls for the current measurement are set to Auto, and all measurement settings coupled to the Auto/Man parameters are automatically set to their optimal value.

For further details of measurement-specific settings (if any), see "Measurement-Specific Details" on page 544 below.

Remote Command	`:COUPle ALL`
Example	`:COUP ALL`
Backwards Compatibility SCPI	`:COUPLE ALL | NONE`
Backwards Compatibility Notes	`:COUP:NONE` puts all Auto/Man parameters in manual mode, decoupling all the coupled instrument parameters. It is retained for backwards compatibility and is *not* recommended for making measurements or new designs

All Auto/Man parameter couplings in the measurement are set to Auto. This includes couplings that may be unavailable or grayed-out due to the current state. For example, in the Swept SA measurement, there is no Auto/Man coupling for RBW while in Zero Span. Nonetheless, if **Auto Couple** were executed while in Zero Span it would set RBW to Auto "behind the scenes" so that, on exit from Zero Span, it would be in Auto.

Any Auto/Man selection specific (local) to the other measurements in the current Mode will not be affected by **Auto Couple**. Any functions that are *not* coupled with other instrument parameters, such as ranging or leveling variables, such as "AutoRange" or "AutoScale", will not be affected.

Executing the **Auto Couple** command generates the informational message, "All Auto/Man functions have been set to Auto".

Each parameter, upon being set to Auto, selects and sets the appropriate auto-coupled value based on that parameter’s coupling rules. The Dependency Resolver orchestrates the couplings for parameters that are dependent on one or more other parameters. The coupling and dependency rules for each parameter are defined in the chapter describing that parameter.

Executing the **Auto Couple** command *does not* affect markers, marker functions, trace or display attributes, or any other instrument setting other than those specifically mentioned above.

Measurement-Specific Details

TOI

Parameters affected by Auto Couple are:

- Center Frequency Step
- Resolution Bandwidth
- Span/RBW Ratio
- Sweep Time
- Video BandwidthVBW/RBW ratio
- Upper and Lower Tone (set to Sense
-)Zero span measurement Resolution Bandwidth
- Zero span measurement Dwell Time

Harmonics

For Harmonics, these parameters are:

- Resolution Bandwidth
- Fundamental Frequency
- Dwell Time
- Range Table Resolution Bandwidths
- Range Table Dwell Times

Meas Preset

Restores all the measurement parameters to their default values.

Remote Command	`:CONFigure:CDPower`
Example	`:CONF:CDP`
Couplings	Selecting Meas Preset restores all measurement parameters to these default values

3.4.8.2 Radio

The Radio tab contains controls to select the Radio Device, and enable or disable HSPA/HSPA+ options.

Radio Device

Allows you to specify the device to be used.

Remote Command	`[:SENSe]:RADio:STANdard:DEVice BTS | MS` `[:SENSe]:RADio:STANdard:DEVice?`
Example	`:RAD:STAN:DEV MS` `:RAD:STAN:DEV?`
Preset	BTS
State Saved	Saved in instrument state.
Range	BTS | MS
Backwards Compatibility SCPI	`[:SENSe]:RADio:DEVice`

HSPA Enable

Allows you to turn on or off the HSDPA/HSUPA option enable. This selection is necessary because some of the auto detection functions that expect an HSPA signal are less tolerant when the signal is noisy or distorted. When the HSPA signal is not expected, turn HSPA Enable off.

Remote Command	`[:SENSe]:RADio:CONFigure:HSDPa[:STATe] 0 | 1 | OFF | ON` `[:SENSe]:RADio:CONFigure:HSDPa[:STATe]?`
Example	`:RAD:CONF:HSDP 0` `:RAD:CONF:HSDP?`
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

HSPA+ Enable

Allows you to turn on or off the HSPA+ option enable. This selection is necessary because some of the auto detection functions that expect an HSPA+ signal are less tolerant when the signal is noisy or distorted. When the HSPA+ signal is not expected, turn HSPA+ Enable off.

Remote Command	`[:SENSe]:RADio:CONFigure:EHSPa[:STATe] OFF | ON | 0 | 1` `[:SENSe]:RADio:CONFigure:EHSPa[:STATe]?`
Example	`:RAD:CONF:EHSP 0` `:RAD:CONF:EHSP?`
Notes	When HSPA enable is OFF, HSPA+ function is disabled too.
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

3.4.8.3 Sync

This tab enables you to set sync parameters.

Sync Type (BTS)

Displays a menu that allows you to select the Sync Type. The selections are as follows:

- CPICH - Synchronizes with the CPICH channel.
- Pilot-aided Timing Est(imator) - Enables additional symbol timing estimation to each detected code channel through the demod calculation process by referring to the pilot channel (CPICH) timing correlation.
- SCH - Synchronizes with the SCH channel.
- Symbol Based (See Note below) - Accesses the menu for the code symbol to synchronize with. This submenu provides the following selections:
- Symbol Rate - Sets the symbol rate ranging from 7.5 to 960 ksps. The parameter automatically sets the maximum value for Code Number when appropriate.
- Code Number - Sets the code number. The range is 0 to 511 depending on the Symbol Rate setting.
- Antenna-2 CPICH - Synchronizes with the STTD Antenna-2 common pilot channel.
- Pilot-aided Timing Est(imator) - Enables additional symbol timing estimation to each detected code channel through the demod calculation process by referring to the pilot channel (Antenna-2 CPICH) timing correlation.

- Antenna-1 TSTD SCH – Synchronizes with the TSTD SCH Antenna-1
- Antenna-2 TSTD SCH – Synchronizes with the TSTD SCH Antenna-2

NOTE When Sync Type is ‘Symbol Based’, the selected symbol is assumed to be QPSK. Therefore, for cases other than QPSK, it cannot be synchronized correctly. For example, 16QAM HS-PDSCH symbol cannot be used to synchronize.

Remote Command	`[:SENSe]:CDPower:SYNC[:BTS] CPICh | SCH | SYMBol | A2CPich | A1SCh | A2SCh` `[:SENSe]:CDPower:SYNC[:BTS]?`
Example	`:CDP:SYNC SCH` `:CDP:SYNC?`
Notes	This command is effective when `[:SENSe]:RADio:DEVice` is set to BTS
Couplings	SYMBol synchronizes to the code symbol specified by `[:SENSe]:CDPower-:SYNC:SYMBol:SRATe` and the `[:SENSe]:CDPower:SYNC:SYMBol:SPRead` commands
Preset	`CPICh`
State Saved	Yes
Range	CPICH|SCH|Symbol Based|Antenna-2 CPICH|Antenna-1 TSTD SCH|Antenna-2 TSTD SCH

Sync Type (MS)

Selects the channel to synchronize with. You can select from the following types:

- DPCCh - Synchronizes to DPCCH and Slot Format, which is set by `[:SENSe]:CDPower:SFORmat:MS`
- PMESsage - Synchronizes to PRACH Message and Slot Format, which is set by `[:SENSe]:CDPower:PRACh:SIGNature` and `[:SENSe]:CDPower:SFORmat:MS`
- EDPCch - Synchronizes to E-DPCCH C8(1):I, the spreading factor is 256, and the code index is 1 on I-branch)

Remote Command	`[:SENSe]:CDPower:SYNC:MS DPCCh | EDPCch | PMESsage` `[:SENSe]:CDPower:SYNC:MS?`
Example	`:CDP:SYNC:MS DPCC` `:CDP:SYNC:MS?`
Dependencies	This command is effective when `[:SENSe]:RADio:DEVice` is set to MS
Preset	`DPCCh`
State Saved	Yes
Range	DPCCH|E-DPCCH C8(1):I|PRACH Message

Pilot-aided Timing Estimator (BTS only)

Enables additional symbol timing estimation to each detected code channel through the demod calculation process by referring to the pilot channel (i.e. CPICH or Ant2 CPICH, accordingly) timing correlation. It is expected to improve symbol reference vector estimation robustness for some specific impairment conditions: for example, the signal under test is assumed to have asymmetric filter response. Note that this function would not always be effective to any signal condition; on the contrary, turning this “on” may decrease the estimation robustness and measurement speed for some different cases. A typical example it is worth to try this out is when you find that the peak symbol EVM result is unexpectedly high compared to the RMS symbol EVM result.

Remote Command	`[:SENSe]:CDPower:SYNC:CPICh:ESTimator OFF | ON | 0 | 1` `[:SENSe]:CDPower:SYNC:CPICh:ESTimator?`
Example	`:CDP:SYNC:CPIC:EST 0` `:CDP:SYNC:CPIC:EST?`
Notes	This command is effective when `[:SENSe]:RADio:DEVice` is set to BTS and `[:SENSe]:CDPower:SYNC[:BTS]` is set to CPICh or A2CPich
Preset	`OFF`
State Saved	Yes
Range	`OFF|ON`

Synchronization Symbol Rate (BTS only)

Sets the symbol rate of the code symbol to synchronize with.

Sets the symbol rate ranging from 7.5 to 960 ksps. The parameter automatically sets the maximum value for Code Number when appropriate.

Remote Command	`[:SENSe]:CDPower:SYNC:SYMBol:SRATe <integer>` `[:SENSe]:CDPower:SYNC:SYMBol:SRATe?`
Example	`:CDP:SYNC:SYMB:SRAT 30000` `:CDP:SYNC:SYMB:SRAT?`
Notes	This command is effective when `[:SENSe]:RADio:DEVice` is set to BTS, and `[:SENSe]:CDPower:SYNC[:BTS]` is set to SYMBol
Preset	7500
State Saved	Yes
Range	7500|15000|30000|60000|120000|240000|480000|960000

Synchronization Code Number (BTS only)

Sets the spread code number of the code symbol to synchronize with. The range depends on the Symbol Rate setting.

Remote Command	`[:SENSe]:CDPower:SYNC:SYMBol:SPRead <integer>` `[:SENSe]:CDPower:SYNC:SYMBol:SPRead?`
Example	`:CDP:SYNC:SYMB:SPR 255` `:CDP:SYNC:SYMB:SPR?`
Dependencies	This command is effective when `[:SENSe]:RADio:DEVice` is set to BTS, and `[:SENSe]:CDPower:SYNC[:BTS]` is set to SYMBol `[:SENSe]:CDPower:SYNC:SYMBol:SRATe`
Preset	1
State Saved	Yes
Range	(see table below)

[:SENSe]:CDPower:SYNC:SYMBol:SRATe	Range
7500	0 to 511
15000	0 to 255
30000	0 to 127
60000	0 to 63
120000	0 to 31
240000	0 to 15
480000	0 to 7
960000	0 to 3

Min/Max

Min: 0

Max: Dependent on the symbol rate settings as follows:

[:SENSe]:CDPower:SYNC:SYMBol:SRATe	Min/Max
7500	511
15000	255
30000	127
60000	63
120000	31
240000	15
480000	7
960000	3

Slot Format (MS only)

Selects Slot Format for synchronization to the uplink signal.

Remote Command	`[:SENSe]:CDPower:SFORmat:MS SF0 | SF1 | SF2 | SF3 | SF4 | SF5 | AUTO` `[:SENSe]:CDPower:SFORmat:MS?`
Example	`:CDP:SFOR:MS SF2` `:CDP:SFOR:MS?`
Dependencies	This command is effective when `[:SENSe]:RADio:DEVice` is set to MS, and `[:SENSe]:CDPower:SYNC:MS` is set to DPCCh
Preset	`SF0`
State Saved	Yes
Range	`SF0|SF1|SF2|SF3|SF4|SF5|AUTO`

Preamble Signature (MS only)

Sets the Preamble Signature number for PRACH Message detection. Based on this value, the code allocation of the PRACH message control part is calculated.

Remote Command	`[:SENSe]:CDPower:PRACh:SIGNature <integer>`
	`[:SENSe]:CDPower:PRACh:SIGNature?`
	`[:SENSe]:CDPower:PRACh:SIGNature:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:CDPower:PRACh:SIGNature:AUTO?`

Example	`:CDP:PRAC:SIGN 2`
	`:CDP:PRAC:SIGN?`
	`:CDP:PRAC:SIGN:AUTO ON`
	`:CDP:PRAC:SIGN:AUTO?`

Notes	Sets Signature Auto mode to ON for PRACH Preamble detection
Dependencies	This command is effective when `[:SENSe]:RADio:DEVice` is set to MS, and `[:SENSe]:CDPower:SYNC:MS` is set to PMESsage
Preset	0 `ON`
State Saved	Yes Yes
Range	Auto|Man
Min/Max	0/15

Sync Start Slt

Toggles the Sync Start Slot state between on and off. Turning the Sync Start Slot parameter On and specifying the slot number to measure as the first slot, you can use any trigger (even “Free Run”) to get the measurement result beginning with the specified slot number.

Example 1

- Trigger Source: Free Run (Immediate)
- Sync Start Slot state : On
- Sync Start Slot number : 0
- Capture Interval : 1 frame

The synchronization always starts from slot number 0.0 to 15.0 regardless of the trigger type.

Example 2

If the Sync Start Slot state is set to Off, the measurement performs synchronization at any slot found right after the trigger timing.

Remote Command	`[:SENSe]:CDPower:SSLot:NUMBer <integer>`
	`[:SENSe]:CDPower:SSLot:NUMBer?`
	`[:SENSe]:CDPower:SSLot[:STATe] OFF | ON | 0 | 1`
	`[:SENSe]:CDPower:SSLot[:STATe]?`

Example	`:SENS:CDP:SSL:NUMB 5`
	`:SENS:CDP:SSL:NUMB?`
	`:SENS:CDP:SSL:STAT ON`
	`:SENS:CDP:SSL:STAT?`

Notes	Turn first slot number detection mode on or off
Preset	0 OFF
State Saved	Yes Yes
Range	0 to 14 OFF|ON
Min/Max	0/14

Freq Error Tol Range (MS only)

Specifies the frequency error tolerance range. You can select one of the following ranges:

- Normal
- Wide

Wide provides the wide range of the frequency error tolerance. To correctly demodulate signals of higher complexity, a reduced frequency tolerance is required. For example, composite number of channels is modulated on the test signal, the modulation is complex, and frequency error is very critical to demodulate correctly. Therefore, in such a case, to demodulate a complex signal, set this parameter to Normal.

Remote Command	`[:SENSe]:CDPower:FERRor:TRANge WIDE | NORMal` `[:SENSe]:CDPower:FERRor:TRANge?`
Example	`:CDP:FERR:TRAN WIDE` `:CDP:FERR:TRAN?`
Dependencies	This parameter is valid only when the device type is MS (Uplink). When the device type is BTS (Downlink), this control is not shown
Preset	`NORMal`
State Saved	Yes
Range	`WIDE|NORMal`

Primary Scramble Code (BTS only)

Sets a numeric value for the primary scramble code for synchronization.

- Autodetect - The instrument autodetects the primary scramble code. The result is also available using SCPI command, `:READ|FETCh:CDP19?` Available only when Sync Type for BTS is SCH or CPICH and Capture Interval is equal to or more than 1 frame. When Autodetect is not available, the result as detected primary scramble code is not valid
- Manual - You can specify the value for the primary scramble code. The range is 0 to 511

If the Device is set to MS, this label changes to Slot Format to define the DPCCH pilot pattern to synchronize with. It allows you to enter either 0 or 2 slot formats.

The BTS scramble code number (Down Link) is determined by “Primary Scramble Code”, “Scramble Code Offset” and “Scramble Code Type”.

The following information is an excerpt from TS25.213 Section 5.2.2 Scramble Code.

A total of 218-1 = 262,143 scrambling codes, numbered 0...262,142 can be generated. However, not all the scrambling codes are used. The scrambling codes are divided into 512 sets each of a primary scrambling code and 15 secondary scrambling codes.

The primary scrambling codes consist of scrambling codes n=16*i where i=0...511. The i:th set of secondary scrambling codes consists of scrambling codes 16*i+k, where k=1...15.

There is a one-to-one mapping between each primary scrambling code and 15 secondary scrambling codes in a set such that i:th primary scrambling code corresponds to i:th set of secondary scrambling codes.

Hence, according to the above, scrambling codes k = 0, 1, ..., 8191 are used. Each of these codes are associated with a left alternative scrambling code and a right alternative scrambling code, that may be used for compressed frames. The left alternative scrambling code corresponding to scrambling code k is scrambling code number k + 8192, while the right alternative scrambling code corresponding to scrambling code k is scrambling code number k + 16384. The alternative scrambling codes can be used for compressed frames. In this case, the left alternative scrambling code is used if n<SF/2 and the right alternative scrambling code is used if n^3SF/2, where cch,SF,n is the channelization code used for non-compressed frames. The usage of alternative scrambling code for compressed frames is signalled by higher layers for each physical channel respectively.

Primary Scramble Code corresponds to i (i=0 ... 511), Scramble Code Offset corresponds to k (k= 1 ... 15: Secondary Scramble Code, 0: Primary Scramble Code) and Scramble Code Type Left and Right correspond +8192 and +16384 offset respectively.

Remote Command	`[:SENSe]:CDPower:SYNC:SCRamble[:BTS] <integer>`
	`[:SENSe]:CDPower:SYNC:SCRamble[:BTS]?`
	`[:SENSe]:CDPower:SYNC:SCRamble[:BTS]:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:CDPower:SYNC:SCRamble[:BTS]:AUTO?`

Example	`:CDP:SYNC:SCR 1`
	`:CDP:SYNC:SCR?`
	`:CDP:SYNC:SCR:AUTO 1`
	`:CDP:SYNC:SCR:AUTO?`

Notes	Autodetect is available when the following conditions are met: – Option N/W9073A-BFP (auto scramble code detection) is installed – `[:SENSe]:RADio:DEVice` is set to BTS – Sync Type for BTS is set to SCH or CPICH – Capture Interval is equal to or more than 1 frame
Dependencies	This command is effective when `[:SENSe]:RADio:DEVice` is set to BTS
Preset	0

	OFF
State Saved	Yes
Range	Auto Detect|Manual
Min/Max	0/511

Scramble Code (MS only)

Sets the MS scramble code for synchronization. When this control is selected, the "Hex Input" menu appears.

Remote Command	`[:SENSe]:CDPower:SYNC:SCRamble:MS <integer>` `[:SENSe]:CDPower:SYNC:SCRamble:MS?`
Example	`:CDP:SYNC:SCR:MS 0` `:CDP:SYNC:SCR:MS?`
Dependencies	This command is effective when [:SENSe]:RADio:DEVice is set to MS
Preset	0 (0x0; 24 bits)
State Saved	Yes
Min/Max	0 (0x0; 24 bits)/16777215 (0xFFFFFF; 24 bits)

Scramble Code Offset (BTS only)

Sets the number of the scramble code offset used in the measurement.

Remote Command	`[:SENSe]:CDPower:SYNC:SCRamble[:BTS]:OFFSet <integer>` `[:SENSe]:CDPower:SYNC:SCRamble[:BTS]:OFFSet?`
Example	`:CDP:SYNC:SCR:OFFS 1` `:CDP:SYNC:SCR:OFFS?`
Dependencies	This command is effective when `[:SENSe]:RADio:DEVice` is set to BTS. This command is not effective when `[:SENSe]:CDP:SYNC:SCRamble[:BTS]:AUTO` is set to ON
Preset	0
State Saved	Yes
Range	0 to 15 (0 for the primary scramble code; 1 to 15 for the secondary scramble code)
Min/Max	0/15

Scramble Code Type (BTS only)

Sets the BTS primary scramble code type for synchronization.

Sets the scramble code type to Std (standard), Left, or Right to make the measurement.

- LEFT – the left alternative scrambling code whose number is the primary scramble code number + 8192 is used
- RIGHt – the right alternative scrambling code whose number is the primary scrambling code number + 16384 is used
- STANdard – the standard scrambling code whose number is the primary scrambling code number is used

Remote Command	`[:SENSe]:CDPower:SYNC:SCRamble[:BTS]:TYPE LEFT | RIGHt | STANdard` `[:SENSe]:CDPower:SYNC:SCRamble[:BTS]:TYPE?`
Example	`:CDP:SYNC:SCR:TYPE LEFT` `:CDP:SYNC:SCR:TYPE?`
Dependencies	This command is effective when `[:SENSe]:RADio:DEVice` is set to BTS This command is not effective when `[:SENSe]:CDP:SYNC:SCRamble[:BTS]:AUTO` is set to ON
Preset	`STANdard`
State Saved	Yes
Range	`LEFT|RIGHt|STANdard`

Advanced Sync Setup

Enables you to access a dialog for advanced sync parameters.

Chip Rate

Changes the chip rate.

Remote Command	`[:SENSe]:CDPower:CRATe <freq>` `[:SENSe]:CDPower:CRATe?`
Example	`:CDP:CRAT 4000000` `:CDP:CRAT?`
Preset	3.84 MHz
State Saved	Yes
Min/Max	3.456 MHz/4.224 MHz

RRC Filter Control

Specifies the alpha value of the Root Raised Cosine (RRC) filter and changes its status (ON/OFF). This ON/OFF state change requires a measurement restart.

Remote Command	[:SENSe]:CDPower:FILTer:ALPHa <real> [:SENSe]:CDPower:FILTer:ALPHa? [:SENSe]:CDPower:FILTer[:RRC][:STATe] OFF | ON | 0 | 1 [:SENSe]:CDPower:FILTer[:RRC][:STATe]?
Example	:CDP:FILT:ALPH 0.3 :CDP:FILT:ALPH? :CDP:FILT ON :CDP:FILT?
Preset	0.22 ON
State Saved	Yes
Min/Max	0.01/0.50
Backwards Compatibility SCPI	[:SENSe]:CDPower:ALPHa

Spectrum Inversion

Toggles the spectrum function between Normal and Invert.

Invert: This function conjugates the spectrum, which is equivalent to taking the negative of the quadrature component in demodulation.

The correct setting (Normal or Invert) depends on whether the signal at the input of the instrument has a high or low side mix.

Remote Command	[:SENSe]:CDPower:SPECtrum INVert | NORMal [:SENSe]:CDPower:SPECtrum?
Example	:CDP:SPEC INV :CDP:SPEC?
Preset	NORMal
State Saved	Yes
Range	Normal|Invert

SCH Suppression

Subtracts the primary and secondary SCH power leakage from other code channels during the demodulation process in the instrument. This improves symbol EVM, magnitude error and phase error measurement accuracy. Downlink channels with low coding gain can suffer interference of primary and secondary SCH, because they are not orthogonal with other code channels. To correct this, the P-SCH and S-SCH power are calculated in the estimation ("Best Fitting") using MMSE, then they are subtracted from incoming signal before any other channels are demodulated.

Remote Command	`:CALCulate:CDPower:SSUPpress[:STATe] ON | OFF | 1 | 0` `:CALCulate:CDPower:SSUPpress[:STATe] ?`
Example	`:CALC:CDP:SSUP ON` `:CALC:CDP:SSUP?`
Dependencies	This control is available only when Device is BTS
Preset	ON
State Saved	Yes
Range	ON|OFF

MEQ (Equalizer Mode)

Sets the Equalizer mode as follows.

- Off: Equalizer is not active
- Normal: Equalizer is active (Mirror Frequency Spectrum is Off)
- Invert: Equalizer is active (Mirror Frequency Spectrum is On)

Remote Command	`[:SENSe]:CDPower:MEQ OFF | NORMal | INVert` `[:SENSe]:CDPower:MEQ?`
Example	`:CDP:MEQ OFF` `:CDP:MEQ?`
Dependencies	Available when Option BBA or N9073C-DP2 (or both), and N9073C-DFP are installed
Preset	OFF
State Saved	Yes
Range	OFF|NORMal|INVert

3.4.8.4 Time

This tab enables you to set time parameters.

Capture Interval

Accesses a menu that enables you to set the signal capture length for the code domain power measurement.

For details, see "Capture Interval Selection" on page 558.

For the associated remote command, see "Frame Capture Interval (Remote Command only)" on page 558.

Capture Interval Selection

Allows you to set the data capture length, from 1 slot to 16 frames, that will be used in the acquisition.

(1 frame = 10 ms)

Couplings	Changing this parameter forces a change: – 1 slot: 0.067 – 3 slots: 0.2 – 1 frame: 1.0 – 2 frames: 2.0 – 3 frames: 3.0 – 4 frames: 4.0 – frames: 8.0 – 16 frames: 16.0
Preset	1 frame
State Saved	Yes
Range	1 Slot|3 Slots|1 Frame|2 Frames|3 Frames|4 Frames|8 Frames|16 Frames

Frame Capture Interval (Remote Command only)

Sets the data capture length in frames (1 frame equals 10 ms) that will be used in the acquisition.

Remote Command	`[:SENSe]:CDPower:CAPTure:TIME[:FRAMe] <real>` `[:SENSe]:CDPower:CAPTure:TIME[:FRAMe]?`
Example	`:CDP:CAPT:TIME 1` `:CDP:CAPT:TIME?`
Preset	1
State Saved	Yes
Range	0.067 (any value below 1 is rounded to the nearest multiple of 0.067), 1.0, 2.0, 3.0, 4.0 and 8.0 and 16.0 frames (0.67 to 80 ms; 1/15 frame equals 1 slot). Other numeric values between 1 and 16 are rounded to the nearest integer; entries between integers are rounded up, excepting for entries above 16, which are rounded down to 16
Min/Max	0.067/16.0

Meas Offset

Sets the timing offset of measurement interval in slots. (1 slot = 666.6 us)

The sum of `:CALCulate:CDPower:SWEep:TIME` and `:CALCulate:CDPower:SWEep:OFFSet` must be equal to or less than `:SENSe:CDPower:CAPTure:TIME` * 15. If the sum exceeds this value, `:CALCulate:CDPower:SWEep:OFFSet` is adjusted automatically.

Remote Command	`:CALCulate:CDPower:SWEep:OFFSet <integer>` `:CALCulate:CDPower:SWEep:OFFSet?`
Example	`:CALC:CDP:SWE:OFFS 2` `:CALC:CDP:SWE:OFFS?`
Notes	The sum of Meas Offset and "Meas Interval" on page 559 must be equal to or less than Capture Interval. If the sum becomes more than the value, the "Meas Interval" on page 559 is adjusted automatically to Capture Interval – Meas Offset
Preset	0
State Saved	Yes
Min/Max	0/Capture Interval in slot - 1

Meas Interval

Sets the length of the measurement interval in slots (1 slot = 666.6us).

The sum of `:CALCulate:CDPower:SWEep:TIME` and `:CALCulate:CDPower:SWEep:OFFSet` must be equal to or less than `:SENSe:CDPower:CAPTure:TIME` * 15. If the sum exceeds this value, `:CALCulate:CDPower:SWEep:OFFSet` is adjusted automatically.

Remote Command	`:CALCulate:CDPower:SWEep:TIME <integer>` `:CALCulate:CDPower:SWEep:TIME?`
Example	`:CALC:CDP:SWE:TIME 2` `:CALC:CDP:SWE:TIME?`
Notes	The sum of "Meas Offset" on page 559and Meas Interval must be equal to or less than Capture Interval in slot If the sum is larger than the limit value, Meas Interval and/or "Meas Offset" on page 559 is adjusted automatically
Preset	1
State Saved	Yes
Min/Max	1/Capture Interval in slot

Capture Time Diagram

Accesses a diagram that enables you to set up time parameters.

3.4.8.5 Channel/Layer

This tab enables you to set channel/layer parameters.

Symbol Boundary (BTS only)

Opens a menu that enables you to specify the symbol boundary detection mode on downlink.

Available selections are as follows:

Auto Detect

Auto Detect [SCPI Enum: AUTO] - Select this to set the symbol boundary detection to the automatic mode. Various code channels are measured and the most appropriate code channel is selected as the reference channel.

Test Model 1

Test Model 1 - Accesses a menu with further selections of Test Model 1 with 4, 8, 16, 32 or 64 DPCH channels and with S-CCPCH

- Test Model 1 w/4DPCH w/ S-CCPCH [SCPI Enum: TM1D4] - Select this to set the Code Domain Power Measurement to the Test Model 1 with 4 DPCH channels and 1 S-CCPCH channel
- Test Model 1 w/8DPCH w/ S-CCPCH [SCPI Enum: TM1D8] - Select this to set the Code Domain Power Measurement to Test Model 1 with 8 DPCH channels and 1 S-CCPCH channel
- Test Model 1 w/16 DPCH w/ S-CCPCH [SCPI Enum: TM1D16] - Select this to set the Code Domain Power Measurement to the Test Model 1 with 16 DPCH channels and 1 S-CCPCH channel
- Test Model 1 w/32 DPCH w/ S-CCPCH [SCPI Enum: TM1D32] - Select this to set the Code Domain Power Measurement to Test Model 1 with 32 DPCH channels and 1 S-CCPCH channel
- Test Model 1 w/64 DPCH w/ S-CCPCH [SCPI Enum: TM1D64] - Select this to set the Code Domain Power Measurement to Test Model 1 with 64 DPCH channels and 1 S-CCPCH channel

3GPP TS25.141, Table 6.1: Test Model 1 (2009-12 version) (S-CCPCH included)

Type	Number of Channels	Fraction of Power (%)	Level setting (dB)	Channelization Code	Timing offset (x256Tchip)
P-CCPCH+SCH	1	10	-10	1	0
Primary CPICH	1	10	-10	0	0
PICH	1	1.6	-18	16	120
S-CCPCH containing PCH (SF=256)	1	1.6	-18	3	0
DPCH (SF=128)	4*/8*/16/32/64	76.8 in total	See 3GPP TS25.141 table 6.2	See 3GPP TS25.141 table 6.2	See 3GPP TS25.141 table 6.2

Table Note *: Only applicable to Home BS.

Test Model 2

Test Model 2 – Accesses a menu to allow selections of Test Model 2 with S-CCPCH.

– **Test Model 2 w/S-CCPCH** [SCPI Enum: TM2SC] – Select this to set the Code Domain Power measurement to Test Model 2 with 1 S-CCPCH channel

3GPP TS25.141, Table 6.3: Test Model 2 (2002-09 version) (S-CCPCH included)

Type	Number of Channels	Fraction of Power (%)	Level setting (dB)	Channelization Code	Timing offset (x256Tchip)
P-CCPCH+SCH	1	10	-10	1	0
Primary CPICH	1	10	-10	0	0
PICH	1	5	-13	16	120
S-CCPCH containing PCH (SF=256)	1	5	-13	3	0
DPCH (SF=128)	3	2 x 10, 1 x 50	2 x –10, 1 x –3	24, 72, 120	1, 7, 2

Test Model 3

Test Model 3 – Accesses a menu to allow further selections from Test Model 3 with 16 or 32 DPCH channels, and with S-CCPCH.

– **Test Model 3 w/4 DPCH w/ S-CCPCH** [SCPI Enum: TM3D4SC] – Select this to set the Code Domain Power Measurement to Test Model 3 with 4 DPCH channels and 1 S-CCPCH channel

- **Test Model 3 w/8 DPCH w/ S-CCPCH** [SCPI Enum: TM3D8SC] - Select this to set the Code Domain Power Measurement to Test Model 3 with 8 DPCH channels and 1 S-CCPCH channel
- **Test Model 3 w/16 DPCH w/ S-CCPCH** [SCPI Enum: TM3D16SC] - Select this to set the Code Domain Power measurement to Test Model 3 with 16 DPCH channels and 1 S-CCPCH channel
- **Test Model 3 w/32 DPCH w/ S-CCPCH** [SCPI Enum: TM3D32SC] - Select this to set the Code Domain Power measurement to Test Model 3 with 32 DPCH channels and 1 S-CCPCH channel

3GPP TS25.141, Table 6.4: Test Model 3 (2009-12 version) (S-CCPCH included)

Type	Number of Channels	Fraction of Power (%) 16/32	Level settings (dB) 16/32	Channelization Code	Timing offset (x256Tchip)
P-CCPCH+SCH	1	15,8/15,8/12,6/7,9	-8/ -8 / -9 / -11	1	0
Primary CPICH	1	15.8/15.8/12,6/7,9	-8 / -8 / -9 / -11	0	0
PICH	1	2.5/2.5/5/1.6	-16/-16/-13/-18	16	120
S-CCPCH containing PCH (SF=256)	1	2.5/2.5/5/1.6	-16/-16/-13/-18	3	0
DPCH (SF=256)	4*/8*/16/32	63,4/63,4/63,7/80,4 in total	See 3GPP TS25.141 table 6.5	See 3GPP TS25.141 table 6.5	See 3GPP TS25.141 table 6.5

Table Note *: Only applicable to Home BS

Test Model 4

Test Model 4 - Accesses a menu to allow further selections of Test Model 4.

- **Test Model 4 w/P-CPICH** [SCPI Enum: TM4CP] - Select this to set the Code Domain Power measurement to Test Model 4 with 1 CPICH channel
- **Test Model 4** [SCPI Enum: TM4] - Select this to set the Code Domain Power measurement to Test Model 4 (no CPICH channel)

3GPP TS25.141, Table 6.6: Test Model 4 Active Channels (2001-09 version)

Type	Number of Channels	Fraction of Power (%)	Level setting (dB)	Channelization Code	Timing offset	Type
PCCPCH+SCH	1	50 to 1.6	-3 to -18	1	0	PCCPCH+SCH
Primary CPICH[1]	1	10	-10	0	0	Primary CPICH[1]

Table Note 1: The CPICH channel is optional.

Test Model 5

Test Model 5 - Accesses a menu with further selections of Test Model 5. This feature is available when ‘HSPA Enable’ is on.

- Test Model 5 w/2 HS-PDSCH w/6 DPCH [SCPI Enum: TM5H2] - Select this to set the Code Domain Power measurement to Test Model 5 with 2 HS-PDSCH channels and 6 DPCH channels
- Test Model 5 w/4 HS-PDSCH w/14 DPCH [SCPI Enum: TM5H4] - Select this to set the Code Domain Power measurement to Test Model 5 with 4 HS-PDSCH channels and 14 DPCH channels
- Test Model 5 w/8 HS-PDSCH w/30 DPCH [SCPI Enum: TM5H8] - Select this to set the Code Domain Power measurement to Test Model 5 with 8 HS-PDSCH channels and 30 DPCH channels
- Test Model 5 w/4 HS-PDSCH w/4 DPCH [SCPI Enum: TM5D4] - Select this to set the Code Domain Power Measurement to Test Model 5 with 4 HS-PDSCH channels and 4 DPCH channels
- Enables you to select one from a variety of configurations using Test Model 5. This feature is available when ‘HSPA Enable’ is on

3GPP TS25.141, Table 6.6A: Test Model 5 Active Channels (2009-12 version)

Type	Number of Channels	Fraction of Power (%)	Level setting (dB)	Channelization Code	Timing offset (x256Tchip)
P-CCPCH+SCH	1	7.9	-11	1	0
Primary CPICH	1	7.9	-11	0	0
PICH	1	1.3	-19	16	120
S-CCPCH containing PCH (SF=256)	1	1.3	-19	3	0
DPCH	30/14/6/4	14/14.2/14.4/14.	See 3GPP	See 3GPP	See 3GPP

Type	Number of Channels	Fraction of Power (%)	Level setting (dB)	Channelization Code	Timing offset (x256Tchip)
(SF=128)	(*)	2 in total	TS25.141 table 6.6.B	TS25.141 table 6.6B	TS25.141 table 6.6.B
HS-SCCH	2	4 in total	See 3GPP TS25.141 table 6.6C	See 3GPP TS25.141 table 6.6C	See 3GPP TS25.141 table 6.6C
HS-PDSCH (16QAM)	8/4/2(*)	63.6/63.4/63.2 in total	See 3GPP TS25.141 table 6.6D	See 3GPP TS25.141 table 6.6D	See 3GPP TS25.141 table 6.6D

Table Note *: 2 HS-PDSCH shall be taken together with 6 DPCH, 4 HS-PDSCH shall be taken with 14 DPCH or (for Home BS only) 4 DPCH, and 8 HS-PDSCH shall be taken together with 30 DPCH.

Test Model 6

Test Model 6 – Accesses a menu with further selections of Test Model 6. This feature is available when both 'HSPA Enable' and 'HSPA+ Enable' are on.

- **Test Model 6 w/8 HS-PDSCH w/30 DPCH** [SCPI Enum: TM6H8] – Select this to set the Code Domain Power measurement to Test Model 6 with 8 HS-PDSCH channels and 30 DPCH channels
- **Test Model 6 w/4 HS-PDSCH w/4 DPCH** [SCPI Enum: TM6D4] – Select this to set the Code Domain Power measurement to Test Model 6 with 4HS-PDSCH channels and 4 DPCH channels

3GPP TS25.141 Table 6.6E: Test Model 6 Active Channels

Type	Number of Channels	Fraction of Power (%)	Level setting (dB)	Channelization Code	Timing offset (x256Tchip)
P-CCPCH+SCH	1	7.9	-11	1	0
Primary CPICH	1	7.9	-11	0	0
PICH	1	1.3	-19	16	120
S-CCPCH containing PCH (SF=256)	1	1.3	-19	3	0
DPCH (SF=128)	30/4*	27.1 in total	See 3GPP TS25.141 table 6.6F	See 3GPP TS25.141 table 6.6F	See 3GPP TS25.141 table 6.6F
HS-SCCH	2	4 in total	See 3GPP TS25.141 table 6.6G	See 3GPP TS25.141 table 6.6G	See 3GPP TS25.141 table 6.6G

Type	Number of Channels	Fraction of Power (%)	Level setting (dB)	Channelization Code	Timing offset (x256Tchip)
HS-PDSCH (64QAM)	8/4*	50.5 in total	See 3GPP TS25.141 table 6.6H	See 3GPP TS25.141 table 6.6H	See 3GPP TS25.141 table 6.6H

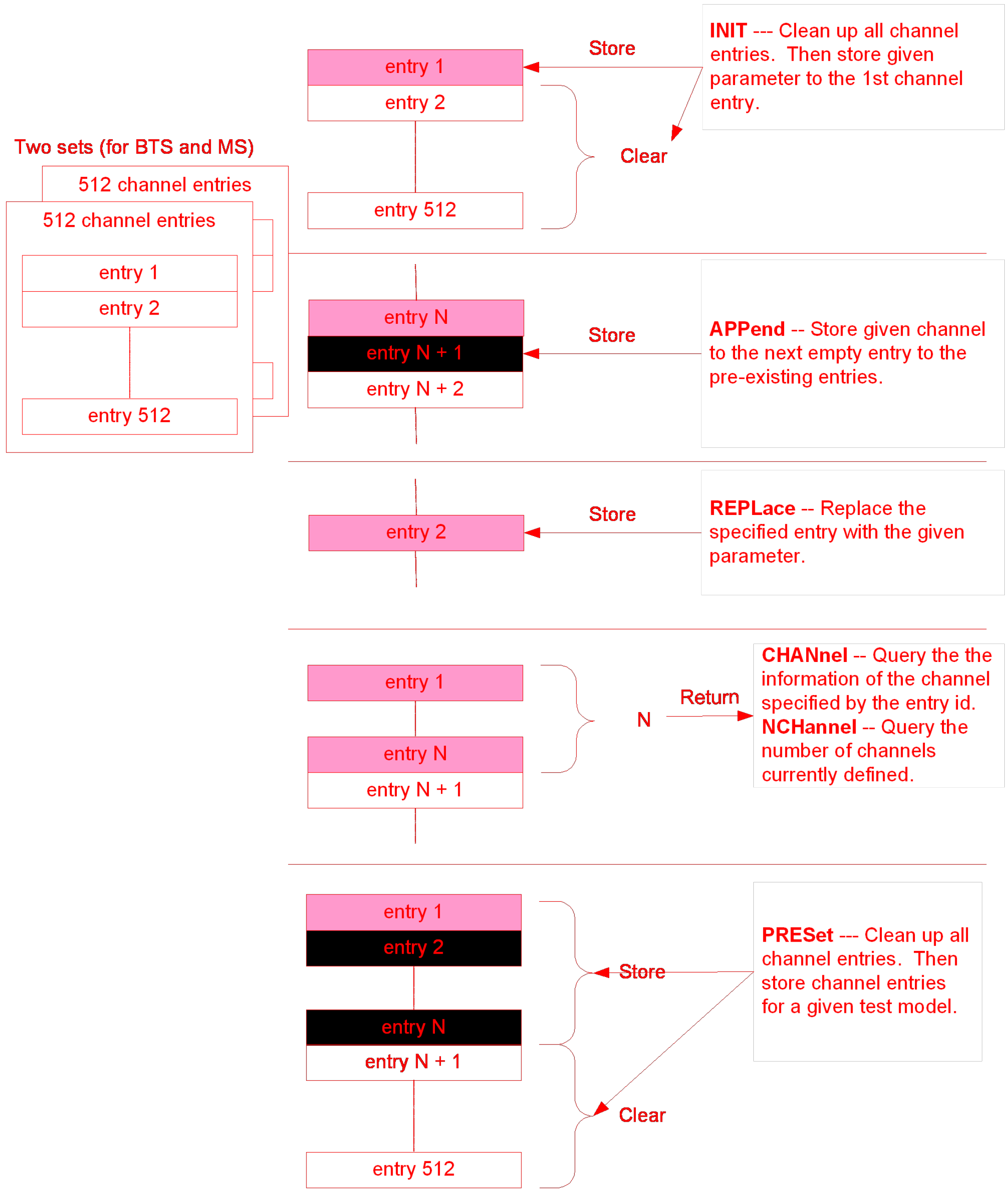
Table Note *: 8 HS-PDSCH shall be taken together with 30 DPCH, and (for Home BS only) 4 HS-PDSCH shall be taken with 4 DPCH.

Custom

Custom [SCPI Enum: CUSTom] – Provides a flexible way to specify predefined active channels. By choosing it, you can specify a customized list of active channels using the following remote command: Initialize List, Append List and Replace List.

The following commands handle the list of the custom active channel list for BTS.

- **INIT** – Cleans up all channel entries. Then stores given parameter to the 1st channel entry. See "Initialize List (Remote Command Only)" on page 566
- **APPend** – Stores given channel to the next empty entry to the pre-existing entries. See "Append List (Remote Command Only)" on page 569
- **REPLace** - Replaces the specified entry with the given parameter. See "Replace List (Remote Command Only)" on page 571
- **CHANnel** – Queries the information of the channel specified by the entry id. See "Query List (Remote Command Only)" on page 574
- **NCHannel** - Queries the number of channels currently defined. See "Symbol Boundary Custom Active Channel List – Number Of Entries BTS (Remote Command Only)" on page 575
- **PRESet** – Cleans up all channel entries. Then stores channel entries for a given test model. See "Symbol Boundary Custom Active Channel List – Load Preset Setting BTS (Remote Command Only)" on page 576



Initialize List (Remote Command Only)

Initializes the current custom active channel list. This creates a new entry with the given parameter.

Parameter	Name/Value	Description
1	<symbol_rate>	Specifies symbol rate of the channel

Parameter	Name/Value	Description
2	<code_num>	Specifies code number of the channel
3	QPSK	Specifies the channel's modulation scheme is QPSK
	QAM16	Specifies the channel's modulation scheme is QAM16 This choice is available only for channels with symbol rate 240000 Only when 'HSPA' functionality is enabled, 'QAM16' parameter is allowed
	QAM64	Specifies the channel's modulation scheme is QAM64 This choice is available only for channels with symbol rate 240000 Only when both 'HSPA' functionality and 'HSPA+' functionality are enabled, 'QAM64' parameter is allowed

Remote Command	`[:SENSe]:CDPower:SBOundary:LIST[:BTS]:INIT <symbol_rate>, <code_num>, QPSK | QAM16 | QAM64`

Example	In order to predefine the following channels:
	- CPICH (C8(0))
	- P-CCPCH (C8(1))
	- S-CCPCH(C8(3))
	- PICH(C8(16))
	- HS-DPCCH (C4(15)) 16QAM modulated
	`:CDP:SBO:LIST:INIT 15000,0, QPSK`
	`:CDP:SBO:LIST:APP 15000,1, QPSK`
	`:CDP:SBO:LIST:APP 15000,3, QPSK`
	`:CDP:SBO:LIST:APP 15000,16, QPSK`
	`:CDP:SBO:LIST:APP 240000,15, QAM16`
	`:CDP:SBO:LIST:NCH?`
	5
	`:CDP:SBO:LIST:CHAN? 1`
	15000,0, QPSK
	`:CDP:SBO:LIST:CHAN? 2`
	15000,1, QPSK
	`:CDP:SBO:LIST:CHAN? 3`
	15000,3, QPSK
	`:CDP:SBO:LIST:CHAN? 4`
	15000,16, QPSK
	`:CDP:SBO:LIST:CHAN? 5`

	240000,15, QAM16

Notes	Error messages associated with this parameter
	One of the following error messages is logged if the given parameter is invalid
	If an error is reported, the SCPI command is rejected and instrument's settings do not change
	(1) "Missing Parameter"
	This error is reported if the number of parameters is less than 3
	For example,
	`:SENSe:CDPower:SBOundary:LIST:BTS:INIT, 15000, 0`
	The 3rd parameter is missing.
	(2) "Illegal parameter value"
	This error is reported if parameter type is invalid or if enum value is invalid.
	For example,
	`:SENSe:CDPower:SBOundary:LIST:BTS:INIT, 15000, ON, QPSK`
	The 2nd parameter must be integer
	`:SENSe:CDPower:SBOundary:LIST:BTS:INIT 15001, 8, QPSK`
	1st parameter value (Symbol Rate) is not allowed
	Only the values given in Range field are valid for the Symbol Rate. You may specify these in numeric form, but they are interpreted as an enumeration and the error results if the value does not translate to one in the list
	(3) "Data out of range"
	This error is reported if parameter value is out of range
	For example,
	`:SENSe:CDPower:SBOundary:LIST:BTS:INIT 15000, 256, QPSK`
	The 2nd parameter is out of range
	1. "Setting Conflict"
	This error is reported if the given code channel overlaps other code channel on code domain
	For example, if a user sends the following two commands, the second command causes the error message because C7(0) overlaps C8(0)
	`:SENSe:CDPower:SBOundary:LIST:BTS:INIT 15000, 0, QPSK`
	The example above is OK
	`:SENSe:CDPower:SBOundary:LIST:BTS:APPend 30000, 0, QPSK`
	C7(0) overlaps C8(0)

Dependencies	(1) This command is effective when `[:SENSe]:RADio:DEVice` is set to BTS and `[:SENSe]:CDPower:SBOundary[:BTS]` is set to CUSTom (2) QAM16 for the 3rd parameter is available only when HSPA Enable is On QAM64 for the 3rd parameter is available only when both HSPA Enable and HSPA+ Enable are on
State Saved	Yes
Range	symbol_rate = 7500|15000|30000|60000|120000|240000|480000|960000

0<= code_num <= 511 if symbol_rate = 7500

0<= code_num <= 255 if symbol_rate = 15000

0<= code_num <= 127 if symbol_rate = 30000

0<= code_num <= 63 if symbol_rate = 60000

0<= code_num <= 31 if symbol_rate = 120000

0<= code_num <= 15 if symbol_rate = 240000

0<= code_num <= 7 if symbol_rate = 480000

0<= code_num <= 3 if symbol_rate = 960000

QAM16 and QAM64 for the 3rd parameter available only for channels with symbol rate 240000. For other channels, specify QPSK

Append List (Remote Command Only)

Appends the entry on the list of custom active channel list for BTS.

Parameter	Name/Value	Description
1	<symbol_rate>	Specifies symbol rate of the channel
2	<code_num>	Specifies code number of the channel
3	QPSK	Specifies the channel's modulation scheme is QPSK
	QAM16	Specifies the channel's modulation scheme is QAM16 This choice is available only for channels with symbol rate 240000 Only when 'HSPA' functionality is enabled, 'QAM16' parameter is allowed
	QAM64	Specifies the channel's modulation scheme is QAM64 This choice is available only for channels with symbol rate 240000. Only when both 'HSPA' functionality and 'HSPA+' functionality are enabled, 'QAM64' is valid to select

Remote Command	`[:SENSe]:CDPower:SBOundary:LIST[:BTS]:APPend <symbol_rate>, <code_num>, QPSK | QAM16 | QAM64`

Example	In order to predefine the following channels:
	- CPICH (C8(0))
	- P-CCPCH (C8(1))
	- S-CCPCH(C8(3))
	- PICH(C8(16))
	- HS-DPCCH (C4(15)) 16QAM modulated
	`:CDP:SBO:LIST:INIT 15000,0, QPSK`
	`:CDP:SBO:LIST:APP 15000,1, QPSK`
	`:CDP:SBO:LIST:APP 15000,3, QPSK`
	`:CDP:SBO:LIST:APP 15000,16, QPSK`

	`:CDP:SBO:LIST:APP 240000,15, QAM16`
	`:CDP:SBO:LIST:NCH?`
	5
	`:CDP:SBO:LIST:CHAN? 1`
	15000,0, QPSK
	`:CDP:SBO:LIST:CHAN? 2`
	15000,1, QPSK
	`:CDP:SBO:LIST:CHAN? 3`
	15000,3, QPSK
	`:CDP:SBO:LIST:CHAN? 4`
	15000,16, QPSK
	`:CDP:SBO:LIST:CHAN? 5`
	240000,15, QAM16

Notes	The maximum number of entries is 512
	Error messages associated with this parameter
	One of the following error messages is logged if the given parameter is invalid
	If an error is reported, the SCPI command is rejected and the instrument's settings do not change
	(1) "Missing Parameter"
	This error is reported if the number of parameters is less than 4
	For example,
	`:SENSe:CDPower:SBOundary:LIST:BTS:APPend, 15000, 0`
	The 3rd parameter is missing
	(2) "Illegal parameter value"
	This error is reported if parameter type is invalid or if enum value is invalid
	For example,
	`:SENSe:CDPower:SBOundary:LIST:BTS:APPend 15000, ON, QPSK`
	The 2nd parameter must be an integer
	`:SENSe:CDPower:SBOundary:LIST:BTS:APPend, 15001, 8, QPSK`
	The 1st parameter value (Symbol Rate) is not allowed
	Only the values given in Range field are valid for the Symbol Rate. You may specify these in numeric form, but they are interpreted as an enumeration and the error results if the value does not translate to one in the list
	(3) "Data out of range"
	This error is reported if parameter value is out of range
	For example,
	`:SENSe:CDPower:SBOundary:LIST:BTS:APPend 15000, 256, QPSK`
	The 2nd parameter is out of range

	1. "Setting Conflict"
	This error is reported if the given code channel overlaps other code channel on code domain
	For example, if a user sends the following two commands, the second command causes the error message because C7(0) overlaps C8(0)
	`:SENSe:CDPower:SBOundary:LIST:BTS:INIT, 15000, 0, QPSK`
	The example above is OK
	`:SENSe:CDPower:SBOundary:LIST:BTS:APPend 30000, 0, QPSK`
	C7(0) overlaps C8(0)

Dependencies	This command is effective when [:SENSe]:RADio:DEVice is set to BTS and [:SENSe]:CDPower-:SBOundary[:BTS] is set to CUSTom QAM16 for the 3rd parameter is available only when HSPA Enable is On QAM64 for the 3rd parameter is available only when both HSPA Enable and HSPA+ Enable are on
State Saved	Yes
Range	symbol_rate = 7500|15000|30000|60000|120000|240000|480000|960000 0<= code_num <= 511 if symbol_rate = 7500 0<= code_num <= 255 if symbol_rate = 15000 0<= code_num <= 127 if symbol_rate = 30000 0<= code_num <= 63 if symbol_rate = 60000 0<= code_num <= 31 if symbol_rate = 120000 0<= code_num <= 15 if symbol_rate = 240000 0<= code_num <= 7 if symbol_rate = 480000 0<= code_num <= 3 if symbol_rate = 960000 QAM16 andQAM64 for the 3rd parameter available only for channels with symbol rate 240000. For other channels, specify QPSK

Replace List (Remote Command Only)

Replaces the entry of the custom active channel list for BTS.

Parameter	Name/Value	Description
1	<entry_id>	Specifies entry ID of the channel to replace
2	<symbol_rate>	Specifies symbol rate of the channel
3	<code_num>	Specifies code number of the channel

Parameter	Name/Value	Description
4	QPSK	Specifies the channel's modulation scheme is QPSK
	QAM16	Specifies the channel's modulation scheme is QAM16 This choice is available only for channels with symbol rate 240000 Only when 'HSPA' functionality is enabled, 'QAM16' parameter is allowed
	QAM64	Specifies the channel's modulation scheme is QAM64 This choice is available only for channels with symbol rate 240000 Only when both 'HSPA' functionality and 'HSPA+' functionality are enabled, 'QAM64' is valid to select

Remote Command	`[:SENSe]:CDPower:SBOundary:LIST[:BTS]:REPLace <entry_id>, <symbol_rate>, <code_num>, QPSK | QAM16 | QAM64`

Example	In order to predefine the following channels:
	- CPICH (C8(0))
	- P-CCPCH (C8(1))
	- S-CCPCH(C8(3))
	- PICH(C8(16))
	- HS-DPCCH (C4(15)) 16QAM modulated
	`:CDP:SBO:LIST:INIT 15000,0, QPSK`
	`:CDP:SBO:LIST:APP 15000,1, QPSK`
	`:CDP:SBO:LIST:APP 15000,3, QPSK`
	`:CDP:SBO:LIST:APP 15000,16, QPSK`
	`:CDP:SBO:LIST:APP 240000,15, QAM1`
	And, P-CCPCH(C8(3)) is replaced as follows.
	`:CDP:SBO:LIST:REPLA 3,15000,5,QPSK`
	`:CDP:SBO:LIST:NCH?`
	5
	`:CDP:SBO:LIST:CHAN? 1`
	15000,0, QPSK
	`:CDP:SBO:LIST:CHAN? 2`
	15000,1, QPSK
	`:CDP:SBO:LIST:CHAN? 3`
	15000,5, QPSK
	`:CDP:SBO:LIST:CHAN? 4`

	15000,16, QPSK `:CDP:SBO:LIST:CHAN? 5` 240000,15, QAM16

Notes	The maximum number of entries is 512
	Error messages associated with this parameter
	One of the following error messages is logged if the given parameter is invalid
	If an error is reported, the SCPI command is rejected and the instrument's settings do not change
	(1) "Missing Parameter"
	This error is reported if the number of parameters is less than 4
	For example,
	`:SENSe:CDPower:SBOundary:LIST:BTS:REPLace 1,15000, 0`
	The 4th parameter is missing.
	(2) "Illegal parameter value"
	This error is reported if parameter type is invalid or if enum value is invalid
	For example,
	`:SENSe:CDPower:SBOundary:LIST:BTS:REPLace 1,15000, ON, QPSK`
	The 3rd parameter must be an integer.
	`:SENSe:CDPower:SBOundary:LIST:BTS:REPLace 1,15001, 8, QPSK`
	The 2nd parameter value (Symbol Rate) is not allowed
	Only the values given in Range field are valid for the Symbol Rate. You may specify these in numeric form, but they are interpreted as an enumeration and the error results if the value does not translate to one in the list
	3. "Data out of range"
	This error is reported if parameter value is out of range
	For example,
	`:SENSe:CDPower:SBOundary:LIST:BTS:REPLace 1,15000, 256, QPSK`
	The 3rd parameter is out of range
	4. "Setting Conflict"
	This error is reported if the given code channel overlaps other code channel on code domain
	For example, if a user sends the following two commands, the second command causes the error message because C7(0) overlaps C8(0)
	`:SENSe:CDPower:SBOundary:LIST:BTS:INIT 15000, 0, QPSK`
	The example above is OK
	`:SENSe:CDPower:SBOundary:LIST:BTS:REPLace 1,30000, 0, QPSK`
	C7(0) overlaps C8(0)

Dependencies	This command is effective when `[:SENSe]:RADio:DEVice` is set to BTS and `[:SENSe]:CDPower:SBOundary[:BTS]` is set to CUSTom QAM16 for the 4th parameter is available only when HSPA Enable is On

	QAM64 for the 4th parameter is available only when both HSPA Enable and HSPA+ Enable are on
State Saved	Yes
Range	The entry ID must be: 1 <= entry_id <= The number of entries that have been defined (see "Test Model 1" on page 560) symbol_rate = 7500|15000|30000|60000|120000|240000|480000|960000 0<= code_num <= 511 if symbol_rate = 7500 0<= code_num <= 255 if symbol_rate = 15000 0<= code_num <= 127 if symbol_rate = 30000 0<= code_num <= 63 if symbol_rate = 60000 0<= code_num <= 31 if symbol_rate = 120000 0<= code_num <= 15 if symbol_rate = 240000 0<= code_num <= 7 if symbol_rate = 480000 0<= code_num <= 3 if symbol_rate = 960000 QAM16and QAM64 for the 4th parameter available only for channels with symbol rate 240000. For other channels, specify QPSK

Query List (Remote Command Only)

Returns the entry of the custom active channel list for BTS.

Parameter	Name	Description
1	<entry_id>	Specifies entry ID of the channel to query

Remote Command	`[:SENSe]:CDPower:SBOundary:LIST[:BTS]:CHANnel? <entry_id>`

Example	In order to predefine the following channels:
	- CPICH (C8(0))
	- P-CCPCH (C8(1))
	- S-CCPCH(C8(3))
	- PICH(C8(16))
	- HS-DPCCH (C4(15)) 16QAM modulated
	`:CDP:SBO:LIST:INIT 15000,0, QPSK`
	`:CDP:SBO:LIST:APP 15000,1, QPSK`
	`:CDP:SBO:LIST:APP 15000,3, QPSK`
	`:CDP:SBO:LIST:APP 15000,16, QPSK`
	`:CDP:SBO:LIST:APP 240000,15, QAM16`
	`:CDP:SBO:LIST:NCH?`
	5
	`:CDP:SBO:LIST:CHAN? 1`

	15000,0, QPSK
	`:CDP:SBO:LIST:CHAN? 2`
	15000,1, QPSK
	`:CDP:SBO:LIST:CHAN? 3`
	15000,5, QPSK
	`:CDP:SBO:LIST:CHAN? 4`
	15000,16, QPSK
	`:CDP:SBO:LIST:CHAN? 5`
	240000,15, QAM16

Notes	The maximum number of entries is 512
	Default value of the parameter
	By default, there is one channel defined. (CPICH C8(0))
	In order to query the default entry, specify 1 for <entry_id>:
	`:SENSe:CDPower:SBOundary:LIST:BTS:CHANnel? 1`
	The instrument returns an array of three values:
	15000, 0, QPSK
	Query command needs <entry_id> parameter
	<entry_id> parameter is always required for query command
	The range of the parameter is from 1 to the total number of channels you have defined. For example, if you have defined two channels, you can query them as follows:
	`:SENSe:CDPower:SBOundary:LIST:BTS:CHANnel? 1`
	`:SENSe:CDPower:SBOundary:LIST:BTS:CHANnel? 2`
	If you want to know the number of channels you have defined, send the following query command:
	`:SENSe:CDPower:SBOundary:LIST:BTS:NCHannels?`

Dependencies	This command is effective when `[:SENSe]:RADio:DEVice` is set to BTS and `[:SENSe]:CDPower:SBOundary[:BTS]` is set to CUSTom QAM16 for the 4th parameter is available only when HSPA Enable is On QAM64 for the 4th parameter is available only when both HSPA Enable and HSPA+ Enable are on
Preset	15000, 0, QPSK
State Saved	Yes
Range	The entry ID must be: 1 <= entry_id <= The number of entries that have been defined. (See "Symbol Boundary Custom Active Channel List – Number Of Entries BTS (Remote Command Only)" on page 575)

Symbol Boundary Custom Active Channel List – Number Of Entries BTS (Remote Command Only)

Returns the number of entries in the custom predefined active channel list for BTS.

Remote Command	`[:SENSe]:CDPower:SBOundary:LIST[:BTS]:NCHannels?`

Example	`:SENS:CDP:SBO:LIST:BTS:NCH?`
Notes	This command is a query-only command
Dependencies	This command is effective when `[:SENSe]:RADio:DEVice` is set to BTS and `[:SENSe]:CDPower:SBOundary[:BTS]` is set to CUSTom
Preset	1
State Saved	No

Symbol Boundary Custom Active Channel List - Load Preset Setting BTS (Remote Command Only)

Loads preset setting to the custom active channel list for BTS.

Remote Command	`[:SENSe]:CDPower:SBOundary:LIST[:BTS]:PRESet TM1D16 | TM1D32 | TM1D64 | TM1D16SC | TM1D32SC | TM1D64SC | TM2 | TM2SC | TM3D16 | TM3D32 | TM3D16SC | TM3D32SC | TM4 | TM4CP | TM5H2 | TM5H4 | TM5H8 | TM6H8`
Example	`:SENS:CDP:SBO:LIST:BTS:PRES TM1D64`
Notes	This is a query-only command
Dependencies	(1) This command is effective when `[:SENSe]:RADio:DEVice` is set to BTS and `[:SENSe]:CDPower:SBOundary[:BTS]` is set to CUSTom (2) TM5H2, TM5H4, TM5H8 parameters are allowed if HSPA Enable is On (3)TM6H8 parameter is allowed if HSPA+ Enable is On
State Saved	No
Range	`TM1D16|TM1D32|TM1D64|TM1D16SC|TM1D32SC|TM1D64SC| TM2 | TM2SC | TM3D16 | TM3D32 | TM3D16SC | TM3D32SC | TM4 | TM4CP | TM5H2 | TM5H4 | TM5H8 | TM6H8`

Remote Command	`[:SENSe]:CDPower:SBOundary[:BTS] AUTO | TM1D4SC | TM1D8SC | TM1D16 | TM1D32 | TM1D64 | TM1D16SC | TM1D32SC | TM1D64SC | TM2 | TM2SC | TM3D4SC | TM3D8SC | TM3D16 | TM3D32 | TM3D16SC | TM3D32SC | TM4 | TM4CP | TM5H2 | TM5H4 | TM5H8 | TM5D4 | TM6H8 | TM6D4 | CUSTom` `[:SENSe]:CDPower:SBOundary[:BTS]?`
Example	`:CDP:SBO:BTS TM1D16` `:CDP:SBO:BTS?`
Notes	The reason that TM5H2, TM5H4 and TM5H8 have been selected is to align the enumerations with those of ESG For Test Model 5, W-CDMA HSPA option license is necessary to make parameters available. In addition, you must enable W-CDMA HSPA option functionality. Otherwise, this parameter is not available --- Test Model 5 is inactive (grayed out) and SCPI commands for Test Model 5 have no effect For Test Model 6, both W-CDMA HSPA+ option (N9073C-3FP) and W-CDMA HSPA option (N9073C-2FP) license are necessary to make the parameter available In addition, you must enable W-CDMA HSPA+ option functionality. Otherwise Test Model 6 is inactive

	(grayed out) and SCPI commands for Test Model 6 have no effect According to the 3GPP standard change for the test model, S-CCPCH needs to be supported in each test model. Therefore, for backward compatibility, the command of the test model is aliased as follows: TM1D16 -> TM1D16SC TM1D32 -> TM1D32SC TM1D64 -> TM1D64SC TM2 -> TM2SC TM3D16 -> TM3D16SC TM3D32 -> TM3D32SC
Dependencies	This command is effective when `[:SENSe]:RADio:DEVice` is set to BTS
Preset	`AUTO`
State Saved	Yes

Symbol Boundary (MS only)

Selects the symbol boundary detection mode for MS. Accesses the selection menu for the symbol boundary detection modes to specify active channel detection scheme on uplink.

Auto Detect

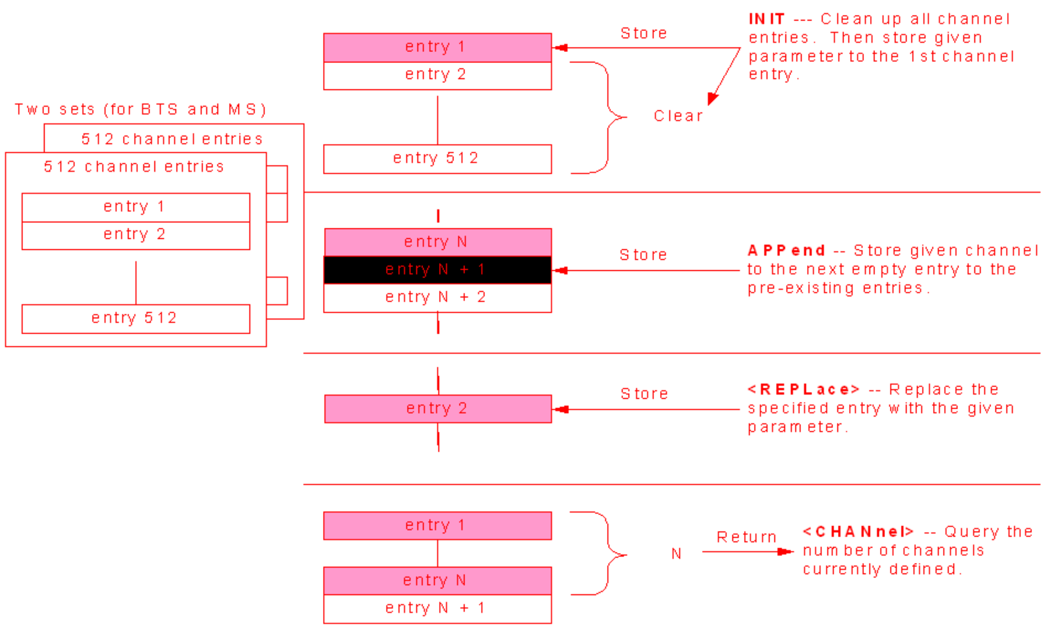
Auto Detect [SCPI Enum: `AUTO`] – Sets the symbol boundary detection to the automatic mode. Various code channels are measured and the most appropriate code channel is selected as the reference channel.

Custom

Custom [SCPI Enum: `CUSTom`] –Provides a flexible way to specify predefined active channels. By choosing it, you can specify a customized list of active channels using the following remote commands: Initialize List, Append List and Replace List.

The following commands handle the list of the custom active channel list for MS.

- INIT – Cleans up all channel entries. Then stores given parameter to the 1st channel entry. See "Initialize List (Remote Command Only)" on page 578
- APPend – Stores given channel to the next empty entry to the pre-existing entries. See "Append List (Remote Command Only)" on page 580
- REPLace - Replaces the specified entry with the given parameter. See "Replace List (Remote Command Only)" on page 581
- CHANnel – Queries the information of the channel specified by the entry id. See "Query List (Remote Command Only)" on page 583
- NCHannel - Queries the number of channels currently defined



Initialize List (Remote Command Only)

Initializes the current custom active channel list. This creates a new entry with the given parameter.

Parameter	Name/Value	Description
1	<symbol_rate>	Specifies symbol rate of the channel
2	<code_num>	Specifies spreading code of the channel
3	IPH	Specifies the channel is on I-axis
	QPH	Specifies the channel Is on Q-axis

Remote Command	`[:SENSe]:CDPower:SBOundary:LIST:MS:INIT <symbol_rate>, <code_num>, IPH | QPH`

Example	In order to predefine the following channels:
	- DPCCH (C8(0):Q)
	- DPDCH (C6(16):I)
	`:CDP:SBO:LIST:MS:INIT 15000, 0, QPH`
	`:CDP:SBO:LIST:MS:APP 60000, 16, IPH`
	`:CDP:SBO:LIST:MS:NCH?`
	2
	`:CDP:SBO:LIST:MS:CHAN? 1`

	15000, 0, QPH `:CDP:SBO:LIST:MS:CHAN? 2` 60000, 16, IPH

Notes	The maximum number of entries is 512
	One of the following error messages is logged if the given parameter is invalid
	If an error is reported, the SCPI command is rejected and the instrument’s settings do not change
	(1) “Missing Parameter”
	This error is reported if the number of parameters is less than 3
	For example,
	`:SENSe:CDPower:SBOundary:LIST:MS:INIT 15000, 0`
	The 3rd parameter is missing
	(2) “Illegal parameter value”
	This error is reported if parameter type is invalid or if enum value is invalid
	For example,
	`:SENSe:CDPower:SBOundary:LIST:MS:INIT 15000, ON, QPH`
	The 2nd parameter must be an integer
	`:SENSe:CDPower:SBOundary:LIST:MS:INIT 15001, 0, QPH`
	The 1st parameter value (Symbol Rate) is not allowed
	Only the values given in Range field are valid for the Symbol Rate. You may specify these in numeric form, but they are interpreted as an enumeration and the error results if the value does not translate to one in the list
	(3) “Data out of range”
	This error is reported if parameter value is out of range
	For example,
	`:SENSe:CDPower:SBOundary:LIST:MS:INIT 15000, 256, QPH`
	The 2nd parameter is out of range
	(4) “Setting Conflict”
	This error is reported if the given code channel overlaps other code channel on code domain
	For example, if a user sends the following two commands, the second command causes the error message because C7(0):Q overlaps C8(0):Q
	`:SENSe:CDPower:SBOundary:LIST:MS:INIT 15000, 0, QPH`
	The example above is OK
	`:SENSe:CDPower:SBOundary:LIST:MS:APPend 30000, 0, QPH`
	C7(0):Q overlaps C8(0):Q

Dependencies	This command is effective when `[:SENSe]:RADio:DEVice` is set to MS and `[:SENSe]:CDPower:SBOundary:MS` is set to CUSTom Symbol_rate = 1920000 is available when HSPA Enable is On
State Saved	Yes
Range	symbol_rate = 15000|30000|60000|120000|240000|480000|960000|19200000 0<= code_num <= 255 if symbol_rate = 15000

0<= code_num <= 127 if symbol_rate = 30000

0<= code_num <= 63 if symbol_rate = 60000

0<= code_num <= 31 if symbol_rate = 120000

0<= code_num <= 15 if symbol_rate = 240000

0<= code_num <= 7 if symbol_rate = 480000

0<= code_num <= 3 if symbol_rate = 960000

0<= code_num <= 1 if symbol_rate = 1920000

Append List (Remote Command Only)

Appends the entry of the custom active channel list.

Parameter	Name/Value	Description
1	<symbol_rate>	Specifies symbol rate of the channel
2	<code_num>	Specifies spreading code of the channel
3	IPH	Specifies the channel is on I-axis
	QPH	Specifies the channel Is on Q-axis

Remote Command

```
[:SENSe]:CDPower:SBOundary:LIST:MS:APPend <symbol_rate>, <code_num>, IPH | QPH
```

Example

In order to predefine the following channels:

- DPCCH (C8(0):Q)
- DPDCH (C6(16):I)

```
:CDP:SBO:LIST:MS:INIT 15000, 0, QPH
:CDP:SBO:LIST:MS:APP 60000, 16, IPH
:CDP:SBO:LIST:MS:NCH?
```

2

```
:CDP:SBO:LIST:MS:CHAN? 1
```

15000, 0, QPH

```
:CDP:SBO:LIST:MS:CHAN? 2
```

60000, 16, IPH

Notes

The maximum number of entries is 512

One of the following error messages is logged if the given parameter is invalid

If an error is reported, the SCPI command is rejected and the instrument's settings do not change

(1) "Missing Parameter"

This error is reported if the number of parameters is less than 3

For example,

```
:SENSe:CDPower:SBOundary:LIST:MS:APPend 15000, 0
```

The 3rd parameter is missing

	(2) "Illegal parameter value"
	This error is reported if parameter type is invalid or if enum value is invalid
	For example,
	`:SENSe:CDPower:SBOundary:LIST:MS:APPend 15000, ON, QPH`
	The 2nd parameter must be an integer
	`:SENSe:CDPower:SBOundary:LIST:MS:APPend 15001, 0, QPH`
	The 1st parameter value (Symbol Rate) is not allowed
	Only the values given in Range field are valid for the Symbol Rate. You may specify these in numeric form, but they are interpreted as an enumeration and the error results if the value does not translate to one in the list
	(3) "Data out of range"
	This error is reported if parameter value is out of range
	For example,
	`:SENSe:CDPower:SBOundary:LIST:MS:APPend 15000, 256, QPH`
	The 2nd parameter is out of range
	(4) "Setting Conflict"
	This error is reported if the given code channel overlaps other code channel on code domain
	For example, if a user sends the following two commands, the second command causes the error message because C7(0):Q overlaps C8(0):Q
	`:SENSe:CDPower:SBOundary:LIST:MS:INIT 15000, 0, QPH`
	The example above is OK
	`:SENSe:CDPower:SBOundary:LIST:MS:APPend 30000, 0, QPH`
	C7(0):Q overlaps C8(0):Q

Dependencies	This command is effective when `[:SENSe]:RADio:DEVice` is set to MS and `[:SENSe]:CDPower:SBOundary:MS` is set to CUSTom Symbol_rate = 1920000 is available when HSPA Enable is On
State Saved	Yes
Range	symbol_rate = 15000|30000|60000|120000|240000|480000|960000|19200000 0<= code_num <= 255 if symbol_rate = 15000 0<= code_num <= 127 if symbol_rate = 30000 0<= code_num <= 63 if symbol_rate = 60000 0<= code_num <= 31 if symbol_rate = 120000 0<= code_num <= 15 if symbol_rate = 240000 0<= code_num <= 7 if symbol_rate = 480000 0<= code_num <= 3 if symbol_rate = 960000 0<= code_num <= 1 if symbol_rate = 1920000

Replace List (Remote Command Only)

Replaces the entry of the custom active channel list.

Parameter	Name/Value	Description
1	<entry_id>	Specifies entry ID of the channel to replace
2	<symbol_rate>	Specifies symbol rate of the channel
3	<code_num>	Specifies spreading code of the channel
4	IPH	Specifies the channel is on I-axis
	QPH	Specifies the channel Is on Q-axis

Remote Command	`[:SENSe]:CDPower:SBOundary:LIST:MS:REPLace <entry_id>,<symbol_rate>, <code_num>, IPH | QPH`

Example	In order to predefine the following channels:
	- DPCCH (C8(0):Q)
	- DPDCH (C6(16):I)
	`:CDP:SBO:LIST:MS:INIT 15000, 0, QPH`
	`:CDP:SBO:LIST:MS:APP 60000, 16, IPH`
	`:CDP:SBO:LIST:MS:NCH?`
	2
	And, replace 2nd entry
	`:CDP:SBO:LIST:MS:REPL 2, 60000,17,QPH`
	`:CDP:SBO:LIST:MS:CHAN? 1`
	15000, 0, QPH
	`:CDP:SBO:LIST:MS:CHAN? 2`
	60000, 17, IPH

Notes	The maximum number of entries is 512
	One of the following error messages is logged if the given parameter is invalid
	If an error is reported, the SCPI command is rejected and the instrument’s settings do not change
	(1) “Missing Parameter”
	This error is reported if the number of parameters is less than 4
	For example,
	`:SENSe:CDPower:SBOundary:LIST:MS:REPLace 1,15000, 0`
	The 4th parameter is missing.
	(2) “Illegal parameter value”
	This error is reported if parameter type is invalid or if enum value is invalid
	For example,
	`:SENSe:CDPower:SBOundary:LIST:MS: REPLace 1,15000, ON, QPH`
	The 3rd parameter must be an integer
	`:SENSe:CDPower:SBOundary:LIST:MS:REPLace 1,15001, 0, QPH`
	The 2nd parameter value (Symbol Rate) is not allowed

	Only the values given in Range field are valid for the Symbol Rate. You may specify these in numeric form, but they are interpreted as an enumeration and the error results if the value does not translate to one in the list
	(3) "Data out of range"
	This error is reported if parameter value is out of range
	For example,
	`:SENSe:CDPower:SBOundary:LIST:MS:APPend 15000, 256, QPH`
	The 3rd parameter is out of range
	(4) "Setting Conflict"
	This error is reported if the given code channel overlaps other code channel on code domain
	For example, if a user sends the following two commands, the second command causes the error message because C7(0):Q overlaps C8(0):Q
	`:SENSe:CDPower:SBOundary:LIST:MS:INIT 15000, 0, QPH`
	The example above is OK
	`:SENSe:CDPower:SBOundary:LIST:MS: REPLace 1,30000, 0, QPH`
	C7(0):Q overlaps C8(0):Q

Dependencies	This command is effective when `[:SENSe]:RADio:DEVice` is set to MS and `[:SENSe]:CDPower:SBOundary:MS` is set to CUSTom Symbol_rate = 1920000 is available when HSPA Enable is On
State Saved	Yes
Range	The entry ID must be: 1 <= entry_id <= The number of entries that have been defined (see "Test Model 1" on page 560) symbol_rate = 15000|30000|60000|120000|240000|480000|960000|19200000 0<= code_num <= 255 if symbol_rate = 15000 0<= code_num <= 127 if symbol_rate = 30000 0<= code_num <= 63 if symbol_rate = 60000 0<= code_num <= 31 if symbol_rate = 120000 0<= code_num <= 15 if symbol_rate = 240000 0<= code_num <= 7 if symbol_rate = 480000 0<= code_num <= 3 if symbol_rate = 960000 0<= code_num <= 1 if symbol_rate = 1920000

Query List (Remote Command Only)

Returns the entry of the custom active channel list.

Parameter	Name/Value	Description
1	<entry_id>	Specifies entry ID of the channel to query

Remote Command	`[:SENSe]:CDPower:SBOundary:LIST:MS:CHANnel? <entry_id>`

Example	In order to predefine the following channels:
	- DPCCH (C8(0):Q)
	- DPDCH (C6(16):I)
	`:CDP:SBO:LIST:MS:INIT 15000, 0, QPH`
	`:CDP:SBO:LIST:MS:APP 60000, 16, IPH`
	`:CDP:SBO:LIST:MS:NCH?`
	2
	`:CDP:SBO:LIST:MS:CHAN? 1`
	15000, 0, QPH
	`:CDP:SBO:LIST:MS:CHAN? 2`
	60000, 16, IPH

Notes	The maximum number of entries is 512
	Default value of the parameter
	By default, there is one channel defined. (DPCCH C8(0):Q)
	In order to query the default entry, specify 1 for <entry_id>:
	`:SENSe:CDPower:SBOundary:LIST:MS:CHANnel? 1`
	The instrument returns an array of three values:
	`15000, 0, QPH`
	Query command needs <entry_id> parameter
	<entry_id> parameter is always required for query command
	The range of the parameter is from 1 to the total number of channels you have defined. For example, if you have defined two channels, you can query them as follows:
	`:SENSe:CDPower:SBOundary:LIST:MS:CHANnel? 1`
	`:SENSe:CDPower:SBOundary:LIST:MS:CHANnel? 2`
	If you want to know the number of channels you have defined, send the following query command:
	`:SENSe:CDPower:SBOundary:LIST:NCHannels:MS?`

Dependencies	This command is effective when `[:SENSe]:RADio:DEVice` is set to MS and `[:SENSe]:CDPower:SBOundary:MS` is set to CUSTom Symbol_rate = 1920000 is available when HSPA Enable is On
Preset	15000, 0, QPH
State Saved	Yes
Range	The entry ID must be: 1 <= entry_id <= The number of entries that have been defined. (See Custom Active Channel List for MS)

Symbol Boundary Custom Active Channel List – Number of Entries (MS only)

Returns the number of entries in the custom predefined active channel list MS.

Remote Command	[:SENSe]:CDPower:SBOundary:LIST:MS:NCHannels?
Example	:SENS:CDP:SBO:LIST:MS:NCH?
Notes	This command is a query-only command
Dependencies	This command is effective when [:SENSe]:RADio:DEVice is set to MS and [:SENSe]:CDPower:SBOundary:MS is set to CUSTom
Preset	1
State Saved	No

Remote Command	[:SENSe]:CDPower:SBOundary:MS AUTO | CUSTom [:SENSe]:CDPower:SBOundary:MS?
Example	:CDP:SBO:MS CUST :CDP:SBO:MS?
Dependencies	This parameter is effective when [:SENSe]:RADio:DEVice is set to MS If "Radio Device" selection is "BTS", a different control (Symbol Boundary BTS) appears
Preset	AUTO
State Saved	Yes
Range	AUTO|CUSTom

DPCH/E-DPCH Configuration (MS only)

This parameter configures how DPDCH, HS-DPCCH, E-DPCCH and E-DPDCH are recognized.

Remote Command	:CALCulate:CDPower:DPCH:MS:CONFigure C1 | C2WDpdch | C2WODpdch | C3 :CALCulate:CDPower:DPCH:MS:CONFigure?
Example	:CALC:CDP:DPCH:MS:CONF C3 :CALC:CDP:DPCH:MS:CONF?
Dependencies	This parameter is available when HSPA mode is enabled, Device is MS and Sync Type is DPCCH or E-DPCCH
Preset	C1
State Saved	Yes
Range	Config 1 (no E-DPCH)|Config 2 w/ DPDCH | Config 2 w/o DPDCH|Config 3 (no DPDCH)

Symbol Rate

Sets a symbol rate.

Remote Command	:CALCulate:CDPower:SRATe <integer>

	`:CALCulate:CDPower:SRATe?`
Example	`:CALC:CDP:SRAT 30000` `:CALC:CDP:SRAT?`
Dependencies	1920000 choice for MS is available only when HSPA is enabled
Preset	15000
State Saved	Yes
Range	7500|15000|30000|60000|120000|240000|480000|960000 for BTS 15000|30000|60000|120000|240000|480000|960000|1920000 for MS

Code Number

Sets a spread code.

Remote Command	`:CALCulate:CDPower:SPRead <integer>` `:CALCulate:CDPower:SPRead?`
Example	`:CALC:CDP:SPR 1` `:CALC:CDP:SPR?`
Couplings	Coupled with Section "Symbol Rate" on page 585, "Symbol Rate" on page 585
Preset	0
State Saved	Yes
Min/Max	Min: 0 Max: Dependent on the Symbol Rate as follows:

`:CALCulate:CDPower:SRATe`	Max
7500	511
15000	255
30000	127
60000	63
120000	31
240000	15
480000	7
960000	3
1920000	1

Mod Scheme (BTS Only)

Sets the modulation scheme.

- **Auto**: The specified channel by Symbol Rate and Code Number is considered to be modulated by auto-detected scheme
- **QPSK**: The specified channel by Symbol Rate and Code Number is considered to be modulated by QPSK
- **16QAM**: The specified channel by Symbol Rate and Code Number is considered to be modulated by 16QAM
- **64QAM**: The specified channel by Symbol Rate and Code Number is considered to be modulated by 64QAM

Remote Command	`:CALCulate:CDPower:MTYPe AUTO | QPSK | QAM16 | QAM64` `:CALCulate:CDPower:MTYPe?`
Example	`:CALC:CDP:MTYP QAM16` `:CALC:CDP:MTYP?`
Notes	W-CDMA HSPA option needs to be installed and enabled. Otherwise, this parameter is not available and SCPI commands for Modulation Scheme do not have effect To select "QAM64", W-CDMA HSPA+ option needs to be installed and enabled. Otherwise it is unavailable and the SCPI command to select "QAM64" is not valid
Dependencies	This control is active when Device is BTS *and* Symbol Rate is 240 ksps This control is inactive when Device is BTS *and* Symbol Rate is *not* 240 ksps. In this case, the last setting (Auto/QPSK/16QAM/64QAM) is displayed on the control even though the "QPSK" setting is always used This control is not displayed when Device is MS
Preset	`AUTO`
State Saved	Yes
Range	`AUTO|QPSK|QAM16|QAM64`

I/Q Branch (MS only)

Selects the I phase or Q phase for the demodulation axis.

Remote Command	`:CALCulate:CDPower:AXIS[:MS] IPH | QPH | IQCombined` `:CALCulate:CDPower:AXIS[:MS]?`
Example	`:CALC:CDP:AXIS IPH` `:CALC:CDP:AXIS?`
Notes	IPH – I Phase QPH – Q Phase IQCombined – Combined I and Q Phase
Dependencies	This command is effective when `[:SENSe]:RADio:DEVice` is set to MS This menu label is grayed out when `[:SENSe]:RADio:DEVice` is set to BTS
Preset	`QPH`

State Saved	Yes
Range	IPH|QPH|IQCombined

DTX/Burst Detect

For downlink signals, enables you to detect the power burst, for either “CM” (Compressed Mode) or “DTX”. In the Compressed Mode, both I and Q symbol powers are off. In DTX, one of the I or Q symbol power (or both) can be off.

For uplink signals, allows you to detect the HS-DPCCH burst, which the sub-frame does not align with the DPCCH slot boundary.

Remote Command	:CALCulate:CDPower:DTXBurst 0 | 1 | OFF | ON :CALCulate:CDPower:DTXBurst?
Example	:CALC:CDP:DTXB ON :CALC:CDP:DTXB?
Preset	OFF
State Saved	Yes

tDPCH (BTS only)

Toggles between Auto and Man. tDPCH value can be set when manual is selected. When AUTO is selected, tDPCH value is shown as "---". tDPCH specifies chip offset (1 unit = 256 chips) of DPCH slot #0 start point from CPICH slot #0 start position. tDPCH value affects the measurement results such as Symbol EVM (RMS, Peak), Symbol Magnitude Error, Symbol Phase Error, and Channel Power (Average Power). In this case, only (tDPCH mod 10) is concerned. This is the offset from CPICH slot boundary to DPCH slot boundary.

When input manually, this value is not checked by verifying the pilot pattern.

This value is set at its auto number and “---“ is replaced with the detected number, if Time Offset detection Auto mode is set to ON and tDPCH is detected successfully. Otherwise the value is not changed.

Remote Command	:CALCulate:CDPower:TDPCh <integer> :CALCulate:CDPower:TDPCh? :CALCulate:CDPower:TDPCh:AUTO OFF | ON | 0 | 1 :CALCulate:CDPower:TDPCh:AUTO?
Example	:CALC:CDP:TDPC 10 :CALC:CDP:TDPC? :CALC:CDP:TDPC:AUTO ON

	:CALC:CDP:TDPC:AUTO?
Notes	Sets tDPCH value manually, when :CALCulate:CDPower:TDPCh:AUTO is OFF. This value is set at its auto number if Time Offset detection Auto mode is set to ON – OFF – tDPCH can manually be set by :CALCulate:CDPower:TDPCh – ON – tDPCH is given automatically as a result of measurement for the specified Code Channel
Preset	0 ON
State Saved	Yes Yes
Range	Auto|Man
Min/Max	0/149

tHS-DPCCH (MS only)

Uplink HS-DPCCH's slots are not aligned with DPCCH slots. Therefore, to analyze its Symbol EVM and Demod Bits correctly, you need to manually specify the slot offset of the HS-DPCCH. Because SF256 code channel has 10 symbol per slot, the actual effective value is MOD (N, 10) even if the value is set more than 10.

Only manual setting is supported.

Remote Command	:CALCulate:CDPower:THSDpcch <integer> :CALCulate:CDPower:THSDpcch?
Example	:CALC:CDP:THSD 35 :CALC:CDP:THSD?
Notes	Auto detection of the tHS-DPCCH is not supported
Preset	0
State Saved	Yes
Min/Max	0/250

Tx Diversity I/Q Axis Rotation

Sets the rotation of the I/Q Axis.

Remote Command	:CALCulate:CDPower:IQPHase:ROTation <real> :CALCulate:CDPower:IQPHase:ROTation?
Example	:CALC:CDP:IQPH:ROT 0.0 :CALC:CDP:IQPH:ROT?
Notes	Input value is as follows -135.0 =< Input-Value =< +180.0

	The input value is rounded to the nearest value in the following 0|+45|+90|+135|+180|+225(= -135)|+270(= -90)|+315(= -45)
Preset	0.0
State Saved	Yes
Min/Max	-135.0/180.0

Advanced Channel/Layer Setup

Enables you to access a dialog for advanced sync parameters.

Active Threshold

Toggles the active channel identification function between Auto and Man.

When set to Auto, the active channels are determined automatically by the internal algorithm.

When set to Man, the active channel identification is determined by a user definable threshold ranging from 0.00 to -100.00 dB.

Remote Command	`:CALCulate:CDPower:ASET:THReshold <real>`
	`:CALCulate:CDPower:ASET:THReshold?`
	`:CALCulate:CDPower:ASET:THReshold:AUTO OFF | ON | 0 | 1`
	`:CALCulate:CDPower:ASET:THReshold:AUTO?`

Example	`:CALC:CDP:ASET:THR -50.0`
	`:CALC:CDP:ASET:THR?`
	`:CALC:CDP:ASET:THR:AUTO ON`
	`:CALC:CDP:ASET:THR:AUTO?`

Notes	Turn the automatic mode On or Off, for the active channel identification function: – OFF – The active channel identification for each code channel is determined by a value set by `:CALCulate:CDPower:ASET:THReshold` – ON – The internal algorithm determines the active channels automatically
Dependencies	BTS: This command is effective when "Symbol Boundary (BTS only)" on page 560 is set to AUTO MS: This command is always effective
Preset	0.0 ON
State Saved	Yes Yes
Range	Auto|Man
Min/Max	-100.0/0.0

Multi Channel Estimator

Toggles the multi-channel estimator function by MMSE between On and Off.

- On: The individual code channels are aligned to the pilot channel to improve the phase error (whether each code phase is aligned or not). This takes a longer time
- Off: The phase information is computed from one coded signal only. (The phase of each code channel needs to be aligned to the pilot channel)

Remote Command	[:SENSe]:CDPower:MCEStimator OFF | ON | 0 | 1 [:SENSe]:CDPower:MCEStimator?
Example	:CDP:MCES ON :CDP:MCES?
Preset	OFF
State Saved	Yes
Range	OFF|ON

Timing Estimation

Selects timing estimation function by MMSE between channel-by-channel and global.

- CHANnel-by-Channel - The code channels are estimated using individual channel timing. This takes a longer time
- GLOBal: The individual code channels are estimated using global timing

Remote Command	[:SENSe]:CDPower:MCEStimator:TIMing CHANnel | GLOBal [:SENSe]:CDPower:MCEStimator:TIMing?
Example	:CDP:MCES:TIM GLOB :CDP:MCES:TIM?
Dependencies	Only when Multi Channel Estimator is ON, this parameter is valid. When Multi Channel Estimator is OFF, this setting is forced to GLOBAL and the control is grayed out
Preset	GLOBal
State Saved	Yes
Range	Channel by Channel|Global

PICH Code Number

Specifies the code number of PICH (Paging Indicator Channel), which has the DTX (no transmission) part. PICH has 300 bits in 1 radio frame, but last 12 bits are not transmitted. Therefore, PICH needs the special handling to measure the code domain power. PICH Code Number specifies which code channel should be considered as PICH.

Note: Active ID auto-detection is done by Bebop regardless of this parameter. However, the result could be 7.5ksps channel if PICH's two consecutive demod bits are the same. This UI forces such 7.5ksps channels to be 15ksps channels.

Remote Command	`[:SENSe]:CDPower:PICH:SPRead <integer>` `[:SENSe]:CDPower:PICH:SPRead?`
Example	`:CDP:PICH:SPR 5` `:CDP:PICH:SPR?`
Notes	If PICH Code Number and MICH Code Number are the same, the channel is considered as PICH This parameter is meaningful only when Symbol Boundary setting is Auto
Dependencies	This parameter is available only for BTS
Preset	16
State Saved	Yes
Min/Max	2/255

MICH Code Number

Specifies the code number of MICH (MBMS Indicator channel), which has the DTX (no transmission) part. MICH has 300 bits in 1 radio frame, but last 6 symbols (12 bits) are not transmitted. Therefore, MICH needs the special handling to measure the code domain power. MICH Code Number specifies which code channel should be considered as MICH.

Since MICH is optional channel, the parameter has BAF setting (On|Off).

Remote Command	`[:SENSe]:CDPower:MICH:SPRead <integer>`
	`[:SENSe]:CDPower:MICH:SPRead?`
	`[:SENSe]:CDPower:MICH:STATe OFF | ON | 0 | 1`
	`[:SENSe]:CDPower:MICH:STATe?`

Example	`:SENS:CDP:MICH:SPR 4`
	`:SENS:CDP:MICH:SPR?`
	`:SENS:CDP:MICH:STAT ON`
	`:SENS:CDP:MICH:STAT?`

Notes	If PICH Code Number and MICH Code Number are the same, the channel is considered as PICH This parameter is meaningful only when Symbol Boundary setting is Auto This parameter enables or disables MICH code number setting
Dependencies	This parameter is active for BTS, but grayed out for MS
Preset	2 `OFF`

State Saved	Yes Yes
Range	2 to 255 OFF|ON
Min/Max	2/255

S-CCPCH Symbol Rate (BTS only)

To calculate the EVM value correctly, specifies the symbol rate for S-CCPCH (Secondary Common Control Physical Channel), which might be modulated with 64QAM, and is hard to detect as correct channelization code.

Remote Command	[:SENSe]:CDPower:SCCPch:SRATe <integer> [:SENSe]:CDPower:SCCPch:SRATe?
Example	:CDP:SCCP:SRAT 15000 :CDP:SCCP:SRAT?
Notes	This command is effective when [:SENSe]:RADio:DEVice is set to BTS This parameter is available only when both W-CDMA HSPA+ option (N9073C-3FP) and HSPA option (N9073C-2FP) licenses are installed, and HSPA+ option is enabled. Otherwise this control and the SCPI command are unavailable
Preset	15000
State Saved	Yes
Range	15000|30000|60000|120000|240000|480000|960000

S-CCPCH Code Number (BTS only)

To calculate the EVM value correctly, specifies the code number for S-CCPCH (Secondary Common Control Physical Channel), which might be modulated with 64QAM, and is hard to detect as correct channelization code.

Remote Command	[:SENSe]:CDPower:SCCPch:SPRead <integer> [:SENSe]:CDPower:SCCPch:SPRead?
Example	:CDP:SCCP:SPR 255 :CDP:SCCP:SPR?
Notes	This command is effective when [:SENSe]:RADio:DEVice is set to BTS This parameter is available only when both W-CDMA HSPA+ option (N9073C-3FP) and HSPA option (N9073C-2FP) licenses are installed, and HSPA+ option is enabled. Otherwise this control and the SCPI command are unavailable
Preset	3
State Saved	Yes
Min/Max	Min: 0

Max: Dependent on S-CCPCH Symbol Rate as follows:

[:SENSe]:CDP:SCCPch:SRATe	Max
15000	255
30000	127
60000	63
120000	31
240000	15
480000	7
960000	3

Frequency Compensation

Toggles the setting of the frequency compensation to calculate the symbol EVM.

Remote Command	:CALCulate:CDPower:SEVM:FCOMpen ON | OFF | 1 | 0 :CALCulate:CDPower:SEVM:FCOMpen?
Example	:CALC:CDP:SEVM:FCOM ON :CALC:CDP:SEVM:FCOM?
Preset	ON
State Saved	Yes
Range	ON|OFF

Phase Compensation

Toggles the setting of the phase compensation to calculate the symbol EVM.

Remote Command	:CALCulate:CDPower:SEVM:PCOMpen ON | OFF | 1 | 0 :CALCulate:CDPower:SEVM:PCOMpen?
Example	:CALC:CDP:SEVM:PCOM ON :CALC:CDP:SEVM:PCOM?
Preset	ON
State Saved	Yes
Range	ON|OFF

3.4.8.6 Packed Mode (Remote Command Only)

Selects the packed mode for Demod bits in SCPI result (of READ:CDP12).

- **OFF**: Demod Bits are not packed. (1.0:“1”, 0.0:“0”, -1.0:“X”)
- **PKM1**: Demod Bits per symbol is packed into 1 float value in bit-slice manner as follows:

64QAM(No DTX)	Float value 0......X5X4X3X2X1X0 (X5:I1, X4:Q1, X3:I2, X2:Q2, X1:I3, X0:Q3)
16QAM(No DTX)	Float value 0......0X3X2X1X0 (X3:I1, X2:Q1, X1:I2, X0:Q2)
QPSK(With DTX)	Float value 0......0M1M0B1B01
4PAM (No DTX)	Float value 0......0 I1 I2 Q1 Q2
4PAM on I branch and BPSK on Q branch (No DTX)	Float value 0......0 I1 I2 0 Q
BPSK on I branch and 4PAM on Q branch (No DTX)	Float value 0......0 0 I Q1 Q2

Table Note 1: The meaning of each bit is

- M1: Mask for B1 (1:DTX, 0:Normal)
- M0: Mask for B0, B1:I, B0:Q

NOTE Packed Mode is only available via the SCPI command, and changing Packed Mode does not bring any change on the results of Front panel display. It only controls the result format of `:READ|MEAS|FETCH|CONF:CDP12`.

Remote Command	`:CALCulate:CDPower:PACKed OFF | PKM1` `:CALCulate:CDPower:PACKed?`
Example	`:CALC:CDP:PACK OFF` `:CALC:CDP:PACK?`
Preset	`OFF`
State Saved	Yes
Range	`OFF|PKM1`

3.4.9 Sweep

The Sweep key contains controls which allow you to control the sweep and measurement functions of the instrument.

3.4.9.1 Sweep/Control

Contains controls for the Sweep and Control functions of the instrument, such as Sweep Time and Continuous/Single.

Sweep/Measure

Allows you to toggle between Continuous and Single sweep or measurement operation. The Single/Continuous state is Meas Global, so the setting affects *all* measurements.

The front-panel key **Single/Cont** performs exactly the same function

NOTE In the `WAVeform` measurement, this control only appears in the Meas Bar, and not in the **Sweep/Control** tab.

See "More Information" on page 596

Remote Command	`:INITiate:CONTinuous OFF | ON | 0 | 1` `:INITiate:CONTinuous?`

Example	`:INIT:CONT 0`
	`:INIT:CONT OFF`
	puts instrument into Single measurement operation
	`:INIT:CONT 1`
	`:INIT:CONT ON`
	puts instrument into Continuous measurement operation

Preset	ON Note that `:SYST:PRES` sets `:INIT:CONT` to `ON` but `*RST` sets `:INIT:CONT` to `OFF`
State Saved	Saved in instrument state
Annunciation	The **Single/Continuous** icon in the Meas Bar changes depending on the setting: – A line with an arrow is Single – A loop with an arrow is Continuous

More Information

With **Avg/Hold Num** (in the **Meas Setup** menu) set to **Off** or set to **On** with a value of 1, a sweep is taken after the trigger condition is met; and the instrument continues to take new sweeps after the current sweep has completed and the trigger condition is again met. However, with **Avg/Hold Num** set to On with a value >1, multiple sweeps (data acquisitions) are taken for the measurement. The trigger condition must be met prior to each sweep. The sweep is not stopped when the average count k equals the number N set for Avg/Hold Num is reached, but the number k stops incrementing. A measurement average usually applies to all traces, marker results, and numeric results, but sometimes only applies to the numeric results.

If the instrument is in Single measurement, pressing the **Cont/Single** toggle control does not change k and does not cause the sweep to be reset; the only action is to put the instrument into Continuous measurement operation.

If it is already in Continuous sweep:

- the `:INIT:CONT 1` command has no effect
- the `:INIT:CONT 0` command will place the instrument in Single Sweep but will have no effect on the current sequence until k = N, at which point the current sequence will stop and the instrument will go to the idle state.

See "Restart" on page 1738 control description for details on the `:INIT:IMM` (Restart) function.

If you are already in Single sweep, the `:INIT:CONT OFF` command has no effect.

If you are already in Single Sweep, then pressing the **Cont/Single** toggle control in the middle of a sweep does not restart the sweep or sequence. Similarly, pressing the **Cont/Single** toggle control does not restart the sweep or sequence if the sweep is not in the idle state (for example, if you are taking a very slow sweep, or the instrument is waiting for a trigger). Even though pressing the **Cont/Single** toggle control in the middle of a sweep does *not* restart the sweep, sending `:INIT:IMM` *does* reset it.

Restart

The **Restart** function restarts the current sweep, or measurement, or set of averaged/held sweeps or measurements. In measurements that support pausing, if you are Paused, pressing **Restart** performs a **Resume**.

The Restart function is accessed in several ways:

- Pressing the **Restart** key
- Sending the remote command `:INIT:IMM`
- Sending the remote command `:INIT:REST`

See "More Information" on page 598

Remote Command	`:INITiate[:IMMediate]` `:INITiate:RESTart`
Example	`:INIT:IMM` `:INIT:REST`
Notes	`:INIT:REST` and `:INIT:IMM` and the front-panel **Restart** key perform exactly the same function
Couplings	Resets average/hold count k For the first sweep, overwrites all active (update=on) traces with new current data For application modes, resets other parameters as required by the measurement
Status Bits/OPC	This is an Overlapped command

dependencies	The `:STATus:OPERation` register bits 0 through 8 are cleared The `:STATus:QUEStionable` register bit 9 (INTegrity sum) is cleared The `SWEEPING` bit is set The `MEASURING` bit is set
Backwards Compatibility Notes	For Spectrum Analysis mode in ESA and PSA, the **Restart** hardkey and the `:INIT:REST` command restart trace averages (displayed average count reset to 1) for a trace in **Clear Write**, but did not restart **Max Hold** and **Min Hold** In the X-Series, the **Restart** hardkey and the `:INIT:REST` command restart not only **Trace Average**, but **Max Hold** and **Min Hold** traces as well For wireless comms modes in ESA and PSA, the **Restart** hardkey and the `:INIT:REST` command restarted every measurement, including all traces and numeric results. There is no change to this operation

More Information

The **Restart** function first aborts the current sweep or measurement as quickly as possible. It then resets the sweep and trigger systems, sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is in the process of aligning when a Restart is executed, the alignment finishes before the restart function is performed.

Even when set for Single operation, multiple sweeps may be taken when **Restart** is pressed (for example, when averaging/holding is on). Thus when we say that Restart "restarts a measurement," depending on the current settings, we may mean:

- It restarts the current sweep
- It restarts the current measurement
- It restarts the current set of sweeps if any trace is in Trace Average, Max Hold or Min Hold
- It restarts the current set of measurements if Averaging, or Max Hold, or Min Hold is on for the measurement

With Average/Hold Number (in Meas Setup menu) set to 1, or Averaging off, or no trace in Trace Average or Hold, a single sweep is equivalent to a single measurement. A single sweep is taken after the trigger condition is met; and the instrument stops sweeping once that sweep has completed. However, with Average/Hold Number >1 and at least one trace set to Trace Average, Max Hold, or Min Hold (SA Measurement) or Averaging on (most other measurements), multiple sweeps/data acquisitions are taken for a single measurement. The trigger condition must be met prior to each sweep. The sweep is stopped when the average count k equals the number N set for Average/Hold Number. A measurement average usually applies to all traces, marker results, and numeric results, but sometimes only applies to the numeric results.

Once the full set of sweeps has been taken, the instrument will go to the idle state. To take one more sweep without resetting the average count, increment the average count by 1, by pressing the step up key while Average/Hold Number is the active function, or by sending the remote command `:CALC:AVER:TCON UP`.

Pause/Resume

Pauses a measurement after the current data acquisition is complete.

When a measurement is paused:

- The label on this control changes to **Resume**. Pressing **Resume** un-pauses the measurement.
- Pressing **Restart** also performs a **Resume**.

Remote Command	`:INITiate:PAUSe` `:INITiate:RESume`
Example	`:INIT:PAUS` `:INIT:RES`
Dependencies	Not displayed in Modes that do not support pausing
Couplings	When Averaging is On, if the measurement is paused no more updates will occur until either a Resume or Restart occurs If the measurement is resumed, the averaging continues to use the traces from before the Pause occurred and continues to use the traces from the point where the Resume occurred. This still provides real-time traces, but they will no longer be gap free In a view with a Waterfall window, when the measurement is paused, the Waterfall stops updating. When Resume is selected, the Waterfall will retain the existing traces and continue updating using traces from the point at which Resume was selected. The time stamp of the individual Waterfall traces will show the time from the beginning of the measurement the trace relates to, showing there was a gap in the Waterfall capture In Density view, when the measurement is paused, the Density Display stops updating. When the measurement is resumed, if Persistence is `ON`, the persistence fading will continue from the point when the measurement was paused If a Restart occurs, the average counter is reset and all results are discarded. The measurement begins again, using traces after the Restart occurred

Abort (Remote Command Only)

This command stops the current measurement. It aborts the current measurement as quickly as possible, resets the sweep and trigger systems, and puts the measurement into an "idle" state. If the instrument is in the process of aligning when `:ABORt` is sent, the alignment finishes before the abort function is performed, so `:ABORt` does *not* abort an alignment.

If the instrument is set for Continuous measurement, it sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is set for Single measurement, it remains in the "idle" state until an :INIT:IMM command is received.

Remote Command	:ABORt
Example	:ABOR
Notes	If :INIT:CONT is ON, then a new continuous measurement will start immediately, with sweep (data acquisition) occurring once the trigger condition has been met If :INIT:CONT is OFF, then :INIT:IMM is used to start a single measurement, with sweep (data acquisition) occurring once the trigger condition has been met
Dependencies	For continuous measurement, :ABORt is equivalent to the **Restart** key Not all measurements support the abort command
Status Bits/OPC dependencies	The :STATus:OPERation register bits 0 through 8 are cleared The :STATus:QUEStionable register bit 9 (INTegrity sum) is cleared Since all the bits that feed into OPC are cleared by :ABORt, the :ABORt will cause the *OPC query to return true

3.4.9.2 X Scale

This tab accesses controls that enable you to set the horizontal scale parameters.

X Ref Value

Controls the reference value of the X scale of the current measurement in the I/Q Error window.

Remote Command	:DISPlay:CDPower:WINDow4|5|6|8:TRACe:X[:SCALe]:RLEVel <real> :DISPlay:CDPower:WINDow4|5|6|8:TRACe:X[:SCALe]:RLEVel? Window numbers are as follows: – Mag Error: 4 – Phase Error: 5 – EVM : 6 – Symb Power: 8
Example	4-Mag Error Window :DISP:CDP:WIND4:TRAC:X:RLEV 0.0 5-Phase Error Window :DISP:CDP:WIND5:TRAC:X:RLEV 0.0 6-EVM Window

	`:DISP:CDP:WIND6:TRAC:X:RLEV 0.0`
	8-Symb Power Window
	`:DISP:CDP:WIND8:TRAC:X:RLEV 0.0`

Notes	Target window to control depends on the SubOpCode
Couplings	If Auto Scaling is set to On, this value is automatically determined by the measurement result. When you set this value manually, Auto Scaling automatically changes to Off
Preset	0.000
State Saved	Yes
Min/Max	0/5000000.0

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now the VIEW parameter is not used and defaults to 1. All Windows are referenced through VIEW 1. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command
Mag Error	`DISP:CDP:VIEW3:WIND:TRAC:X:RLEV 0.0`	`DISP:CDP:WIND4:TRAC:X:RLEV 0.0`
Phase Error	`DISP:CDP:VIEW3:WIND2:TRAC:X:RLEV 0.0`	`DISP:CDP:WIND5:TRAC:X:RLEV 0.0`
EVM	`DISP:CDP:VIEW3:WIND3:TRAC:X:RLEV 0.0`	`DISP:CDP:WIND6:TRAC:X:RLEV 0.0`

Symb Power	!Code Domain View
	`DISP:CDP:VIEW4:WIND2:TRAC:X:RLEV 0.0`
	!Demod Bits View
	`DISP:CDP:VIEW5:WIND2:TRAC:X:RLEV 0.0`
	!Demod Bits View (Long Mode)
	`DISP:CDP:VIEW6:WIND:TRAC:X:RLEV 0.0`
		`DISP:CDP:WIND8:TRAC:X:RLEV 0.0`

X Scale/Div

Sets the horizontal scale by changing a value per division.

Remote Command	`:DISPlay:CDPower:WINDow4|5|6|8:TRACe:X[:SCALe]:PDIVision <real>`
	`:DISPlay:CDPower:WINDow4|5|6|8:TRACe:X[:SCALe]:PDIVision?`
	Window numbers are as follows:
	– Mag Error: 4
	– Phase Error: 5

	– EVM : 6 – Symb Power: 8

Example	4-Mag Error Window
	`:DISP:CDP:WIND4:TRAC:X:PDIV 1.0`
	5-Phase Error Window
	`:DISP:CDP:WIND5:TRAC:X:PDIV 1.0`
	6-EVM Window
	`:DISP:CDP:WIND6:TRAC:X:PDIV 1.0`
	8-Symb Power Window
	`:DISP:CDP:WIND8:TRAC:X:PDIV 1.0`

Notes	Target window to control depends on the SubOpCode
Couplings	If Auto Scaling is set to On, this value is automatically determined by the measurement result. When you set this value manually, Auto Scaling automatically changes to Off
Preset	8-Symb Power: 16.0 All other windows: 0.9
State Saved	Yes
Min/Max	0.1/500000.0

Backwards Compatibility SCPI

Window	Old SCPI Command	New SCPI Command
Mag Error	`DISP:CDP:VIEW3:WIND:TRAC:X:PDIV 1.0`	`DISP:CDP:WIND4:TRAC:X:PDIV 1.0`
Phase Error	`DISP:CDP:VIEW3:WIND2:TRAC:X:PDIV 1.0`	`DISP:CDP:WIND5:TRAC:X:PDIV 1.0`
EVM	`DISP:CDP:VIEW3:WIND3:TRAC:X:PDIV 1.0`	`DISP:CDP:WIND6:TRAC:X:PDIV 1.0`

Symb Power	!Code Domain View
	`DISP:CDP:VIEW4:WIND2:TRAC:X:PDIV 1.0`
	!Demod Bits View
	`DISP:CDP:VIEW5:WIND2:TRAC:X:PDIV 1.0`
	!Demod Bits View (Long Mode)
	`DISP:CDP:VIEW6:WIND:TRAC:X:PDIV 1.0`
		`DISP:CDP:WIND8:TRAC:X:PDIV 1.0`

Auto Scaling

Determines the scale per division and reference value for the X axis based on the current measurement results.

Remote Command	`:DISPlay:CDPower:WINDow4|5|6|8:TRACe:X[:SCALe]:COUPle 0 | 1 | OFF | ON`
	`:DISPlay:CDPower:WINDow4|5|6|8:TRACe:X[:SCALe]:COUPle?`
	Window numbers are as follows:
	– Mag Error: 4
	– Phase Error: 5
	– EVM : 6
	– Symb Power: 8

Example	4-Mag Error Window
	`:DISP:CDP:WIND4:TRAC:X:COUP ON`
	5-Phase Error Window
	`:DISP:CDP:WIND5:TRAC:X:COUP ON`
	6-EVM Window
	`:DISP:CDP:WIND6:TRAC:X:COUP ON`
	8-Symb Power Window
	`:DISP:CDP:WIND8:TRAC:X:COUP ON`

Couplings	Upon pressing the Restart front-panel key, the Auto Scaling function automatically determines the scale per division and reference values based on the measurement results if this parameter is set to On. When you set a value to either Scale/Div or Ref Value manually, Auto Scaling automatically changes to Off
Preset	ON
State Saved	Yes
Range	OFF|ON

Backwards Compatibility SCPI

Window	Old SCPI Command	New SCPI Command
Mag Error	`DISP:CDP:VIEW3:WIND:TRAC:X:COUP ON`	`DISP:CDP:WIND4:TRAC:X:COUP ON`
Phase Error	`DISP:CDP:VIEW3:WIND2:TRAC:X:COUP ON`	`DISP:CDP:WIND5:TRAC:X:COUP ON`
EVM	`DISP:CDP:VIEW3:WIND3:TRAC:X:COUP ON`	`DISP:CDP:WIND6:TRAC:X:COUP ON`

Symb Power	!Code Domain View
	`DISP:CDP:VIEW4:WIND2:TRAC:X:COUP ON`
	!Demod Bits View
	`DISP:CDP:VIEW5:WIND2:TRAC:X:COUP ON`
	!Demod Bits View (Long Mode)
	`DISP:CDP:VIEW6:WIND:TRAC:X:COUP ON`
		`DISP:CDP:WIND8:TRAC:X:COUP ON`

Start Code Number

Sets the start value of the code range for the code domain power graph (CDP).

Remote Command	`:DISPlay:CDPower:CDOMain:SPAN:STARt <integer>` `:DISPlay:CDPower:CDOMain:SPAN:STARt?`
Example	`:DISP:CDP:CDOM:SPAN:STAR 10` `:DISP:CDP:CDOM:SPAN:STAR?`
Notes	The max value is device sensitive: BTS: 448 MS: 192
Couplings	Start Code Number and "Stop Code Number" on page 604 are coupled to each other, according to the following condition: Stop Code Number > Start Code Number If changing Start Code Number does not satisfy this condition, Stop Code Number is changed to satisfy the following condition Stop Code Number – Start Code Number = 63
Preset	0
State Saved	Yes
Min	0
Max	448

Stop Code Number

Sets the stop value of the code range for the code domain power graph (CDP).

Remote Command	`:DISPlay:CDPower:CDOMain:SPAN:STOP <integer>` `:DISPlay:CDPower:CDOMain:SPAN:STOP?`
Example	`:DISP:CDP:CDOM:SPAN:STOP 200` `:DISP:CDP:CDOM:SPAN:STOP?`
Notes	The max value is device sensitive: BTS: 511 MS: 255
Couplings	"Start Code Number" on page 604 and Stop Code Number are coupled to each other, according to: Stop Code Number > Start Code Number If changing Stop Code Number does not satisfy this condition, Start Code Number is changed to satisfy the following condition Stop Code Number – Start Code Number = 63
Preset	511

State Saved	Yes
Min	63
Max	511

Expand

Toggles the expanding function of the code domain power graph between On and Off. If set to On, the CDP graph is expanded horizontally to show 64 spread codes centered at the scale or the marker position. If toggled back to Off, the spread code range returns to the previous setting.

Notes	This control is valid only for Power Bar Graph window
Preset	Off
State Saved	Yes
Range	On|Off

3.4.10 Trace

Trace is not supported in the WCDMA Code Domain Measurement.

3.5 Power Control

The Power Control Measurement capability is one of the major functions of a W-CDMA (3GPP) digital radio system. For downlink signals, code domain power analysis and power versus time measurements based on symbols are used to analyze the power control function, as individual code channel powers are controlled. However, for uplink signals, the entire signal is controlled by the power control function, so code domain power analysis or power versus time measurement techniques do not provide relevant information. This Power Control measurement provides a solution for 3GPP uplink conformance tests, and can be used to accurately design, characterize, evaluate, and verify 3GPP transmitters, components, and devices for mobile stations.

The Power Control Measurement, also called a Power Step Measurement, includes three types of measurements:

1. Slot Power-measures uplink slot power level
2. PRACH Power-measures uplink PRACH preamble power level and message power level
3. Slot Phase-measures phase error, frequency error and EVM of uplink slots in addition to their slot power

The Slot Power and PRACH Power Measurement can be done using two methods:

- Waveform Method- is asynchronous. It provides results using a specified information bandwidth and a specified filter type for the number of frames, 1 through 8, specified by the capture interval.
- Chip Power Method- is synchronized to chip timing. It re-samples the power measurement results based on the chip clock timing of the radio system.

The Slot Phase Measurement is always made based on synchronized chip timing.

NOTE **The current Power Control Measurement can only measure uplink signals. Therefore, the Pwr Control menus are active only when the Radio Device selection is MS.**

Power Control Commands

The following commands and queries are used to retrieve the measurement results:

`:CONFigure:PCONtrol`

`:CONFigure:PCONtrol:NDEFault`

`:INITiate:PCONtrol`

`:FETCh:PCONtrol[n]?`

`:READ:PCONtrol[n]?`

`:MEASure:PCONtrol[n]?`

Remote Command Results for Power Control

For the queries listed above, the results returned depend on the value of **n**, as follows.

<table>
<tr><th>Index: n</th><th>Results Returned</th></tr>
<tr><td>0</td><td>Returns unprocessed I/Q trace data, as a series of comma-separated trace points, in volts. The I values are listed first in each pair, using the 0 through even-indexed values. The Q values are the odd-indexed values</td></tr>
<tr><td>1 (or not specified)</td><td>Returns the following 4 comma-separated scalar results in the following order:
1. Number of slots is an integer number of the number of slots found in the captured data. (In case of PRACH Power measurement, it always returns 0)
2. Number of PRACH preamble is an integer number to give the number of PRACH preamble burst found in captured data. (In case of Slot measurement, it always returns 0)
3. Number of PRACH Message is an integer number to give the number of PRACH Message found in captured data. (In case of Slot measurement, it always returns 0) This number must be 1 or 0, because once PRACH Message is found, no more PRACH burst search is performed after PRACH Message burst
4. First Slot Number is an integer number presenting the first slot number in the captured data. The returned value is valid in the following cases. In other cases, the returned value is 0
– View Selection is Slot Power and Meas Method is Chip Power
– View Selection is Slot Phase or Slot Phase w/Pwr Graph
DPCCH Slot Format: (floating)
– If Sync Type is DPCCH , the DPCCH slot format value used for synchronization is returned.
  – 0.0: Slot Format 0
  – 1.0: Slot Format 1
  – 2.0: Slot Format 2
  – 3.0: Slot Format 3
  – 4.0: Slot Format 4
  – 5.0: Slot Format 5
– If Sync Type is PRACH, the value returned is -999.0
In BTS mode, the value returned is -999.0
Preamble Signature: (floating)
– BTS mode
  – The returned value is always -999.0
– MS mode
  – In Preamble Signature auto-detection mode, the detected signature code number(from 0.0 to 15.0) is returned when Sync Type is PRACH Message
  – In Preamble Signature manual setting mode, the returned value is the same as the parameter setting. When Sync Type is not PRACH Message, the returned value is -999.0</td></tr>
<tr><td>2</td><td>Waveform/ChipPower trace data
Returns comma-separated waveform or chip power trace data (in dBm)</td></tr>
<tr><td>3</td><td>Slot Power Measurement trace (Absolute Power Measurement)
Returns comma-separated post-processed data trace for measured data. With "Slot Power Measurement" selected, the slot averaged data trace (in dBm) is returned. (This data trace corresponds to the ‘Result’ column in the Result window.) Number of slot is given as 1st parameter in :MEASure:PCONTrol?</td></tr>
<tr><td>4</td><td>PRACH Power result – returns comma-separated post-processed data Npreamble: Number of PRACH Preamble
– 1st number: Pre-Burst Off Pwr (float, in dBm) of 1st PRACH preamble</td></tr>
</table>

Index: n	Results Returned
	– 2nd number: Burst On Pwr (float, in dBm) of 1st PRACH preamble – 3rd number: Burst On Pwr relative to the previous data (float, in dB) of 1st PRACH (This returns always 0.0) – 4th number: Post-Burst Off Pwr (float, in dBm) of 1st PRACH preamble – 5th number: Time Offset (float, in chip) of 1st PRACH preamble This returns always 0.0) – ... – (N-1)*5+1: Pre-Burst Off Pwr (float, in dBm) of Nth PRACH preamble – (N-1)*5+2: Burst On Pwr (float, in dBm) of Nth PRACH preamble – (N-1)*5+3: Burst On Pwr relative to the previous data (float, in dB) of – Nth PRACH preamble – (N-1)*5+4: Post-Burst Off Pwr (float, in dBm) of Nth PRACH preamble – N*5: Time Offset (float, in chip) of Nth PRACH preamble – ... – (Npreamble-1)*5+1: Pre-Burst Off Pwr (float, in dBm) of Npreambleth PRACH preamble – (Npreamble-1)*5+2: Burst On Pwr (float, in dBm) of Npreambleth PRACH preamble – (Npreamble-1)*5+3: Burst On Pwr relative to the previous data (float, in dB) of Npreambleth PRACH preamble – (Npreamble-1)*5+4: Post-Burst Off Pwr (float, in dBm) of Npreambleth PRACH preamble – Npreamble*5: Time Offset (float, in chip) of Npreambleth PRACH preamble – Npreamble*5+1: Pre-Burst Off Pwr (float, in dBm) of PRACH Message (if available) – Npreamble*5+2: Burst On Pwr (float, in dBm) of PRACH Message (if available) – Npreamble*5+3: Burst On Pwr relative to the previous data (float, in dB) PRACH Message (if available) – Npreamble*5+4: Post-Burst Off Pwr (float, in dBm) of PRACH Message (if available) – Npreamble*5+5: Time Offset (float, in chip) of PRACH Message (if available)
5	Slot Power Measurement trace (Relative Power measurement –1) Returns comma-separated post-processed data trace for measured data. With "Slot Power Measurement" selected, the relative power with the previous slot data trace (in dB) is returned. (This data trace corresponds to the 'Delta Adj Pwr' column in the Result window.) The first data returns always '0.0' The number of slot is given as 1st parameter in :MEASure:PCONTrol?
6	Slot Power Measurement trace (Relative Power Measurement – 2) Returns comma-separated post-processed data trace for measured data. With "Slot Power Measurement" selected, the relative power level with the first slot (in dB) is returned. (This data trace corresponds to the 'Rel Pwr' column in the Results window.) The first data returns always '0.0' The number of slots is the first parameter from :MEASure:PCONTrol?
7	Chip by chip phase error trace Returns a series of floating point numbers (in degrees) that represents chip by chip phase error The number of values returned is equal to the number of chips in the capture interval
8	Chip phase error best-fit line

Index: n	Results Returned
	Returns a series of floating point numbers (in degrees) that represents best-fit phase line of chips to minimize the EVM of the slot The number of values returned is equal to the number of chips in the capture interval
9	Slot Phase Discontinuity Returns a series of floating point numbers (in degrees) that represents phase difference between the end of the previous slot and the beginning of the slot The number of values returned is equal to the number of slots in the capture interval
10	Slot phase error from the reference phase at the beginning of the slot Returns a series of floating point numbers (in degrees) that represents absolute phase error at the beginning of each slot The number of values returned is equal to the number of slots in the capture interval
11	RMS EVM of slots based on the best-fit line Returns a series of floating point numbers (in degrees) that represents RMS EVM of each slot excluding 25us at the beginning and tail of the slot The number of values returned is equal to the number of slots in the capture interval
12	RMS Magnitude error of slots Returns a series of floating point numbers (in degrees) that represents RMS Magnitude error of each slot excluding 25us at the beginning and end of the slot The number of values returned is equal to the number of slots in the capture interval
13	RMS Phase error of slot Returns a series of floating point numbers (in degrees) that represents frequency error of each slot, which is an element of the RMS EVM The number of values returned is equal to the number of slots in the capture interval
14	IQ Offset of slots Returns a series of floating point numbers (in dB) that represents IQ Origin Offset of each slot, which is an element of the RMS EVM The number of values returned is equal to the number of slots in the capture interval
15	Frequency error of the best-fit line for slots Returns a series of floating point numbers (in Hz) that represents frequency error of each slot, which is equivalent to the amount of the slope of the best-fit line and frequency error of the reference frequency that measurement algorithm determines for synchronization, and an element of the RMS EVM The number of values returned is equal to the number of slots in the capture interval
16	Active Channel List: Returns a series of floating point numbers: slot offset, symbol rate (ex. 15 ksps), OVSF code number, 1.0 (I) or -1.0 (Q) and relative power level for the active channels. The results would look like the following: – 1st number = Slot Offset – 2nd number = Symbol Rate – 3rd number = OVSF Code Number – 4th number = either +1(I) or -1(Q) – 5th number = Power Level (in dB) – … – (N-1) * 5 + 1st number = Slot Offset – (N-1) * 5 + 2nd number = Symbol Rate – (N-1) * 5 + 3rd number = OVSF Code Number – (N-1) * 5 + 4th number = either +1(I) or -1(Q) – (N-1) * 5 + 5th number = Power Level (in dB) N = number of total detected active channels in the captured signal Slot Offset: For the results of the latter half of a slot, 0.5 is added when Meas Interval is set to 0.5 First Slot Number (absolute number) is given by the 4th parameter of `:MEASure:PCONtrol[1]?` This result is available only after the measurement is done with no error when Measurement Type is Slot Phase (SPHase). Otherwise, 0.0 is returned
17	Numbers of active channels detected in a slot or a half slot: Returns a series of floating point numbers that represent number of active channels detected in either each slot or each half slot depending on Meas Interval

Index: n	Results Returned
	setting. The number of values returned are determined by Capture Interval and Meas Interval. For example, if Capture Interval is 1 Frame and Meas Interval is 1.0, 15 values are returned. If Capture Interval is 1 Frame and Meas Interval is 0.5 slots, 30 values are returned This result is available only after the measurement is done with no error when Measurement Type is Slot Phase (SPHase). Otherwise, 0.0 is returned

3.5.1 Views

The Power Control measurement has four views as follows.

These Views are multiple-window Views. When in a multiple window View, you select a window by touching it. The menu controls may sometimes change depending on which window is selected.

Whenever the View changes, the default menu is Frequency, unless otherwise specified in the View description.

View	Result
Slot Power	RF Envelope/Chip Power Graph
	Slot Power Table
PRACH Power	RF Envelope/Chip Power Graph
	PRACH Power Table
Slot Phase	Slot Phase Graph
	Slot Phase Table
Slot Phase w/Pwr Graph	Chip Power Graph
	Slot Power Table

View Selection Remote Commands

Allows you to select the desired measurement view.

- The Enumerated ID is used with the SCPI Command `:DISP:PCON:VIEW` ("View Selection by Name" on page 610)
- The Numeric ID is used with the SCPI Command `:DISP:PCON:VIEW:NSEL` ("View Selection by Number" on page 611)

Enumerated ID	Numeric ID	View Name
`POWer`	1	Slot Power
`PRACh`	3	PRACH Power
`PHASe`	2	Slot Phase
`SPPower`	4	Slot Phase w/Pwr Graph

View Selection by Name

Allows you to specify the view via its enumerated ID string.

Remote Command	`:DISPlay:PCONtrol:VIEW[:SELect] POWer | PHASe | PRACh | SPPower` `:DISPlay:PCONtrol:VIEW[:SELect]?`
Example	`:DISP:PCON:VIEW POW` `:DISP:PCON:VIEW?`
Notes	Measurement Type control under Meas Setup behaves in the same way as view switch. For details, see "Measurement Type" on page 681
Preset	`POWer`
State Saved	Yes
Range	Slot Power|PRACH Power|Slot Phase|Slot Phase w/Pwr Graph

View Selection by Number

Allows you to specify the view via its numeric ID value.

Remote Command	`:DISPlay:PCONtrol:VIEW:NSELect <integer>` `:DISPlay:PCONtrol:VIEW:NSELect?`
Example	`:DISP:PCON:VIEW:NSEL 1` `:DISP:PCON:VIEW:NSEL?`
Preset	1
State Saved	Yes
Min/Max	1/4

3.5.1.1 Slot Power

Windows: "Power Graph (RF Envelope/Chip Power)" on page 612, "Slot Power Metrics" on page 612

Example	`:DISP:PCON:VIEW POW`

3.5.1.2 PRACH Power

Windows: "Power Graph (RF Envelope/Chip Power)" on page 612, , "PRACH Power Metrics" on page 613

Example	`:DISP:PCON:VIEW PRAC`

3.5.1.3 Slot Phase

Windows: "Phase Graph" on page 614, "Slot Phase Metrics" on page 614

Example	`:DISP:PCON:VIEW PHAS`

3.5.1.4 Slot Phase w/Pwr Graph

Windows:"Power Graph (RF Envelope/Chip Power)" on page 612, "Slot Power Metrics" on page 612

Example	`:DISP:PCON:VIEW SPP`

3.5.2 Windows

The following section contains information on the Power Control Measurement windows.

3.5.2.1 Window Number List

Window	Number
Power	1
Slot Power Metrics	2
PRACH Power Metrics	3
Phase	4
Slot Phase Metrics	5

Power Graph (RF Envelope/Chip Power)

The power graph window appears in the Slot Power View, PRACH Power View and Slot Phase w/Pwr Graph View. In the Slot Phase w/Pwr Graph View, the contents are the same as those returned by the Slot Power Measurement in the Chip Power Method.

Marker Operation	Yes
Corresponding Trace	– yellow - Waveform/Chip Power trace (n=2) – light blue – Averaged absolute power level of each slot (n=3), which is also displayed in the “Result” column in the Metrics window (This trace is available only for Slot Power View and Slot Phase w/Pwr Graph View)

Slot Power Metrics

This window appears in the Slot Power View and Slot Phase w/Pwr Graph View. In the Slot Phase w/Pwr Graph View, the table contents are the same as those returned by the Slot Power Measurement in the Chip Power Method.

Name	Corresponding Results	Resolution
Number of slots	n=1 1st element Number of slots found in the captured data. (In case of PRACH	nnn

Name	Corresponding Results	Resolution
	Power measurement, it always returns 0)	
Slot	(1) If Meas Method is Waveform, it counts up from 1 to the number of slots (2) If Meas Method is Chip Power, there are two ways to show the slot number: – If the control "Slot Number" on the Display menu is Relative, the result counts up from 1 to the number of slots – If the control "Slot Number" on the Display menu is Absolute, the result shows the absolute slot number determined by the scrambling code In case (1), no corresponding information is returned via SCPI In case (2), the first slot number is always returned via SCPI (n=1 4th element)	nnn:
Result	n=3 Averaged absolute power level of each slot, which is also displayed as a light blue trace in RF Envelope window	nn.nn dBm
Delta Adjacent Pwr	n=5 Relative power level to the previous slot	nn.nn dB
Relative Pwr	n=6 Relative power level to the first slot	nn.nn dB

PRACH Power Metrics

This table window appears in the PRACH Power View.

Name	Corresponding Results	Resolution
Preamble	n=1 2nd and 3rd elements The preamble number counts of 1 to the number of PRACH preambles found in the captured data It indicates "Message" for the PRACH message burst	
Pre-Burst Off Pwr	n=4 (Npreamble - 1) * 5 + 1 th element Pre-Burst Off Power of Nth burst	nn.nn dBm
Burst On Pwr	n=4 (Npreamble - 1) *5 + 2 th element Burst On Power of Nth burst	nn.nn dBm
Burst On Pwr	n=4 (Npreamble - 1) *5 + 3 th element Burst On Power relative to the previous burst	nn.nn dB
Post-Burst Off Pwr	n=4 (Npreamble - 1) *5 + 4 th element Post-Burst Off Power of N th burst	nn.nn dBm
Time Offset Chip	n=4 (Npreamble - 1) *5 + 5 th element Time Offset relative to the previous burst	--- for first PRACH burst nnnnn for others

Phase Graph

This graph window appears in the Slot Phase View.

Marker Operation	Yes for all traces
Corresponding Trace	yellow – Chip phase error trace from the reference phase (n=7) light blue – Chip phase error best-fit line (n=8) violet – Phase Discontinuity line

Slot Phase Metrics

This table window appears in the Slot Phase View.

Name	Corresponding Results	Resolution
Number of slots	n=1 1st Number of slots found in the captured data. (In case of PRACH Power measurement, it always returns 0)	nnn
Slot	None Count up from 1 to Number of slots	nnn:
Phase Disc	n=9 Slot phase discontinuity from the previous slot. (Phase difference between the end of the previous slot and the beginning of the current slot)	nnn.nn degrees
Phase	n=10 Slot phase error from the reference phase at the beginning of the current slot	nnn.nn degrees
RMS EVM	n=11 RMS EVM of slots based on the best-fit line excluding 25us at the beginning and the end of the slot	nn.nn %
RMS Magnitude Error	n=12 RMS magnitude Error of the slot. It is an element of RMS EVM of the slot	nnn.nn degrees
RMS Phase Error	n=13 RMS Phase Error of the slot. It is an element of RMS EVM of the slot	nnn.nn degrees
IQ Origin Offset	n=14 IQ Origin offset of the slot. It is an element of RMS EVM of the slot	nnn.nn dB
Frequency Error	n=15 Frequency Error of the best-fit line for slots excluding 25 us at the beginning and the end of the slot It also includes the frequency error of the reference frequency that the measurement algorithm determines for synchronization	nnnn.nn Hz

3.5.3 Amplitude

The Amplitude front-panel key activates the Amplitude menu and selects Reference Value as the active function.

3.5.3.1 Y Scale

The Y Scale Tab contains controls that pertain to the Y axis parameters of the measurement. These parameters control how data on the vertical (Y) axis is displayed and control instrument settings that affect the vertical axis.

Ref Value

Sets the value for the absolute power reference. The functionality depends on the selected window. The reference line is at the top, center, or bottom of the graticule, depending on the value of the Ref Position function.

Remote Command	`:DISPlay:PCONtrol:WINDow[1]|4:TRACe:Y[:SCALe]:RLEVel <real>`
	`:DISPlay:PCONtrol:WINDow[1]|4:TRACe:Y[:SCALe]:RLEVel?`
	Window numbers are as follows:
	– Power: 1
	– Phase: 4

Example	1-Power window
	`:DISP:PCON:WIND:TRAC:Y:RLEV 0.0`
	4-Phase window
	`:DISP:PCON:WIND4:TRAC:Y:RLEV 0.0`

Couplings	When Auto Scaling is On (default), this value is automatically determined by the measurement result. When you set a value manually, Auto Scaling changes to Off
Preset	1-Power: 10.0 dBm 4-Phase: 0.0 deg
State Saved	Yes
Min/Max	1-Power: -250.0 dBm / 250.0 dBm 4-Phase: -36000.0 deg/36000.0 deg

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now the VIEW parameter is not used and defaults to 1. All Windows are referenced through VIEW 1. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command
Power	DISP:PCON:VIEW:WIND:TRAC:Y:RLEV 10.0	DISP:PCON:WIND:TRAC:Y:RLEV 0.0
Phase	DISP:PCON:VIEW2:WIND:TRAC:Y:RLEV 0.0	DISP:PCON:WIND4:TRAC:Y:RLEV 0.0

Scale/Div

Sets the units per division of vertical scale in the logarithmic display.

Remote Command	:DISPlay:PCONtrol:WINDow[1]|4:TRACe:Y[:SCALe]:PDIVision <rel_ampl> :DISPlay:PCONtrol:WINDow[1]|4:TRACe:Y[:SCALe]:PDIVision? Window numbers are as follows: – Power: 1 – Phase: 4
Example	1-Power window :DISP:PCON:WIND:TRAC:Y:PDIV 10.0 4-Phase window :DISP:PCON:WIND4:TRAC:Y:PDIV 10.0
Couplings	When the Auto Scaling is On, this value is automatically determined by the measurement result When the user sets a value manually, Auto Scaling automatically changes to Off
Preset	1-Power: 10.00 dB 4-Phase: 50.0 degrees
State Saved	Yes
Min/Max	1-Power: 0.1/20 dB 4-Phase: 0.01/3600.0 degrees

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now the VIEW parameter is not used and defaults to 1. All Windows are referenced through VIEW 1. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command
Power	DISP:PCON:VIEW1:WIND:TRAC:Y:PDIV 10.0	DISP:PCON:WIND:TRAC:Y:PDIV 10.0
Phase	DISP:PCON:VIEW2:WIND:TRAC:Y:PDIV 50.0	DISP:PCON:WIND4:TRAC:Y:PDIV 10.0

Ref Position

Positions the reference level at the top, center or bottom of the Y Scale display. Changing the reference position does not change the reference level value.

Remote Command	`:DISPlay:PCONtrol:WINDow[1]|4:TRACe:Y[:SCALe]:RPOSition TOP | CENTer | BOTTom`
	`:DISPlay:PCONtrol:WINDow[1]|4:TRACe:Y[:SCALe]:RPOSition?`
	Window numbers are as follows:
	– Power: 1
	– Phase: 4

Example	1-Power window
	`:DISP:PCON:WIND:TRAC:Y:RPOS TOP`
	4-Phase window
	`:DISP:PCON:WIND4:TRAC:Y:RPOS TOP`

Preset	1-Power: `TOP` 4-Phase: `CENTer`
State Saved	Yes
Range	`TOP|CENTer|BOTTom`

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now the VIEW parameter is not used and defaults to 1. All Windows are referenced through VIEW 1. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command
Power	`DISP:PCON:VIEW:WIND:TRAC:Y:RPOS TOP`	`DISP:PCON:WIND:TRAC:Y:RPOS TOP`
Phase	`DISP:PCON:VIEW2:WIND:TRAC:Y:RPOS TOP`	`DISP:PCON:WIND4:TRAC:Y:RPOS TOP`

Auto Scaling

Toggles the Auto Scaling function between On and Off.

Remote Command	`:DISPlay:PCONtrol:WINDow[1]|4:TRACe:Y[:SCALe]:COUPle 0 | 1 | OFF | ON`
	`:DISPlay:PCONtrol:WINDow[1]|4:TRACe:Y[:SCALe]:COUPle?`
	Window numbers are as follows:
	– Power: 1

	– Phase: 4

Example	1-Power window
	`:DISP:PCON:WIND:TRAC:Y:COUP ON`
	4-Phase window
	`:DISP:PCON:WIND4:TRAC:Y:COUP ON`

Notes	When Auto Scaling is On and the Restart front-panel key is pressed, this function automatically determines the scale per division and reference values based on the measurement results When you set a value to either Scale/Div or Ref Value manually, Auto Scaling automatically changes to Off
Preset	ON
State Saved	Yes
Range	OFF|ON

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now the VIEW parameter is not used and defaults to 1. All Windows are referenced through VIEW 1. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command
Power	DISP:PCON:VIEW:WIND:TRAC:Y:COUP ON	DISP:PCON:WIND:TRAC:Y:COUP ON
Phase	DISP:PCON:VIEW2:WIND:TRAC:Y:COUP ON	DISP:PCON:WIND4:TRAC:Y:COUP ON

3.5.3.2 Attenuation

Controls the attenuator functions and interactions between the attenuation system components.

There are two attenuator configurations in the X-Series. One is a Dual-Attenuator configuration consisting of a mechanical attenuator and an optional electronic attenuator. The other configuration uses a single attenuator with combined mechanical and electronic sections thatcontrols all the attenuation functions. Different models in the X-Series come with different configurations.

– See "Dual-Attenuator Configurations" on page 619

– See "Single-Attenuator Configuration" on page 620

Most attenuation settings are the same for all measurements – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset.

This tab is only available when the hardware set includes an input attenuator, which is typically only the case when using Keysight's box instruments. For example, this tab does not appear in:

– VXT models M9420A/21A/10A/11A

– E7760

– M9391A

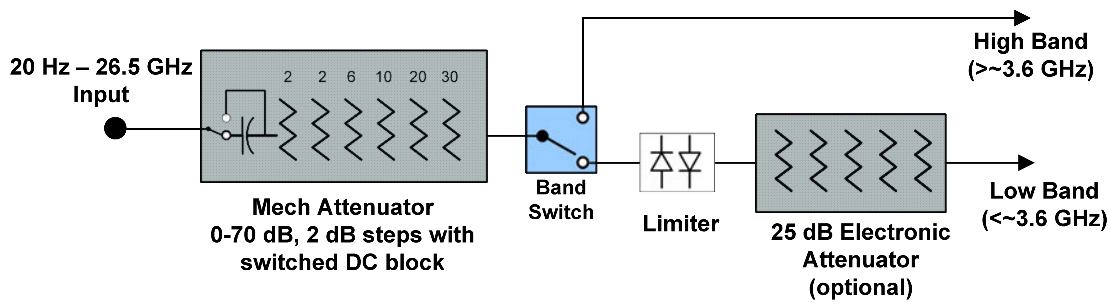
– M9393A

This tab also does not appear in UXM. In UXM all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

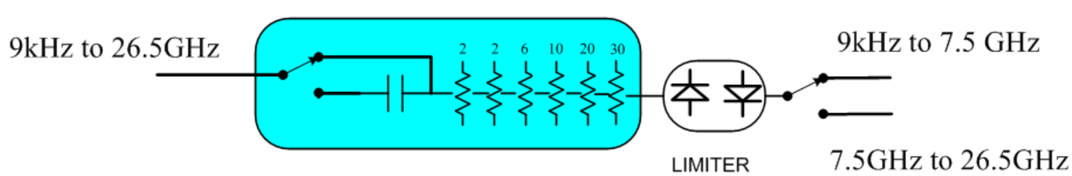
Dependencies	In measurements that support the I/Q inputs, this tab is unavailable when I/Q is the selected input, and is replaced by the Range tab in that case

Dual-Attenuator Configurations

Configuration 1: Mechanical attenuator + optional electronic attenuator

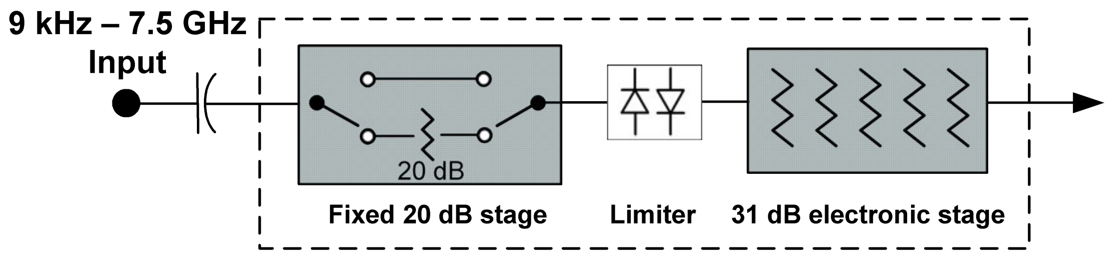


Configuration 2: Mechanical attenuator, no optional electronic attenuator



(note that Configuration 2 is not strictly speaking a dual-section attenuator, since there is no electronic section available. However, it behaves exactly like Configuration 1 without the Electronic Attenuator option EA3, therefore for the sake of this document it is grouped into the “Dual-Attenuator” configuration)

Single-Attenuator Configuration



You can tell which attenuator configuration you have by pressing the Attenuation tab, which (in most Modes) opensthe Attenuation menu. If the first control in the Attenuation menu says **Mech Atten** you have the Dual-Attenuator configuration. If the first control says **Atten** you have the Single-Attenuator configuration.

(Note that depending on the measurement, there may be no Auto/Man functionality on the Mech Atten control).

In the Single-Attenuator configuration, youcontrol the attenuation with a single control, as the fixed stage has only two states. In the Dual-Attenuator configuration, both stages have significant range so you are given separate control of the mechanical and electronic attenuator stages.

When you have the Dual-Attenuator configuration, you may still have only a Single-Attenuator, because unless option EA3 (the Electronic Attenuator option) is available, and you purchase it, you will have only the mechanical attenuator.

Full Range Atten

The **Full Range Atten** control and **Attenuator Summary** only appear in N9041B, when the RF input is selected and the RF Input Port is set to RF Input 2, and the Full Range Attenuator is installed. The Full Range Attenuator adds a second input attenuator at the beginning of the RF Input 2, which enhances the protection and optimizes the performance of the extra internal mixers used by RF Input 2.

Remote Command	`[:SENSe]:POWer[:RF]:FRATten <rel_ampl>` `[:SENSe]:POWer[:RF]:FRATten?`
Example	`:POW:FRAT 14` `:POW:FRAT?`

Notes	When you enter an amplitude value that falls between valid values, the value will be incremented to the next smallest valid value
Dependencies	Only appears if input RF is selected, and RF Input Port 2 is selected, and the Full Range Attenuator exists
Couplings	This value is never changed by any coupling, however other couplings use this value. See the **Reference Level** and "Mech Atten" on page 1750 command descriptions
Preset	20 dB
State Saved	Saved in instrument state
Min	0 dB
Max	Only valid values are 0, 6, 14, 20 dB
Annotation	When the Input is RF, and the Input Port is RF Input 2, and the Full Range Attenuator is installed: On the Meas Bar, the field “Atten” displays as follows: – If the sweep is entirely < 50 GHz, the value shown after “Atten:” is equal to Mech Atten + Elec Atten + Full Range Atten – If the sweep is entirely > 50 GHz, the value shown after “Atten:” is equal to Full Range Atten – If the sweep straddles 50 GHz, the value shown after “Atten:” is preceded by the symbol “>=” and is equal to Full Range Atten In the **Amplitude**, "Attenuation" on page 1747 menu, and the Atten Meas Bar dropdown menu panel, a summary is displayed as follows: “Total Atten below 50 GHz” followed by the value of Full Range Atten + Mech Atten + Elec Atten “Total Atten above 50 GHz” followed by the value of Full Range Atten For example, if Mech Atten = 6 dB, Elec Atten = 4 dB, and Full Range Atten = 20 dB, the summary below is shown: – Attenuator summary: – Total Atten below 50 GHz: 30 dB – Total Atten above 50 GHz: 20 dB

Mech Atten

This control is labeled **Mech Atten** in Dual-Attenuator models and **Atten** in Single-Attenuator models. In the Dual-Attenuator configuration, this control only affects the mechanical attenuator.

This control lets you modify the attenuation applied to the RF input signal path. This value is normally auto coupled to the Ref Level, the Internal Preamp Gain, any External Gain that is entered, and the Max Mixer Level, as described in the table below.

See "Attenuator Configurations and Auto/Man" on page 623

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation <rel_ampl>` `[:SENSe]:POWer[:RF]:ATTenuation?`

	`[:SENSe]:POWer[:RF]:ATTenuation:AUTO OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:ATTenuation:AUTO?`

Example	`:POW:ATT 20`
	Dual-Attenuator configuration: sets the mechanical attenuator to 20 dB
	Single-Attenuator mode: sets the main attenuation to 20 dB (see below for definition of “main” attenuation)
	In either case, if the attenuator was in Auto, it is set to Manual
	`:POW:ATT:AUTO ON`
	Turn Auto Mech Atten ON

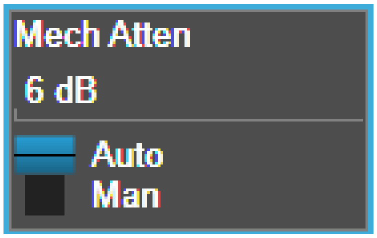
Dependencies	Some measurements do not support the Auto setting of "Mech Atten" on page 621. In these measurements, the Auto/Man selection is not available, and the Auto/Man toggle function is not available In Dual-Attenuator configurations, when the electronic attenuator is enabled, the mechanical attenuator has no auto setting and the Auto/Man toggle function is not available. The state of Auto/Man is remembered and restored when the electronic attenuator is once again disabled. This is described in more detail in "Elec Atten" on page 1753 See "Attenuator Configurations and Auto/Man" on page 623 for more information on the Auto/Man functionality `:POW:ATT:AUTO` is only available in measurements that support Mech Atten Auto, such as Swept SA
Couplings	If the RF Input Port is the RF Input: – If the USB Preamp is connected to USB, use 0 dB for Mech Atten – Otherwise compute the auto-selected value of Mech Atten based on **Reference Level**, Int Preamp, External Gain, Ref Level Offset, Max Mixer Level, µW Path Control and IF Gain settings. Limit this value to be no less than 6 dB (total attenuation below 6 dB can never be chosen by Auto) – In the N9041B, if the RF Input Port is RF Input 2, use the formula above and subtract the Full Range Atten value from the result to determine the Mech Atten. Limit the value so that it is never lower than 0 dB and so that total attenuation, including Full Range Atten, is never less than 6 dB (total attenuation, including Full Range Atten below 6 dB, can never be chosen by Auto) In External Mixingand BBIQ, where the Attenuator is not in the signal path, the Attenuator setting changes as described above when "Mech Atten" on page 621 is in Auto, but no changes are made to the actual attenuator hardware setting until the input is changed back to the RF Input For CXA-m with option FSA (Fine-Step Attenuator or 2 dB steps), the FSA-like behavior is only available when the frequency setting is <= 7.5GHz. So, when the frequency is changed from below 7.5GHz to above 7.5GHz, the attenuation setting will be changed to a multiple of 10dB which will be no smaller than the previous setting. For example, 4dB attenuation will be changed to 10dB
Preset	The preset for Mech Attenuation is “Auto” The Auto value of attenuation is 10 dB ON
State Saved	Saved in instrument state
Min	0 dB The attenuation set by this control cannot be decreased below 6 dB with the knob or step keys. Values

	below 6 dB must be directly entered from the keypad or via SCPI. This protects against setting a dangerously small attenuation value, which can put the instrument at risk of damage to input circuitry. If the current mechanical attenuation is below 6 dB, it can be increased with the knob and step keys, but not decreased
Max	CXA Option 503 or 507: 50 dB EXA: 60 dB All other models: 70 dB Note that in the Single-Attenuator configuration, the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB.
Annotation	The current value for Total Atten is displayed in the Measurement Bar at the top of the display. A value appears for Electronic Attenuation only if the Electronic Attenuator is enabled. The annotation appears as Atten: <total> dB (e<elec>) The e letter is in amber in Single-Attenuator configurations For example: Dual-Attenuator configuration: Atten: 24 dB (e14) Indicating the total attenuation is at 24 dB and the electronic attenuation is at 14 dB Single-Attenuator configuration: A: 24 dB (e14) Indicating the total attenuation is at 24 dB and the “soft” attenuation is at 14 dB (see below for definition of “soft” attenuation) When in Manual, a # sign appears in front of Atten in the annotation

Attenuator Configurations and Auto/Man

As described in "Attenuation" on page 1747 , there are two distinct attenuator configurations available in the X-Series, the single attenuator and Dual-Attenuator configurations. In Dual-Attenuator configurations, we have the mechanical attenuation and the electronic attenuation, and the current total attenuation is the sum of the electronic + mechanical attenuation. In Single-Attenuator configurations, we refer to the attenuation set using "Mech Atten" on page 621 (or `:POW:ATT`) as the “main” attenuation; and the attenuation that is set by `:POW:EATT` as the “soft” attenuation (`:POW:EATT` is honored even in the Single-Attenuator configuration, for compatibility purposes). Then the current total attenuation is the sum of the main + soft attenuation. See "Elec Atten" on page 1753 for more on “soft” attenuation.

NOTE	In some measurements, the **Mech Atten** control has an Auto/Man function. In these measurements, an Auto/Man switch is shown on the **Mech Atten** control:



Note that in configurations that include an Electronic Attenuator, this switch is only shown when the Electronic Attenuator is disabled.

In other measurements, **Mech Atten** has no Auto/Man function. In these measurements, no switch is shown on the **Mech Atten** control:

Mech Atten also appears with no switch, as above, in configurations that include an Electronic Attenuator but when the Electronic Attenuator is enabled.

Elec Atten

Controls the Electronic Attenuator in Dual-Attenuator configurations. This control does not appear in Single-Attenuator configurations, as the control of both the mechanical and electronic stages of the Single-Attenuator is integrated into the single **Atten** control.

This control includes an Enable/Disable toggle switch; it is only possible to enter a value for the Electronic Attenuator when this switch is in the “Enable” position.

See "More Information" on page 625

<table>
<tr><td>Remote Command</td><td><code>[:SENSe]:POWer[:RF]:EATTenuation <rel_ampl></code>
<code>[:SENSe]:POWer[:RF]:EATTenuation?</code>
<code>[:SENSe]:POWer[:RF]:EATTenuation:STATe OFF | ON | 0 | 1</code>
<code>[:SENSe]:POWer[:RF]:EATTenuation:STATe?</code></td></tr>
<tr><td>Example</td><td><code>:POW:EATT 10</code>
<code>:POW:EATT?</code>
<code>:POW:EATT:STAT ON</code>
<code>:POW:EATT:STAT?</code></td></tr>
<tr><td>Notes</td><td>Electronic Attenuation’s specification is defined only when Mechanical Attenuation is 6 dB</td></tr>
<tr><td>Dependencies</td><td>This control only appears in Dual-Attenuator models with an Electronic Attenuator installed and licensed. It does not appear in models with the Single-Attenuator configuration, as in the Single-</td></tr>
</table>

	Attenuator configuration there is no “electronic attenuator” there is only a single integrated attenuator (which has both a mechanical and electronic stage). However, in the Single-Attenuator configuration, EATT SCPI commands are accepted for compatibility with other X-series instruments and set a “soft” attenuation as described in . The “soft” attenuation is treated as an addition to the “main” attenuation value set by the Atten control or the POW:ATT SCPI command and affects the total attenuation displayed on the Atten control and the Meas Bar The electronic attenuator (and the “soft” attenuation function provided in Single-Attenuator configurations) is unavailable above the low band (0-3.6 GHz, 0-3.4 GHz 0-3GHz, depending on the model). If the low band ranges from 0-3.6GHz, and Stop Frequency of the instrument is > 3.6 GHz, then the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed out If the Internal Preamp is on, meaning it is set to Low Band or Full, the electronic attenuator (and the “soft” attenuation function provided in Single-Attenuator configurations) is unavailable. In this case the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed out If either of the above is true, if the SCPI command is sent, an error indicating that the electronic attenuator is unavailable will be sent If both of the above are true, pressing the control will generate error message -221, in other words, the frequency range lockout takes precedence If the electronic/soft Attenuator is enabled, then the Stop Freq of the instrument is limited to 3.6 GHz and the Internal Preamp is unavailable The SCPI-only “soft” electronic attenuation for the single-attenuator configuration is not available in all measurements; in particular, it is not available in the Swept SA measurement
Couplings	Enabling and disabling the Electronic Attenuator affects the setting of the Mechanical Attenuator (in Dual-Attenuator configurations). This is described in more detail below and in the section "Attenuator Configurations and Auto/Man" on page 1752
Preset	`OFF` (Disabled) for Swept SA measurement `ON` (Enabled) for all other measurements that support the electronic attenuator
State Saved	Saved in instrument state
Min	0 dB
Max	Dual-Attenuator configuration: 24 dB Single-Attenuator configuration: the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB
Annotation	See Annotation under the **Mech Atten** control description

More Information

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear. These advantages primarily aid in remote operation and are negligible for front panel use. See "Using the Electronic Attenuator: Pros and Cons" on page 626 for a detailed discussion of the pros and cons of using the electronic attenuator.

For the Single-Attenuator configuration, for SCPI backwards compatibility, the “soft” attenuation feature replaces the Dual-Attenuator configuration’s electronic attenuator. All the same couplings and limitations apply. See "Attenuator Configurations and Auto/Man" on page 1752

Mechanical Attenuator Transition Rules

When the Electronic Attenuator is enabled, the Mechanical Attenuator transitions to a state that has no Auto function. Below are the rules for transitioning the Mechanical Attenuator. Note that the information below ONLY applies to the Dual-Attenuator configurations, and ONLY when the Electronic Attenuator is installed:

When the Electronic Attenuation is enabled from a disabled state:

The Mechanical Attenuator is initialized to 10 dB (this is its optimal performance setting). You can then set it as desired with SCPI, numeric keypad, step keys, or knob, and it behaves as it normally would in manual mode

The Auto/Man state of (Mech) Atten is saved

The Auto/Man toggle on the (Mech) Atten control disappears and the auto rules are disabled

The Electronic Attenuator is set to 10 dB less than the previous value of the Mechanical Attenuator, within the limitation that it must stay within the range of 0 to 24 dB of attenuation

Examples in the Dual-Attenuator configuration:

Mech Atten at 20 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 10 dB. New total attenuation equals the value before Elec Atten enabled

Mech Atten at 0 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 0 dB. New total attenuation does not equal the value before Elec Atten enabled

Mech Atten at 40 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 24 dB. New total attenuation does not equal the value before Elec Atten enabled

When the Electronic Attenuation is disabled from an enabled state:

The Elec Atten control is grayed out

- The Auto/Man state of (Mech) Atten is restored

If now in Auto, (Mech) Atten recouples

If now in Man, (Mech) Atten is set to the value of total attenuation that existed before the Elec Atten was disabled. The resulting value is rounded up to the smallest value possible given the (Mech) Atten Step setting - (That is, 57 dB changes to 58 dB when (Mech) Atten Step is 2 dB)

Using the Electronic Attenuator: Pros and Cons

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear.

The “finer steps” advantage of the electronic attenuator is beneficial in optimizing the alignment of the instrument dynamic range to the signal power in the front panel as well as remote use. Thus, you can achieve improved relative signal measurement accuracy. Compared to a mechanical attenuator with 2 dB steps, the 1 dB resolution of the electronic attenuator only gives better resolution when the odd-decibel steps are used. Those odd-decibel steps are less accurately calibrated than the even-decibel steps, so one tradeoff for this superior relative accuracy is reduced absolute amplitude accuracy.

Another disadvantage of the electronic attenuator is that the spectrum analyzer loses its “Auto” setting, making operation less convenient.

Also, the relationship between the dynamic range specifications (TOI, SHI, compression, and noise) and instrument performance are less well-known with the electrical attenuator. With the mechanical attenuator, TOI, SHI, and compression threshold levels increase dB-for-dB with increasing attenuation, and the noise floor does as well. With the electronic attenuator, there is an excess attenuation of about 1 to 3 dB between 0 and 3.6 GHz, making the effective TOI, SHI, and so forth, less well known. Excess attenuation is the actual attenuation relative to stated attenuation. Excess attenuation is accounted for in the instrument calibration

Adjust Atten for Min Clipping

Sets the combination of mechanical and electronic attenuation and gain based on the current measured signal level so that clipping will be at a minimum.

This is an "immediate action" function, that is, it executes once, when the control is pressed.

The algorithms that are used for the adjustment are documented under "Pre-Adjust for Min Clipping" on page 1757.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate`
Example	`:POW:RANG:OPT IMM`
Notes	Executing Adjust Atten for Min Clipping initiates the measurement.
Dependencies	Does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum measurements For the Waveform measurement, this control is available only in 5G NR Mode

Adjust Atten

Allows you to select;

- Electric attenuator only
- Combination of Electric attenuator and Mechanical attenuator

when the command `[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate` is executed.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize:TYPE EONLy | COMBined` `[:SENSe]:POWer[:RF]:RANGe:OPTimize:TYPE?`

Example	:POW:RANG:OPT:TYPE EONL :POW:RANG:OPT:TYPE?
Dependencies	Does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum measurements For the Waveform measurement, this control is available only in 5G NR Mode
Preset	COMBined
State Saved	Saved in instrument state

Pre-Adjust for Min Clipping

If this function is ON, it applies the adjustment described under "Adjust Atten for Min Clipping" on page 1756 each time a measurement restarts. Therefore, in Continuous measurement mode, it only executes before the first measurement.

In Dual-Attenuator models, you can set **Elec+Mech Atten**, in which case both attenuators participate in the autoranging, or **Elec Atten Only**, in which case the mechanical attenuator does not participate in the autoranging. This latter case results in less wear on the mechanical attenuator and is usually faster.

See "Adjustment Algorithm" on page 629

Selection	Example	Note
Off	:POW:RANGe:OPT:ATT OFF	This is the default setting
Elec Atten Only	:POW:RANGe:OPT:ATT ELEC	Selects only the electric attenuator to participate in auto ranging. This offers less wear on the mechanical attenuator and is usually faster
Mech + Elec Atten	:POW:RANGe:OPT:ATT COMB	In Dual-Attenuator models, this selects both attenuators to participate in the autoranging

Remote Command	[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation OFF | ON | ELECtrical | COMBined [:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation?
Example	:POW:RANG:OPT:ATT OFF :POW:RANG:OPT:ATT?
Notes	The parameter option ELECtrical sets this function to ON in Single-Attenuator models The parameter option COMBined is mapped to ELECtrical in Single-Attenuator models. If you send COMBined, it sets the function to ON and returns ELEC to a query For SCPI compatibility with models that do not have an input attenuator, the ON parameter is honored and mapped to COMBined
Dependencies	This control only appears in Dual-Attenuator models with an Electronic Attenuator installed In instruments with Dual-Attenuator model, when **Enable** "Elec Atten" on page 1753 is OFF or grayed-out, "Pre-Adjust for Min Clipping" on page 628 is grayed-out

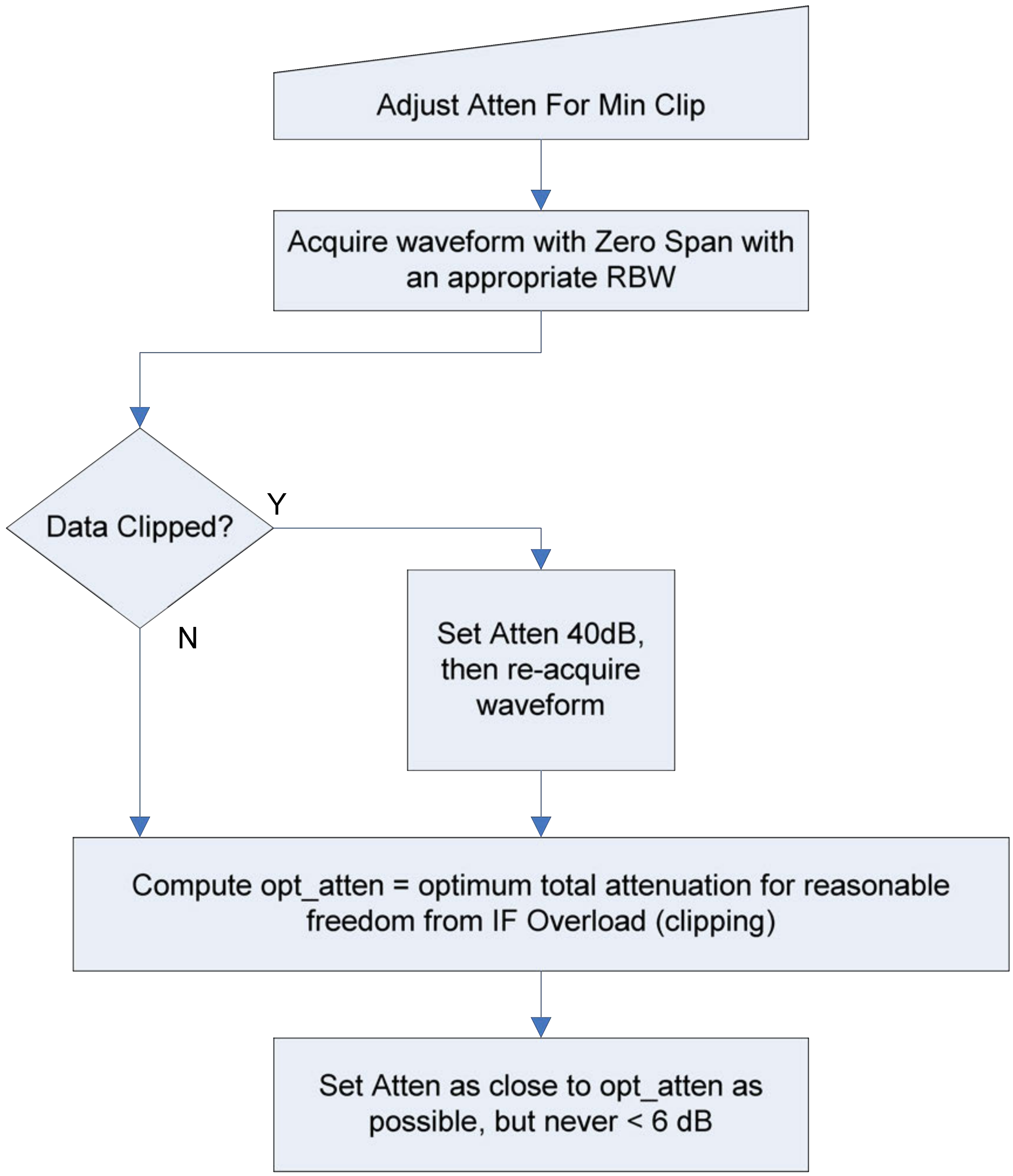
	This control does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum measurements For the Waveform measurement, this control is available only in 5G NR Mode
Preset	`OFF` when Elec Atten is Disabled at preset, otherwise `ELEC`
State Saved	Saved in instrument state
Range	Dual-Attenuator models: Off | Elec Atten Only | Mech + Elec Atten Single-Attenuator models: Off | On

Notes	`ON` aliases to "Elec Atten Only" (`:POW:RANG:OPT:ATT ELEC`) `OFF` aliases to "Off" (`:POW:RANG:OPT:ATT OFF`) `:POW:RANG:AUTO?` returns true if `:POW:RANG:OPT:ATT` is not `OFF`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:RANGe:AUTO ON | OFF | 1 | 0` `[:SENSe]:POWer[:RF]:RANGe:AUTO?`

Adjustment Algorithm

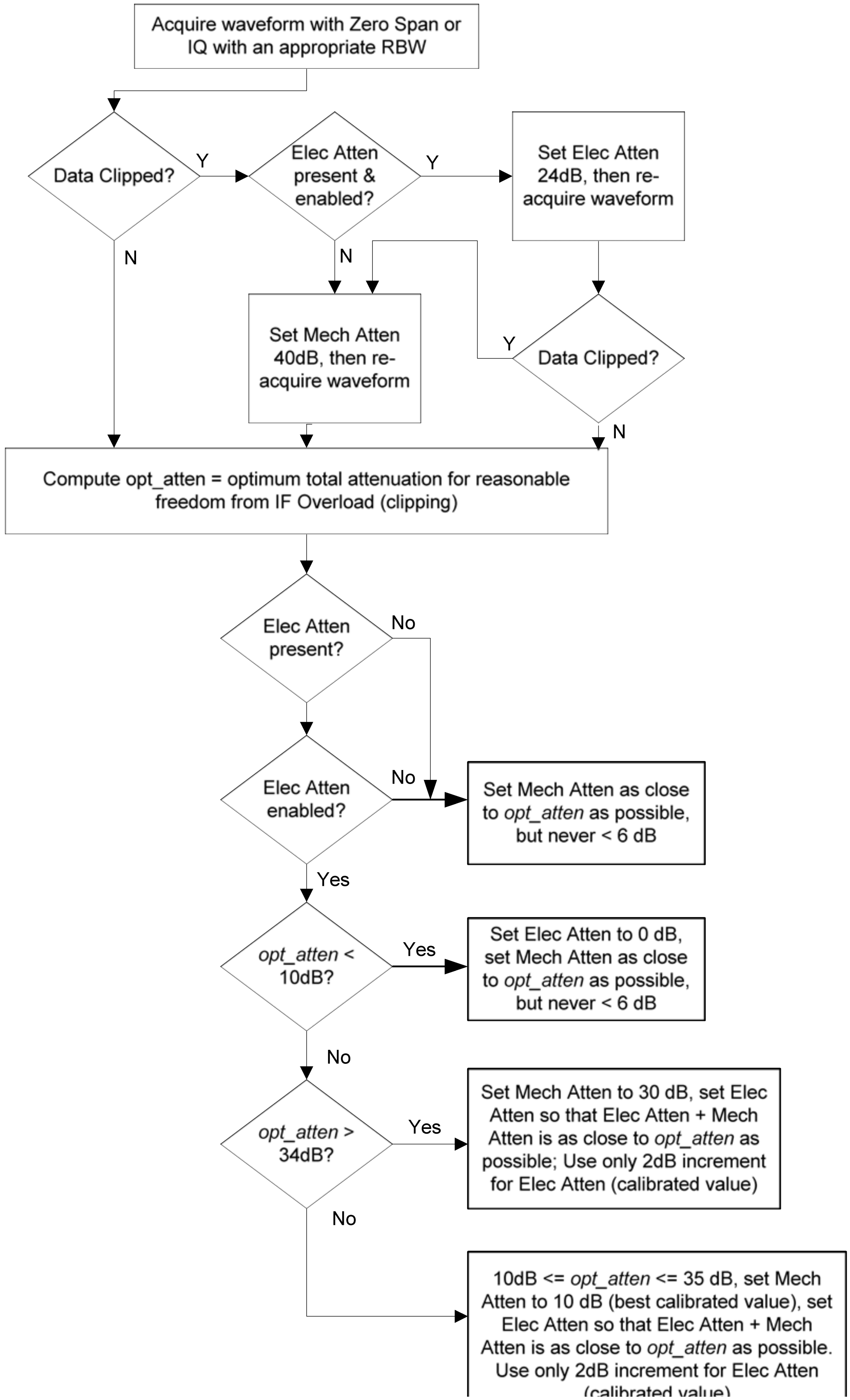
The algorithms for the adjustment are documented below:

Single-Attenuator Models

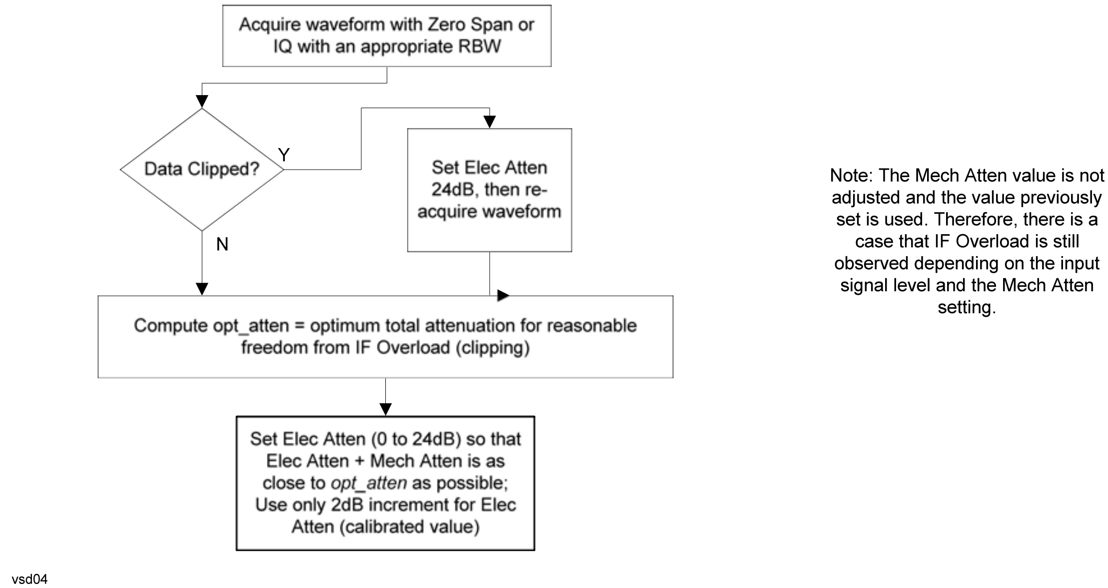


Dual-Attenuator models

"Adjust Atten for Min Clipping" on page 1756 or "Pre-Adjust for Min Clipping" on page 628 selection is Mech + Elec Atten:


Acquire waveform with Zero Span or IQ with an appropriate RBW
Data Clipped?
Y
N
Elec Atten present & enabled?
Y
N
Set Elec Atten 24dB, then re-acquire waveform
Set Mech Atten 40dB, then re-acquire waveform
Data Clipped?
Y
N
Compute opt_atten = optimum total attenuation for reasonable freedom from IF Overload (clipping)
Elec Atten present?
No
Elec Atten enabled?
No
Yes
Set Mech Atten as close to opt_atten as possible, but never < 6 dB
opt_atten < 10dB?
Yes
No
Set Elec Atten to 0 dB, set Mech Atten as close to opt_atten as possible, but never < 6 dB
opt_atten > 34dB?
Yes
No
Set Mech Atten to 30 dB, set Elec Atten so that Elec Atten + Mech Atten is as close to opt_atten as possible; Use only 2dB increment for Elec Atten (calibrated value)
10dB <= opt_atten <= 35 dB, set Mech Atten to 10 dB (best calibrated value), set Elec Atten so that Elec Atten + Mech Atten is as close to opt_atten as possible. Use only 2dB increment for Elec Atten

"Pre-Adjust for Min Clipping" on page 628 selection is Elec Only:



Mech Atten Step

Controls thestep size used when making adjustments to the input attenuation.

This control is labeled **Mech Atten Step** in Dual-Attenuator models and **Atten Step** in Single-Attenuator models. In the Dual-Attenuator configuration, this control only affects the step size of the mechanical attenuator.

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement] 10 dB | 2 dB` `[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement]?`
Example	`:POW:ATT:STEP 2` `:POW:ATT:STEP?`
Notes	This feature has a toggle choice from the front panel, but it takes a specific value (in dB) when used remotely. The only valid values are 2 and 10
Dependencies	Blanked in EXA, CXA and CXA-m if option FSA (2 dB steps) is not present. If blanked, attempts to set it via SCPI yield an error
Couplings	When the attenuation step size changes, the current mechanical attenuation value is adjusted (if necessary) to be quantized to the new step size. That is, if step is set to 10 dB, mech atten is increased if necessary so it is a multiple of 10 dB
Preset	EXA, CXA and CXA-m: 10 dB (2 dB with option FSA) All other models: 2 dB
State Saved	Saved in instrument state

Max Mixer Level

Allows you to set the maximum level to be applied to the mixer for a signal at the top of the screen. By setting this value up or down you can allow more or less signal through the system.

The major impact of changes to **Max Mixer Level** is seen in changes to the value to which **Reference Level** is limited. Max Ref Level depends on Max Mixer Level and Attenuation, and therefore a higher Max Mixer Level may let you set Ref Level higher. However, changing this value can impact your TOI, compression, or dynamic range. The preset value of this function is best for most measurements.

See also "Max Mixer Lvl Rules" on page 1762.

Remote Command	`[:SENSe]:POWer[:RF]:MIXer:RANGe[:UPPer] <real>` `[:SENSe]:POWer[:RF]:MIXer:RANGe[:UPPer]?`
Example	`:POW:MIX:RANG -15 dBm` `:POW:MIX:RANG?`
Dependencies	Only appears in Swept SA and RTSA measurements
Preset	-10 dBm
State Saved	Saved in instrument state
Min	-50 dBm
Max	0 dBm

Max Mixer Lvl Rules

Allows you to optimize the Max Mixer Level setting for certain kinds of measurements.

- `NORMal` – The historical, and thus backwards compatible, setting range (–50 to 0 dBm) and default setting (–10 dBm). The instrument has been designed so that, at the default setting, any signal below the **Reference Level** is extremely unlikely to create ADC overloads. At this mixer level the scale fidelity will be within specifications, thus compression with be negligible.
- `TOI` – Allows a range of settings of the "Max Mixer Level" on page 1762, –50 to –10 dBm, that can be optimum for measurements limited by the instrument third-order dynamic range. The default setting, –25 dBm, is commonly appropriate but RBW affects this. A good setting for Max Mixer Level would be higher than the optimum mixer level by half of the attenuator step size.
- `COMPression` – Allows a range of settings of the Max Mixer Level, –10 to +10 dBm or more, that can be optimum for measurements limited by the tradeoffs between instrument accuracy due to compression, and dynamic range due to the noise floor. The default setting, –3 dBm, is commonly appropriate, representing mixer drive levels that cause 1 dB or less compression at most carrier frequencies.

Typical measurements that would be optimized by this setting are the measurement of low sideband levels, including nulls, in angle-modulated signals (FM and PM). Also pulsed-RF measurements, including finding nulls to estimate pulse width, which are often best done with significant overdrive (compression) of the front end.

Setting Name (readback)	Setting Name (verbose)	Max Mixer Level Preset Value, dBm	Max Mixer Level minimum value, dBm	Max Mixer Level maximum value, dBm
NORMal	Normal – balance TOI, noise, and compression	–10	–50	0
TOI	TOI-limited dynamic range	–25	–50	–10
COMPression	Compression-limited dynamic range	–3	–10	+30

Remote Command	`[:SENSe]:POWer[:RF]:MIXer:RULEs NORMal | TOI | COMPression` `[:SENSe]:POWer[:RF]:MIXer:RULEs?`
Example	`:POW:MIX:RULE:COMP`
Dependencies	Only appears in Swept SA and RTSA
Preset	`NORM`

3.5.3.3 Range (Non-attenuator models)

This tab is only available for Keysight's modular signal analyzers and certain other Keysight products. Examples include:

- VXT
- E7760
- M9391A
- M9393A

This tab also does not appear in UXM. In UXM, all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

State Saved	No

Range

Represents the amplitude of the largest sinusoidal signal that could be present within the IF without being clipped by the ADC. For signals with high peak-to-average ratios, the range may need to exceed the rms signal power by a significant amount to avoid clipping.

This is a measurement global setting.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe <real>` `[:SENSe]:POWer[:RF]:RANGe?`
Example	`:POW:RANG 10 dBm` `:POW:RANG?`
Notes	The MIN and MAX values are affected by the External Gain parameters, and by the **Center Frequency** The hardware compensates for frequency response and alters the Range setting
Preset	0 dBm
State Saved	Yes
Min	-100
Max	100
Annotation	Meas Bar

Adjust Range for Min Clipping

Sets the combination of attenuation and gain based on the current measured signal level so that clipping will be at a minimum.

This is an "immediate action" function, that is, it executes once, when the key is pressed.

This key does not appear in measurements that do not support this functionality.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate`
Notes	Executing Adjust Range for Min Clipping initiates the measurement
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760

Pre-Adjust for Min Clipping

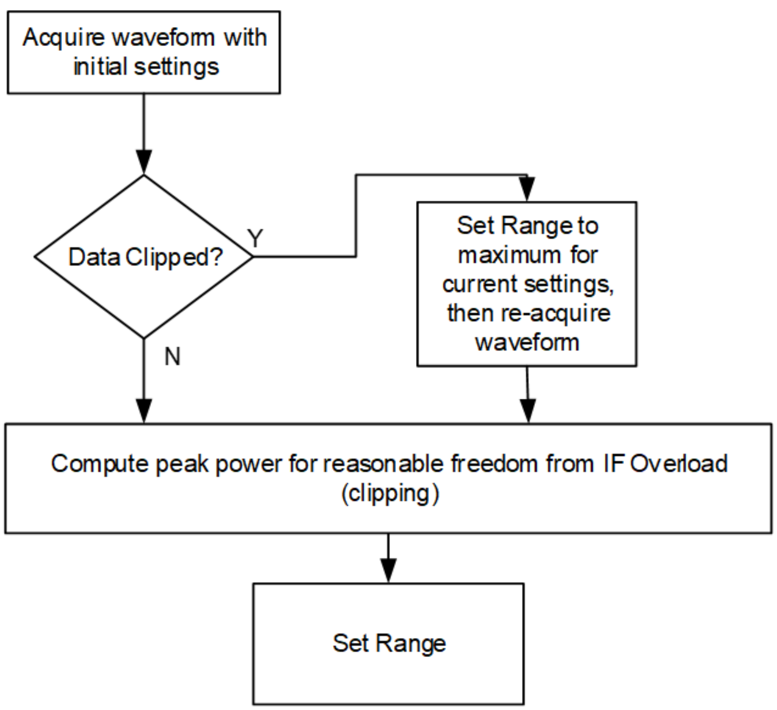
If this function is `ON`, it applies the adjustment described under Adjust Range For Min Clipping each time a measurement restarts. Therefore, in Continuous measurement mode, it only executes before the first measurement.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation OFF | ON | ELECtrical | COMBined`

	[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation?
Notes	Because there is no attenuator control available in these models, the control displays only ON and OFF choices. However, for SCPI compatibility with other platforms, all three parameters (ELECtrical, COMBined, and ON) are honored and all are mapped to ELECtrical, so if any of these three parameters is sent, a subsequent query will return ELEC
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760
Preset	OFF for Swept SA measurement; ON for all other measurements that support **Pre-Adjust for Min Clipping**
State Saved	Saved in instrument state

Adjustment Algorithm

The algorithm for the adjustment is documented below:



Peak-to-Average Ratio

Used with "Range (Non-attenuator models)" on page 1864 to optimize the level control in the instrument. The value is the ratio, in dB, of the peak power to the average power of the signal to be measured. A ratio of 0 should be used for sinusoidal signals; for 802.11g OFDM signals use 9 dB.

All Applications (Modes) show the current value of Peak-to-Average ratio on the control. However, some applications do not permit changing the value. In these situations, the control is grayed-out.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:PARatio <real>` `[:SENSe]:POWer[:RF]:RANGe:PARatio?`
Example	`:POW:RANG:PAR 12 dB`
Notes	In some Applications (Modes) this parameter is read-only; meaning the value will appear on the control and query via SCPI, but is not changeable. In such applications the control is grayed-out. Attempting to change the value via SCPI will be ignored but no error message will be generated
Dependencies	This control does not appear in Spectrum Analyzer Mode
Preset	10 dB VXT Models M9410A/11A: 0 dB
State Saved	Saved in instrument state
Min	0 dB
Max	20 dB VXT Models M9410A/11A: 50 dB

Mixer Lvl Offset

This is an advanced setting to adjust target Range at the input mixer, which in turn affects the signal level in the instrument's IF. This setting can be used when additional optimization is needed after setting "Peak-to-Average Ratio" on page 1866. Positive values of offset optimize noise performance over distortion, negative values optimize distortion performance over noise.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet <real>` `[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet?`
Example	`:POW:RANG:MIX:OFFS -5 dB`
Preset	0 dB
State Saved	Saved in instrument state
Min	-35 dB VXT Models M9410A/11A: -34 dB
Max	30 dB

3.5.3.4 Signal Path

Contains controls that pertain to the routing of the signal through the frontend of the instrument.

In general, this tab only appears in instruments whose hardware supports this signal routing. For example, this tab does not appear in many of the modular instrument products, including VXT Models M9420/21A. It also does not appear in UXM.

This tab *does* appear in VXT Models M9410A/11A because the Software Preselection control is in this tab, and VXT Models M9410A/11A implement a version of Software Preselection.

Presel Center

Pressing this control adjusts the centering of the preselector filter to optimize the amplitude accuracy at the frequency of the selected marker. If the selected marker is not on when **Presel Center** is pressed, the instrument turns on the selected marker, performs a peak search, and then performs centering on the marker's center frequency. If the selected marker is already on and between the start and stop frequencies of the instrument, the instrument performs the preselector calibration on that marker's frequency. If the selected marker is already on, but outside the frequency range between Start Freq and Stop Freq, the instrument first performs a peak search, and then performs centering on the marker's center frequency.

The value displayed on "Preselector Adjust" on page 1869 will change to reflect the new preselector tuning.

A number of considerations should be observed to ensure proper operation. See "Proper Preselector Operation" on page 639.

Remote Command	`[:SENSe]:POWer[:RF]:PCENter`
Example	`:POW:PCEN`
Notes	Note that the rules outlined above under the control description apply for the remote command as well as the key. The result of the command is dependent on marker position, etc. Any message shown by the control press is also shown in response to the remote command
Dependencies	Does not appear in CXA-m Does not appear in VXT Models M9410A/11A Grayed-out if the microwave preselector is off – If the selected marker's frequency is below Band 1, an advisory message is generated "Preselector not used in this frequency range" and no action is taken – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz – Blank in models that do not include a preselector, such as option 503. If the remote command is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View
Couplings	The active marker position determines where the centering will be attempted If the instrument is in a measurement such as averaging when centering is initiated, the act of centering the preselector restarts averaging, but the first average trace will not be taken until the centering is completed The offset applied to do the centering reads out on the "Preselector Adjust" on page 1869 control
Status Bits/OPC dependencies	When centering the preselector, `*OPC` will not return true until the process is complete and a subsequent measurement has completed, nor will results be returned to `:READ` or `:MEASure` queries The Measuring bit should remain set while this command is operating and should not go false until the subsequent sweep/measurement has completed

Proper Preselector Operation

A number of considerations should be observed to ensure proper operation:

1 If the selected marker is off, the instrument turns on a marker, performs a peak search, and adjusts the preselector using the selected marker's frequency. It uses the "highest peak" peak search method unqualified by threshold or excursion, so that there is no chance of a 'no peak found' error. It continues with that peak, even if it is the peak of just noise. Therefore, for this operation to work properly, there should be a signal on screen in a preselected range for the peak search to find

2 If the selected marker is already on, the instrument attempts the centering at that marker's frequency. There is no preselector for signals below about 3.6 GHz, so if the marker is on a signal below 3.6 GHz, no centering will be attempted and an advisory message generated

3 In some models, the preselector can be bypassed. If it is bypassed, no centering will be attempted in that range and a message will be generated

Preselector Adjust

Allows you to manually adjust the preselector filter frequency to optimize its response to the signal of interest. This function is only available when "Presel Center" on page 1868is available.

For general purpose signal analysis, using **Presel Center** is recommended. Centering the filter minimizes the impact of long-term preselector drift. **Preselector Adjust** can be used instead to manually optimize the preselector. One application of manual optimization would be to peak the preselector response, which both optimizes the signal-to-noise ratio and minimizes amplitude variations due to small (short-term) preselector drifting.

When **Presel Center** is performed, the offset applied to do the centering becomes the new value of **Preselector Adjust**.

Remote Command	`[:SENSe]:POWer[:RF]:PADJust <freq>` `[:SENSe]:POWer[:RF]:PADJust?`
Example	`:POW:PADJ 100KHz` `:POW:PADJ?`
Notes	The value on the control reads out to 0.1 MHz resolution
Dependencies	– Does not appear in CXA-m – Does not appear in VXT Models M9410A/11A – Grayed-out if microwave preselector is off – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz

	– Blank in models that do not include a preselector, such as option 503. If the SCPI is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View
Preset	0 MHz
State Saved	The **Preselector Adjust** value set by "Presel Center" on page 1868, or by manually adjusting **Preselector Adjust** It is not saved in instrument state, and does not survive a Preset or power cycle
Min	-500 MHz
Max	500 MHz
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PADJust` `[:SENSe]:POWer[:RF]:MMW:PADJust`

Notes	PSA had multiple preselectors, and you could select which preselector to adjust. Since the X-Series has only one mm/uW preselector, the preselector selection control is no longer available. However, to provide backward compatibility, we accept the legacy remote commands The command form has no effect, the query always returns `MWAVe`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:PADJust:PRESelector MWAVe | MMWave | EXTernal` `[:SENSe]:POWer[:RF]:PADJust:PRESelector?`

Internal Preamp

Accesses a menu of controls for the internal preamps. Turning on the preamp gives a better noise figure, but a poorer inter-modulation distortion (TOI) to noise floor dynamic range. You can optimize this setting for your particular measurement.

The instrument takes the preamp gain into account as it sweeps. If you sweep outside of the range of the preamp, the instrument will also account for that. The displayed result always reflects the correct gain.

For some measurements, when the preamp is on and any part of the displayed frequency range is below the lowest frequency for which the preamp has specifications, a warning condition message appears in the status line. For example, for a preamp with a 9 kHz lowest specified frequency: "Preamp: Accy unspec'd below 9 kHz".

Selection	Example	Note
Off	`:POW:GAIN OFF`	
Low Band	`:POW:GAIN ON` `:POW:GAIN:BAND LOW`	Sets the internal preamp to use only the low band. The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Low Band selection in the dropdown

Selection	Example	Note
Full Range	:POW:GAIN ON :POW:GAIN:BAND FULL	Sets the internal preamp to use its full range. The low band (0-3.6 GHz, 0-3.4 GHz, 0-3GHz, depending on the model) is supplied by the low band preamp and the frequencies above low band are supplied by the high band preamp The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Full Range selection in the dropdown. If the high band option is not installed the Full Range selection does not appear

Remote Command	[:SENSe]:POWer[:RF]:GAIN:BAND LOW | FULL [:SENSe]:POWer[:RF]:GAIN:BAND? [:SENSe]:POWer[:RF]:GAIN[:STATe] OFF | ON | 0 | 1 [:SENSe]:POWer[:RF]:GAIN[:STATe]?
Example	:POW:GAIN:BAND LOW :POW:GAIN:BAND? :POW:GAIN OFF :POW:GAIN?
Dependencies	Preamp is not available on all hardware platforms. If the preamp is not present or is unlicensed, the control is not shown Does not appear in VXT Models M9410A/11A/15A If :POW:GAIN:BAND FULL is sent when a low band preamp is available, the preamp band parameter is set to LOW instead of FULL, and an "Option not installed" message is generated The preamp is not available when the electronic/soft attenuator is enabled
Preset	LOW OFF
State Saved	Saved in instrument state
Annotation	When the USB Preamp is not connected to USB, the Preamp annotation in the Meas Bar says "Off" if the preamp is off and displays the frequency range of the low band or full range preamp depending on the setting. For example, if the Preamp is set to Low Band and the Low Band is 3.6 GHz the annotation says "3.6 GHz". If it is a 13.6 GHz preamp and it is set to Full Range the annotation says "13.6 GHz" When the USB Preamp is connected to USB, the Preamp annotation says "Preamp: USB" if the internal preamp is off or "Preamp: USB, Int" if the internal preamp is on (only for measurements that support the USB preamp)

LNA

Lets you turn the Low Noise Amplifier (LNA) on or off.

The LNA is an additional preamplifier that provides superior DANL and frequency range compared to the Internal Preamp. The LNA provides lower system noise figure, especially at frequencies above 100 MHz, and can be operated up to the full range of 50 GHz instruments.

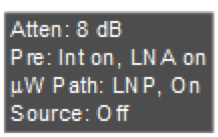
For best possible sensitivity, the LNA can be turned on together with the "Internal Preamp" on page 1870, although if you operate both preamps together, note that the TOI (distortion) specifications are impacted. The sensitivity improvement of this combination is substantial when operating in high band (frequencies above 3.6 GHz).

See "More Information" on page 642

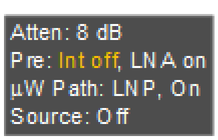
Remote Command	`[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe] OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe]?`
Example	`:POW:GAIN:LNA ON`
Dependencies	Requires option LNA Option LNA is not required by VXT model M9415A Does not appear in VXT models M9420A/21A/10A/11A May not appear in some measurements
Preset	`OFF`
State Saved	Saved in State

More Information

When the LNA is installed, the preamp annotation changes to show the state of both the LNA and the Internal Preamp. Below is an example:



Note that when operating entirely in the low band (below about 3.6 GHz), if the LNA is on, the Internal Preamp is switched off (even if you have its switch set to ON). This is because the noise performance is actually degraded in low band if both preamps are on. In this case, the annotation reflects the actual state of the two preamps, but the Internal Preamp annotation displays in amber, to warn you that the actual state of the Internal Preamp does not match the **Internal Preamp** switch control display:



µW Path Control

Options for this control include **µW Preselector Bypass** (Option MPB), **Low Noise Path** (Option LNP) and **Full Bypass Enable** in the High Band path circuits.

When the µW Preselector is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. When **Low Noise Path Enable** is selected, the instrument automatically bypasses certain circuitry in the high frequency bands that can contribute to noise, when it is appropriate based on other instrument settings.

For most applications, the preset state is **Standard Path**, which provides the best remote-control throughput, minimizes acoustic noise from switching and minimizes the risk of wear in the hardware switches, particularly in remote test scenarios where both low band and high band setups will follow in rapid succession. In this path, the bypass of the low band/high band switch and microwave preamp is never activated, which can cause some noise degradation but preserves the life of the bypass switch.

For applications that utilize the wideband IF paths, the preset state is **µW Preselector Bypas**s, if option MPB is present. This is because, when using a wideband IF such as the 140 MHz IF, the µW Preselector's bandwidth can be narrower than the available IF bandwidth, causing degraded amplitude flatness and phase linearity, so it is desirable to bypass the preselector in the default case.

You may choose **Low Noise Path Enable** for a lower noise floor, especially in the 21-26.5 GHz region, though without improving many measures of dynamic range, and without giving the best possible noise floor. The preamp, if purchased and used, gives better noise floor than does **Low Noise Path Enable**, but the preamp's compression threshold and third-order intercept are much poorer than that of **Low Noise Path Enable**.

A fourth choice is **Full Bypass Enable**, which combines **µW Preselector Bypass** and **Low Noise Path Enable**. Because this can bypass most of the circuitry between the input and the first mixer, care should be taken when using this setting to avoid damaging the mixer. **Full Bypass Enable** is only available if both options LNP and MPB are present, as well as option FBP.

Path	Example	Note
Standard Path	:POW:MW:PATH STD	Normal setting for most measurements. µW Preselector in circuit, Low Noise Path disabled
Low Noise Path Enable	:POW:MW:PATH LNP	See "Low Noise Path Enable" on page 647
µW Preselector Bypass	:POW:MW:PATH MPB	See "µW Preselector Bypass" on page 649
Full Bypass Enable	:POW:MW:PATH FULL	See "Full Bypass Enable" on page 650

Remote Command `[:SENSe]:POWer[:RF]:MW:PATH STD | LNPath | MPBypass | FULL`

	`[:SENSe]:POWer[:RF]:MW:PATH?`

Example	`:POW:MW:PATH LNP`
	Enables the Low Noise path
	`:POW:MW:PATH?`

Notes	If "Presel Center" on page 1868 is performed, the instrument will momentarily switch to the Standard Path, regardless of the setting of **µW Path Control** The DC Block will always be switched in when the low noise path is switched in, to protect succeeding circuitry from DC. Note that this does not mean "when the low noise path is enabled" but when, based on the Low Noise Path rules, the path is actually switched in. This can happen when the selection is **Low Noise Path Enable** or **Full Bypass Enable.** In the case where the DC Block is switched in the instrument is now AC coupled. However, if you selected DC coupling, the UI would still behave as though it were DC coupled, including all annunciation, warnings, status bits, and responses to SCPI queries. This is because, based on other settings, the instrument could switch out the low noise path at any time and hence go back to being DC coupled Alignment switching ignores the settings in this menu, and restores them when finished
Dependencies	Does not appear in CXA-m Does not appear in VXT Models M9410A/11A Does not appear in BBIQ and External Mixing The **Low Noise Path Enable** selection does not appear unless Option LNP is present and licensed The **µW Preselector Bypass** selection does not appear unless Option MPB is present and licensed The **Full Bypass Enable** selection does not appear unless options LNP and MPB are both present as well as option FBP In any of these cases, if the required options are not present and the SCPI command is sent, error -241, "Hardware missing; Option not installed" is generated **Low Noise Path Enable** and **Full Bypass Enable** are grayed-out if the current measurement does not support them **Low Noise Path Enable** and **Full Bypass Enable** are not supported in Avionics and MMR Modes. In any of these cases (that is, the feature is not supported in either measurement or mode), if the SCPI command is sent, the following error is generated: -221, "Setting Conflict; Feature not supported for this measurement"
Preset	All except modes specified below: `STD` IQ Analyzer, VXA, Pulse and Avionics mode: – MPB option present and licensed: `MPB` – MPB option not present and licensed: `STD`
State Saved	Save in instrument state
Range	Standard Path|Low Noise Path Enable|µW Presel Bypass|Full Bypass Enable
Annotation	In the Meas Bar, if the Standard path is chosen, it says: µW Path: Standard If Low Noise Path is enabled but the LNP switch is not thrown, it shows: µW Path: LNP,Off If the Low Noise Path is enabled and the LNP switch IS thrown, it shows: µW Path: LNP,On

If the preselctor is bypassed, it says:

µW Path: Bypass

If Full Bypass Enable is selected but the LNP switch is not thrown, it shows:

µW Path: FByp,Off

If Full Bypass Enable is selected and the LNP switch IS thrown, it shows:

µW Path: FByp,On

µW Path Control Auto [Mode: VMA, WLAN, NR5G, CQM]

In VMA, WLAN, 5G NR, CQM modes, an Auto/Man switch is added to **µW Path Control**:

This allows the function to automatically switch based on certain Auto Rules as shown below:

VMA Mode

Measurement	When µW Path Control is in Auto:
Digital Demod	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Custom OFDM	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Presel Bypass
SEM	Always Presel Bypass
Spurious Emissions	Always Standard Path

WLAN Mode

Measurement	When µW Path Control is in Auto:
Modulation Analysis	Always Presel Bypass

Measurement	When µW Path Control is in Auto:
Spectral Flatness	Always Presel Bypasss
Power vs Time	Always Presel Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Always Presel Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Always Presel Bypass
SEM	1. For 11be 320M, when 'Enabled Wideband IF for FFT' is OFF or 'Sweep Type Rule' is Best Dynamic Range, auto µW path is standard. 2. For other cases, auto µW path is presel bypass if presel bypass is enabled, auto µW path is standard if presel bypass is not enabled.
Spurious Emissions	Always Standard Path

5G NR Mode

Measurement	When µW Path Control is in Auto:
Modulation Analysis	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and "Allow Full Bypass in Auto" is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and "Allow Full Bypass in Auto" is On), otherwise choose Preselector Bypass
Channel Power	Always Standard Path
Occupied BW	Always Standard Path
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Standard Path
SEM	Always Standard Path
Spurious Emissions	Always Standard Path
Transmit On|Off Power	Use Standard Path unless tuned frequency > 3.6 GHz and Info BW > 15 MHz, in which case choose Preselector Bypass

Channel Quality Mode

Measurement	When µW Path Control is in Auto:
Group Delay	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and "Allow Full Bypass in Auto" is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in

Measurement	When µW Path Control is in Auto:
	which case choose Preselector Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass

Remote Command	`[:SENSe]:POWer[:RF]:MW:PATH:AUTO ON | OFF | 1 | 0` `[:SENSe]:POWer[:RF]:MW:PATH:AUTO?`
Example	`:POW:MW:PATH:AUTO ON` `:POW:MW:PATH:AUTO?`
Dependencies	Only appears in VMA, WLAN, 5G NR and CQM modes
Couplings	See the tables above
Preset	`ON`
Range	`ON|OFF`

Low Noise Path Enable

You may select **Low Noise Path Enable**, which gives a lower noise floor under some circumstances, particularly when operating in the 21-26.5 GHz region. With the Low Noise Path enabled, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

- The instrument is not in the Low Band, meaning:
- the start frequency is above 3.5 GHz and
- the stop frequency is above 3.6 GHz
- the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Low Noise Path Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Low Noise Path Enable** is selected in the user interface. The only time the Low Noise Path is used is when **Low Noise Path Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

For measurements that use IQ acquisition, the low noise path is used when **Center Frequency** is in High Band (> 3.6 GHz) and no preamp is in use. In other words, the rules above are modified to use only the center frequency to qualify which path to switch in. This is not the case for FFTs in the Swept SA measurement; they use the same rules as swept measurements.

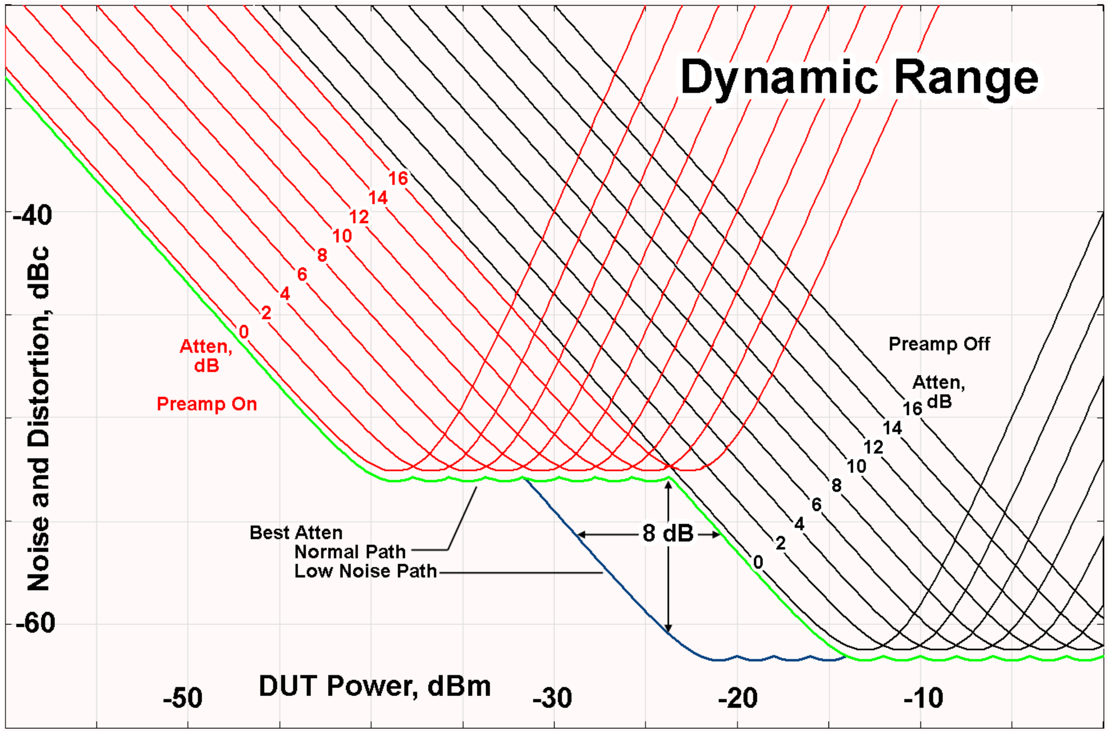
Note that the Low Noise Path, while giving improved DANL, has the disadvantage of decreased TOI performance and decreased gain compression performance relative to the standard path.

Note also that the bypass switch is a mechanical switch and has finite life, so if the **Low Noise Path Enable** is selected, it is possible to cause frequent cycling of this switch by frequently changing instrument settings such that the above conditions hold true only some of the time. A user making tests of this nature should consider opting for the **Standard Path**, which will never throw the bypass switch, at the expense of some degraded noise performance.

The low noise path is useful for situations where the signal level is so low that the instrument performance is dominated by noise even with 0 dB attenuation, but still high enough that the preamp option would have excessive third-order intermodulation or compression. The preamp, if purchased and used, gives better noise floor than does the "Low Noise Path." However, its compression threshold and third-order intercept are much poorer than that of the non-preamp path.

There are some applications, typically for signals around –30 dBm, for which the third-order dynamic range of the standard path is good enough, but the noise floor is not low enough even with 0 dB input attenuation. When the third-order dynamic range of the preamp path is too little and the noise floor of the standard path is too high, the Low Noise Path can provide the best dynamic range

The graph below illustrates the concept. It shows, in red, the performance of an instrument at different attenuation settings, both with the preamp on and off, in a measurement that is affected by both instrument noise and instrument TOI. The green shows the best available dynamic range, offset by 0.5 dB for clarity. The blue shows how the best available dynamic range improves for moderate signal levels with the low noise path switched in. In this illustration, the preamp improves the noise floor by 15 dB while degrading the third-order intercept by 30 dB, and the low noise path reduces loss by 8 dB. The attenuator step size is 2 dB.



There are other times where selecting the low noise path improves performance, too. Compression-limited measurements such as finding the nulls in a pulsed-RF spectrum can profit from the low noise path in a way similar to the TOI-limited measurement illustrated. Accuracy can be improved when the low noise path allows the optimum attenuation to increase from a small amount like 0, 2 or 4 dB to a larger amount, giving better return loss at the instrument input. Harmonic measurements, such as second and third harmonic levels, are much improved using the low noise path because of the superiority of that path for harmonic (though not intermodulation) distortion performance.

µW Preselector Bypass

Toggles the preselector bypass switch for band 1 and higher. When the microwave presel is on, the signal path is preselected. When the microwave preselector is off, the signal path is not preselected. The preselected path is the normal path for the instrument.

The preselector is a tunable bandpass filter which prevents signals away from the frequency of interest from combining in the mixer to generate in-band spurious signals (images). The consequences of using a preselector filter are its limited bandwidth, the amplitude and phase ripple in its passband, and any amplitude and phase instability due to center frequency drift.

Option MPB or pre-selector bypass provides an unpreselected input mixer path for certain X-Series signal analyzers with frequency ranges above 3.6 GHz. This signal path allows a wider bandwidth and less amplitude variability, which is an advantage when doing modulation analysis and broadband signal analysis. The disadvantage is that, without the preselector, image signals will be displayed. Another disadvantage of bypassing the preselector is increased LO emission levels at the front panel input port.

Image responses are separated from the real signal by twice the 1st IF. For IF Paths of 10 MHz and 25 MHz, the 1st IF is 322.5 MHz, so the image response and the real signal will be separated by 645 MHz. The 1st IF will be different for other IF Path settings. When viewing a real signal and its corresponding image response in internal mixing, the image response will be to the left of the real signal.

Also, the image response and the real signal typically have the same amplitude and exhibit the same shape factor.

However, if Option FS1, Fast Sweep Capability, is enabled, the image response in the Swept SA measurement appears lower in amplitude and has a much wider shape factor compared to the real signal.

Full Bypass Enable

With **Full Bypass Enable** selected, the microwave preselector is bypassed. In addition, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

- The instrument is not in the Low Band, meaning:
- the start frequency is above 3.5 GHz and
- the stop frequency is above 3.6 GHz.
- the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. The only time the Low Noise Path is used is when **Full Bypass Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

CAUTION

When **Full Bypass Enable** is selected, and "Attenuation" on page 1747 is set to 0 dB, there will be a direct AC connection between the input and the first converter when the Low Noise Path switches in (when Start Freq >3.6 GHz and the Preamp is either not licensed, set to Low Band, or Off). This puts the first converter at high risk to be damaged by high AC power. Consequently, whenever **Full Bypass Enable** is selected, a warning message appears in the status bar:

Full Bypass Enabled, maximum safe input power reduced

Microwave Preselector Bypass Backwards Compatibility

Example	`:POW:MW:PRES OFF` Bypasses the microwave preselector
Notes	Included for Microwave Preselector Bypass backwards compatibility The `ON` parameter sets the `STD` path (`:POW:MW:PATH STD`) The `OFF` parameter sets path `MPB` (`:POW:MW:PATH MPB`)
Preset	`ON`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe] ON | OFF | 0 | 1` `[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe]?`

Frequency Extender Preselection Bypass

Frequency Extender Preselection Bypass only applies to the high frequency path of the Frequency Extender and only if the Frequency Extender allows it. For example, the V3050A high frequency path is 50 – 110 GHz and does allow control of the preselector bypass.

When the Frequency Extender’s preselection is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. For bandwidths greater than 2.5 [GHz], it is recommended that the signal bypass the Frequency Extender Preselector since the max bandwidth of the Preselector can be as narrow as 2.5 [GHz].

For most applications, the preset state is `OFF`, which gives the best remote-control throughput, minimizes acoustic noise from switching, minimizes out of band spurs, and minimizes the risk of wear in the hardware switches.

Coupling with Microwave Preselector Control

The control of whether to apply or bypass the Frequency Extender’s preselection is dependent on the Microwave Path Control setting.

The coupling between the Microwave Path Control and Frequency Extender Preselector Bypass is described below.

UW PATH CTRL	UW PRESELECTOR	VIKING PRESELECTOR
Standard Path	On	**On**
Low Noise Path Enable	On	**On**
uW Presel Bypass	Off	**Off**
Full Bypass Enable	Off	**Off**

In other words…

uW Path Ctrl == Standard
uW Path Ctrl == Low Noise
→ Viking PreselBypass == Off

uW Path Ctrl == Bypass
uW Path Ctrl == Full Bypass
→ Viking PreselBypass == On

For the Frequency Extender Preselector Bypass to take effect, it requires a Frequency Extender device (such as V3050A) be connected and External RF (ERFIN) selected as the input.

The Frequency Extender Preselector is applied or bypassed depending on the Microwave Path Control setting only when the acquisition is above 50 [GHz]. Hence, it will be bypassed only when the acquisition is above 50 [GHz].

Preselector and Bandwidth Conflict

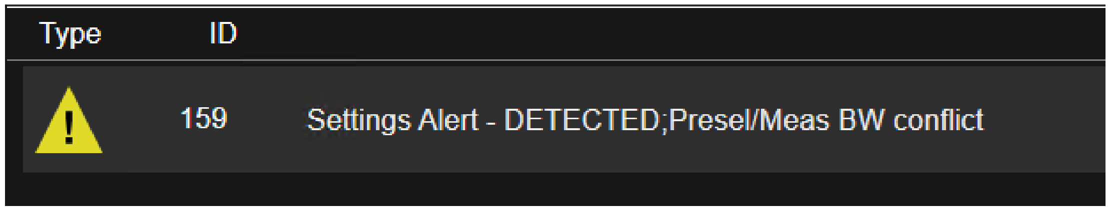
When the Frequency Extender Preselector is applied and the signal bandwidth is greater than 2.5 [GHz], then a settings alert message will show to warn the user that the signal may be distorted due to the limitation of the Frequency Extender Preselector bandwidth.

An example of the settings alert message is shown below.

Settings Alert message in the Status Bar at the bottom of the display.

Settings Alert message in the error queue

.



Software Preselection

Software Preselection is provided in some instruments, either to compensate for issues with provided hardware preselection or to provide the preselection function when there is no hardware preselector.

N9041B

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 50 GHz, software preselection must be used to suppress and separate images above 50 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

In the N9041B, Software Preselection only applies for frequencies above 50 GHz, therefore it is only used for RF Input 2. Even if it is turned on, it will not be used for other inputs and never for frequencies below 50 GHz. This is why the label of this control contains the parenthetical note “(>~50 GHz)”.

Note that in the N9041B, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

N9042B+V3050A

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 88 GHz, software preselection must be used to suppress and separate images above 88 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

For N9042B+V3050A, Software Preselection only applies for frequencies above 88 GHz, therefore it is only used for External RF. Even if it is turned on, it will not be used for other inputs and never for frequencies below 88 GHz. This is why the label of this control contains the parenthetical note “(>~88 GHz)”.

Note that for N9042B+V3050A, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

VXT models M9410A/11A

Software Preselection is used to provide the preselection function, as there is no hardware preselector in these models. Two background traces are taken and compared point by point, and the point with the lowest amplitude from the two traces is used. This provides a method to reduce spurs that are internally generated within the VXT, but the user should note the following when using Software Preselection:

- There is some speed cost due to the need to take multiple captures
- Taking the point with the lowest amplitude in each trace will make the average noise level lower at all points that do not have a spur. This can reduce the accuracy of the measurement of noise and noise-like signals.

Because of the difficulty in identifying spurs manually, you are encouraged to leave Software Preselection ON at all times in VXT models M9410A/11A. If you turn it off in order to speed up your measurement or improve noise accuracy, be aware of unwanted onscreen spurs.

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel:STATe 0 | 1 | ON | OFF` `[:SENSe]:POWer[:RF]:SWPresel:STAT?`
Example	`:POW:SWPR:STAT 1` `:POW:SWPR:STAT?`
Dependencies	Only appears in N9041B, N9042B+V2050A, and VXT models M9410A/11A. Does not appear in all measurements
Couplings	Sweep Time is affected by SW Preselection. Also Auto Tune supports SW Preselection, so set SW Preselection state and then do Auto Tune
Preset	N9041B: OFF N9042B+V3050A: ON M9410A/11A: ON
State Saved	Saved in instrument state

SW Preselection Type

Specifies the algorithm used for software preselection.

Two hidden sweeps are taken in succession. The second sweep is offset in LO frequency by 2*IF/N. For each point in each trace, the smaller amplitude from the two traces is taken and placed in that point in the selected trace. The Peak detector is auto-selected to improve the image suppression effectiveness. Responses of each trace that lie on top of one another will remain and are valid signals. Other signals are images and are suppressed. The action of taking the smaller of the two traces will make the average noise level lower in all points that do not have an image, thus reducing the accuracy of the measurement of noise and noise-like signals.

- NORMal - mathematically removes all image and multiple responses of signals present at the input
- ADVanced - any trace processing (such as “max hold” or trace averaging) is performed on the points of both candidate traces before the “select minimum” operation occurs. This form of processing works better for non-stationary signals, such as pulsed-RF signals

Remote Command	[:SENSe]:POWer[:RF]:SWPResel NORMal | ADVanced [:SENSe]:POWer[:RF]:SWPResel?
Example	:POW:SWPR NORM :POW:SWPR?
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed-out. Its grayout message is “Unavailable unless SW Presel enabled”
Preset	N9041B: ADVanced N9042B+V3050A: NORMal
State Saved	Saved in instrument state

SW Preselection BW

Specifies the effective bandwidth to be used for Software Preselection.

The choices are:

- NORMal – when making Swept measurements, a software preselection algorithm is used which takes up to 4 background acquisitions, then post-processes the result. This algorithm can remove images from signals with an occupied bandwidth up to around 3 GHz. (Default/Preset setting). When making FFT measurements, this algorithm is not used, instead the same algorithm is used as for NARRow (below)
- NARRow– a software preselection algorithm is used which takes two background acquisitions, then post-processes the result to detect and remove images from wideband signals with occupied bandwidths up to 2 GHz. This increases the risk of images failing to be rejected, but improves the measurement speed

Remote Command	[:SENSe]:POWer[:RF]:SWPResel:BW NORMal | NARRow [:SENSe]:POWer[:RF]:SWPResel:BW?
Example	:POW:SWPR:BW NARR
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed out. Its grayout message is “Unavailable unless SW Presel enabled” For N9042B+V3050A the parameter is SCPI only and always set to NARRow when Software

	Preselection is enabled
Preset	N9041B: NORMal N9042B+V3050A: NARRow
State Saved	Saved in instrument state

High Freq Prefilter

Lets you set the state of Prefilter for Center Frequencies above 1310 MHz.

In VXT Models M9410A/11A, the Receiver RF path has a bank of filters that come after the RF Attenuator in the signal path. Since this bank of filters precedes the mixer they are known as the “Prefilter” bank. Their purpose is to eliminate unwanted in-band mixing products by filtering out all but the desired frequencies before the signals get to the mixer. There are 13 prefilter bands to cover the frequencies between 9 kHz and 6000 MHz. The Prefilter provides the necessary rejection of the unwanted signal.

Remote Command	`[:SENSe]:<measurement>:PFILter[:STATe] ON | OFF | 1 | 0` `[:SENSe]:<measurement>:PFILter[:STATe]?`

Example	For example, to enable High Freq Prefilter in IQ Analyzer Mode:
	For the Complex Spectrum Measurement:
	`:SPEC:PFIL ON`
	For the IQ Waveform Measurement:
	`:WAV:PFIL ON`
	`:`

Dependencies	This control only appears in VXT models M9410A/11A with center frequency above 1310 MHz
Preset	See “Prefilter Presets” below
State Saved	Saved in instrument state

Prefilter Presets

Meas	Mode	Preset
SPEC	BASIC	OFF
WAV	BASIC, WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
MON	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
RHO	WCDMA	OFF
CDP	WCDMA	OFF
PCON	WCDMA	OFF
EVMQ	WCDMA	OFF
CHP	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF

Meas	Mode	Preset
OBW	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
ACP	WCDMA, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
SEM	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PST	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PVT	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF
EVM	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF
FLAT	WLAN	OFF
EVMM	WLAN	OFF
CEVM	LTEAFDD, LTEATDD	OFF
PAVT	5GNR, VMA	OFF
DDEM	VMA	OFF
OFDM	VMA	OFF
SAN	SA	ON
HARM	SA	ON

3.5.4 BW

The BW key opens the bandwidth menu, which contains controls for the Information Bandwidth functions of the instrument.

The Information BW functions control filter bandwidth and filter type. There are two filter types, Gaussian and Flattop. The Gaussian filters have a response curve that is parabolic on a log scale. The Flattop filter shape is a close approximation of a rectangular filter.

3.5.4.1 Settings

The Settings tab contains the basic Bandwidth functions. It is the only tab under Bandwidth.

Info BW

Enables you to specify the information bandwidth for the instrument. This is used to set the hardware filter of the ADC.

Remote Command	[:SENSe]:PCONtrol:BANDwidth[:RESolution] <freq> [:SENSe]:PCONtrol:BANDwidth[:RESolution]?
Example	:PCON:BAND 8.0e6 :PCON:BAND?
Preset	6 MHz
State Saved	Yes

Min	100000
Max	8 MHz
Backwards Compatibility SCPI	[:SENSe]:PCONtrol:BWIDth[:RESolution]

Filter Type

Toggles the filter shapes between Gaussian and Flat (flattop).

Remote Command	[:SENSe]:PCONtrol:BANDwidth[:RESolution]:TYPE FLATtop | GAUSsian [:SENSe]:PCONtrol:BANDwidth[:RESolution]:TYPE?
Example	:PCON:BAND:TYPE FLAT :PCON:BAND:TYPE?
Preset	FLATtop
State Saved	Yes
Range	FLATtop|GAUSsian
Backwards Compatibility SCPI	[:SENSe]:PCONtrol:BWIDth[:RESolution]:TYPE

3.5.5 Display

The Display Menu lets you configure display items for the current Mode, Measurement View or Window.

3.5.5.1 Meas Display

The Meas Display tab contains controls for setting up the display for the current Measurement, View or Window.

Slot Number

Selects how the measurement results are shown. The following options are available:

RELative	The Slot column of the measurement results shows relative slot number to the beginning of the captured data. In this case, the slot number always begins with 1
ABSolute	The Slot column shows absolute slot number determined by scrambling code. In this case, the range of slot number is 0 to 14

Remote Command	:DISPlay:PCONtrol:WINDow:TEXT:SNUMber RELative | ABSolute :DISPlay:PCONtrol:WINDow:TEXT:SNUMber?
Example	:DISP:PCON:WIND:TEXT:SNUM REL :DISP:PCON:WIND:TEXT:SNUM?
Notes	This parameter is available only for the Slot Metrics window
Preset	REL
State Saved	Yes
Range	Relative|Absolute

Chip Phase Trace

Toggles the chip-by-chip phase trace (yellow trace) On and Off.

Remote Command	:DISPlay:PCONtrol:WINDow4:TRACe:CPHase[:STATe] ON | OFF | 1 | 0 :DISPlay:PCONtrol:WINDow4:TRACe:CPHase[:STATe]?
Example	:DISP:PCON:WIND4:TRAC:CPH ON :DISP:PCON:WIND4:TRAC:CPH?
Notes	This parameter is available only for the Phase graph
Preset	OFF
Range	ON|OFF
Backwards Compatibility SCPI	:DISPlay:PCONtrol:VIEW[1]:WINDow[1]:TRACe:CPHase[:STATe]

3.5.5.2 View

Contains controls for selecting the current **View**, and for editing User Views.

Views

The Power Control measurement has four views as follows.

These Views are multiple-window Views. When in a multiple window View, you select a window by touching it. The menu controls may sometimes change depending on which window is selected.

Whenever the View changes, the default menu is Frequency, unless otherwise specified in the View description.

View	Result
Slot Power	RF Envelope/Chip Power Graph
	Slot Power Table

View	Result
PRACH Power	RF Envelope/Chip Power Graph
	PRACH Power Table
Slot Phase	Slot Phase Graph
	Slot Phase Table
Slot Phase w/Pwr Graph	Chip Power Graph
	Slot Power Table

View Selection Remote Commands

Allows you to select the desired measurement view.

– The Enumerated ID is used with the SCPI Command `:DISP:PCON:VIEW` ("View Selection by Name" on page 660)

– The Numeric ID is used with the SCPI Command `:DISP:PCON:VIEW:NSEL` ("View Selection by Number" on page 660)

Enumerated ID	Numeric ID	View Name
POWer	1	Slot Power
PRACh	3	PRACH Power
PHASe	2	Slot Phase
SPPower	4	Slot Phase w/Pwr Graph

View Selection by Name

Allows you to specify the view via its enumerated ID string.

Remote Command	`:DISPlay:PCONtrol:VIEW[:SELect] POWer | PHASe | PRACh | SPPower` `:DISPlay:PCONtrol:VIEW[:SELect]?`
Example	`:DISP:PCON:VIEW POW` `:DISP:PCON:VIEW?`
Notes	Measurement Type control under Meas Setup behaves in the same way as view switch. For details, see "Measurement Type" on page 681
Preset	POWer
State Saved	Yes
Range	Slot Power|PRACH Power|Slot Phase|Slot Phase w/Pwr Graph

View Selection by Number

Allows you to specify the view via its numeric ID value.

Remote	`:DISPlay:PCONtrol:VIEW:NSELect <integer>`

Command	:DISPlay:PCONtrol:VIEW:NSELect?
Example	:DISP:PCON:VIEW:NSEL 1 :DISP:PCON:VIEW:NSEL?
Preset	1
State Saved	Yes
Min/Max	1/4

Slot Power

Windows: "Power Graph (RF Envelope/Chip Power)" on page 612, "Slot Power Metrics" on page 612

Example	:DISP:PCON:VIEW POW

PRACH Power

Windows: "Power Graph (RF Envelope/Chip Power)" on page 612, , "PRACH Power Metrics" on page 613

Example	:DISP:PCON:VIEW PRAC

Slot Phase

Windows: "Phase Graph" on page 614, "Slot Phase Metrics" on page 614

Example	:DISP:PCON:VIEW PHAS

Slot Phase w/Pwr Graph

Windows:"Power Graph (RF Envelope/Chip Power)" on page 612, "Slot Power Metrics" on page 612

Example	:DISP:PCON:VIEW SPP

User View

Lets you choose a View from the saved User Views for the current measurement. This panel only appears if a User View exists for the current measurement.

Remote Command	:DISPlay:VIEW:ADVanced:SELect <alphanumeric> :DISPlay:VIEW:ADVanced:SELect?
Example	Select Baseband as the current View

	:DISP:VIEW:ADV:SEL “Baseband”

Notes	You must be in the measurement whose View you are trying to set to send the command. You can only set Views for the current measurement using this command
	For predefined views, the parameter is derived from the view name that is shown in the View list in the user interface. For example, if you are trying to select the Trace Zoom view in the Swept SA measurement, you send:
	`:DISP:VIEW:ADV:SEL "Trace Zoom"`
	because “Trace Zoom” is the name of the View as seen in the Mode/Meas dialog or in the Display, View menu
	You *cannot* use the legacy View parameter (which in this case would be `TZOom`) with `:DISP:VIEW:ADV:SEL`
	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case. Thus, both of the following forms work:
	`:DISP:VIEW:ADV:SEL "Trace Zoom"`
	`:DISP:VIEW:ADV:SEL "TRACE ZOOM"`
	If the specified view is not a valid View, the query returns the error message “-224, Illegal parameter value; View with the name <alphanumeric> does not exist”
	If the display is disabled (via `:DISP:ENAB OFF`) then the error message “-221, Settings conflict; View SCPI cannot be used while Display is disabled” is generated

Backwards Compatibility SCPI	The legacy node `:DISPlay:VIEW[:SELect]` is retained for backwards compatibility, but it only supports predefined views

Restore Layout to Default

Restores the Layout to the default for Basic.

Modified Views are very temporary; if you exit the current measurement they are discarded, and they are not saved in State. To retain this View for later use, and to be able to return easily to your original Basic View, you can save your edited View as a “User View”.

Save Layout as New View

Saves your new View as a User View. An alpha keyboard appears, which lets you name your new View; the default is the old View name plus a number.

Remote Command	`:DISPlay:VIEW:ADVanced:NAME <alphanumeric>`
Example	`:DISP:VIEW:ADV:NAME “Baseband”` Creates a new View named `Baseband` from the current View, and selects it as the current View
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case

	If `<alphanumeric>` name already exists as a View, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; User View SCPI cannot be used while Display is disabled" is generated

Re-Save User View

You can re-edit a User View; if you make changes, then an asterisk will appear next to the User View's name. You can then tap **Re-Save User View** to save it back to its existing name, or **Save Layout as New View** to add another, new User View.

This is a front panel function only, there is no remote command available to perform this function. To do this remotely, you must first perform **Save Layout as New View**, then delete the old User View and rename the new one with the name of the View you just deleted.

Rename User View

You can rename the current View by giving it a new unique name. Only User Views can be renamed, if the current View is a Predefined View, an error occurs.

Remote Command	`:DISPlay:VIEW:ADVanced:REName <alphanumeric>`
Example	`:DISP:VIEW:ADV:REN "Baseband"`
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the `<alphanumeric>` specifying the new name is already present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot rename a Predefined View" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete User View

You can delete the current View if it is a User View. The default view becomes the current view for the Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:DELete`
Example	`:DISP:VIEW:ADV:DEL`
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the `<alphanumeric>` is not present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> does not exist" is generated

	If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot delete a Predefined View" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete All User Views

Deletes all previously saved User Views. The default view becomes the current view for the Measurement if a User View was the current view when this command was executed.

Remote Command	`:DISPlay:VIEW:ADVanced:DELete:ALL`
Example	`:DISP:VIEW:ADV:DEL:ALL`
Notes	Disabled if there are no User Views

View Editor Remote Commands

The following remote commands help you manage Views and User Views. Note that the SCPI node for User Views handles both Predefined and User Views. The legacy nodes, `:DISPlay:VIEW[:SELect]` and `:DISPlay:VIEW:NSEL`, are retained for backwards compatibility, but they only support predefined views.

View Listing Query

Returns a string containing a comma-separated list of names for *all* the Views, including User Views, available for the current Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:CATalog?`
Example	`:DISP:VIEW:ADV:CAT?`
Notes	Returns a quoted string of the available Views for the current measurement, separated by commas. The list includes names for *all* the Views, including User Views, available for the current Measurement Example: `"Normal,Trace Zoom,Spectrogram,Baseband,myView1,yourView1"` No distinction is made between Predefined and User Views If you switch measurements with the display disabled (via `:DISP:ENAB OFF`), then query the list of available Views, the result is undefined

User View Listing Query

Returns a string containing a comma-separated list of names for *only* the User Views available for the current Measurement.

Remote Command	:DISPlay:VIEW:ADVanced:USER:CATalog?
Example	:DISP:VIEW:ADV:USER:CAT?
Notes	Returns a quoted string of the available User Views for the current measurement, separated by commas. Example: "Baseband,myView1,yourView1" If you switch measurements with the display disabled (see "Display Enable (Remote Command Only)" on page 1894), then query the list of available Views, the result is undefined

3.5.5.3 Annotation

Contains controls for setting up the annotation for the current Mode or Measurement.

Graticule

Turns the display graticule On or Off for all windows with graticules in all measurements in the current Mode. Also turns the graticule Y-Axis annotation on and off.

Remote Command	:DISPlay:GRATicule[:STATe] OFF | ON | 0 | 1 :DISPlay:GRATicule[:STATe]?
Example	:DISP:GRAT OFF
Notes	The graticule is the set of horizontal and vertical lines that make up the grid/divisions for the X-Axis and Y-Axis
Preset	ON
State Saved	Saved in instrument state
Backwards Compatibility SCPI	:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe] OFF | ON | 0 | 1 :DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe]? This command is accepted for backwards compatibility with older instruments, but the WINDow, TRACe and GRID parameters are ignored

Screen Annotation

Controls the display of the annunciation and annotation around the graticule, including any annotation on lines (such as the display line, the threshold line, etc.) and the Y-Axis annotation, for all windows with screen annotation in all measurements in the current Mode.

This does *not* include marker annotation (or the N dB result). When OFF, the graticule expands to fill the entire graticule area, leaving only the 1.5% gap above the graticule, as described in the Trace section.

Remote Command	`:DISPlay:ANNotation:SCReen[:STATe] OFF | ON | 0 | 1` `:DISPlay:ANNotation:SCReen[:STATe]?`
Example	`:DISP:ANN:SCR OFF`
Dependencies	Grayed-out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Trace Annotation

Turns on and off the labels on the traces, showing their detector (or their Math Mode) as described in the **Trace** section, for all windows in all measurements in the current Mode for which Trace Annotation on/off is supported.

If Trace Math is being performed on a trace, then the Trace Math annotation replaces the detector annotation.

For measurements that support limit lines, this key also turns on and off the labels on the Limit Lines. The label is the Limit number annotation and Limit Comment displayed on the graph. If the length of the comment is greater than 20 characters, the first 8 characters and the last 8 characters are displayed, joined with ….

Remote Command	`:DISPlay:ANNotation:TRACe[:STATe] ON | OFF | 1 | 0` `:DISPlay:ANNotation:TRACe[:STATe]?`
Example	`:DISP:ANN:TRAC OFF`
Preset	`OFF`
State Saved	Saved in instrument state

Control Annotation

Turns on and off the display of values on the Active Function controls for all measurements in the current Mode. This is a security feature.

Remote Command	`:DISPlay:ACTivefunc[:STATe] ON | OFF | 1 | 0` `:DISPlay:ACTivefunc[:STATe]?`
Example	`:DISP:ACT OFF`
Dependencies	Grayed out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Meas Bar

Turns the Measurement Bar at the top of the screen on and off for all measurements in the current Mode. When `OFF`, the graticule area expands to fill the area formerly occupied by the Measurement Bar.

Remote Command	`:DISPlay:ANNotation:MBAR[:STATe] OFF | ON | 0 | 1` `:DISPlay:ANNotation:MBAR[:STATe]?`
Example	`:DISP:ANN:MBAR OFF`
Dependencies	Grayed out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Display Enable (Remote Command Only)

Turns the display on/off, including the display drive circuitry. The backlight stays lit to confirm that the instrument is on. The display enable setting is mode global. Theare three reasons for turning the display off:

1. To increase speed as much as possible by freeing the instrument from having to update the display
2. To reduce emissions from the display, drive circuitry
3. For security purposes

If you have turned off the display:

– and you are in local operation, the display can be turned back on by pressing any key or by sending `:SYSTem:DEFaults MISC` or `:DISPlay:ENABle ON` (neither `*RST` nor :SYSTem:PRESet enable the display)

– and you are in remote operation, the display can be turned back on by pressing the **Local** or **Esc** keys, or by sending `:SYSTem:DEFaults MISC` or `:DISPlay:ENABle ON` (neither `*RST` nor `:SYSTem:PRESet` enable the display)

– and you are using either the `:SYSTem:KLOCk` command or GPIB local lockout, then *no* front-panel key press will turn the display back on. You must turn it back on remotely.

If the display is `OFF`, many SCPI commands related to User Views and Multiscreen functionality do not work, and return the error messages "-221, Settings conflict; Screen SCPI cannot be used when Display is disabled" or "221, Settings conflict; View SCPI cannot be used while Display is disabled". These commands include:

Name	Command
Select User View	:DISPlay:VIEW:ADVanced:SELect
Rename User View	:DISPlay:VIEW:ADVanced:REName
Delete User View	:DISPlay:VIEW:ADVanced:DELete
Create User View	:DISPlay:VIEW:ADVanced:NAME
Select Screen	:INSTrument:SCReen:SELect
Delete Screen	:INSTrument:SCReen:DELete
Delete All But This Screen	:INSTrument:SCReen:DELete:ALL
Add Screen	:INSTrument:SCReen:CREate
Rename Screen	:INSTrument:SCReen:REName
Sequencer On/Off	:SYSTem:SEQuencer

Remote Command	`:DISPlay:ENABle OFF | ON | 0 | 1` `:DISPlay:ENABle?`
Example	`:DISP:ENAB OFF`
Couplings	`:DISP:ENAB OFF` turns Backlight `OFF` and `:DISP:ENAB ON` turns Backlight `ON`, but changing Backlight settings does *not* change the state of `:DISP:ENAB`
Preset	`ON` Set by `:SYST:DEF MISC`, but not affected by `*RST` or `:SYSTem:PRESet`
State Saved	Not saved in instrument state
Backwards Compatibility Notes	`:SYST:PRES` no longer turns on `:DISPlay:ENABle` as it did in legacy analyzers

3.5.6 Freq

The Freq key opens the Frequency menu, which contains controls that allow you to control the Frequency and Channel parameters of the instrument.

Some features in the Frequency menu are the same for all measurements in the current Mode – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset. For example, the Center Freq setting is the same for all measurements - it does not change as you change measurements.

3.5.6.1 Settings

The Settings Tab contains controls that pertain to the X axis parameters of the measurement. These parameters control how data on the vertical (X) axis is displayed and control instrument settings that affect the horizontal axis.

Center Frequency

Sets the frequency that corresponds to the horizontal center of the graticule. While adjusting the Center Frequency the Span is held constant.

The center frequency setting is the same for all measurements within a mode, that is, it is Meas Global. Some modes are also able to share a Mode Global center frequency value. If this is the case, the Mode will have a **Global** tab in its **Meas Setup** menu.

The **Center Freq** function sets (and queries) the Center Frequency for the currently selected input. If your instrument has multiple inputs, and you select another input, the Center Freq changes to the value for that input. SCPI commands are available to directly set the Center Freq for a specific input.

Center Freq is remembered as you go from input to input. Thus you can set a Center Freq of 10 GHz with the RF Input selected, change to BBIQ and set a Center Freq of 20 MHz, then switch to External Mixing and set a Center Freq of 60 GHz, and when you go back to the RF Input the Center Freq will go back to 10 GHz; back to BBIQ and it is 20 MHz; back to External Mixing and it is 60 GHz.

– See "RF Center Freq" on page 672
– See "Ext Mix Center Freq" on page 672
– See "I/Q Center Freq" on page 673
– See "Center Frequency Presets" on page 670

Remote Command	`[:SENSe]:FREQuency:CENTer <freq>` `[:SENSe]:FREQuency:CENTer?`

Example	Set the Center Frequency to 50 MHz:
	`:FREQ:CENT 50 MHz`
	Increment the Center Frequency by the value of CF Step:
	`:FREQ:CENT UP`
	Return the current value of the Center Frequency:
	`:FREQ:CENT?`

Notes	This command sets the RF, External Mixing or I/Q Center Frequency depending on the selected input For RF input it is equivalent to `:FREQ:RF:CENT` For I/Q input it is equivalent to `:FREQ:IQ:CENT` For External Mixer it is equivalent to `:FREQ:EMIX:CENT` Preset and Max values are dependent on Hardware Options (5xx) If no terminator (e.g. MHz) is sent the terminator Hz is used. If a terminator with unit other than Frequency is used, an invalid suffix error message is generated
Preset	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 670, "RF Center Freq" on page 672, "Ext Mix Center Freq" on page 672 and "I/Q Center Freq" on page 673

State Saved	Saved in instrument state
Min	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 670, "RF Center Freq" on page 672, "Ext Mix Center Freq" on page 672 and "I/Q Center Freq" on page 673
Max	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 670, "RF Center Freq" on page 672, "Ext Mix Center Freq" on page 672 and "I/Q Center Freq" on page 673
Status Bits/OPC dependencies	Non-overlapped

Center Frequency Presets

The following table provides the Center Frequency Presets for the Spectrum Analyzer mode, and the Max Freq, for the various frequency options:

Freq Option	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
503 (all but CXA)	1.805 GHz	3.6 GHz	3.7 GHz
503 (CXA)	1.505 GHz	3.0 GHz	3.08 GHz
507 (all but CXA)	3.505 GHz	7.0 GHz	7.1 GHz
507 (CXA)	3.755 GHz	7.5 GHz	7.58 GHz
508 (all but MXE)	1.805 GHz	3.6 GHz	8.5 GHz
508 (MXE)	4.205 GHz	8.4 GHz	8.5 GHz
513	6.805 GHz	13.6 GHz	13.8 GHz
526 (except CXA and MXE)	13.255 GHz	26.5 GHz	27.0 GHz*
526 (CXA)	13.255 GHz	26.5 GHz	26.55 GHz
526 (MXE)	1.805 GHz	3.6 GHz	27.0 GHz
532	16.005 GHz	32.0 GHz	32.5 GHz
540	20.005 GHz	40.0 GHz	40.5 GHz
543	21.505 GHz	43.0 GHz	43.0 GHz
544	22.005 GHz	44.0 GHz	45.0 GHz
550	25.005 GHz	50.0 GHz	52 GHz
F03 (CXA-m)	1.505 GHz	3.0 GHz	3.08 GHz
F07 (CXA-m)	3.755 GHz	7.5 GHz	7.575 GHz
F13 (CXA-m)	6.805 GHz	13.6 GHz	13.8 GHz
F26 (CXA-m)	13.255 GHz	26.5 GHz	26.55 GHz
504 (M9420A/21A, M8920A)	2.145 GHz	3.88GHz	3.88 GHz
506 (M9420A/21A, M8920A)	3.245 GHz	6.08GHz	6.08 GHz
F06 (M9410A/11A)	1.0 GHz	6.08 GHz	6.08 GHz

Freq Option	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
F06 (M9415A)	1 GHz	1.08 GHz	6.6 GHz
F08 (M9415A)	1 GHz	1.08 GHz	8.6 GHz
F12 (M9415A)	1 GHz	1.08 GHz	12.9 GHz

*For option 526, the Max CF in RTSA is 26.999999995 GHz.

N9041B Center Freq Presets

Input	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
Input 1, all models	25.005 GHz	50.0 GHz	52 GHz
Input 2, opt 585	42.505 GHz	85.0 GHz	86 GHz
Input 2, opt 590	45.005 GHz	90.0 GHz	92 GHz
Input 2, opt 5CX	55.005 GHz	110.0 GHz	110 GHz

Input 2, CXA and MXE

Model	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
CXA opt C75	0.7505 GHz	1.5 GHz	1.58 GHz
MXE	505 MHz	1 GHz	1.000025 GHz

Tracking Generator Frequency Limits (CXA only)

Tracking Generator Option	Min Freq (clips to this freq when turn TG on and can’t tune below while TG on)	If above this Freq, Stop Freq clipped to this Freq when TG turned on	Max Freq (can't tune above) while TG on
T03	9 kHz	3.0 GHz	3.08 GHz
T06	9 kHz	6.0 GHz	6.05 GHz

Tracking Generator Frequency Limits(CXA-m only)

Tracking Generator Option	Min Freq (clips to this freq when turn TG on and can’t tune below while TG on)	If above this Freq, Stop Freq clipped to this Freq when TG turned on	Max Freq (can't tune above) while TG on
T03	2 MHz	3.08 GHz	3.08 GHz
T07	2 MHz	7.575 GHz	7.575 GHz
T13	2 MHz	13.8 GHz	13.8 GHz
T26	2 MHz	26.55 GHz	26.55 GHz

RF Center Freq

SCPI command for specifying the RF Center Frequency. This command will set the Center Frequency to be used when the RF input is selected, even if the RF input is not the input that is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:RF:CENTer <freq>` `[:SENSe]:FREQuency:RF:CENTer?`
Example	`:FREQ:RF:CENT 30 MHz` `:FREQ:RF:CENT?`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode
Dependencies	If the electronic/soft attenuator is enabled, any attempt to set Center Frequency such that the Stop Frequency would be >3.6 GHz fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning
Preset	See table above
State Saved	Saved in instrument state
Min	-79.999995 MHz
Max	See table above. Basically instrument maximum frequency - 5 Hz

Ext Mix Center Freq

SCPI command for specifying the External Mixer Center Frequency. This command will set the Center Frequency to be used when the External Mixer is selected, even if the External Mixer input is not the input which is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:EMIXer:CENTer <freq>` `[:SENSe]:FREQuency:EMIXer:CENTer?`
Example	`:FREQ:EMIX:CENT 60 GHz` `:FREQ:EMIX:CENT?`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode
Couplings	When returning to External Mixing after having been switched to one of the other inputs (e.g., RF), you will come back into the settings that you had when you left External Mixing. So you will come back to the band you were in with the Center Frequency that you had. However, Span is not an input-dependent parameter, therefore you will bring the span over from the other input. Therefore, the instrument comes back with the span from the previous input, limited as necessary by the current mixer setup

Preset	When a Mode Preset is performed while in External Mixing, the Start frequency of the current Mode is set to the nominal Min Freq of the lowest harmonic range in the Harmonic Table for the current mixer setup. Similarly, the Stop frequency of the current Mode is set to the nominal Max Freq of the highest harmonic range in the Harmonic Table. The Center Freq thus presets to the point arithmetically equidistant from these two frequencies Note that, if the current measurement has a limited Span available to it, and cannot achieve the Span shown in the table (Span=Stop Freq – Start Freq), the instrument uses the maximum Span the measurement allows, and still sets the Center Freq to the midpoint of the Start and Stop Freq values in the Harmonic Table When Restore Input/Output Defaults is performed, the mixer presets to the 11970A, whose Start and Stop frequencies are 26.5 and 40 GHz respectively. The center of these two frequencies is 33.25 GHz Therefore, after a Restore Input/Output Defaults, if you go into External Mixing and do a Mode Preset while in the Spectrum Analyzer Mode, the resulting Center Freq is 33.25 GHz
State Saved	Yes
Min	The minimum frequency in the currently selected mixer band + 5 Hz
Max	The maximum frequency in the currently selected mixer band - 5 Hz

I/Q Center Freq

SCPI command for specifying the I/Q Center Frequency. This command will set the Center Frequency to be used when the I/Q input is selected, even if the I/Q input is not the input which is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:IQ:CENTer <freq>` `[:SENSe]:FREQuency:IQ:CENTer?`
Example	`:FREQ:IQ:CENT 30 MHz`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode
Preset	0 Hz
State Saved	Saved in instrument state
Min	-40.049995 MHz
Max	40.049995 MHz

CF Step

Changes the step size for the center frequency and start and stop frequency functions. Once a step size has been selected and the center frequency function is active, the step keys (and the UP|DOWN parameters for Center Frequency from remote commands) change the center frequency by the step-size value. The step size function is useful for finding harmonics and sidebands beyond the current frequency span of the instrument.

Note that the start and stop frequencies also step by the CF Step value.

Remote Command	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement] <freq>`
	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement]?`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO?`

Example	`:FREQ:CENT:STEP 500 MHz`
	`:FREQ:CENT UP`
	increases the current center frequency value by 500 MHz
	`:FREQ:CENT:STEP?`
	`:FREQ:CENT:STEP:AUTO ON`
	`:FREQ:CENT:STEP:AUTO?`

Notes	Preset and Max values are dependent on Hardware Options (5xx)
Dependencies	Span, RBW, Center frequency If the electronic/soft attenuator is enabled, any attempt to change the value of the center frequency >3.6 GHz by pressing the Up-arrow key, fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning
Couplings	When auto-coupled in a non-zero span, the center frequency step size is set to 10% of the span. When auto-coupled in zero span, the center frequency step size is set to the equivalent -3 dB RBW value
Preset	Auto `ON`
State Saved	Saved in instrument state
Min	– (the maximum frequency of the instrument). That is, 27 GHz max freq instrument has a CF step range of +/- 27 GHz. Note that this is the maximum frequency given the current settings of the instrument, so in External Mixing, for example, it is the maximum frequency of the current mixer band
Max	The maximum frequency of the instrument. That is, 27 GHz max freq instrument has a CF step range of +/- 27 GHz. Note that this is the maximum frequency given the current settings of the instrument, so in External Mixing, for example, it is the maximum frequency of the current mixer band
Status Bits/OPC dependencies	non-overlapped

3.5.7 Marker

Accesses a menu that enables you to select, set up and control the markers for the current measurement. If there are no active markers, Marker selects marker 1, sets it to Normal and places it at the center of the display. If the selected marker is Off, it is set to Normal and placed it at the center of the screen on the trace determined by the Marker Trace rules.

3.5.7.1 Select Marker

Specifies the selected marker. The term "selected marker" is used throughout this document to specify which marker will be affected when you change marker settings, perform a Peak Search, etc.

The Select Marker control appears above the menu panel, indicating that it applies to all controls in the Marker menu panels. Select Marker is blanked if you select a tab whose controls do NOT depend on the selected marker (e.g., Counter).

On any menu tab for which **Select Marker** displays, the first control is always **Marker Frequency|Time**.

Notes	The selected marker is remembered even when not in the Marker menu and is used if a Search is done or a Band Function is turned on or for Signal Track or Continuous Peak
Preset	Marker 1
State Saved	The number of the selected marker is saved in instrument state
Annunciation	Appears in the marker results block label for **Normal** and **Delta** markers

3.5.7.2 Settings

The controls on the Settings tab include the Marker active function and a radio button selection of the marker control mode (Normal, Delta, or Off) for the selected marker, as well as additional functions that help you use markers.

Marker Time

Sets the marker X Axis value in the current marker X Axis Scale unit. It has no effect if the control mode is Off, but is the SCPI equivalent of entering an X value if the control mode is Normal or Delta.

Remote Command	`:CALCulate:PCONtrol:MARKer[1]|2|...|12:X <real>` `:CALCulate:PCONtrol:MARKer[1]|2|...|12:X?`
Example	`:CALC:PCON:MARK3:X 0.0` `:CALC:PCON:MARK3:X?`
Notes	If no suffix is sent, uses the fundamental units for the current marker X Axis Scale. If a suffix is sent that does not match the current marker X Axis Scale unit, an error "Invalid suffix" is generated The query returns the marker's absolute X Axis value if the control mode is Normal, or the offset from the marker's reference marker if the control mode is Delta. The query is returned in the fundamental units for the current marker X Axis scale: Hz for Frequency and Inverse Time, seconds for Period and Time. If the marker is Off the response is Not A Number
Preset	After a preset, all Markers are turned OFF, so Marker X Axis Value query returns a Not A Number (NAN)
State Saved	No

Min	–9.9E+37
Max	9.9E+37
Annotation	Mkr # <X value> and <Marker value> upper right on graph

Marker X Axis Position (Remote Command only)

Sets the marker X position in trace points. It has no effect if the control mode is **Off,** but is the SCPI equivalent of entering a value if the control mode is **Normal** or **Delta** - except in trace points rather than X Axis Scale units. The entered value is immediately translated into the current X Axis Scale units for setting the value of the marker.

Remote Command	`:CALCulate:PCONtrol:MARKer[1]|2|...|12:X:POSition <real>` `:CALCulate:PCONtrol:MARKer[1]|2|...|12:X:POSition?`
Example	`:CALC:PCON:MARK10:X:POS 0.0` `:CALC:PCON:MARK10:X:POS?`
Notes	The query returns the marker's absolute X Axis value in trace points if the control mode is Normal, or the offset from the marker's reference marker in trace points if the control mode is Delta. The value is returned as a real number, not an integer, corresponding to the translation from X Axis Scale units to trace points. If the marker is Off the response is *Not A Number (NAN)* This command is not available when Marker Trace of the selected marker (`:CALCulate:PCONtrol:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:TRACe?`) is set to `POLar`. In this case, this command is ignored
Preset	After a preset, all Markers are turned OFF, so Marker X Axis Value query returns a Not A Number (NAN)
State Saved	No
Min	-9.9E+37
Max	9.9E+37

Marker Y Axis Value (Remote Command only)

Queries the marker Y Axis value in the current marker Y Axis unit.

Remote Command	`:CALCulate:PCONtrol:MARKer[1]|2|...|12:Y?`
Example	`:CALC:PCON:MARK11:Y?`
Notes	The query returns the marker Y-axis result if the control mode is Normal or Delta. If the marker is Off, the response is not a number (NAN)
Preset	Result dependent on markers setup and signal source
State Saved	No
Backwards Compatibility SCPI	`:CALCulate:PCONtrol:MARKer[1]|2|...|12:FUNCtion:RESult?`

Marker Mode

Sets the marker control mode to Normal, Delta, or Off. All interactions and dependencies detailed under the control description are enforced when the remote command is sent. If the selected marker is Off, pressing Marker sets it to Normal and places it at the center of the screen on the trace determined by the Marker Trace rules. At the same time, Marker X Axis Value appears on the Active Function area.

The default active function is the active function for the currently selected marker control mode. If the current control mode is Off, there is no active function and the active function is turned off.

Remote Command	`:CALCulate:PCONtrol:MARKer[1]|2|...|12:MODE POSition	DELTa	OFF` `:CALCulate:PCONtrol:MARKer[1]|2|...|12:MODE?`
Example	`:CALC:PCON:MARK:MODE POS` `:CALC:PCON:MARK:MODE?`
Preset	`OFF`
State Saved	Saved in instrument state
Range	`POSition|DELTa|OFF`
Annotation	Mkr # <X value> and <Marker value> upper right on graph

Backward Compatibility SCPI Commands

Sets or queries the state of a marker. Setting a marker which is OFF to state ON or 1 puts it in Normal mode and places it at the center of the screen.

Remote Command	`:CALCulate:PCONtrol:MARKer[1]|2|...|12:STATe OFF	ON	0	1` `:CALCulate:PCONtrol:MARKer[1]|2|...|12:STATe?`
Example	`:CALC:PCON:MARK3:STAT ON` `:CALC:PCON:MARK3:STAT?`
Preset	`OFF`
State Saved	Saved in instrument state
Range	`OFF|ON`

Delta Marker (Reset Delta)

Pressing this button is exactly the same as pressing the “Delta” selection on the Marker Mode radio button. The selected marker becomes a Delta Marker. If the selected marker is already a Delta marker, the reference marker is moved to the current position of the selected marker, thus resetting the Delta to zero.

Marker Settings Diagram

The Marker Settings Diagram lets you configure the Marker system using a visual utility.

All Markers Off

Turns off all markers.

Remote Command	`:CALCulate:PCONtrol:MARKer:AOFF`
Example	`:CALC:PCON:MARK:AOFF`

Couple Markers

When this function is On, moving any marker causes an equal X Axis movement of every other marker which is not Fixed or Off. By “equal X Axis movement” we mean that we preserve the difference between each marker’s X Axis value (in the fundamental x-axis units of the trace that marker is on) and the X Axis value of the marker being moved (in the same fundamental x-axis units).

In the WCDMA mode, when the marker is assigned to the Polar graph, a symbol value (Code Domain measurement) /a chip value (Mod Accuracy and QPSK EVM measurement) is coupled instead of an X axis value.

Note that Fixed markers do not couple. They stay where they were while all the other markers move. Of course, if a Fixed marker is being moved, all the non-fixed markers do move with it.

This may result in markers going off screen.

Remote Command	`:CALCulate:PCONtrol:MARKer:COUPle[:STATe] ON | OFF | 1 | 0` `:CALCulate:PCONtrol:MARKer:COUPle[:STATe]?`
Example	`:CALC:PCON:MARK:COUP ON` `:CALC:PCON:MARK:COUP?`
Preset	`OFF` Presets on Mode Preset and All Markers Off
State Saved	Saved in instrument state

3.5.7.3 Peak Search

The controls on the Peak Search tab allow you to move the marker to selected peaks of the signal, giving you enormous analysis capabilities, particularly when combined with the Delta Marker function.

NOTE

Pressing the **Peak Search** hardkey automatically moves you to the **Peak Search** page of the **Marker** menu *and* performs a Peak Search.

Pressing the **Peak Search** tab once you are already *in* the **Marker** menu does *not* perform a Peak Search.

Marker Time

The Marker Time control is the fundamental control that you use to move a marker around on the trace. This is the same as the Marker Time control on the Settings tab.

Peak Search

Pressing the Peak Search control moves the selected marker to the trace point which has the maximum y-axis value for that marker's trace.

NOTE

Pressing the **Peak Search** hardkey automatically moves you to the **Peak Search** page of the **Marker** menu *and* performs a Peak Search.

Remote Command	`:CALCulate:PCONtrol:MARKer[1]|2|...|12:MAXimum`

Example	`:CALC:PCON:MARK2:MAX`
	`:SYST:ERR?`
	can be used to query the errors to determine if a peak is found. The message "No peak found" will be returned after an unsuccessful search

Notes	Sending this command selects the subopcoded marker This command does not work when the selected marker is located on the polar trace. In this case, the command is ignored

Marker Delta

Pressing this button is exactly the same as pressing the "Delta" selection on the Marker Mode radio button on the Settings tab. The selected marker becomes a Delta Marker. If the selected marker is already a Delta marker, the reference marker is moved to the current position of the selected marker, thus resetting the Delta to zero.

The control is duplicated here in the Peak Search Menu to allow you to conveniently perform a peak search and change the marker's control mode to Delta without having to access two separate menus.

3.5.7.4 Properties

The controls on the Properties tab are used to set certain properties of the selected marker.

Marker Time

The Marker Time control is the fundamental control that you use to move a marker around on the trace. This is the same as the Marker Time control on the Settings tab.

Relative To

Selects the marker to which the selected marker is relative (its reference marker).

Every marker has another marker to which it is relative. This marker is referred to as the “reference marker” for that marker. This attribute is set by the Marker, Properties, Relative To key. The marker must be a Delta marker to make this attribute relevant. If it is a Delta marker, the reference marker determines how the marker is controlled and how its value is displayed. A marker cannot be relative to itself.

Remote Command	`:CALCulate:PCONtrol:MARKer[1]|2|...|12:REFerence <integer>` `:CALCulate:PCONtrol:MARKer[1]|2|...|12:REFerence?`
Example	`:CALC:PCON:MARK:REF 5` `:CALC:PCON:MARK:REF?`
Notes	This command causes the marker specified with the subopcode to become selected Range (for SCPI command): 1 to 12. If the range is exceeded the value is clipped A marker cannot be relative to itself so that choice is not available, and if sent from SCPI generates error -221: “Settings conflict; marker cannot be relative to itself” When queried a single value is returned (the specified marker numbers relative marker)
Couplings	The act of specifying the selected marker’s reference marker makes the selected marker a Delta marker If the reference marker is off it is turned on in Normal mode at the delta marker location
Preset	The preset default “Relative To” marker (reference marker) is the next higher numbered marker (current marker +1). For example, if marker 2 is selected, then it’s default reference marker is marker 3. The exception is marker 12, which has a default reference of marker 1 Set to the defaults by using Restore Mode Defaults. This is not reset by Marker Off, All Markers Off, or Preset
State Saved	Saved in instrument state. Not affected by Marker Off and hence not affected by Preset or power cycle
Min	1
Max	12
Annunciation	Appears in the marker label of a **Delta** marker

Marker Trace

Assigns the specified marker to the designated trace.

Remote Command	:CALCulate:PCONtrol:MARKer[1]|2|...|12:TRACe RFENvelope | SPOWer | CPHase | APHase | DPHase :CALCulate:PCONtrol:MARKer[1]|2|...|12:TRACe?
Example	:CALC:PCON:MARK:TRAC RFEN :CALC:PCON:MARK:TRAC?
Preset	RFENvelope | RFENvelope | RFENvelope | RFENvelope | RFENvelope | RFENvelope | RFENvelope | RFENvelope | RFENvelope | RFENvelope | RFENvelope | RFENvelope
State Saved	Yes
Range	RF Envelope|Slot Power|Chip Phase|Average Chip Phase|Phase Discontinuity

Marker Settings Diagram

The Marker Settings Diagram lets you configure the Marker system using a visual utility. This is the same as the"Marker Settings Diagram" on page 678 control on the Settings tab.

3.5.8 Meas Setup

The Meas Setup menu panel contains functions for setting up the measurement parameters.

3.5.8.1 Measurement Type

Changing Measurement Type behaves in the same way as changing Views. For details, see "Views" on page 659.

Measurement Type	Corresponding View Selection Command
Slot Power	DISP:PCON:VIEW POW
PRACH Power	DISP:PCON:VIEW PRAC
Slot Phase	DISP:PCON:VIEW PHAS
Slot Phase (Power Graph)	DISP:PCON:VIEW SPP

Notes	For backwards compatibility, the command [:SENSe]:PCONtrol:TYPE SPOWer-|PRACh|SPHase remains as SCPI only command and corresponds to view switch as follows: :PCON:TYPE SPOW -> :DISP:PCON:VIEW POW

	:PCON:TYPE PRAC -> :DISP:PCON:VIEW PRAC :PCON:TYPE SPH -> :DISP:PCON:VIEW PHAS
State Saved	Yes
Range	Slot Power|PRACH Power|Slot Phase|Slot Phase (Power Graph)

3.5.8.2 Settings

This tab enables you to set measurement parameters.

IF Gain

Sets the IF Gain function to Auto, Low Gain or High Gain. These settings affect sensitivity and IF overloads.

Remote Command	[:SENSe]:PCONtrol:IF:GAIN[:STATe] ON | OFF | 1 | 0 [:SENSe]:PCONtrol:IF:GAIN[:STATe]? [:SENSe]:PCONtrol:IF:GAIN:AUTO[:STATe] OFF | ON | 0 | 1 [:SENSe]:PCONtrol:IF:GAIN:AUTO[:STATe]?
Example	:PCON:IF:GAIN ON :PCON:IF:GAIN? :PCON:IF:GAIN:AUTO OFF :PCON:IF:GAIN:AUTO?
Notes	Where: – ON = high gain – OFF = low gain
Dependencies	This control does not appear in VXT, M9393A, M9391A, or UXM
Preset	OFF OFF
State Saved	Yes
Range	Low Gain|High Gain

Auto Couple

Immediately puts all Auto/Man functions into Auto. The **Auto Couple** action is confined to the current measurement only. It does not affect other measurements in the mode.

In the Auto state, Auto/Man functions are said to be “coupled”, meaning their values change as you make changes to other values in the measurement. This helps ensure accurate measurements and optimum dynamic range. Auto Couple is an immediate action function, and when it is executed, all the Auto/Man controls for the current measurement are set to Auto, and all measurement settings coupled to the Auto/Man parameters are automatically set to their optimal value.

For further details of measurement-specific settings (if any), see "Measurement-Specific Details" on page 683 below.

Remote Command	`:COUPle ALL`
Example	`:COUP ALL`
Backwards Compatibility SCPI	`:COUPLE ALL | NONE`
Backwards Compatibility Notes	`:COUP:NONE` puts all Auto/Man parameters in manual mode, decoupling all the coupled instrument parameters. It is retained for backwards compatibility and is *not* recommended for making measurements or new designs

All Auto/Man parameter couplings in the measurement are set to Auto. This includes couplings that may be unavailable or grayed-out due to the current state. For example, in the Swept SA measurement, there is no Auto/Man coupling for RBW while in Zero Span. Nonetheless, if **Auto Couple** were executed while in Zero Span it would set RBW to Auto "behind the scenes" so that, on exit from Zero Span, it would be in Auto.

Any Auto/Man selection specific (local) to the other measurements in the current Mode will not be affected by **Auto Couple**. Any functions that are *not* coupled with other instrument parameters, such as ranging or leveling variables, such as "AutoRange" or "AutoScale", will not be affected.

Executing the **Auto Couple** command generates the informational message, "All Auto/Man functions have been set to Auto".

Each parameter, upon being set to Auto, selects and sets the appropriate auto-coupled value based on that parameter's coupling rules. The Dependency Resolver orchestrates the couplings for parameters that are dependent on one or more other parameters. The coupling and dependency rules for each parameter are defined in the chapter describing that parameter.

Executing the **Auto Couple** command *does not* affect markers, marker functions, trace or display attributes, or any other instrument setting other than those specifically mentioned above.

Measurement-Specific Details

TOI

Parameters affected by Auto Couple are:

- Center Frequency Step
- Resolution Bandwidth
- Span/RBW Ratio
- Sweep Time
- Video BandwidthVBW/RBW ratio
- Upper and Lower Tone (set to Sense
-)Zero span measurement Resolution Bandwidth
- Zero span measurement Dwell Time

Harmonics

For Harmonics, these parameters are:

- Resolution Bandwidth
- Fundamental Frequency
- Dwell Time
- Range Table Resolution Bandwidths
- Range Table Dwell Times

Meas Preset

Restores all the measurement parameters to their default values.

Remote Command	`:CONFigure:PCONtrol`
Example	`:CONF:PCON`
Couplings	Selecting meas preset restores all measurement parameters to their default values

3.5.8.3 Radio

The Radio tab contains controls to select the Radio Device, and enable or disable HSPA/HSPA+ options.

Radio Device

Allows you to specify the device to be used.

Remote Command	`[:SENSe]:RADio:STANdard:DEVice BTS | MS` `[:SENSe]:RADio:STANdard:DEVice?`
Example	`:RAD:STAN:DEV MS` `:RAD:STAN:DEV?`
Preset	BTS
State Saved	Saved in instrument state.
Range	BTS | MS
Backwards Compatibility SCPI	`[:SENSe]:RADio:DEVice`

HSPA Enable

Allows you to turn on or off the HSDPA/HSUPA option enable. This selection is necessary because some of the auto detection functions that expect an HSPA signal are less tolerant when the signal is noisy or distorted. When the HSPA signal is not expected, turn HSPA Enable off.

Remote Command	`[:SENSe]:RADio:CONFigure:HSDPa[:STATe] 0 | 1 | OFF | ON` `[:SENSe]:RADio:CONFigure:HSDPa[:STATe]?`
Example	`:RAD:CONF:HSDP 0` `:RAD:CONF:HSDP?`
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

HSPA+ Enable

Allows you to turn on or off the HSPA+ option enable. This selection is necessary because some of the auto detection functions that expect an HSPA+ signal are less tolerant when the signal is noisy or distorted. When the HSPA+ signal is not expected, turn HSPA+ Enable off.

Remote Command	`[:SENSe]:RADio:CONFigure:EHSPa[:STATe] OFF | ON | 0 | 1` `[:SENSe]:RADio:CONFigure:EHSPa[:STATe]?`
Example	`:RAD:CONF:EHSP 0` `:RAD:CONF:EHSP?`
Notes	When HSPA enable is OFF, HSPA+ function is disabled too.

Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

3.5.8.4 Sync

This tab enables you to set sync parameters.

Meas Method

Enables you to access the Meas Method Menu to select the data acquisition method, Waveform or Chip Power.

– WAVeform-Measures and performs a power calculation based on the waveform (raw data of A/D). This means a raw measurement under the specific BW, filter type and Capture Interval

– CPOWer-Measures and performs a power calculation based on the chip power (resample on chip clock). This means a re-sampled power measurement based on the chip clock timing for W-CDMA

The Meas Method is available only for the Slot Power and PRACH Power measurement types.

In the Slot Phase measurement type, resampling on the chip clock is always performed.

Remote Command	`[:SENSe]:PCONtrol:METHod WAVeform | CPOWer` `[:SENSe]:PCONtrol:METHod?`
Example	`:PCON:METH WAV` `:PCON:METH?`
Dependencies	This parameter is available when View Selection is Slot Power or PRACH Power and grayed out when View Selection is Slot Phase or Slot Phase w/Pwr Graph
Preset	WAVeform
State Saved	Yes
Range	Chip Power|Waveform

Slot Format

Enables you to access the Slot Format Menu to specify the slot format to be used for synchronization with the DPCCH Pilot channel. This format is used in the following two cases:

1. View Selection is Slot Power and Meas Method is Chip Power
2. View Selection is Slot Phase or Slot Phase w/Pwr Graph

Remote Command	`[:SENSe]:PCONtrol:SLOT:FORMat AUTO | SF0 | SF1 | SF2 | SF3 | SF4 | SF5` `[:SENSe]:PCONtrol:SLOT:FORMat?`
Example	`:PCON:SLOT:FORM SF0` `:PCON:SLOT:FORM?`
Preset	SF0
State Saved	Yes
Range	AUTO|SF0|SF1|SF2|SF3|SF4|SF5

Sync Start Slot

Specifies the first slot to measure.

When the Sync Start Slot parameter is set to On and the slot number to be used as the first slot to measure is specified, any trigger (even Free Run) initiates a measurement starting with the specified slot number.

For example:

- Trigger Source: Free Run (Immediate)
- Sync Start Slot state : On
- Sync Start Slot number : 0
- Capture Interval : 1 frame

The synchronization always starts from slot number 0.0 to 15.0 regardless of the trigger type.

When Sync Start Slot state is set to Off, the measurement performs synchronization at trigger timing.

Remote Command	`[:SENSe]:PCONtrol:SSLot:NUMBer <integer>`
	`[:SENSe]:PCONtrol:SSLot:NUMBer?`
	`[:SENSe]:PCONtrol:SSLot[:STATe] OFF | ON | 0 | 1`
	`[:SENSe]:PCONtrol:SSLot[:STATe]?`

Example	`:PCON:SSL:NUMB 5`
	`:PCON:SSL:NUMB?`
	`:PCON:SSL ON`
	`:PCON:SSL?`

Notes	Turn first slot number detection mode on or off
Dependencies	The control is not shown when device is MS and Sync Type is PRACH Message
Preset	0 OFF
State Saved	Yes Yes
Range	0 to 14 OFF|ON
Min/Max	0/14

Scramble Code

Sets the mobile station (MS) scramble code for synchronization. When this control is selected, a Hexadecimal Input menu appears.

Remote Command	`[:SENSe]:PCONtrol:SYNC:SCRamble <integer>` `[:SENSe]:PCONtrol:SYNC:SCRamble?`
Example	`:PCON:SYNC:SCR 0` `:PCON:SYNC:SCR?`
Preset	0 (0x0)
State Saved	Yes
Min/Max	0 (0x0; 24 bits)/16777215 (0xFFFFFF; 24 bits)

Preamble Sig

Sets the PRACH Preamble signature pattern to use for synchronization when the Meas Method is set to Chip Power. There are two modes:

- Auto - Automatically synchronizes with one of the PRACH Preamble signature patterns, 0 to 15
- Man - Specifies one of the PRACH Preamble signature patterns to which the synchronization is made

This value is set to its auto number when the PRACH Preamble Signature Auto mode is set to ON.

Remote Command	`[:SENSe]:PCONtrol:PRACh:SIGNature <integer>`
	`[:SENSe]:PCONtrol:PRACh:SIGNature?`
	`[:SENSe]:PCONtrol:PRACh:SIGNature:AUTO 0 | 1 | OFF | ON`
	`[:SENSe]:PCONtrol:PRACh:SIGNature:AUTO?`

Example	`:PCON:PRAC:SIGN 0`

	`:PCON:PRAC:SIGN?`
	 `:PCON:PRAC:SIGN:AUTO ON`
	 `:PCON:PRAC:SIGN:AUTO?`

Notes	When in Auto, the detected PRACH Preamble signature should be displayed. If synchronization fails, "---" should be displayed Set Signature Auto mode ON for PRACH Preamble detection
Preset	0 1
State Saved	Yes Yes
Range	Auto|Man
Min/Max	0/15

PRACH Noise Floor

Enables you to specify the PRACH noise floor. You can determine the signal noise floor level of the PRACH burst signal (since the system cannot recognize the noise floor level of the burst signal). The burst search algorithm needs a burst search threshold level. The level is calculated using this noise floor level and the peak level of the captured trace.

Remote Command	`[:SENSe]:PCONtrol:PRACh:NFLoor <real>` `[:SENSe]:PCONtrol:PRACh:NFLoor?`
Example	`:PCON:PRAC:NFL -70.0` `:PCON:PRAC:NFL?`
Dependencies	This control appears only when View Selection is PRACH Power
Preset	-69
State Saved	Yes
Min/Max	-156/-36

Advanced Sync Setup

The Advanced Sync Setup enables you to access advanced sync parameters in the Meas Setup menus on one screen.

Chip Rate

Changes the chip rate for the measurement.

Remote Command	`[:SENSe]:PCONtrol:CRATe <freq>` `[:SENSe]:PCONtrol:CRATe?`

Example	:PCON:CRAT 3.84e6 :PCON:CRAT?
Preset	3.84 MHz
State Saved	Yes
Min/Max	3.456 MHz/4.224 MHz

Filter Alpha

Sets the alpha value of the root raised cosine (RRC) filter.

Remote Command	[:SENSe]:PCONtrol:FILTer[:RRC]:ALPHa <real> [:SENSe]:PCONtrol:FILTer[:RRC]:ALPHa?
Example	:PCON:FILT:ALPH 0.22 :PCON:FILT:ALPH?
Preset	0.220
State Saved	Yes
Min/Max	0.01/0.50

RRC Filter

Enables you to turn the root-raised cosine filter On, Off, or set it to Auto.

Remote Command	[:SENSe]:PCONtrol:FILTer[:RRC][:STATe] 0 | 1 | OFF | ON [:SENSe]:PCONtrol:FILTer[:RRC][:STATe]? [:SENSe]:PCONtrol:FILTer[:RRC]:AUTO OFF | ON | 0 | 1 [:SENSe]:PCONtrol:FILTer[:RRC]:AUTO?
Example	:PCON:FILT OFF :PCON:FILT? :PCON:FILT:AUTO OFF :PCON:FILT:AUTO?
Couplings	When RRC Filter Auto is ON, RRC Filter State changes depending on the Meas Method: When Meas Method is changed to Chip Power, RRC Filter State is set to ON; and when Meas Method is changed to Waveform, it is set to OFF
Preset	0 ON
State Saved	Yes

PRACH Threshold (Remote Command only)

This number is calculated by the noise floor level and peak level of the captured trace. The threshold level is displayed with the signal as a white horizontal line. The burst search algorithm recognizes the burst that crosses this level.

Remote Command	`[:SENSe]:PCONtrol:PRACh:THReshold?`
Example	`:PCON:PRAC:THR?`
Notes	Query only
Preset	Automatically calculated
State Saved	Yes
Annotation	This value is displayed in bottom right of trace display

3.5.8.5 Time

This tab enables you to set Time parameters.

Capture Interval

Accesses a menu that enables you to select the number of frames for data acquisition.

Notes	For consistency, this parameter must be controlled with a float numeric from remote commands, but the front panel interface uses Enum for easier operation
Preset	4 Frames
State Saved	Yes
Range	1 Frame|2 Frames|4 Frames|8 Frames

Capture Interval (Remote Command only)

Enables you to specify the capture interval in frame units.

Remote Command	`[:SENSe]:PCONtrol:CAPTure:TIME <real>` `[:SENSe]:PCONtrol:CAPTure:TIME?`
Example	`:PCON:CAPT:TIME 4.0` `:PCON:CAPT:TIME?`
Notes	For consistency, this parameter must be controlled with a float numeric from remote commands, but the front panel interface uses Enum for easier operation
Preset	4.0
State Saved	Yes
Range	1.0|2.0|4.0|8.0

Slot Offset

Specifies the number of chips to be offset from the first acquisition data to the slot boundary.

Remote Command	`:CALCulate:PCONtrol:SLOT:OFFSet <real>` `:CALCulate:PCONtrol:SLOT:OFFSet?`
Example	`:CALC:PCON:SLOT:OFFS 0.0` `:CALC:PCON:SLOT:OFFS?`
Preset	0.0
State Saved	Yes
Min/Max	0.0/5120.0

Meas Delay

Specifies the number of chips to be delayed from the slot boundary to the start point of the power measurement. The range is 0.0 chips to (PCG Length - Meas Intvl) chips. The default is 96.0 chips which is equivalent to 25 µs at the 3.840 MHz chip rate.

Remote Command	`:CALCulate:PCONtrol:SLOT:DELay <real>` `:CALCulate:PCONtrol:SLOT:DELay?`
Example	`:CALC:PCON:SLOT:DEL 96.0` `:CALC:PCON:SLOT:DEL?`
Preset	96.0
State Saved	Yes
Min/Max	0.0/`:CALCulate:PCONtrol:SLOT:LENGth` - `:CALCulate:PCONtrol:SLOT:INTerval`

Meas Interval

Specifies the number of chips to be used as the measuring interval for the averaged RMS power measurement.

Remote Command	`:CALCulate:PCONtrol:SLOT:INTerval <real>` `:CALCulate:PCONtrol:SLOT:INTerval?`
Example	`:CALC:PCON:SLOT:INT 1088.0` `:CALC:PCON:SLOT:INT?`
Preset	2368.0
State Saved	Yes
Min/Max	1.0/`:CALCulate:PCONtrol:SLOT:LENGth` - `:CALCulate:PCONtrol:SLOT:OFFSet`

PCG Length

Specifies the number of chips to be used as the integration time for the slot power measurement.

Remote Command	`:CALCulate:PCONtrol:SLOT:LENGth <real>` `:CALCulate:PCONtrol:SLOT:LENGth?`
Example	`:CALC:PCON:SLOT:LENG 2560.0` `:CALC:PCON:SLOT:LENG?`
Preset	2560.0
State Saved	Yes
Min/Max	`:CALCulate:PCONtrol:SLOT:DELay` + `:CALCulate:PCONtrol:SLOT:INTerval` or 768.0 (larger one)/25600.0

Preamble Length

Specifies the number of chips to be used as the length for PRACH preamble power-on period.

Remote Command	`:CALCulate:PCONtrol:PRACh:PLENgth <real>` `:CALCulate:PCONtrol:PRACh:PLENgth?`
Example	`:CALC:PCON:PRAC:PLEN 4096.0` `:CALC:PCON:PRAC:PLEN?`
Preset	4096.0
State Saved	Yes
Min/Max	4000.0/4200.0

Message Length

Specifies the time value, in seconds, to be used as the length for the PRACH message burst-on period.

Remote Command	`:CALCulate:PCONtrol:PRACh:MLENgth <time>` `:CALCulate:PCONtrol:PRACh:MLENgth?`
Example	`:CALC:PCON:PRAC:MLEN 20ms` `:CALC:PCON:PRAC:MLEN?`
Preset	20.0 ms
State Saved	Yes
Min/Max	10.0 ms/20.0 ms

Meas Offset

Sets the measurement offset (excluding the period before and after the reference point due to a transient) for the PRACH Power Measurement.

Remote Command	`:CALCulate:PCONtrol:PRACh:OFFSet <real>` `:CALCulate:PCONtrol:PRACh:OFFSet?`
Example	`:CALC:PCON:PRAC:OFFS 96.0` `:CALC:PCON:PRAC:OFFS?`
Preset	96.0
State Saved	Yes
Min/Max	0.0/200.0

Off Power Interval

Specifies the number of chips to be used as the length for the power-off measurement interval.

Remote Command	`:CALCulate:PCONtrol:PRACh:INTerval <real>` `:CALCulate:PCONtrol:PRACh:INTerval?`
Example	`:CALC:PCON:PRAC:INT 2368.0` `:CALC:PCON:PRAC:INT?`
Preset	2368.0
State Saved	Yes
Min/Max	1.0/12800.0

Transient Period

Allows you to Exclude/Include the Transient Period.

For 3GPP Rel-5 and later releases where tests may include power changes, the measurement interval is further clarified as being one (or a half) timeslot. The exception is when the mean power between slots (or half slots) is expected to change, then the measurement interval is reduced by 25 us at each end of the slot (or half-slot).

- `EXCLude` (default) – Exclude the 25 us (= 96 chips) at each end of the slot (or half-slot) for Phase/EVM calculation
- `INCLude` – Include the transient periods at each end of the slot (or half-slot) for Phase/EVM calculation

Remote Command	[:SENSe]:PCONtrol:SWEep:TIME:TRANsient INCLude | EXCLude [:SENSe]:PCONtrol:SWEep:TIME:TRANsient?
Example	:PCON:SWE:TIME:TRAN EXCL :PCON:SWE:TIME:TRAN?
Preset	EXCLude
State Saved	Yes
Range	INCLude|EXCLude

Meas Interval (Slot Phase)

Sets the slot interval either to 1 or 0.5 for the MS power control measurement.

- 1 slot - default
- 0.5 slot - for Half-slot Phase Discontinuity when HS- DPCCH is present

Remote Command	[:SENSe]:PCONtrol:MINTerval <real> [:SENSe]:PCONtrol:MINTerval?
Example	:PCON:MINT 1 :PCON:MINT?
Dependencies	Enabled only when HSPA enable is On and View Selection is set to Slot Phase
Preset	1.0
State Saved	Yes
Range	1|0.5
Min/Max	0.5/1.0

Capture Time Diagram

Accesses a menu that enables you to set up time parameters.

3.5.8.6 Channel/Layer

This tab enables you to set Channel/Layer parameters.

Symbol Boundary (MS only)

Selects the symbol boundary detection mode for the MS.

Auto Detect

AUTO - Sets the symbol boundary detection to the automatic mode. Various code channels are measured and the most appropriate code channel is selected as the reference channel.

Custom

CUSTom - Provides a flexible way to specify predefined active channels. By choosing it, you can specify a customized list of active channels using the following command::

```
[:SENSe]:PCONtrol:SBOundary:LIST:MS INIT | APPend | <entry_id>, <symbol_rate>,
<code_num>, IPH | QPH
```

All the specified channels are considered as active.

There is no front panel menu key to specify the custom active channel list. The following commands are used to configure the list of custom predefined channels for the MS.

– "Initialize List" on page 696

– "Append List" on page 697

– "Replace List" on page 698

– "Query List" on page 700

– "Symbol Boundary Custom Active Channel List – The Number Of Entries (MS only)" on page 701

Initialize List

Initializes the current custom active channel list. This creates a new entry with the given parameter.

Parameter	Name/Value	Description
1	<symbol_rate>	This parameter specifies the symbol rate of the channel
2	<code_num>	This parameter specifies the spreading code of the channel
3	IPH	Specifies the channel is on the I-axis
	QPH	Specifies the channel Is on the Q-axis

Remote Command	`[:SENSe]:PCONtrol:SBOundary:LIST:MS:INIT <symbol_rate>, <code_num>, IPH | QPH`
Example	In order to predefine the following channels: - DPCCH (C8(0):Q) - DPDCH (C6(16):I)

	`:PCON:SBO:LIST:MS:INIT 15000, 0, QPH`
	`:PCON:SBO:LIST:MS:APP 60000, 16, IPH`
	`:PCON:SBO:LIST:MS:NCH?`
	2
	`:PCON:SBO:LIST:MS:CHAN? 1`
	15000, 0, QPH
	`:PCON:SBO:LIST:MS:CHAN? 2`
	60000, 16, IPH

Notes	1. This command is effective when [:SENSe]:RADio:DEVice is set to MS and [:SENSe]:PCONtrol:SBOundary:MS is set to CUSTom 2. `symbol_rate` = 1920000 is available when HSDPA/HSUPA Enable is On 3. The maximum number of entries is 512 For details of possible error messages, see "Parameter Errors (MS)" on page 699 below
State Saved	Yes
Range	Depends on Symbol Rate. See "Range (MS)" on page 700 below

Append List

Appends the entry of the custom active channel list.

Parameter	Name/Value	Description
1	<symbol_rate>	This parameter specifies the symbol rate of the channel
2	<code_num>	This parameter specifies the spreading code of the channel
3	IPH	Specifies the channel is on the I-axis
	QPH	Specifies the channel Is on the Q-axis

Remote Command	`[:SENSe]:PCONtrol:SBOundary:LIST:MS:APPend <symbol_rate>, <code_num>, IPH | QPH`

Example	In order to predefine the following channels:
	- DPCCH (C8(0):Q)
	- DPDCH (C6(16):I)
	`:PCON:SBO:LIST:MS:INIT 15000, 0, QPH`
	`:PCON:SBO:LIST:MS:APP 60000, 16, IPH`
	`:PCON:SBO:LIST:MS:NCH?`
	2
	`:PCON:SBO:LIST:MS:CHAN? 1`
	15000, 0, QPH
	`:PCON:SBO:LIST:MS:CHAN? 2`

	60000, 16, IPH
Notes	1. This command is effective when [:SENSe]:RADio:DEVice is set to MS and [:SENSe]:PCONtrol:SBOundary:MS is set to CUSTom 2. `symbol_rate` = 1920000 is available when HSDPA/HSUPA Enable is On 3. The maximum number of entries is 512 For details of possible error messages, see "Parameter Errors (MS)" on page 699 below
State Saved	Yes
Range	Depends on Symbol Rate. See "Range (MS)" on page 700 below

Replace List

Replaces the entry of the custom active channel list.

Parameter	Name/Value	Description
1	<entry_id>	This parameter specifies the entry ID of the channel to replace
2	<symbol_rate>	This parameter specifies the symbol rate of the channel
3	<code_num>	This parameter specifies the spreading code of the channel
4	IPH	Specifies the channel is on the I-axis
	QPH	Specifies the channel Is on the Q-axis

Remote Command	`[:SENSe]:PCONtrol:SBOundary:LIST:MS:REPLace <entry_id>,<symbol_rate>, <code_num>, IPH | QPH`

Example	In order to predefine the following channels:
	- DPCCH (C8(0):Q)
	- DPDCH (C6(16):I)
	`:PCON:SBO:LIST:MS:INIT 15000, 0, QPH`
	`:PCON:SBO:LIST:MS:APP 60000, 16, IPH`
	`:PCON:SBO:LIST:MS:NCH?`
	2
	And, replace 2nd entry.
	`:PCON:SBO:LIST:MS:REPL 2, 60000,17,QPH`
	`:PCON:SBO:LIST:MS:CHAN? 1`
	15000, 0, QPH
	`:PCON:SBO:LIST:MS:CHAN? 2`
	60000, 17, IPH

Notes	1. This command is effective when [:SENSe]:RADio:DEVice is set to MS and [:SENSe]:PCONtrol:SBOundary:MS is set to CUSTom

	2. `symbol_rate` = 1920000 is available when HSDPA/HSUPA Enable is On 3. The maximum number of entries is 512 For details of possible error messages, see "Parameter Errors (MS)" on page 699 below
State Saved	Yes
Range	The entry ID must be: 1 <= entry_id <= The number of entries which is currently appended Depends on Symbol Rate. See "Range (MS)" on page 700 below

Parameter Errors (MS)

One of the following error messages is logged if the given parameter is invalid. If an error is reported, the SCPI command is rejected and instrument's settings do not change

Error Type	Cause	Examples
Missing Parameter	The number of parameters is less than 3	`:SENSe:PCONtrol:SBOundary:LIST:MS:APPend 15000, 0` 3rd parameter is missing.

Illegal parameter value	The parameter type is invalid, or the enum value is invalid	`:SENSe:PCONtrol:SBOundary:LIST:MS:APPend 15000, ON, QPH`
		2nd parameter must be an integer
		`:SENSe:PCONtrol:SBOundary:LIST:MS:APPend 15001, 0, QPH`
		1st parameter value (Symbol Rate) is not allowed
		Only the values given in the Range field are valid for the Symbol Rate. You may specify these in numeric form, but they are interpreted as an enumeration and an error results if the value does not translate to one in the list

Data out of range	The parameter value is out of range	`:SENSe:PCONtrol:SBOundary:LIST:MS:APPend 15000, 256, QPH` 2nd parameter is out of range

Setting Conflict	The given code channel overlaps another code channel on Power Control	If you send the following two commands, the second command causes an error message, because C7(0):Q overlaps C8(0):Q
		`:SENSe:PCONtrol:SBOundary:LIST:MS:INIT 15000, 0, QPH`
		Command is OK
		`:SENSe:PCONtrol:SBOundary:LIST:MS:APPend 30000, 0, QPH`
		C7(0):Q overlaps C8(0):Q

Range (MS)

Symbol Rate	Range
15000	0<= code_num <= 255
30000	0<= code_num <= 127
60000	0<= code_num <= 63
120000	0<= code_num <= 31
240000	0<= code_num <= 15
480000	0<= code_num <= 7
960000	0<= code_num <= 3
1920000	0<= code_num <= 1

Query List

Returns the entry of the custom active channel list.

Parameter	Name	Description
1	<entry_id>	This parameter specifies entry ID of the channel to query

Remote Command	`[:SENSe]:PCONtrol:SBOundary:LIST:MS:CHANnel? <entry_id>`

Example	In order to predefine the following channels:
	- DPCCH (C8(0):Q)
	- DPDCH (C6(16):I)
	`:PCON:SBO:LIST:MS:INIT 15000, 0, QPH`
	`:PCON:SBO:LIST:MS:APP 60000, 16, IPH`
	`:PCON:SBO:LIST:MS:NCH?`
	2
	`:PCON:SBO:LIST:MS:CHAN? 1`
	15000, 0, QPH
	`:PCON:SBO:LIST:MS:CHAN? 2`
	60000, 16, IPH

Notes	1. This command is effective when [:SENSe]:RADio:DEVice is set to MS and [:SENSe]:PCONtrol:SBOundary:MS is set to CUSTom 2. `symbol_rate` = 1920000 is available when HSDPA/HSUPA Enable is On 3. The maximum number of entries is 512 Default value of the parameter By default, there is one channel defined. (DPCCH C8(0):Q) In order to query the default entry, specify 1 for <entry_id>:

	`:SENSe:PCONtrol:SBOundary:LIST:MS:CHANnel? 1`
	The instrument returns an array of three values:
	15000, 0, QPH
	Query commands need an <entry_id> parameter
	The <entry_id> parameter is always required for query commands
	The range of the parameter is from 1 to the total number of channels you have defined. For example, if you have defined two channels, you can query them as follows:
	`:SENSe:PCONtrol:SBOundary:LIST:MS:CHANnel? 1`
	`:SENSe:PCONtrol:SBOundary:LIST:MS:CHANnel? 2`
	If you want to know the number of channels you have defined, send the following query command:
	`:SENSe:PCONtrol:SBOundary:LIST:NCHannels:MS?`
	One of the following error messages is logged if the given parameter is invalid
	If an error is reported, the SCPI command is rejected and instrument's settings do not change
	<entry_id> out of range
	The entry ID must be:
	1 <= entry_id <= The number of entries which is currently appended

Preset	15000, 0, QPH
State Saved	Yes
Range	The entry ID must be: 1 <= entry_id <= The number of entries which is currently appended

Symbol Boundary Custom Active Channel List – The Number Of Entries (MS only)

Returns the number of entries in the custom predefined active channel list MS.

Remote Command	`[:SENSe]:PCONtrol:SBOundary:LIST:MS:NCHannels?`
Example	`:PCON:SBO:LIST:MS:NCH?`
Notes	This command is effective when `[:SENSe]:RADio:DEVice` is set to MS and `[:SENSe]:PCONtrol:SBOundary:MS` is set to `CUSTom` This is a query-only command
Preset	1
State Saved	No

NOTE

The Custom choice is selectable even if you have not sent the following SCPI command: `[:SENSe]:PCONtrol:SBOundary:LIST:MS`, because the default custom list contains DPCCH (15000, 0, QPH) as a predefined active channel. Choosing the Custom setting makes one channel (C8(0):Q) active, and all other channels inactive.

Remote Command	`[:SENSe]:PCONtrol:SBOundary:MS AUTO | CUSTom` `[:SENSe]:PCONtrol:SBOundary:MS?`
Example	`:PCON:SBO:MS CUST` `:PCON:SBO:MS?`
Dependencies	This parameter is effective when [:SENSe]:RADio:DEVice is set to MS
Preset	AUTO
State Saved	Yes
Range	AUTO|CUSTom

3.5.9 Sweep

The Sweep key contains controls which allow you to control the sweep and measurement functions of the instrument. This tab accesses controls that enable you to operate the Sweep and Control functions of the instrument.

3.5.9.1 Sweep/Control

Contains controls for the Sweep and Control functions of the instrument, such as Sweep Time and Continuous/Single.

Sweep/Measure

Allows you to toggle between Continuous and Single sweep or measurement operation. The Single/Continuous state is Meas Global, so the setting affects *all* measurements.

The front-panel key **Single/Cont** performs exactly the same function

NOTE: In the `WAVeform` measurement, this control only appears in the Meas Bar, and not in the **Sweep/Control** tab.

See "More Information" on page 703

Remote Command	`:INITiate:CONTinuous OFF | ON | 0 | 1` `:INITiate:CONTinuous?`

Example	`:INIT:CONT 0`
	`:INIT:CONT OFF`
	puts instrument into Single measurement operation
	`:INIT:CONT 1`
	`:INIT:CONT ON`

	puts instrument into Continuous measurement operation
Preset	ON Note that :SYST:PRES sets :INIT:CONT to ON but *RST sets :INIT:CONT to OFF
State Saved	Saved in instrument state
Annunciation	The **Single/Continuous** icon in the Meas Bar changes depending on the setting: – A line with an arrow is Single – A loop with an arrow is Continuous

More Information

With **Avg/Hold Num** (in the **Meas Setup** menu) set to **Off** or set to **On** with a value of 1, a sweep is taken after the trigger condition is met; and the instrument continues to take new sweeps after the current sweep has completed and the trigger condition is again met. However, with **Avg/Hold Num** set to On with a value >1, multiple sweeps (data acquisitions) are taken for the measurement. The trigger condition must be met prior to each sweep. The sweep is not stopped when the average count k equals the number N set for Avg/Hold Num is reached, but the number k stops incrementing. A measurement average usually applies to all traces, marker results, and numeric results, but sometimes only applies to the numeric results.

If the instrument is in Single measurement, pressing the **Cont/Single** toggle control does not change k and does not cause the sweep to be reset; the only action is to put the instrument into Continuous measurement operation.

If it is already in Continuous sweep:

- the `:INIT:CONT 1` command has no effect
- the `:INIT:CONT 0` command will place the instrument in Single Sweep but will have no effect on the current sequence until k = N, at which point the current sequence will stop and the instrument will go to the idle state.

See "Restart" on page 1738 control description for details on the `:INIT:IMM` (Restart) function.

If you are already in Single sweep, the `:INIT:CONT OFF` command has no effect.

If you are already in Single Sweep, then pressing the **Cont/Single** toggle control in the middle of a sweep does not restart the sweep or sequence. Similarly, pressing the **Cont/Single** toggle control does not restart the sweep or sequence if the sweep is not in the idle state (for example, if you are taking a very slow sweep, or the instrument is waiting for a trigger). Even though pressing the **Cont/Single** toggle control in the middle of a sweep does *not* restart the sweep, sending `:INIT:IMM` *does* reset it.

Restart

The **Restart** function restarts the current sweep, or measurement, or set of averaged/held sweeps or measurements. In measurements that support pausing, if you are Paused, pressing **Restart** performs a **Resume**.

The Restart function is accessed in several ways:

- Pressing the **Restart** key
- Sending the remote command `:INIT:IMM`
- Sending the remote command `:INIT:REST`

See "More Information" on page 704

Remote Command	`:INITiate[:IMMediate]` `:INITiate:RESTart`
Example	`:INIT:IMM` `:INIT:REST`
Notes	`:INIT:REST` and `:INIT:IMM` and the front-panel **Restart** key perform exactly the same function
Couplings	Resets average/hold count k For the first sweep, overwrites all active (update=on) traces with new current data For application modes, resets other parameters as required by the measurement
Status Bits/OPC dependencies	This is an Overlapped command The `:STATus:OPERation` register bits 0 through 8 are cleared The `:STATus:QUEStionable` register bit 9 (INTegrity sum) is cleared The `SWEEPING` bit is set The `MEASURING` bit is set
Backwards Compatibility Notes	For Spectrum Analysis mode in ESA and PSA, the **Restart** hardkey and the `:INIT:REST` command restart trace averages (displayed average count reset to 1) for a trace in **Clear Write**, but did not restart **Max Hold** and **Min Hold** In the X-Series, the **Restart** hardkey and the `:INIT:REST` command restart not only **Trace Average**, but **Max Hold** and **Min Hold** traces as well For wireless comms modes in ESA and PSA, the **Restart** hardkey and the `:INIT:REST` command restarted every measurement, including all traces and numeric results. There is no change to this operation

More Information

The **Restart** function first aborts the current sweep or measurement as quickly as possible. It then resets the sweep and trigger systems, sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is in the process of aligning when a Restart is executed, the alignment finishes before the restart function is performed.

Even when set for Single operation, multiple sweeps may be taken when **Restart** is pressed (for example, when averaging/holding is on). Thus when we say that Restart "restarts a measurement," depending on the current settings, we may mean:

- It restarts the current sweep
- It restarts the current measurement
- It restarts the current set of sweeps if any trace is in Trace Average, Max Hold or Min Hold
- It restarts the current set of measurements if Averaging, or Max Hold, or Min Hold is on for the measurement

With Average/Hold Number (in Meas Setup menu) set to 1, or Averaging off, or no trace in Trace Average or Hold, a single sweep is equivalent to a single measurement. A single sweep is taken after the trigger condition is met; and the instrument stops sweeping once that sweep has completed. However, with Average/Hold Number >1 and at least one trace set to Trace Average, Max Hold, or Min Hold (SA Measurement) or Averaging on (most other measurements), multiple sweeps/data acquisitions are taken for a single measurement. The trigger condition must be met prior to each sweep. The sweep is stopped when the average count k equals the number N set for Average/Hold Number. A measurement average usually applies to all traces, marker results, and numeric results, but sometimes only applies to the numeric results.

Once the full set of sweeps has been taken, the instrument will go to the idle state. To take one more sweep without resetting the average count, increment the average count by 1, by pressing the step up key while Average/Hold Number is the active function, or by sending the remote command `:CALC:AVER:TCON UP`.

Pause/Resume

Pauses a measurement after the current data acquisition is complete.

When a measurement is paused:

- The label on this control changes to **Resume**. Pressing **Resume** un-pauses the measurement.
- Pressing **Restart** also performs a **Resume**.

Remote Command	`:INITiate:PAUSe` `:INITiate:RESume`
Example	`:INIT:PAUS` `:INIT:RES`

Dependencies	Not displayed in Modes that do not support pausing
Couplings	When Averaging is On, if the measurement is paused no more updates will occur until either a Resume or Restart occurs If the measurement is resumed, the averaging continues to use the traces from before the Pause occurred and continues to use the traces from the point where the Resume occurred. This still provides real-time traces, but they will no longer be gap free In a view with a Waterfall window, when the measurement is paused, the Waterfall stops updating. When Resume is selected, the Waterfall will retain the existing traces and continue updating using traces from the point at which Resume was selected. The time stamp of the individual Waterfall traces will show the time from the beginning of the measurement the trace relates to, showing there was a gap in the Waterfall capture In Density view, when the measurement is paused, the Density Display stops updating. When the measurement is resumed, if Persistence is `ON`, the persistence fading will continue from the point when the measurement was paused If a Restart occurs, the average counter is reset and all results are discarded. The measurement begins again, using traces after the Restart occurred

Abort (Remote Command Only)

This command stops the current measurement. It aborts the current measurement as quickly as possible, resets the sweep and trigger systems, and puts the measurement into an "idle" state. If the instrument is in the process of aligning when `:ABORt` is sent, the alignment finishes before the abort function is performed, so `:ABORt` does *not* abort an alignment.

If the instrument is set for Continuous measurement, it sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is set for Single measurement, it remains in the "idle" state until an `:INIT:IMM` command is received.

Remote Command	`:ABORt`
Example	`:ABOR`
Notes	If `:INIT:CONT` is `ON`, then a new continuous measurement will start immediately, with sweep (data acquisition) occurring once the trigger condition has been met If `:INIT:CONT` is `OFF`, then `:INIT:IMM` is used to start a single measurement, with sweep (data acquisition) occurring once the trigger condition has been met
Dependencies	For continuous measurement, `:ABORt` is equivalent to the **Restart** key Not all measurements support the abort command
Status Bits/OPC dependencies	The `:STATus:OPERation` register bits 0 through 8 are cleared The `:STATus:QUEStionable` register bit 9 (INTegrity sum) is cleared Since all the bits that feed into OPC are cleared by `:ABORt`, the `:ABORt` will cause the *OPC query to return true

3.5.9.2 X Scale

This tab accesses controls that enable you to set the horizontal scale parameters.

Ref Value

Sets the display reference value for the current measurement.

Remote Command	`:DISPlay:PCONtrol:WINDow[1]|4:TRACe:X[:SCALe]:RLEVel <time>`
	`:DISPlay:PCONtrol:WINDow[1]|4:TRACe:X[:SCALe]:RLEVel?`
	Window numbers are as follows:
	– Power: 1
	– Phase: 4

Example	1-Power window
	`:DISP:PCON:WIND:TRAC:X:RLEV 0.0`
	4-Phase window
	`:DISP:PCON:WIND4:TRAC:X:RLEV 0.0`

Couplings	If the Scale Coupling is On, this value is automatically determined by the measurement result. When you set a value manually, Scale Coupling automatically changes to Off
Preset	0.0 s
State Saved	Yes
Min/Max	-1.0/10.0 s

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now the VIEW parameter is not used and defaults to 1. All Windows are referenced through VIEW 1. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command
Power	`DISP:PCON:VIEW:WIND:TRAC:X:RLEV 10.0`	`DISP:PCON:WIND:TRAC:X:RLEV 0.0`
Phase	`DISP:PCON:VIEW2:WIND:TRAC:X:RLEV 0.0`	`DISP:PCON:WIND4:TRAC:X:RLEV 0.0`

Scale/Div

Enables you to enter a time value to change the horizontal scale.

Remote Command	`:DISPlay:PCONtrol:WINDow[1]|4:TRACe:X[:SCALe]:PDIVision <time>` `:DISPlay:PCONtrol:WINDow[1]|4:TRACe:X[:SCALe]:PDIVision?`

	Window numbers are as follows: – Power: 1 – Phase: 4

Example	1-Power windo
	`:DISP:PCON:WIND:TRAC:X:PDIV 4.0e-3`
	4-Phase window
	`:DISP:PCON:WIND4:TRAC:X:PDIV 4.0e-3`

Couplings	If the Scale Coupling is On, this value is automatically determined by the measurement result. When you set a value manually, Scale Coupling automatically changes to Off
Preset	4.000 ms
State Saved	Yes
Min/Max	1.0 ns/1.0 s

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now the VIEW parameter is not used and defaults to 1. All Windows are referenced through VIEW 1. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command
Power	`DISP:PCON:VIEW:WIND:TRAC:X:PDIV 4.0e-3`	`DISP:PCON:WIND:TRAC:X:PDIV 4.0e-3 0.0`
Phase	`DISP:PCON:VIEW2:WIND:TRAC:X:PDIV 4.0e-3`	`DISP:PCON:WIND4:TRAC:X:PDIV 4.0e-3 0.0`

Ref Position

Sets the display reference position to Left, Ctr (center), or Right.

Remote Command	`:DISPlay:PCONtrol:WINDow[1]|4:TRACe:X[:SCALe]:RPOSition LEFT | CENTer | RIGHt`
	`:DISPlay:PCONtrol:WINDow[1]|4:TRACe:X[:SCALe]:RPOSition?`
	Window numbers are as follows:
	– Power: 1
	– Phase: 4

Example	1-Power window
	`:DISP:PCON:WIND:TRAC:X:RPOS LEFT`
	4-Phase window
	`:DISP:PCON:WIND4:TRAC:X:RPOS LEFT`

Preset	LEFT
State Saved	Yes
Range	LEFT|CENTer|RIGHt

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now the VIEW parameter is not used and defaults to 1. All Windows are referenced through VIEW 1. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command
Power	DISP:PCON:VIEW:WIND:TRAC:X:RPOS LEFT	DISP:PCON:WIND:TRAC:X:RPOS LEFT
Phase	DISP:PCON:VIEW2:WIND:TRAC:X:RPOS LEFT	DISP:PCON:WIND4:TRAC:X:RPOS LEFT

Auto Scaling

Toggles the scale coupling function between On and Off.

Remote Command	:DISPlay:PCONtrol:WINDow[1]|4:TRACe:X[:SCALe]:COUPle 0 | 1 | OFF | ON :DISPlay:PCONtrol:WINDow[1]|4:TRACe:X[:SCALe]:COUPle? Window numbers are as follows: – Power: 1 – Phase: 4
Example	:DISP:PCON:WIND:TRAC:X:COUP ON :DISP:PCON:WIND:TRAC:X:COUP?
Couplings	When Auto Scaling is On and the Restart front-panel key is pressed, this function automatically determines the scale per division and reference values based on the measurement results When you set a value to either Scale/Div or Ref Value manually, Auto Scaling automatically changes to Off
Preset	ON
State Saved	Saved in instrument state
Range	OFF|ON

3.5.10 Trace

Trace is not supported in the WCDMA Power Control Measurement.

3.6 QPSK EVM Measurement

The quadrature phase shift keying (QPSK) error vector magnitude (EVM) measurement is a measure of phase and amplitude modulation quality that relates the performance of the actual signal compared to an ideal signal as a percentage, as calculated over the course of the ideal constellation. These phase and frequency errors are measures of modulation quality for the W-CDMA (3GPP) system, and can be quantified through QPSK EVM measurements.

QPSK EVM Measurement Commands

The following commands and queries are used to retrieve the measurement results:

`:CONFigure:EVMQpsk`

`:CONFigure:EVMQpsk:NDEFault`

`:FETCh:EVMQpsk[n]?`

`:READ:EVMQpsk[n]?`

`:MEASure:EVMQpsk[n]?`

Remote Command Results for QPSK EVM Measurement

The following table describes the results returned by the queries listed above, according to the index value `n`.

n	Results Returned
0	Returns unprocessed I/Q trace data, as a series of comma-separated trace points, in volts
not specified or n = 1	Returns the following 11 scalar results: 1. RMS EVM is a floating point number (in percent) of EVM over the entire measurement area 2. RMS EVM maximum is the maximum RMS EVM over the average counts 3. Peak EVM is a floating point number (in percent) of peak EVM in the measurement area 4. Peak EVM maximum is the maximum peak EVM over the average counts 5. Magnitude Error is a floating point number (in percent) of averaged magnitude error over the entire measurement area 6. Magnitude Error maximum is a floating point number over the average counts 7. Phase Error is a floating point number (in degrees) of the averaged phase error over the entire measurement area 8. Phase Error maximum is the maximum phase error over the average counts 9. Frequency Error is a floating point number (in Hz) of the frequency error in the measured signal 10. Frequency Error maximum is the maximum frequency error over the average counts 11. I/Q Origin Offset is a floating point number (in dB) of the I and Q error (magnitude squared) offset from the origin

n	Results Returned
2	**EVM trace** – Returns a series of floating point numbers (in percent) that represent each sample in the EVM trace. The first number is the symbol 0 decision point. There are X points per symbol (X=points/chip). Therefore, the decision points are at 0, 1*X, 2*X, and so on
3	**Magnitude error trace** – Returns a series of floating point numbers (in percent) that represent each sample in the magnitude error trace. The first number is the symbol 0 decision point. There are X points per symbol (X=points/chip). Therefore, the decision points are at 0, 1*X, 2*X, ...
4	**Phase error trace** – Returns a series of floating point numbers (in percent) that represent each sample in the phase error trace. The first number is the symbol 0 decision point. There are X points per symbol (X=points/chip). Therefore, the decision points are at 0, 1*X, 2*X, ...
5	**Corrected measured trace** – Returns a series of floating point numbers that alternately represent I and Q pairs of the corrected measured trace. The magnitude of each I and Q pair are normalized to 1.0. The first number is the I sample of symbol 0 decision point and the second number is the Q sample of symbol 0 decision point. There are X points per symbol (X=points/chip). Therefore, the series of numbers is: – 1st number = I of the symbol 0 decision point – 2nd number = Q of the symbol 0 decision point – ... – (2*X)+1 number = I of the symbol 1 decision point – (2*X)+2 number = Q of the symbol 1 decision point – ... – (2*X)*N+1 th number = I of the symbol N decision point – (2*X)*N+2 th number = Q of the symbol N decision point

3.6.1 Views

The table below shows the Views and Windows used for this Measurement.

These Views are multiple-window Views and you select a window by touching it. The menu controls may sometimes change depending on which window is selected.

Whenever the View changes, the default menu is Frequency, unless otherwise specified in the View description.

View	Result
I/Q Measured Polar Graph	I/Q Measured Polar Graph
	Metrics
I/Q Error	Mag Error Graph
	Phase Error Graph
	EVM Graph
	Small-sized Metrics

The following remote commands are available for view selection:

View Selection by Name

Selects the format for the measurement results view.

Remote Command	:DISPlay:EVMQpsk:VIEW[:SELect] POLar | ERRor :DISPlay:EVMQpsk:VIEW[:SELect]?
Example	:DISP:EVMQ:VIEW ERR :DISP:EVMQ:VIEW?
Couplings	Changing parameter of "ViewNum" (:DISPlay:EVMQpsk:VIEW:NSELect) also changes this parameter
Preset	POLar
State Saved	Yes
Range	I/Q Measured Polar Graph|I/Q Error

View Selection by Number

Displays the numeric values of the measurement results.

Remote Command	:DISPlay:EVMQpsk:VIEW:NSELect <integer> :DISPlay:EVMQpsk:VIEW:NSELect?
Example	:DISP:EVMQ:VIEW:NSEL 2 :DISP:EVMQ:VIEW:NSEL?
Couplings	Changing parameter of "View" (:DISPlay:EVMQpsk:VIEW[:SELect]) also changes this parameter
Preset	1
State Saved	Yes
Min/Max	1/2

3.6.1.1 I/Q Measured Polar Graph

Windows: "I/Q Measured Polar Graph" on page 713, "Metrics" on page 713

Combination view of the I/Q demodulated signals using vector lines to connect the chip dots.

Example	:DISP:EVMQ:VIEW POL

3.6.1.2 I/Q Error

Windows: "Mag Error Graph" on page 714, "Phase Error Graph" on page 714, "EVM Graph" on page 714, "Small-sized Metrics" on page 715

Provides a combination view. This view consists of the above four windows.

3.6.2 Windows

3.6.2.1 Window Number List

Window	Number
Metrics	1
I/Q Measured Polar	2
Mag Error	3
Phase Error	4
EVM	5
Small-sized Metrics	6

I/Q Measured Polar Graph

The Graph window appears in the I/Q Measured Polar Graph View:

Polar Graph consists of Constellation points and Vector line.

Marker Trace	Yes
Corresponding Trace	Display I/Q trace (n=5)

Metrics

The Metrics window appears in the following Views:

View	Size	Position
I/Q Measured Polar Graph	Full, one thirds width	Left

Shows numeric results of the I/Q polar graph.

Name		Type	Description	Unit	Format
RMS EVM		float64	EVM over the entire measurement area	percent	XX.XX %
Peak EVM		float64	peak EVM in the measurement area.	percent	XX.XX %
Mag Error	Avg	float64	averaged magnitude error over the entire measurement area	percent	XX.XX %
	Max	float64	maximum magnitude error over the entire measurement area	percent	XX.XX %
Phase Error	Avg	float64	averaged phase error over the entire measurement area	°	XX.XX °
	Max	float64	maximum phase error over	°	XX.XX °

Name		Type	Description	Unit	Format
			the entire measurement area		
Freq Error	Avg	float64	averaged frequency error in the measured signal.	Hz	XX.XX Hz
	Max	float64	maximum frequency error in the measured signal	Hz	XX.XX Hz
I/Q Origin Offset		float64	the I and Q error (magnitude squared) offset from the origin.	dB	XX.XX dB

Mag Error Graph

This graph appears in the following View:

View	Size	Position
I/Q Error	Half, half width	Upper left

Marker Trace	Yes
Corresponding Trace	Magnitude Error trace (n=3)

Phase Error Graph

This graph appears in the following View:

View	Size	Position
I/Q Error	Half, half width	Upper right

Marker Trace	Yes
Corresponding Trace	Phase Error trace (n=4)

EVM Graph

This graph appears in the following View:

View	Size	Position
I/Q Error	Half, half width	Lower left

Marker Trace	Yes
Corresponding Trace	EVM trace (n=2)

Small-sized Metrics

This window appears in the following View. The contents are the same as those in the"Metrics" on page 713 window.

View	Size	Position
I/Q Error	Half, half width	Lower right

3.6.3 Amplitude

Activates the **Amplitude** menu and selects **Reference Level** or **Reference Value** as the active function, depending on the measurement.

Some features in this menu apply to multiple measurements. Some other features apply only to specific measurements and their controls are blanked or grayed-out in measurements that do not support the feature.

3.6.3.1 Y Scale

The Y Scale Tab contains controls that pertain to the Y axis parameters of the measurement. These parameters control how data on the vertical (Y) axis is displayed and control instrument settings that affect the vertical axis.

Ref Value

Sets the absolute power reference value in the Mag Error, Phase Error and EVM windows. The functionality depends on the selected window. The reference line is at the top, center, or bottom of the graticule, depending on the value of the Ref Position function.

Remote Command	`:DISPlay:EVMQpsk:WINDow3|4|5:TRACe:Y[:SCALe]:RLEVel <real>`
	`:DISPlay:EVMQpsk:WINDow3|4|5:TRACe:Y[:SCALe]:RLEVel?`
	Window numbers are as follows:
	– Mag Error: 3
	– Phase Error: 4
	– EVM: 5

Example	3-Mag Error
	`:DISP:EVMQ:WIND3:TRAC:Y:RLEV 0`
	4-Phase Error
	`:DISP:EVMQ:WIND4:TRAC:Y:RLEV 0`
	5-EVM
	`:DISP:EVMQ:WIND5:TRAC:Y:RLEV 0`

Couplings	When Auto Scaling is On (default), this value is automatically determined by the measurement result. When you set a value manually, Auto Scaling changes to Off
Preset	0.0
State Saved	Yes
Min/Max	3-Mag Error: -500 % / 500 % 4-Phase Error: -36000 deg / 36000 deg 5-EVM: -500 % / 500 %

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now only Window number is sent. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command
Mag Error	`DISP: EVMQ:VIEW2:WIND:TRAC:Y:RLEV 0.0`	`DISP: EVMQ:WIND3:TRAC:Y:RLEV 0.0`
Phase Error	`DISP: EVMQ:VIEW2:WIND2:TRAC:Y:RLEV 0.0`	`DISP: EVMQ:WIND4:TRAC:Y:RLEV 0.0`
EVM	`DISP: EVMQ:VIEW2:WIND3:TRAC:Y:RLEV 0.0`	`DISP: EVMQ:WIND5:TRAC:Y:RLEV 0.0`

Scale/Div

Sets the units per division of vertical scale in the logarithmic display. However, since the Auto Scaling is defaulted to On, this value is automatically determined by the measurement result. When you set a value manually, Auto Scaling automatically changes to Off.

Remote Command	`:DISPlay:EVMQpsk:WINDow3|4|5:TRACe:Y[:SCALe]:PDIVision <real>`
	`:DISPlay:EVMQpsk:WINDow3|4|5:TRACe:Y[:SCALe]:PDIVision?`
	– Window numbers are as follows:
	– Mag Error: 3
	– Phase Error: 4
	– EVM: 5

Example	3-Mag Error
	`:DISP:EVMQ:WIND3:TRAC:Y:PDIV 10.0`
	4-Phase Error
	`:DISP:EVMQ:WIND4:TRAC:Y:PDIV 10.0`
	5-EVM

	`:DISP:EVMQ:WIND5:TRAC:Y:PDIV 10.0`
Couplings	When the Auto Scaling is On, this value is automatically determined by the measurement result When the user sets a value manually, Auto Scaling automatically changes to Off
Preset	3-Mag Error: 1 4-Phase Error | 5-EVM: 0.5
State Saved	Yes
Min/Max	3-Mag Error | 5-EVM: 0.1/50 4-Phase Error: 0.1/360

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now only Window number is sent. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command
Mag Error	`DISP:EVMQ:VIEW2:WIND:TRAC:Y:PDIV 25`	`DISP:EVMQ:WIND3:TRAC:Y:PDIV 10.0`
Phase Error	`DISP:EVMQ:VIEW2:WIND2:TRAC:Y:PDIV 25`	`DISP:EVMQ:WIND4:TRAC:Y:PDIV 10.0`
EVM	`DISP:EVMQ:VIEW2:WIND3:TRAC:Y:PDIV 20`	`DISP:EVMQ:WIND5:TRAC:Y:PDIV 10.0`

Ref Position

Positions the Y-axis scale reference level at the top, center or bottom of the display. Changing the reference position does not change the reference level value. This function can be used for all three QPSK EVM measurement results graphs.

Remote Command	`:DISPlay:EVMQpsk:WINDow3|4|5:TRACe:Y[:SCALe]:RPOSition TOP | CENTer | BOTTom`
	`:DISPlay:EVMQpsk:WINDow3|4|5:TRACe:Y[:SCALe]:RPOSition?`
	Window numbers are as follows:
	– Mag Error: 3
	– Phase Error: 4
	– EVM: 5

Example	3-Mag Error `:DISP:EVMQ:WIND3:TRAC:Y:RPOS TOP` 4-Phase Error

	:DISP:EVMQ:WIND4:TRAC:Y:RPOS TOP 5-EVM :DISP:EVMQ:WIND5:TRAC:Y:RPOS TOP
Notes	When Auto Scaling is On and this parameter is changed, Ref Value changes to adjust the trace to one that is most suitable for the window
Preset	3-Mag Error | 4-Phase Error: CENTer 5-EVM: BOTTom
State Saved	Yes
Range	TOP|CENTer|BOTTom

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now only Window number is sent. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command
Mag Error	DISP:EVMQ:VIEW2:WIND:TRAC:Y:RPOS TOP	DISP:EVMQ:WIND3:TRAC:Y:RPOS TOP
Phase Error	DISP:EVMQ:VIEW2:WIND2:TRAC:Y:RPOS TOP	DISP:EVMQ:WIND4:TRAC:Y:RPOS TOP
EVM	DISP:EVMQ:VIEW2:WIND3:TRAC:Y:RPOS TOP	DISP:EVMQ:WIND5:TRAC:Y:RPOS TOP

Auto Scaling

Toggles the Auto Scaling function between On and Off. Upon pressing the Restart front-panel key, this function automatically determines the scale per division and reference values based on the measurement results.

Remote Command	:DISPlay:EVMQpsk:WINDow3|4|5:TRACe:Y[:SCALe]:COUPle 0 | 1 | OFF | ON :DISPlay:EVMQpsk:WINDow3|4|5:TRACe:Y[:SCALe]:COUPle? Window numbers are as follows: – Mag Error: 3 – Phase Error: 4 – EVM: 5
Example	3-Mag Error :DISP:EVMQ:WIND3:TRAC:Y:COUP ON 4-Phase Error :DISP:EVMQ:WIND4:TRAC:Y:COUP ON

	5-EVM :DISP:EVMQ:WIND5:TRAC:Y:COUP ON
Notes	When Auto Scaling is On and the Restart front-panel key is pressed, this function automatically determines the scale per division and reference values based on the measurement results When you set a value to either Scale/Div or Ref Value manually, Auto Scaling automatically changes to Off
Preset	ON
State Saved	Yes
Range	OFF|ON

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now only Window number is sent. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command
Mag Error	DISP:EVMQ:VIEW2:WIND:TRAC:Y:COUP ON	DISP:EVMQ:WIND3:TRAC:Y:COUP ON
Phase Error	DISP:EVMQ:VIEW2:WIND2:TRAC:Y:COUP ON	DISP:EVMQ:WIND4:TRAC:Y:COUP ON
EVM	DISP:EVMQ:VIEW2:WIND3:TRAC:Y:COUP ON	DISP:EVMQ:WIND5:TRAC:Y:COUP ON

3.6.3.2 Attenuation

Controls the attenuator functions and interactions between the attenuation system components.

There are two attenuator configurations in the X-Series. One is a Dual-Attenuator configuration consisting of a mechanical attenuator and an optional electronic attenuator. The other configuration uses a single attenuator with combined mechanical and electronic sections thatcontrols all the attenuation functions. Different models in the X-Series come with different configurations.

– See "Dual-Attenuator Configurations" on page 720

– See "Single-Attenuator Configuration" on page 721

Most attenuation settings are the same for all measurements – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset.

This tab is only available when the hardware set includes an input attenuator, which is typically only the case when using Keysight’s box instruments. For example, this tab does not appear in:

– VXT models M9420A/21A/10A/11A

– E7760

– M9391A

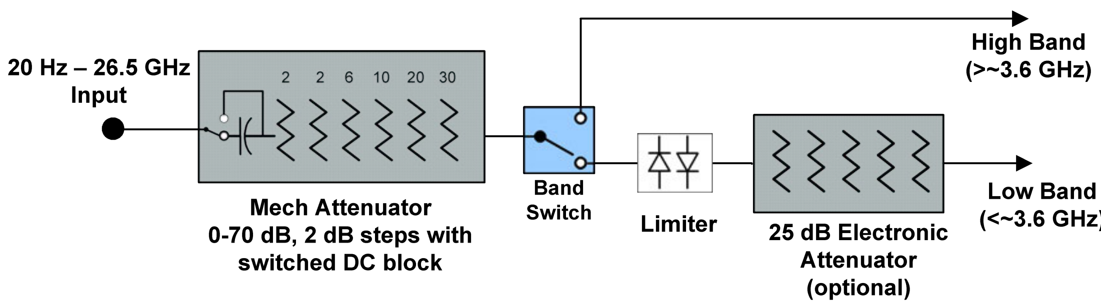
– M9393A

This tab also does not appear in UXM. In UXM all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

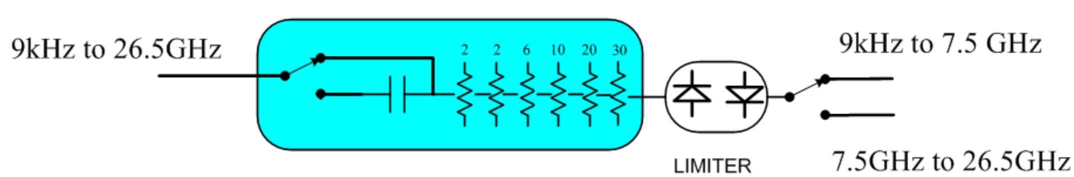
Dependencies	In measurements that support the I/Q inputs, this tab is unavailable when I/Q is the selected input, and is replaced by the Range tab in that case

Dual-Attenuator Configurations

Configuration 1: Mechanical attenuator + optional electronic attenuator

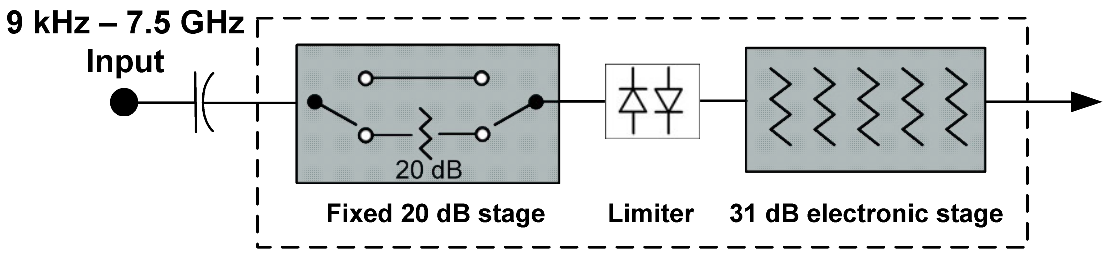


Configuration 2: Mechanical attenuator, no optional electronic attenuator



(note that Configuration 2 is not strictly speaking a dual-section attenuator, since there is no electronic section available. However, it behaves exactly like Configuration 1 without the Electronic Attenuator option EA3, therefore for the sake of this document it is grouped into the “Dual-Attenuator” configuration)

Single-Attenuator Configuration



You can tell which attenuator configuration you have by pressing the Attenuation tab, which (in most Modes) opensthe Attenuation menu. If the first control in the Attenuation menu says **Mech Atten** you have the Dual-Attenuator configuration. If the first control says **Atten** you have the Single-Attenuator configuration.

(Note that depending on the measurement, there may be no Auto/Man functionality on the Mech Atten control).

In the Single-Attenuator configuration, youcontrol the attenuation with a single control, as the fixed stage has only two states. In the Dual-Attenuator configuration, both stages have significant range so you are given separate control of the mechanical and electronic attenuator stages.

When you have the Dual-Attenuator configuration, you may still have only a Single-Attenuator, because unless option EA3 (the Electronic Attenuator option) is available, and you purchase it, you will have only the mechanical attenuator.

Full Range Atten

The **Full Range Atten** control and **Attenuator Summary** only appear in N9041B, when the RF input is selected and the RF Input Port is set to RF Input 2, and the Full Range Attenuator is installed. The Full Range Attenuator adds a second input attenuator at the beginning of the RF Input 2, which enhances the protection and optimizes the performance of the extra internal mixers used by RF Input 2.

Remote Command	`[:SENSe]:POWer[:RF]:FRATten <rel_ampl>` `[:SENSe]:POWer[:RF]:FRATten?`
Example	`:POW:FRAT 14` `:POW:FRAT?`
Notes	When you enter an amplitude value that falls between valid values, the value will be incremented to the

	next smallest valid value
Dependencies	Only appears if input RF is selected, and RF Input Port 2 is selected, and the Full Range Attenuator exists
Couplings	This value is never changed by any coupling, however other couplings use this value. See the **Reference Level** and "Mech Atten" on page 1750 command descriptions
Preset	20 dB
State Saved	Saved in instrument state
Min	0 dB
Max	Only valid values are 0, 6, 14, 20 dB
Annotation	When the Input is RF, and the Input Port is RF Input 2, and the Full Range Attenuator is installed: On the Meas Bar, the field “Atten” displays as follows: – If the sweep is entirely < 50 GHz, the value shown after “Atten:” is equal to Mech Atten + Elec Atten + Full Range Atten – If the sweep is entirely > 50 GHz, the value shown after “Atten:” is equal to Full Range Atten – If the sweep straddles 50 GHz, the value shown after “Atten:” is preceded by the symbol “>=” and is equal to Full Range Atten In the **Amplitude**, "Attenuation" on page 1747 menu, and the Atten Meas Bar dropdown menu panel, a summary is displayed as follows: “Total Atten below 50 GHz” followed by the value of Full Range Atten + Mech Atten + Elec Atten “Total Atten above 50 GHz” followed by the value of Full Range Atten For example, if Mech Atten = 6 dB, Elec Atten = 4 dB, and Full Range Atten = 20 dB, the summary below is shown: – Attenuator summary: – Total Atten below 50 GHz: 30 dB – Total Atten above 50 GHz: 20 dB

Mech Atten

This control is labeled **Mech Atten** in Dual-Attenuator models and **Atten** in Single-Attenuator models. In the Dual-Attenuator configuration, this control only affects the mechanical attenuator.

This control lets you modify the attenuation applied to the RF input signal path. This value is normally auto coupled to the Ref Level, the Internal Preamp Gain, any External Gain that is entered, and the Max Mixer Level, as described in the table below.

See "Attenuator Configurations and Auto/Man" on page 724

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation <rel_ampl>` `[:SENSe]:POWer[:RF]:ATTenuation?`

	`[:SENSe]:POWer[:RF]:ATTenuation:AUTO OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:ATTenuation:AUTO?`

Example	`:POW:ATT 20`
	Dual-Attenuator configuration: sets the mechanical attenuator to 20 dB
	Single-Attenuator mode: sets the main attenuation to 20 dB (see below for definition of “main” attenuation)
	In either case, if the attenuator was in Auto, it is set to Manual
	`:POW:ATT:AUTO ON`
	Turn Auto Mech Atten ON

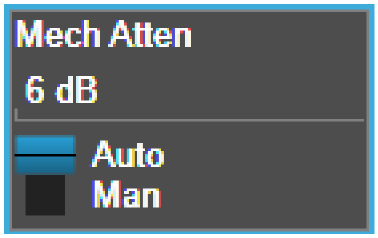
Dependencies	Some measurements do not support the Auto setting of "Mech Atten" on page 722. In these measurements, the Auto/Man selection is not available, and the Auto/Man toggle function is not available In Dual-Attenuator configurations, when the electronic attenuator is enabled, the mechanical attenuator has no auto setting and the Auto/Man toggle function is not available. The state of Auto/Man is remembered and restored when the electronic attenuator is once again disabled. This is described in more detail in "Elec Atten" on page 1753 See "Attenuator Configurations and Auto/Man" on page 724 for more information on the Auto/Man functionality `:POW:ATT:AUTO` is only available in measurements that support Mech Atten Auto, such as Swept SA
Couplings	If the RF Input Port is the RF Input: – If the USB Preamp is connected to USB, use 0 dB for Mech Atten – Otherwise compute the auto-selected value of Mech Atten based on **Reference Level**, Int Preamp, External Gain, Ref Level Offset, Max Mixer Level, µW Path Control and IF Gain settings. Limit this value to be no less than 6 dB (total attenuation below 6 dB can never be chosen by Auto) – In the N9041B, if the RF Input Port is RF Input 2, use the formula above and subtract the Full Range Atten value from the result to determine the Mech Atten. Limit the value so that it is never lower than 0 dB and so that total attenuation, including Full Range Atten, is never less than 6 dB (total attenuation, including Full Range Atten below 6 dB, can never be chosen by Auto) In External Mixingand BBIQ, where the Attenuator is not in the signal path, the Attenuator setting changes as described above when "Mech Atten" on page 722 is in Auto, but no changes are made to the actual attenuator hardware setting until the input is changed back to the RF Input For CXA-m with option FSA (Fine-Step Attenuator or 2 dB steps), the FSA-like behavior is only available when the frequency setting is <= 7.5GHz. So, when the frequency is changed from below 7.5GHz to above 7.5GHz, the attenuation setting will be changed to a multiple of 10dB which will be no smaller than the previous setting. For example, 4dB attenuation will be changed to 10dB
Preset	The preset for Mech Attenuation is “Auto” The Auto value of attenuation is 10 dB ON
State Saved	Saved in instrument state
Min	0 dB The attenuation set by this control cannot be decreased below 6 dB with the knob or step keys. Values below 6 dB must be directly entered from the keypad or via SCPI. This protects against setting a

	dangerously small attenuation value, which can put the instrument at risk of damage to input circuitry. If the current mechanical attenuation is below 6 dB, it can be increased with the knob and step keys, but not decreased
Max	CXA Option 503 or 507: 50 dB EXA: 60 dB All other models: 70 dB Note that in the Single-Attenuator configuration, the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB.
Annotation	The current value for Total Atten is displayed in the Measurement Bar at the top of the display. A value appears for Electronic Attenuation only if the Electronic Attenuator is enabled. The annotation appears as Atten: <total> dB (e<elec>) The e letter is in amber in Single-Attenuator configurations For example: Dual-Attenuator configuration: Atten: 24 dB (e14) Indicating the total attenuation is at 24 dB and the electronic attenuation is at 14 dB Single-Attenuator configuration: A: 24 dB (e14) Indicating the total attenuation is at 24 dB and the “soft” attenuation is at 14 dB (see below for definition of “soft” attenuation) When in Manual, a # sign appears in front of Atten in the annotation

Attenuator Configurations and Auto/Man

As described in "Attenuation" on page 1747 , there are two distinct attenuator configurations available in the X-Series, the single attenuator and Dual-Attenuator configurations. In Dual-Attenuator configurations, we have the mechanical attenuation and the electronic attenuation, and the current total attenuation is the sum of the electronic + mechanical attenuation. In Single-Attenuator configurations, we refer to the attenuation set using "Mech Atten" on page 722 (or `:POW:ATT`) as the “main” attenuation; and the attenuation that is set by `:POW:EATT` as the “soft” attenuation (`:POW:EATT` is honored even in the Single-Attenuator configuration, for compatibility purposes). Then the current total attenuation is the sum of the main + soft attenuation. See "Elec Atten" on page 1753 for more on “soft” attenuation.

NOTE	In some measurements, the **Mech Atten** control has an Auto/Man function. In these measurements, an Auto/Man switch is shown on the **Mech Atten** control:



Note that in configurations that include an Electronic Attenuator, this switch is only shown when the Electronic Attenuator is disabled.

In other measurements, **Mech Atten** has no Auto/Man function. In these measurements, no switch is shown on the **Mech Atten** control:

Mech Atten also appears with no switch, as above, in configurations that include an Electronic Attenuator but when the Electronic Attenuator is enabled.

Elec Atten

Controls the Electronic Attenuator in Dual-Attenuator configurations. This control does not appear in Single-Attenuator configurations, as the control of both the mechanical and electronic stages of the Single-Attenuator is integrated into the single **Atten** control.

This control includes an Enable/Disable toggle switch; it is only possible to enter a value for the Electronic Attenuator when this switch is in the “Enable” position.

See "More Information" on page 726

Remote Command	`[:SENSe]:POWer[:RF]:EATTenuation <rel_ampl>`
	`[:SENSe]:POWer[:RF]:EATTenuation?`
	`[:SENSe]:POWer[:RF]:EATTenuation:STATe OFF | ON | 0 | 1`
	`[:SENSe]:POWer[:RF]:EATTenuation:STATe?`

Example	`:POW:EATT 10`
	`:POW:EATT?`
	`:POW:EATT:STAT ON`
	`:POW:EATT:STAT?`

Notes	Electronic Attenuation’s specification is defined only when Mechanical Attenuation is 6 dB
Dependencies	This control only appears in Dual-Attenuator models with an Electronic Attenuator installed and licensed. It does not appear in models with the Single-Attenuator configuration, as in the Single-Attenuator configuration there is no “electronic attenuator” there is only a single integrated attenuator

	(which has both a mechanical and electronic stage). However, in the Single-Attenuator configuration, EATT SCPI commands are accepted for compatibility with other X-series instruments and set a “soft” attenuation as described in . The “soft” attenuation is treated as an addition to the “main” attenuation value set by the Atten control or the POW:ATT SCPI command and affects the total attenuation displayed on the Atten control and the Meas Bar The electronic attenuator (and the “soft” attenuation function provided in Single-Attenuator configurations) is unavailable above the low band (0-3.6 GHz, 0-3.4 GHz 0-3GHz, depending on the model). If the low band ranges from 0-3.6GHz, and Stop Frequency of the instrument is > 3.6 GHz, then the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed out If the Internal Preamp is on, meaning it is set to Low Band or Full, the electronic attenuator (and the “soft” attenuation function provided in Single-Attenuator configurations) is unavailable. In this case the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed out If either of the above is true, if the SCPI command is sent, an error indicating that the electronic attenuator is unavailable will be sent If both of the above are true, pressing the control will generate error message -221, in other words, the frequency range lockout takes precedence If the electronic/soft Attenuator is enabled, then the Stop Freq of the instrument is limited to 3.6 GHz and the Internal Preamp is unavailable The SCPI-only “soft” electronic attenuation for the single-attenuator configuration is not available in all measurements; in particular, it is not available in the Swept SA measurement
Couplings	Enabling and disabling the Electronic Attenuator affects the setting of the Mechanical Attenuator (in Dual-Attenuator configurations). This is described in more detail below and in the section "Attenuator Configurations and Auto/Man" on page 1752
Preset	OFF (Disabled) for Swept SA measurement ON (Enabled) for all other measurements that support the electronic attenuator
State Saved	Saved in instrument state
Min	0 dB
Max	Dual-Attenuator configuration: 24 dB Single-Attenuator configuration: the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB
Annotation	See Annotation under the **Mech Atten** control description

More Information

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear. These advantages primarily aid in remote operation and are negligible for front panel use. See "Using the Electronic Attenuator: Pros and Cons" on page 727 for a detailed discussion of the pros and cons of using the electronic attenuator.

For the Single-Attenuator configuration, for SCPI backwards compatibility, the “soft” attenuation feature replaces the Dual-Attenuator configuration’s electronic attenuator. All the same couplings and limitations apply. See "Attenuator Configurations and Auto/Man" on page 1752

Mechanical Attenuator Transition Rules

When the Electronic Attenuator is enabled, the Mechanical Attenuator transitions to a state that has no Auto function. Below are the rules for transitioning the Mechanical Attenuator. Note that the information below ONLY applies to the Dual-Attenuator configurations, and ONLY when the Electronic Attenuator is installed:

When the Electronic Attenuation is enabled from a disabled state:

The Mechanical Attenuator is initialized to 10 dB (this is its optimal performance setting). You can then set it as desired with SCPI, numeric keypad, step keys, or knob, and it behaves as it normally would in manual mode

The Auto/Man state of (Mech) Atten is saved

The Auto/Man toggle on the (Mech) Atten control disappears and the auto rules are disabled

The Electronic Attenuator is set to 10 dB less than the previous value of the Mechanical Attenuator, within the limitation that it must stay within the range of 0 to 24 dB of attenuation

Examples in the Dual-Attenuator configuration:

Mech Atten at 20 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 10 dB. New total attenuation equals the value before Elec Atten enabled

Mech Atten at 0 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 0 dB. New total attenuation does not equal the value before Elec Atten enabled

Mech Atten at 40 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 24 dB. New total attenuation does not equal the value before Elec Atten enabled

When the Electronic Attenuation is disabled from an enabled state:

The Elec Atten control is grayed out

- The Auto/Man state of (Mech) Atten is restored

If now in Auto, (Mech) Atten recouples

If now in Man, (Mech) Atten is set to the value of total attenuation that existed before the Elec Atten was disabled. The resulting value is rounded up to the smallest value possible given the (Mech) Atten Step setting - (That is, 57 dB changes to 58 dB when (Mech) Atten Step is 2 dB)

Using the Electronic Attenuator: Pros and Cons

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear.

The “finer steps” advantage of the electronic attenuator is beneficial in optimizing the alignment of the instrument dynamic range to the signal power in the front panel as well as remote use. Thus, you can achieve improved relative signal measurement accuracy. Compared to a mechanical attenuator with 2 dB steps, the 1 dB resolution

of the electronic attenuator only gives better resolution when the odd-decibel steps are used. Those odd-decibel steps are less accurately calibrated than the even-decibel steps, so one tradeoff for this superior relative accuracy is reduced absolute amplitude accuracy.

Another disadvantage of the electronic attenuator is that the spectrum analyzer loses its “Auto” setting, making operation less convenient.

Also, the relationship between the dynamic range specifications (TOI, SHI, compression, and noise) and instrument performance are less well-known with the electrical attenuator. With the mechanical attenuator, TOI, SHI, and compression threshold levels increase dB-for-dB with increasing attenuation, and the noise floor does as well. With the electronic attenuator, there is an excess attenuation of about 1 to 3 dB between 0 and 3.6 GHz, making the effective TOI, SHI, and so forth, less well known. Excess attenuation is the actual attenuation relative to stated attenuation. Excess attenuation is accounted for in the instrument calibration

Adjust Atten for Min Clipping

Sets the combination of mechanical and electronic attenuation and gain based on the current measured signal level so that clipping will be at a minimum.

This is an "immediate action" function, that is, it executes once, when the control is pressed.

The algorithms that are used for the adjustment are documented under "Pre-Adjust for Min Clipping" on page 1757.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate`
Example	`:POW:RANG:OPT IMM`
Notes	Executing Adjust Atten for Min Clipping initiates the measurement.
Dependencies	Does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum measurements For the Waveform measurement, this control is available only in 5G NR Mode

Adjust Atten

Allows you to select;

– Electric attenuator only

– Combination of Electric attenuator and Mechanical attenuator

when the command `[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate` is executed.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize:TYPE EONLy | COMBined` `[:SENSe]:POWer[:RF]:RANGe:OPTimize:TYPE?`

Example	`:POW:RANG:OPT:TYPE EONL` `:POW:RANG:OPT:TYPE?`
Dependencies	Does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum measurements For the Waveform measurement, this control is available only in 5G NR Mode
Preset	`COMBined`
State Saved	Saved in instrument state

Pre-Adjust for Min Clipping

If this function is `ON`, it applies the adjustment described under "Adjust Atten for Min Clipping" on page 1756 each time a measurement restarts. Therefore, in Continuous measurement mode, it only executes before the first measurement.

In Dual-Attenuator models, you can set **Elec+Mech Atten**, in which case both attenuators participate in the autoranging, or **Elec Atten Only**, in which case the mechanical attenuator does not participate in the autoranging. This latter case results in less wear on the mechanical attenuator and is usually faster.

See "Adjustment Algorithm" on page 730

Selection	Example	Note
Off	`:POW:RANGe:OPT:ATT OFF`	This is the default setting
Elec Atten Only	`:POW:RANGe:OPT:ATT ELEC`	Selects only the electric attenuator to participate in auto ranging. This offers less wear on the mechanical attenuator and is usually faster
Mech + Elec Atten	`:POW:RANGe:OPT:ATT COMB`	In Dual-Attenuator models, this selects both attenuators to participate in the autoranging

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation OFF | ON | ELECtrical | COMBined` `[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation?`
Example	`:POW:RANG:OPT:ATT OFF` `:POW:RANG:OPT:ATT?`
Notes	The parameter option `ELECtrical` sets this function to `ON` in Single-Attenuator models The parameter option `COMBined` is mapped to `ELECtrical` in Single-Attenuator models. If you send `COMBined`, it sets the function to `ON` and returns `ELEC` to a query For SCPI compatibility with models that do not have an input attenuator, the `ON` parameter is honored and mapped to `COMBined`
Dependencies	This control only appears in Dual-Attenuator models with an Electronic Attenuator installed In instruments with Dual-Attenuator model, when **Enable** "Elec Atten" on page 1753 is `OFF` or grayed-out, "Pre-Adjust for Min Clipping" on page 729 is grayed-out This control does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum

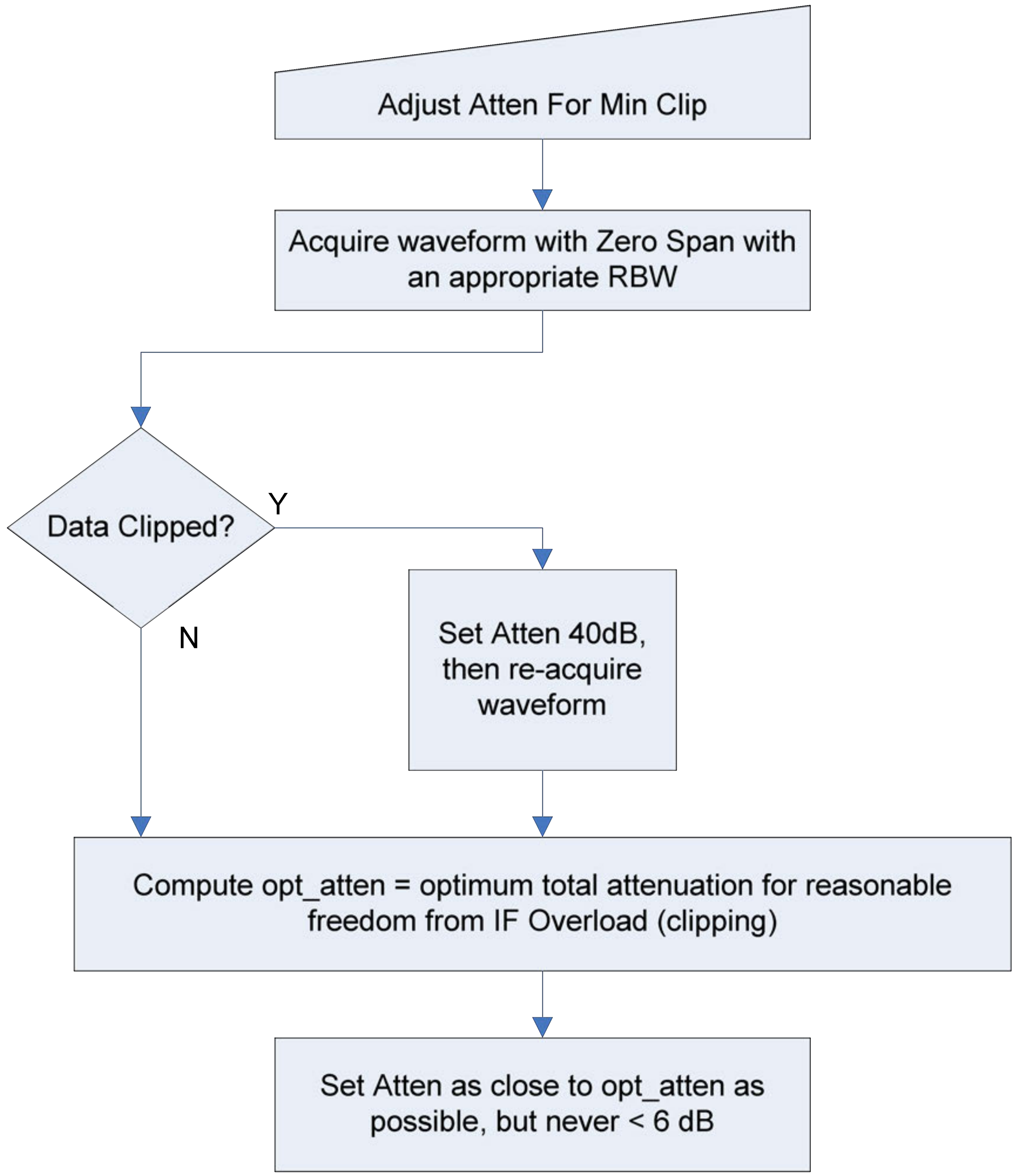
	measurements For the Waveform measurement, this control is available only in 5G NR Mode
Preset	`OFF` when Elec Atten is Disabled at preset, otherwise `ELEC`
State Saved	Saved in instrument state
Range	Dual-Attenuator models: Off | Elec Atten Only | Mech + Elec Atten Single-Attenuator models: Off | On

Notes	`ON` aliases to "Elec Atten Only" (`:POW:RANG:OPT:ATT ELEC`) `OFF` aliases to "Off" (`:POW:RANG:OPT:ATT OFF`) `:POW:RANG:AUTO?` returns true if `:POW:RANG:OPT:ATT` is not `OFF`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:RANGe:AUTO ON | OFF | 1 | 0` `[:SENSe]:POWer[:RF]:RANGe:AUTO?`

Adjustment Algorithm

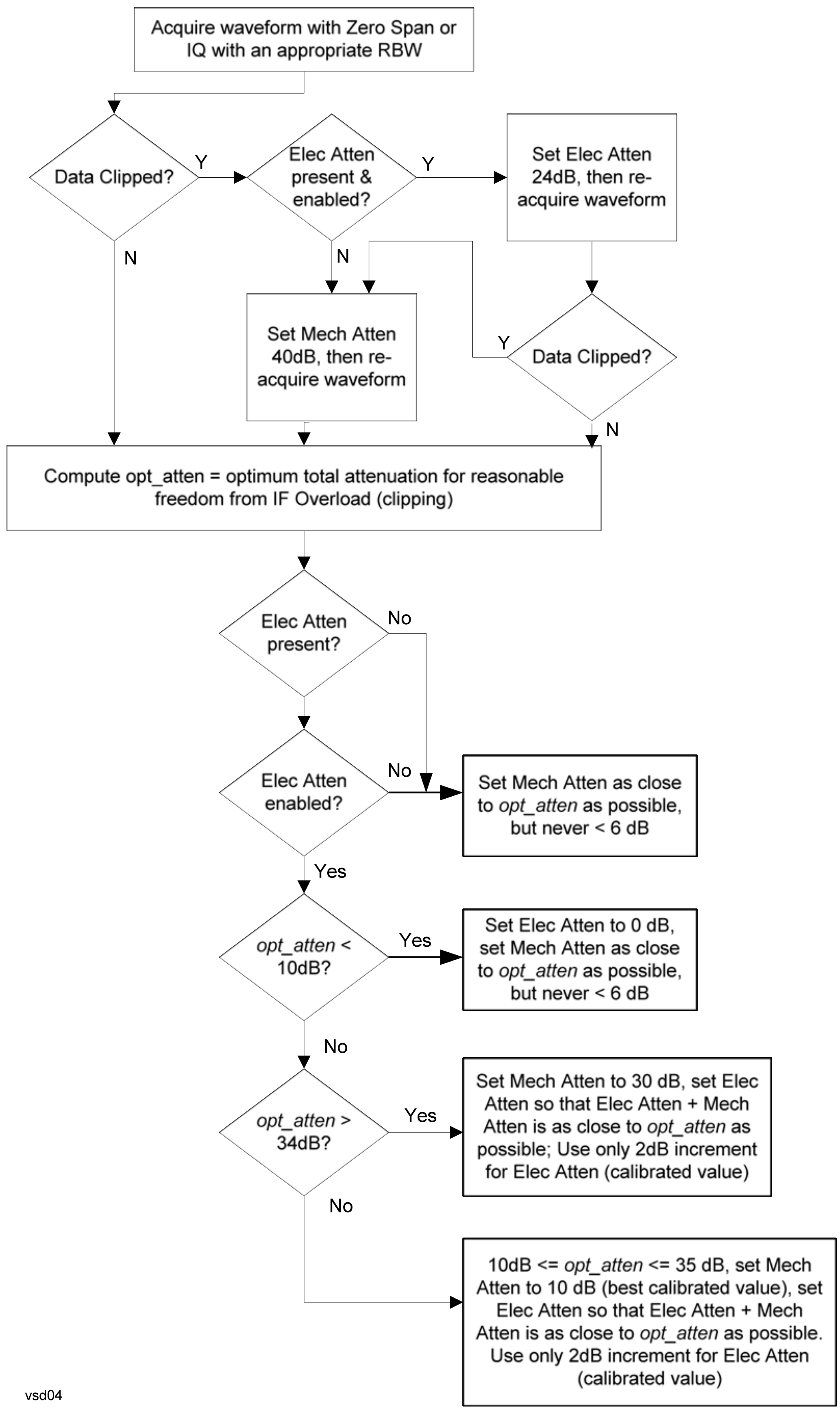
The algorithms for the adjustment are documented below:

Single-Attenuator Models

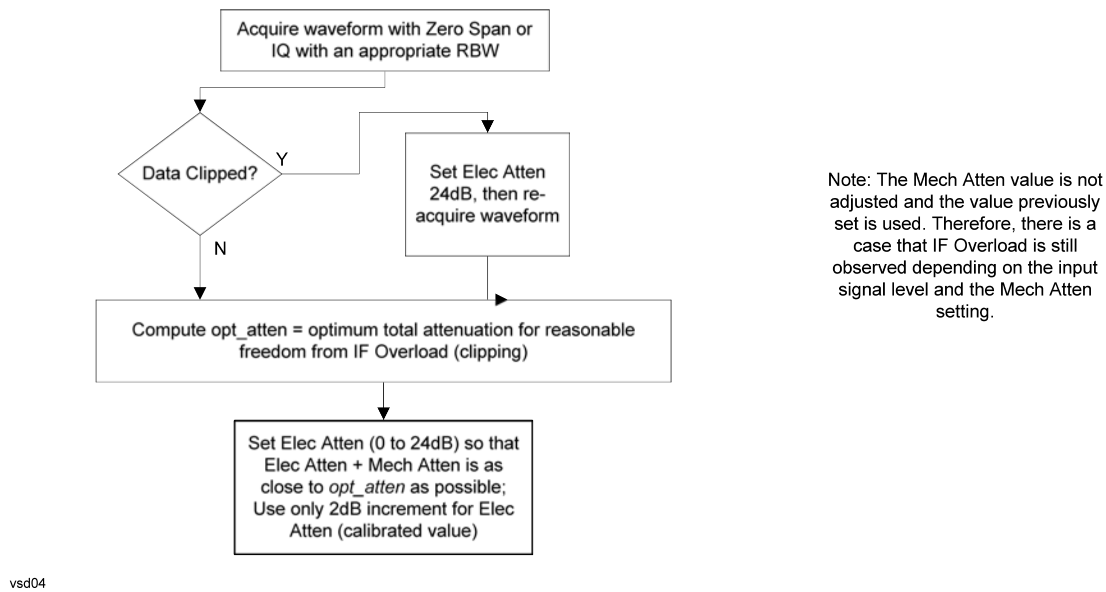


Dual-Attenuator models

"Adjust Atten for Min Clipping" on page 1756 or "Pre-Adjust for Min Clipping" on page 729 selection is Mech + Elec Atten:


Acquire waveform with Zero Span or IQ with an appropriate RBW
Data Clipped?
Y
N
Elec Atten present & enabled?
Y
N
Set Elec Atten 24dB, then re-acquire waveform
Set Mech Atten 40dB, then re-acquire waveform
Y
Data Clipped?
N
Compute opt_atten = optimum total attenuation for reasonable freedom from IF Overload (clipping)
Elec Atten present?
No
Elec Atten enabled?
No
Set Mech Atten as close to *opt_atten* as possible, but never < 6 dB
Yes
opt_atten < 10dB?
Yes
Set Elec Atten to 0 dB, set Mech Atten as close to *opt_atten* as possible, but never < 6 dB
No
opt_atten > 34dB?
Yes
Set Mech Atten to 30 dB, set Elec Atten so that Elec Atten + Mech Atten is as close to *opt_atten* as possible; Use only 2dB increment for Elec Atten (calibrated value)
No
10dB <= *opt_atten* <= 35 dB, set Mech Atten to 10 dB (best calibrated value), set Elec Atten so that Elec Atten + Mech Atten is as close to *opt_atten* as possible. Use only 2dB increment for Elec Atten (calibrated value)
vsd04

"Pre-Adjust for Min Clipping" on page 729 selection is Elec Only:



Mech Atten Step

Controls thestep size used when making adjustments to the input attenuation.

This control is labeled **Mech Atten Step** in Dual-Attenuator models and **Atten Step** in Single-Attenuator models. In the Dual-Attenuator configuration, this control only affects the step size of the mechanical attenuator.

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement] 10 dB | 2 dB` `[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement]?`
Example	`:POW:ATT:STEP 2` `:POW:ATT:STEP?`
Notes	This feature has a toggle choice from the front panel, but it takes a specific value (in dB) when used remotely. The only valid values are 2 and 10
Dependencies	Blanked in EXA, CXA and CXA-m if option FSA (2 dB steps) is not present. If blanked, attempts to set it via SCPI yield an error
Couplings	When the attenuation step size changes, the current mechanical attenuation value is adjusted (if necessary) to be quantized to the new step size. That is, if step is set to 10 dB, mech atten is increased if necessary so it is a multiple of 10 dB
Preset	EXA, CXA and CXA-m: 10 dB (2 dB with option FSA) All other models: 2 dB
State Saved	Saved in instrument state

Max Mixer Level

Allows you to set the maximum level to be applied to the mixer for a signal at the top of the screen. By setting this value up or down you can allow more or less signal through the system.

The major impact of changes to **Max Mixer Level** is seen in changes to the value to which **Reference Level** is limited. Max Ref Level depends on Max Mixer Level and Attenuation, and therefore a higher Max Mixer Level may let you set Ref Level higher. However, changing this value can impact your TOI, compression, or dynamic range. The preset value of this function is best for most measurements.

See also "Max Mixer Lvl Rules" on page 1762.

Remote Command	`[:SENSe]:POWer[:RF]:MIXer:RANGe[:UPPer] <real>` `[:SENSe]:POWer[:RF]:MIXer:RANGe[:UPPer]?`
Example	`:POW:MIX:RANG -15 dBm` `:POW:MIX:RANG?`
Dependencies	Only appears in Swept SA and RTSA measurements
Preset	-10 dBm
State Saved	Saved in instrument state
Min	-50 dBm
Max	0 dBm

Max Mixer Lvl Rules

Allows you to optimize the Max Mixer Level setting for certain kinds of measurements.

- `NORMal` – The historical, and thus backwards compatible, setting range (–50 to 0 dBm) and default setting (–10 dBm). The instrument has been designed so that, at the default setting, any signal below the **Reference Level** is extremely unlikely to create ADC overloads. At this mixer level the scale fidelity will be within specifications, thus compression with be negligible.
- `TOI` – Allows a range of settings of the "Max Mixer Level" on page 1762, –50 to –10 dBm, that can be optimum for measurements limited by the instrument third-order dynamic range. The default setting, –25 dBm, is commonly appropriate but RBW affects this. A good setting for Max Mixer Level would be higher than the optimum mixer level by half of the attenuator step size.
- `COMPression` – Allows a range of settings of the Max Mixer Level, –10 to +10 dBm or more, that can be optimum for measurements limited by the tradeoffs between instrument accuracy due to compression, and dynamic range due to the noise floor. The default setting, –3 dBm, is commonly appropriate, representing mixer drive levels that cause 1 dB or less compression at most carrier

frequencies. Typical measurements that would be optimized by this setting are the measurement of low sideband levels, including nulls, in angle-modulated signals (FM and PM). Also pulsed-RF measurements, including finding nulls to estimate pulse width, which are often best done with significant overdrive (compression) of the front end.

Setting Name (readback)	Setting Name (verbose)	Max Mixer Level Preset Value, dBm	Max Mixer Level minimum value, dBm	Max Mixer Level maximum value, dBm
NORMal	Normal – balance TOI, noise, and compression	–10	–50	0
TOI	TOI-limited dynamic range	–25	–50	–10
COMPression	Compression-limited dynamic range	–3	–10	+30

Remote Command	[:SENSe]:POWer[:RF]:MIXer:RULEs NORMal | TOI | COMPression [:SENSe]:POWer[:RF]:MIXer:RULEs?
Example	:POW:MIX:RULE:COMP
Dependencies	Only appears in Swept SA and RTSA
Preset	NORM

3.6.3.3 Range (Baseband Input models)

This tab is only available when Option BBA is present (I/Q Baseband Inputs), the current measurement supports option BBA, and I/Q is the selected input. It replaces the Attenuation tab in that case.

Each input channel (I and Q) has four internal gain ranges. The maximum allowed voltage in each gain range is slightly more than the nominal value, so the break point between ranges is a few millivolts higher than the nominal (setting a peak voltage of 0.502 mV will still map to the 0.5 V Peak range).

Gain Setting	Volts RMS	Volts Peak	Volts Peak - Peak	dBm (50Ω)	Break Point
0 dB	0.7071	1.0	2.0	10	n/a
6 dB	0.3536	0.5	1.0	4	0.502 V Peak
12 dB	0.1768	0.25	0.5	-2	0.252 V Peak
18 dB	0.0884	0.125	0.25	-8	0.127 V Peak

Dependencies	Available only when the selected input is I/Q. If the current measurement does not support baseband inputs, an error will be displayed: “No result; Meas invalid with I/Q inputs”

State Saved	No

Range Auto/Man

The Auto setting for Range causes the range to be set based on the Y Scale settings. When Range is "Auto", the I & Q Range are set based on the top of the Y Scale when the Y scale is in dB units (for example, power), or to the max(abs(top), abs(bottom)) when the Y scale reference is not at the top of the screen.

Not all measurements support **Range Auto/Man**. If Auto is not supported in the current measurement, this control is grayed-out displaying "Man", and `MAN` is returned to a SCPI query, but this does *not* change the Auto/Man setting for Range. When you switch to a measurement that supports Auto, it goes back to Auto if it was previously in Auto mode.

Remote Command	`[:SENSe]:VOLTage:IQ:RANGe:AUTO OFF | ON | 0 | 1` `[:SENSe]:VOLTage:IQ:RANGe:AUTO?`

Example	Put the I Range and Q Range in manual.
	`:VOLT:IQ:RANG:AUTO OFF`
	`:VOLT:IQ:RANG:AUTO?`

Dependencies	If Auto is not supported, sending the SCPI command generates an error
Couplings	When in Auto, both I Range and Q Range are set to the same value, computed as follows: Maximum absolute value is computed for the Y Scale. The top and bottom of the graph are computed based on Ref Value, Scale/Div, and Ref Position. Formula: Y_{Max} = max(abs(top), abs(bottom)) The I Range and Q Range are then set to Y_{Max}
Preset	`ON`
State Saved	Saved in instrument state
Annotation	When in Man, the Range annotation is preceded by "#"

This is an alternate form of the command to match the `POWer` form of the I Range and Q Range SCPI.

Remote Command	`[:SENSe]:POWer:IQ:RANGe:AUTO OFF | ON | 0 | 1` `[:SENSe]:POWer:IQ:RANGe:AUTO?`

Example	Put the I Range and Q Range in manual
	`:POW:IQ:RANG:AUTO OFF`
	`:POW:IQ:RANG:AUTO?`

Notes	`:POW:IQ:RANG:AUTO` is an alternate form of `:VOLT:IQ:RANG:AUTO`, to maintain consistency with I Range and Q Range, which support both the `POWer` and `VOLTage` forms of the command
Preset	`ON`
Range	Auto | Man

I Range

The internal gain range for the I channel when the Input Path is I Only or I and I/Q. Used for both the I and Q channels when the Input Path is I+jQ.

Remote Command	`[:SENSe]:VOLTage:IQ[:I]:RANGe[:UPPer] <voltage>` `[:SENSe]:VOLTage:IQ[:I]:RANGe[:UPPer]?`

Example	Set the I Range to 0.5 V Peak
	`:VOLT:IQ:RANG 0.5 V`
	`:VOLT:IQ:RANG?`

Notes	The numeric entries are mapped to the smallest gain range whose break point is greater than or equal to the value, or 1 V Peak if the value is greater than 1 V
Couplings	When "Q Same as I" on page 1580 is On, the **I Range** value will be copied to "Q Range" on page 1578 Changing the value also sets Range = Man
Preset	1 V Peak
State Saved	Saved in instrument state
Range	1 V Peak (10 dBm @ 50 Ω) | 0.5 V Peak (4 dBm @ 50Ω) | 0.25 V Peak (-2 dBm @ 50Ω) | 0.125 V Peak (-8 dBm @ 50Ω)
Min	0.125 V
Max	1 V
Annotation	The Range annotation replaces the RF Input context's "Atten" annotation "Rng: <I Range>". When Range = Man the annotation is preceded by "#" The I Range is not annotated in Input Path Q Only. When I Range and Q Range are the same, the annotation is "Rng: <Range>". When I Range and Q Range are different and the Input Path is Ind I/Q, the annotation is "Rng: <I Range>, <Q Range>" and "Peak" is removed from the text. Examples: "Rng: 1 V Peak" the I Range is 1 V Peak "Rng: 1 V, 0.5 V " the I Range is 1 V Peak and the Q Range is 0.5 V Peak

This is an alternate form of the command to allow entry as a power.

Remote Command	`[:SENSe]:POWer:IQ[:I]:RANGe[:UPPer] <ampl>` `[:SENSe]:POWer:IQ[:I]:RANGe[:UPPer]?`

Example	Set the I Range to 0.5 V Peak when Reference Z is 50 Ω, and to 1.0 V Peak when Reference Z is 75 **Ω**
	`:POW:IQ:RANG 4 dBm`
	`:POW:IQ:RANG?`

Notes	The `POWer` form of the command is provided for convenience. It maps to the same underlying gain range parameter as the `VOLTage` form of the command The Reference Z (not the I channel Input Z) is used to convert the power to peak voltage, which is then used to set the I Range as with the `VOLTage` form of the command. The power values of the 4 range states (1V Peak, 0.5V Peak, 0.25V Peak, and 0.125V Peak) will vary with Reference Z. Here are some examples: 50 Ω: 10, 4, -2, -8

	75 Ω: 8.2, 2.2, -3.8, -9.8 600 Ω: -0.8, -6.8, -12.8, -18.9
Preset	10.0 dBm
Range	-20 dBm to 10 dBm
Min	-20 dBm
Max	10 dBm

Q Range

The internal gain range for the Q channel.**Q Range** only applies to Input Path Q Only and Ind I/Q. For input I+jQ "I Range" on page 1577 determines both I and Q channel range settings.

Remote Command	`[:SENSe]:VOLTage:IQ:Q:RANGe[:UPPer] <voltage>` `[:SENSe]:VOLTage:IQ:Q:RANGe[:UPPer]?`

Example	Set the Q Range to 0.5 V Peak:
	`:VOLT:IQ:Q:RANG 0.5 V`
	`:VOLT:IQ:Q:RANG?`

Notes	The numeric entries are mapped to the smallest gain range whose break point is greater than or equal to the value, or 1 V Peak if the value is greater than 1 V **Q Range** is only used for Input Path Q Only and Ind I/Q. For input I+jQ, "I Range" on page 1577 determines both I and Q channel range settings
Couplings	When "Q Same as I" on page 1580 is On, the "I Range" on page 1577 value is copied to **Q Range** and the range value keys are disabled Changing the value also sets Range = Man
Preset	1 V Peak
State Saved	Saved in instrument state
Range	1 V Peak (10 dBm @ 50Ω) | 0.5 V Peak (4 dBm @ 50Ω) | 0.25 V Peak (-2 dBm @ 50Ω) | 0.125 V Peak (-8 dBm @ 50Ω)
Min	0.125 V
Max	1 V
Annotation	The Range annotation replaces the RF Input context's "Atten" annotation "Rng: <Q Range>". When Range = Man the annotation is preceded by "#" The Q Range is not annotated in Input Path I Only or I+jQ. When I Range and Q Range are the same, the annotation is "Rng: <Range>". When I Range and Q Range are different and the Input Path is Ind I/Q, the annotation is "Rng: <I Range>, <Q Range>" and "Peak" is removed from the text. Examples: "Rng: 1 V Peak" the Q Range is 1 V Peak "Rng: 1 V, 0.5 V " the I Range is 1 V Peak and the Q Range is 0.5 V Peak

This is an alternate form of the command to allow entry as a power.

Remote	`[:SENSe]:POWer:IQ:Q:RANGe[:UPPer] <ampl>`

Command	[:SENSe]:POWer:IQ:Q:RANGe[:UPPer]?
Example	Sets the Q Range to 0.5 V Peak when Reference Z is 50 Ω, and to 1.0 V Peak when Reference Z is 75 Ω: :POW:IQ:Q:RANG 4 dBm :POW:IQ:Q:RANG?
Notes	The POWer form of the command is provided for convenience. It maps to the same underlying gain range parameter as the VOLTage form of the command The Reference Z (not the Q channel Input Z) is used to convert the power to peak voltage, which is then used to set the Q Range as with the VOLTage form of the command. The power values of the 4 range states (1V Peak, 0.5V Peak, 0.25V Peak, and 0.125V Peak) will vary with Reference Z. Here are some examples: 50 Ω: 10, 4, -2, -8 75 Ω: 8.2, 2.2, -3.8, -9.8 600 Ω: -0.8, -6.8, -12.8, -18.9
Preset	10.0 dBm
Range	-20 dBm to 10 dBm
Min	-20 dBm
Max	10 dBm

Q Same as I

Many, but not all, usages require the I and Q channels to have an identical setup. To simplify channel setup, **Q Same as I** causes the Q channel range to be mirrored from the I channel. That way you only need to set up one channel (the I channel). The I channel values are copied to the Q channel, so at the time **Q Same as I** is Off, the I and Q channel setups will be identical.

Remote Command	[:SENSe]:VOLTage|POWer:IQ:MIRRored OFF | ON | 0 | 1 [:SENSe]:VOLTage|POWer:IQ:MIRRored?
Example	Turn off the mirroring of I Range to Q Range. :VOLT:IQ:MIRR OFF :POW:IQ:MIRR OFF
Couplings	When ON, the "I Range" on page 1577 value is mirrored (copied) to the "Q Range" on page 1578
Preset	ON
State Saved	Saved in instrument state
Range	OFF|ON

3.6.3.4 Range (Non-attenuator models)

This tab is only available for Keysight's modular signal analyzers and certain other Keysight products. Examples include:

– VXT

– E7760

– M9391A

– M9393A

This tab also does not appear in UXM. In UXM, all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

State Saved	No

Range

Represents the amplitude of the largest sinusoidal signal that could be present within the IF without being clipped by the ADC. For signals with high peak-to-average ratios, the range may need to exceed the rms signal power by a significant amount to avoid clipping.

This is a measurement global setting.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe <real>` `[:SENSe]:POWer[:RF]:RANGe?`
Example	`:POW:RANG 10 dBm` `:POW:RANG?`
Notes	The MIN and MAX values are affected by the External Gain parameters, and by the **Center Frequency** The hardware compensates for frequency response and alters the Range setting
Preset	0 dBm
State Saved	Yes
Min	-100
Max	100
Annotation	Meas Bar

Adjust Range for Min Clipping

Sets the combination of attenuation and gain based on the current measured signal level so that clipping will be at a minimum.

This is an "immediate action" function, that is, it executes once, when the key is pressed.

This key does not appear in measurements that do not support this functionality.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate`
Notes	Executing Adjust Range for Min Clipping initiates the measurement
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760

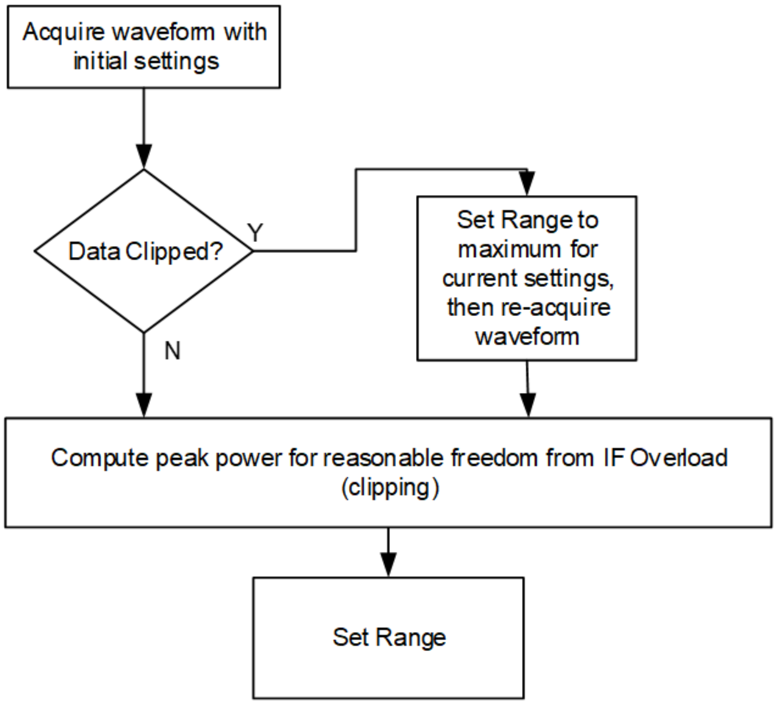
Pre-Adjust for Min Clipping

If this function is ON, it applies the adjustment described under Adjust Range For Min Clipping each time a measurement restarts. Therefore, in Continuous measurement mode, it only executes before the first measurement.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation OFF | ON | ELECtrical | COMBined` `[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation?`
Notes	Because there is no attenuator control available in these models, the control displays only ON and OFF choices. However, for SCPI compatibility with other platforms, all three parameters (ELECtrical, COMBined, and ON) are honored and all are mapped to ELECtrical, so if any of these three parameters is sent, a subsequent query will return ELEC
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760
Preset	OFF for Swept SA measurement; ON for all other measurements that support **Pre-Adjust for Min Clipping**
State Saved	Saved in instrument state

Adjustment Algorithm

The algorithm for the adjustment is documented below:



Peak-to-Average Ratio

Used with "Range (Non-attenuator models)" on page 1864 to optimize the level control in the instrument. The value is the ratio, in dB, of the peak power to the average power of the signal to be measured. A ratio of 0 should be used for sinusoidal signals; for 802.11g OFDM signals use 9 dB.

All Applications (Modes) show the current value of Peak-to-Average ratio on the control. However, some applications do not permit changing the value. In these situations, the control is grayed-out.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:PARatio <real>` `[:SENSe]:POWer[:RF]:RANGe:PARatio?`
Example	`:POW:RANG:PAR 12 dB`
Notes	In some Applications (Modes) this parameter is read-only; meaning the value will appear on the control and query via SCPI, but is not changeable. In such applications the control is grayed-out. Attempting to change the value via SCPI will be ignored but no error message will be generated
Dependencies	This control does not appear in Spectrum Analyzer Mode
Preset	10 dB VXT Models M9410A/11A: 0 dB
State Saved	Saved in instrument state
Min	0 dB
Max	20 dB

	VXT Models M9410A/11A: 50 dB

Mixer Lvl Offset

This is an advanced setting to adjust target Range at the input mixer, which in turn affects the signal level in the instrument's IF. This setting can be used when additional optimization is needed after setting "Peak-to-Average Ratio" on page 1866. Positive values of offset optimize noise performance over distortion, negative values optimize distortion performance over noise.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet <real>` `[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet?`
Example	`:POW:RANG:MIX:OFFS -5 dB`
Preset	0 dB
State Saved	Saved in instrument state
Min	-35 dB VXT Models M9410A/11A: -34 dB
Max	30 dB

3.6.3.5 Signal Path

Contains controls that pertain to the routing of the signal through the frontend of the instrument.

In general, this tab only appears in instruments whose hardware supports this signal routing. For example, this tab does not appear in many of the modular instrument products, including VXT Models M9420/21A. It also does not appear in UXM.

This tab *does* appear in VXT Models M9410A/11A because the Software Preselection control is in this tab, and VXT Models M9410A/11A implement a version of Software Preselection.

Presel Center

Pressing this control adjusts the centering of the preselector filter to optimize the amplitude accuracy at the frequency of the selected marker. If the selected marker is not on when **Presel Center** is pressed, the instrument turns on the selected marker, performs a peak search, and then performs centering on the marker's center frequency. If the selected marker is already on and between the start and stop frequencies of the instrument, the instrument performs the preselector calibration on that marker's frequency. If the selected marker is already on, but outside the frequency range between Start Freq and Stop Freq, the instrument first performs a peak search, and then performs centering on the marker's center frequency.

The value displayed on "Preselector Adjust" on page 1869 will change to reflect the new preselector tuning.

A number of considerations should be observed to ensure proper operation. See "Proper Preselector Operation" on page 744.

Remote Command	`[:SENSe]:POWer[:RF]:PCENter`
Example	`:POW:PCEN`
Notes	Note that the rules outlined above under the control description apply for the remote command as well as the key. The result of the command is dependent on marker position, etc. Any message shown by the control press is also shown in response to the remote command
Dependencies	Does not appear in CXA-m Does not appear in VXT Models M9410A/11A Grayed-out if the microwave preselector is off – If the selected marker's frequency is below Band 1, an advisory message is generated "Preselector not used in this frequency range" and no action is taken – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz – Blank in models that do not include a preselector, such as option 503. If the remote command is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View
Couplings	The active marker position determines where the centering will be attempted If the instrument is in a measurement such as averaging when centering is initiated, the act of centering the preselector restarts averaging, but the first average trace will not be taken until the centering is completed The offset applied to do the centering reads out on the "Preselector Adjust" on page 1869 control
Status Bits/OPC dependencies	When centering the preselector, `*OPC` will not return true until the process is complete and a subsequent measurement has completed, nor will results be returned to `:READ` or `:MEASure` queries The Measuring bit should remain set while this command is operating and should not go false until the subsequent sweep/measurement has completed

Proper Preselector Operation

A number of considerations should be observed to ensure proper operation:

1 If the selected marker is off, the instrument turns on a marker, performs a peak search, and adjusts the preselector using the selected marker's frequency. It uses the "highest peak" peak search method unqualified by threshold or excursion, so that there is no chance of a 'no peak found' error. It continues with that peak, even if it is the peak of just noise. Therefore, for this operation to work properly, there should be a signal on screen in a preselected range for the peak search to find

2 If the selected marker is already on, the instrument attempts the centering at that marker's frequency. There is no preselector for signals below about 3.6 GHz, so if the marker is on a signal below 3.6 GHz, no centering will be attempted and an advisory message generated

3 In some models, the preselector can be bypassed. If it is bypassed, no centering will be attempted in that range and a message will be generated

Preselector Adjust

Allows you to manually adjust the preselector filter frequency to optimize its response to the signal of interest. This function is only available when "Presel Center" on page 1868is available.

For general purpose signal analysis, using **Presel Center** is recommended. Centering the filter minimizes the impact of long-term preselector drift. **Preselector Adjust** can be used instead to manually optimize the preselector. One application of manual optimization would be to peak the preselector response, which both optimizes the signal-to-noise ratio and minimizes amplitude variations due to small (short-term) preselector drifting.

When **Presel Center** is performed, the offset applied to do the centering becomes the new value of **Preselector Adjust**.

Remote Command	`[:SENSe]:POWer[:RF]:PADJust <freq>` `[:SENSe]:POWer[:RF]:PADJust?`
Example	`:POW:PADJ 100KHz` `:POW:PADJ?`
Notes	The value on the control reads out to 0.1 MHz resolution
Dependencies	– Does not appear in CXA-m – Does not appear in VXT Models M9410A/11A – Grayed-out if microwave preselector is off – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz – Blank in models that do not include a preselector, such as option 503. If the SCPI is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View
Preset	0 MHz
State Saved	The **Preselector Adjust** value set by "Presel Center" on page 1868, or by manually adjusting **Preselector Adjust** It is not saved in instrument state, and does not survive a Preset or power cycle
Min	-500 MHz
Max	500 MHz
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PADJust` `[:SENSe]:POWer[:RF]:MMW:PADJust`

Notes	PSA had multiple preselectors, and you could select which preselector to adjust. Since the X-Series has only one mm/uW preselector, the preselector selection control is no longer available. However, to provide backward compatibility, we accept the legacy remote commands The command form has no effect, the query always returns `MWAVe`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:PADJust:PRESelector MWAVe | MMWave | EXTernal` `[:SENSe]:POWer[:RF]:PADJust:PRESelector?`

Internal Preamp

Accesses a menu of controls for the internal preamps. Turning on the preamp gives a better noise figure, but a poorer inter-modulation distortion (TOI) to noise floor dynamic range. You can optimize this setting for your particular measurement.

The instrument takes the preamp gain into account as it sweeps. If you sweep outside of the range of the preamp, the instrument will also account for that. The displayed result always reflects the correct gain.

For some measurements, when the preamp is on and any part of the displayed frequency range is below the lowest frequency for which the preamp has specifications, a warning condition message appears in the status line. For example, for a preamp with a 9 kHz lowest specified frequency: "Preamp: Accy unspec'd below 9 kHz".

Selection	Example	Note
Off	`:POW:GAIN OFF`	
Low Band	`:POW:GAIN ON` `:POW:GAIN:BAND LOW`	Sets the internal preamp to use only the low band. The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Low Band selection in the dropdown
Full Range	`:POW:GAIN ON` `:POW:GAIN:BAND FULL`	Sets the internal preamp to use its full range. The low band (0-3.6 GHz, 0-3.4 GHz, 0-3GHz, depending on the model) is supplied by the low band preamp and the frequencies above low band are supplied by the high band preamp The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Full Range selection in the dropdown. If the high band option is not installed the Full Range selection does not appear

Remote Command	`[:SENSe]:POWer[:RF]:GAIN:BAND LOW | FULL` `[:SENSe]:POWer[:RF]:GAIN:BAND?`

	`[:SENSe]:POWer[:RF]:GAIN[:STATe] OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:GAIN[:STATe]?`

Example	`:POW:GAIN:BAND LOW`
	`:POW:GAIN:BAND?`
	`:POW:GAIN OFF`
	`:POW:GAIN?`

Dependencies	Preamp is not available on all hardware platforms. If the preamp is not present or is unlicensed, the control is not shown Does not appear in VXT Models M9410A/11A/15A If `:POW:GAIN:BAND FULL` is sent when a low band preamp is available, the preamp band parameter is set to `LOW` instead of `FULL`, and an "Option not installed" message is generated The preamp is not available when the electronic/soft attenuator is enabled
Preset	`LOW` `OFF`
State Saved	Saved in instrument state
Annotation	When the USB Preamp is not connected to USB, the Preamp annotation in the Meas Bar says “Off” if the preamp is off and displays the frequency range of the low band or full range preamp depending on the setting. For example, if the Preamp is set to Low Band and the Low Band is 3.6 GHz the annotation says “3.6 GHz”. If it is a 13.6 GHz preamp and it is set to Full Range the annotation says “13.6 GHz” When the USB Preamp is connected to USB, the Preamp annotation says “Preamp: USB” if the internal preamp is off or “Preamp: USB, Int” if the internal preamp is on (only for measurements that support the USB preamp)

LNA

Lets you turn the Low Noise Amplifier (**LNA**) on or off.

The LNA is an additional preamplifier that provides superior DANL and frequency range compared to the Internal Preamp. The LNA provides lower system noise figure, especially at frequencies above 100 MHz, and can be operated up to the full range of 50 GHz instruments.

For best possible sensitivity, the LNA can be turned on together with the "Internal Preamp" on page 1870, although if you operate both preamps together, note that the TOI (distortion) specifications are impacted. The sensitivity improvement of this combination is substantial when operating in high band (frequencies above 3.6 GHz).

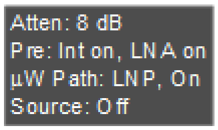
See "More Information" on page 748

Remote Command	`[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe] OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe]?`
Example	`:POW:GAIN:LNA ON`
Dependencies	Requires option LNA

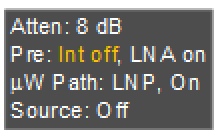
	Option LNA is not required by VXT model M9415A Does not appear in VXT models M9420A/21A/10A/11A May not appear in some measurements
Preset	OFF
State Saved	Saved in State

More Information

When the LNA is installed, the preamp annotation changes to show the state of both the LNA and the Internal Preamp. Below is an example:



Note that when operating entirely in the low band (below about 3.6 GHz), if the LNA is on, the Internal Preamp is switched off (even if you have its switch set to ON). This is because the noise performance is actually degraded in low band if both preamps are on. In this case, the annotation reflects the actual state of the two preamps, but the Internal Preamp annotation displays in amber, to warn you that the actual state of the Internal Preamp does not match the **Internal Preamp** switch control display:



µW Path Control

Options for this control include **µW Preselector Bypass** (Option MPB), **Low Noise Path** (Option LNP) and **Full Bypass Enable** in the High Band path circuits.

When the µW Preselector is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. When **Low Noise Path Enable** is selected, the instrument automatically bypasses certain circuitry in the high frequency bands that can contribute to noise, when it is appropriate based on other instrument settings.

For most applications, the preset state is **Standard Path**, which provides the best remote-control throughput, minimizes acoustic noise from switching and minimizes the risk of wear in the hardware switches, particularly in remote test scenarios where both low band and high band setups will follow in rapid succession. In this path, the bypass of the low band/high band switch and microwave preamp is never activated, which can cause some noise degradation but preserves the life of the bypass switch.

For applications that utilize the wideband IF paths, the preset state is **µW Preselector Bypass**, if option MPB is present. This is because, when using a wideband IF such as

the 140 MHz IF, the µW Preselector's bandwidth can be narrower than the available IF bandwidth, causing degraded amplitude flatness and phase linearity, so it is desirable to bypass the preselector in the default case.

You may choose **Low Noise Path Enable** for a lower noise floor, especially in the 21-26.5 GHz region, though without improving many measures of dynamic range, and without giving the best possible noise floor. The preamp, if purchased and used, gives better noise floor than does **Low Noise Path Enable**, but the preamp's compression threshold and third-order intercept are much poorer than that of **Low Noise Path Enable**.

A fourth choice is **Full Bypass Enable**, which combines **µW Preselector Bypass** and **Low Noise Path Enable**. Because this can bypass most of the circuitry between the input and the first mixer, care should be taken when using this setting to avoid damaging the mixer. **Full Bypass Enable** is only available if both options LNP and MPB are present, as well as option FBP.

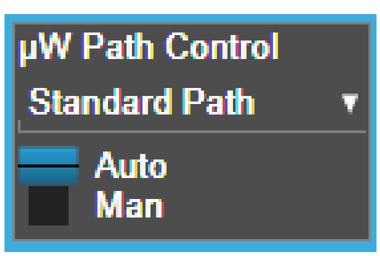
Path	Example	Note
Standard Path	:POW:MW:PATH STD	Normal setting for most measurements. µW Preselector in circuit, Low Noise Path disabled
Low Noise Path Enable	:POW:MW:PATH LNP	See "Low Noise Path Enable" on page 753
µW Preselector Bypass	:POW:MW:PATH MPB	See "µW Preselector Bypass" on page 754
Full Bypass Enable	:POW:MW:PATH FULL	See "Full Bypass Enable" on page 755

Remote Command	[:SENSe]:POWer[:RF]:MW:PATH STD | LNPath | MPBypass | FULL [:SENSe]:POWer[:RF]:MW:PATH?
Example	:POW:MW:PATH LNP Enables the Low Noise path :POW:MW:PATH?
Notes	If "Presel Center" on page 1868 is performed, the instrument will momentarily switch to the Standard Path, regardless of the setting of **µW Path Control** The DC Block will always be switched in when the low noise path is switched in, to protect succeeding circuitry from DC. Note that this does not mean "when the low noise path is enabled" but when, based on the Low Noise Path rules, the path is actually switched in. This can happen when the selection is **Low Noise Path Enable** or **Full Bypass Enable.** In the case where the DC Block is switched in the instrument is now AC coupled. However, if you selected DC coupling, the UI would still behave as though it were DC coupled, including all annunciation, warnings, status bits, and responses to SCPI queries. This is because, based on other settings, the instrument could switch out the low noise path at any time and hence go back to being DC coupled Alignment switching ignores the settings in this menu, and restores them when finished
Dependencies	Does not appear in CXA-m Does not appear in VXT Models M9410A/11A Does not appear in BBIQ and External Mixing

	The **Low Noise Path Enable** selection does not appear unless Option LNP is present and licensed The **µW Preselector Bypass** selection does not appear unless Option MPB is present and licensed The **Full Bypass Enable** selection does not appear unless options LNP and MPB are both present as well as option FBP In any of these cases, if the required options are not present and the SCPI command is sent, error -241, "Hardware missing; Option not installed" is generated **Low Noise Path Enable** and **Full Bypass Enable** are grayed-out if the current measurement does not support them **Low Noise Path Enable** and **Full Bypass Enable** are not supported in Avionics and MMR Modes. In any of these cases (that is, the feature is not supported in either measurement or mode), if the SCPI command is sent, the following error is generated: -221, “Setting Conflict; Feature not supported for this measurement”
Preset	All except modes specified below: `STD` IQ Analyzer, VXA, Pulse and Avionics mode: – MPB option present and licensed: `MPB` – MPB option not present and licensed: `STD`
State Saved	Save in instrument state
Range	Standard Path|Low Noise Path Enable|µW Presel Bypass|Full Bypass Enable
Annotation	In the Meas Bar, if the Standard path is chosen, it says: µW Path: Standard If Low Noise Path is enabled but the LNP switch is not thrown, it shows: µW Path: LNP,Off If the Low Noise Path is enabled and the LNP switch IS thrown, it shows: µW Path: LNP,On If the preselctor is bypassed, it says: µW Path: Bypass If Full Bypass Enable is selected but the LNP switch is not thrown, it shows: µW Path: FByp,Off If Full Bypass Enable is selected and the LNP switch IS thrown, it shows: µW Path: FByp,On

µW Path Control Auto [Mode: VMA, WLAN, NR5G, CQM]

In VMA, WLAN, 5G NR, CQM modes, an Auto/Man switch is added to **µW Path Control**:



This allows the function to automatically switch based on certain Auto Rules as shown below:

VMA Mode

Measurement	When µW Path Control is in Auto:
Digital Demod	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Custom OFDM	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Presel Bypass
SEM	Always Presel Bypass
Spurious Emissions	Always Standard Path

WLAN Mode

Measurement	When µW Path Control is in Auto:
Modulation Analysis	Always Presel Bypass
Spectral Flatness	Always Presel Bypasss
Power vs Time	Always Presel Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Always Presel Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Always Presel Bypass
SEM	1. For 11be 320M, when 'Enabled Wideband IF for FFT' is OFF or 'Sweep Type Rule' is Best Dynamic Range, auto µW path is standard. 2. For other cases, auto µW path is presel bypass if presel bypass is enabled, auto µW path is standard if presel bypass is not enabled.
Spurious Emissions	Always Standard Path

5G NR Mode

Measurement	When µW Path Control is in Auto:
Modulation	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in

Measurement	When µW Path Control is in Auto:
Analysis	which case choose Full Bypass if conditions warrant(FBP Option is available and "Allow Full Bypass in Auto" is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and "Allow Full Bypass in Auto" is On), otherwise choose Preselector Bypass
Channel Power	Always Standard Path
Occupied BW	Always Standard Path
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Standard Path
SEM	Always Standard Path
Spurious Emissions	Always Standard Path
Transmit On|Off Power	Use Standard Path unless tuned frequency > 3.6 GHz and Info BW > 15 MHz, in which case choose Preselector Bypass

Channel Quality Mode

Measurement	When µW Path Control is in Auto:
Group Delay	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and "Allow Full Bypass in Auto" is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass

Remote Command	`[:SENSe]:POWer[:RF]:MW:PATH:AUTO ON | OFF | 1 | 0` `[:SENSe]:POWer[:RF]:MW:PATH:AUTO?`
Example	`:POW:MW:PATH:AUTO ON` `:POW:MW:PATH:AUTO?`
Dependencies	Only appears in VMA, WLAN, 5G NR and CQM modes
Couplings	See the tables above
Preset	ON
Range	ON|OFF

Low Noise Path Enable

You may select **Low Noise Path Enable**, which gives a lower noise floor under some circumstances, particularly when operating in the 21-26.5 GHz region. With the Low Noise Path enabled, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

- The instrument is not in the Low Band, meaning:
- the start frequency is above 3.5 GHz and
- the stop frequency is above 3.6 GHz
- the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Low Noise Path Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Low Noise Path Enable** is selected in the user interface. The only time the Low Noise Path is used is when **Low Noise Path Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

For measurements that use IQ acquisition, the low noise path is used when **Center Frequency** is in High Band (> 3.6 GHz) and no preamp is in use. In other words, the rules above are modified to use only the center frequency to qualify which path to switch in. This is not the case for FFTs in the Swept SA measurement; they use the same rules as swept measurements.

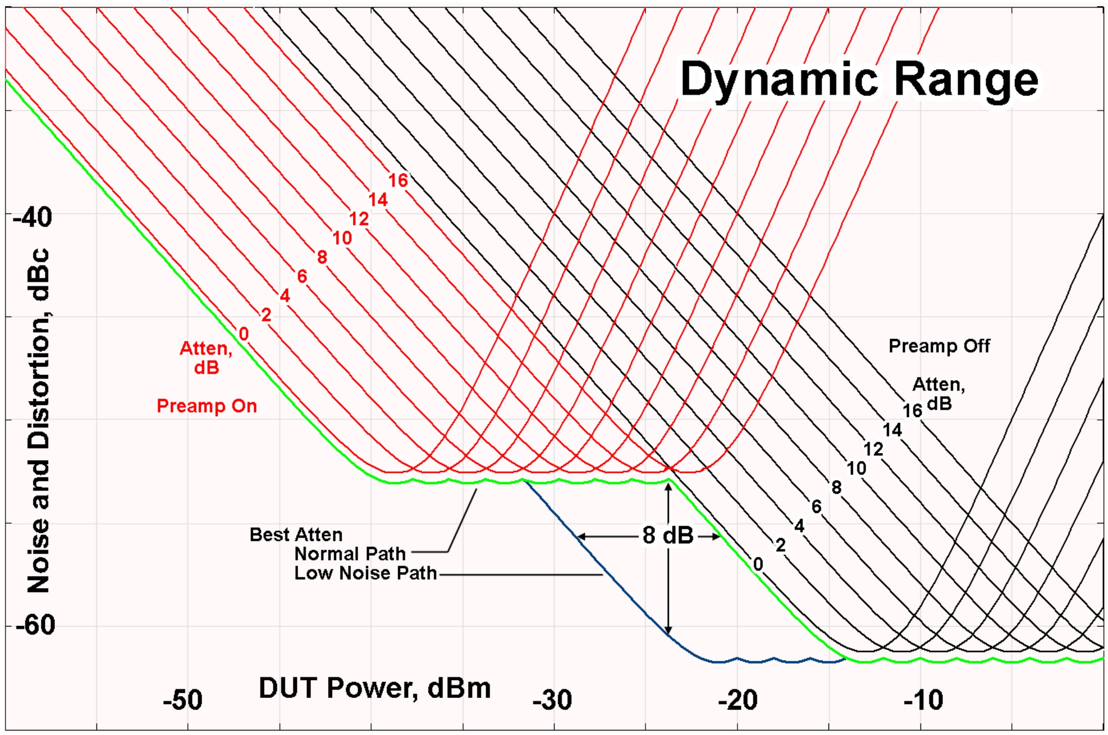
Note that the Low Noise Path, while giving improved DANL, has the disadvantage of decreased TOI performance and decreased gain compression performance relative to the standard path.

Note also that the bypass switch is a mechanical switch and has finite life, so if the **Low Noise Path Enable** is selected, it is possible to cause frequent cycling of this switch by frequently changing instrument settings such that the above conditions hold true only some of the time. A user making tests of this nature should consider opting for the **Standard Path**, which will never throw the bypass switch, at the expense of some degraded noise performance.

The low noise path is useful for situations where the signal level is so low that the instrument performance is dominated by noise even with 0 dB attenuation, but still high enough that the preamp option would have excessive third-order intermodulation or compression. The preamp, if purchased and used, gives better noise floor than does the “Low Noise Path.” However, its compression threshold and third-order intercept are much poorer than that of the non-preamp path.

There are some applications, typically for signals around –30 dBm, for which the third-order dynamic range of the standard path is good enough, but the noise floor is not low enough even with 0 dB input attenuation. When the third-order dynamic range of the preamp path is too little and the noise floor of the standard path is too high, the Low Noise Path can provide the best dynamic range

The graph below illustrates the concept. It shows, in red, the performance of an instrument at different attenuation settings, both with the preamp on and off, in a measurement that is affected by both instrument noise and instrument TOI. The green shows the best available dynamic range, offset by 0.5 dB for clarity. The blue shows how the best available dynamic range improves for moderate signal levels with the low noise path switched in. In this illustration, the preamp improves the noise floor by 15 dB while degrading the third-order intercept by 30 dB, and the low noise path reduces loss by 8 dB. The attenuator step size is 2 dB.



There are other times where selecting the low noise path improves performance, too. Compression-limited measurements such as finding the nulls in a pulsed-RF spectrum can profit from the low noise path in a way similar to the TOI-limited measurement illustrated. Accuracy can be improved when the low noise path allows the optimum attenuation to increase from a small amount like 0, 2 or 4 dB to a larger amount, giving better return loss at the instrument input. Harmonic measurements, such as second and third harmonic levels, are much improved using the low noise path because of the superiority of that path for harmonic (though not intermodulation) distortion performance.

µW Preselector Bypass

Toggles the preselector bypass switch for band 1 and higher. When the microwave presel is on, the signal path is preselected. When the microwave preselector is off, the signal path is not preselected. The preselected path is the normal path for the instrument.

The preselector is a tunable bandpass filter which prevents signals away from the frequency of interest from combining in the mixer to generate in-band spurious signals (images). The consequences of using a preselector filter are its limited bandwidth, the amplitude and phase ripple in its passband, and any amplitude and phase instability due to center frequency drift.

Option MPB or pre-selector bypass provides an unpreselected input mixer path for certain X-Series signal analyzers with frequency ranges above 3.6 GHz. This signal path allows a wider bandwidth and less amplitude variability, which is an advantage when doing modulation analysis and broadband signal analysis. The disadvantage is that, without the preselector, image signals will be displayed. Another disadvantage of bypassing the preselector is increased LO emission levels at the front panel input port.

Image responses are separated from the real signal by twice the 1st IF. For IF Paths of 10 MHz and 25 MHz, the 1st IF is 322.5 MHz, so the image response and the real signal will be separated by 645 MHz. The 1st IF will be different for other IF Path settings. When viewing a real signal and its corresponding image response in internal mixing, the image response will be to the left of the real signal.

Also, the image response and the real signal typically have the same amplitude and exhibit the same shape factor.

However, if Option FS1, Fast Sweep Capability, is enabled, the image response in the Swept SA measurement appears lower in amplitude and has a much wider shape factor compared to the real signal.

Full Bypass Enable

With **Full Bypass Enable** selected, the microwave preselector is bypassed. In addition, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

- The instrument is not in the Low Band, meaning:
- the start frequency is above 3.5 GHz and
- the stop frequency is above 3.6 GHz.
- the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. The only time the Low Noise Path is used is when **Full Bypass Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

CAUTION When **Full Bypass Enable** is selected, and "Attenuation" on page 1747 is set to 0 dB, there will be a direct AC connection between the input and the first converter

when the Low Noise Path switches in (when Start Freq >3.6 GHz and the Preamp is either not licensed, set to Low Band, or Off). This puts the first converter at high risk to be damaged by high AC power. Consequently, whenever **Full Bypass Enable** is selected, a warning message appears in the status bar:

Full Bypass Enabled, maximum safe input power reduced

Microwave Preselector Bypass Backwards Compatibility

Example	`:POW:MW:PRES OFF` Bypasses the microwave preselector
Notes	Included for Microwave Preselector Bypass backwards compatibility The `ON` parameter sets the `STD` path (`:POW:MW:PATH STD`) The `OFF` parameter sets path `MPB` (`:POW:MW:PATH MPB`)
Preset	`ON`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe] ON | OFF | 0 | 1` `[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe]?`

Frequency Extender Preselection Bypass

Frequency Extender Preselection Bypass only applies to the high frequency path of the Frequency Extender and only if the Frequency Extender allows it. For example, the V3050A high frequency path is 50 – 110 GHz and does allow control of the preselector bypass.

When the Frequency Extender's preselection is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. For bandwidths greater than 2.5 [GHz], it is recommended that the signal bypass the Frequency Extender Preselector since the max bandwidth of the Preselector can be as narrow as 2.5 [GHz].

For most applications, the preset state is `OFF`, which gives the best remote-control throughput, minimizes acoustic noise from switching, minimizes out of band spurs, and minimizes the risk of wear in the hardware switches.

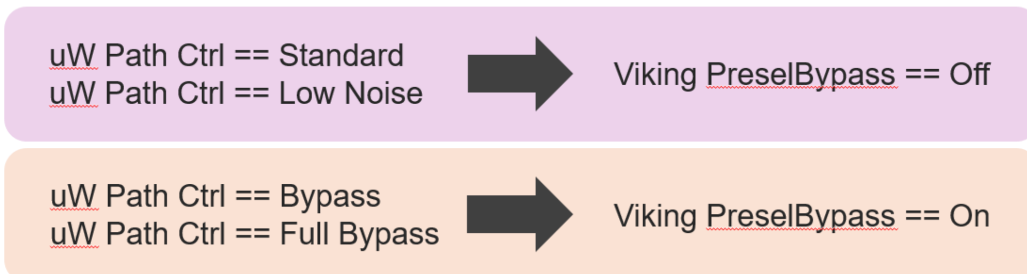
Coupling with Microwave Preselector Control

The control of whether to apply or bypass the Frequency Extender's preselection is dependent on the Microwave Path Control setting.

The coupling between the Microwave Path Control and Frequency Extender Preselector Bypass is described below.

UW PATH CTRL	UW PRESELECTOR	VIKING PRESELECTOR
Standard Path	On	**On**
Low Noise Path Enable	On	**On**
uW Presel Bypass	Off	**Off**
Full Bypass Enable	Off	**Off**

In other words…



For the Frequency Extender Preselector Bypass to take effect, it requires a Frequency Extender device (such as V3050A) be connected and External RF (ERFIN) selected as the input.

The Frequency Extender Preselector is applied or bypassed depending on the Microwave Path Control setting only when the acquisition is above 50 [GHz]. Hence, it will be bypassed only when the acquisition is above 50 [GHz].

Preselector and Bandwidth Conflict

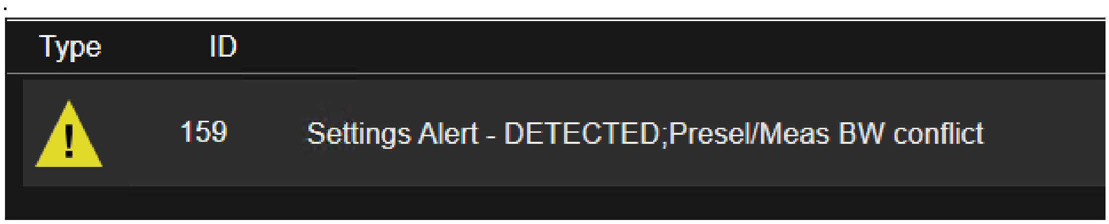
When the Frequency Extender Preselector is applied and the signal bandwidth is greater than 2.5 [GHz], then a settings alert message will show to warn the user that the signal may be distorted due to the limitation of the Frequency Extender Preselector bandwidth.

An example of the settings alert message is shown below.

Settings Alert message in the Status Bar at the bottom of the display.

Settings Alert message in the error queue

.



Software Preselection

Software Preselection is provided in some instruments, either to compensate for issues with provided hardware preselection or to provide the preselection function when there is no hardware preselector.

N9041B

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 50 GHz, software preselection must be used to suppress and separate images above 50 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

In the N9041B, Software Preselection only applies for frequencies above 50 GHz, therefore it is only used for RF Input 2. Even if it is turned on, it will not be used for other inputs and never for frequencies below 50 GHz. This is why the label of this control contains the parenthetical note “(>~50 GHz)”.

Note that in the N9041B, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

N9042B+V3050A

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 88 GHz, software preselection must be used to suppress and separate images above 88 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

For N9042B+V3050A, Software Preselection only applies for frequencies above 88 GHz, therefore it is only used for External RF. Even if it is turned on, it will not be used for other inputs and never for frequencies below 88 GHz. This is why the label of this control contains the parenthetical note “(>~88 GHz)”.

Note that for N9042B+V3050A, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

VXT models M9410A/11A

Software Preselection is used to provide the preselection function, as there is no hardware preselector in these models. Two background traces are taken and compared point by point, and the point with the lowest amplitude from the two traces is used. This provides a method to reduce spurs that are internally generated within the VXT, but the user should note the following when using Software

Preselection:

- There is some speed cost due to the need to take multiple captures
- Taking the point with the lowest amplitude in each trace will make the average noise level lower at all points that do not have a spur. This can reduce the accuracy of the measurement of noise and noise-like signals.

Because of the difficulty in identifying spurs manually, you are encouraged to leave Software Preselection ON at all times in VXT models M9410A/11A. If you turn it off in order to speed up your measurement or improve noise accuracy, be aware of unwanted onscreen spurs.

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel:STATe 0 | 1 | ON | OFF` `[:SENSe]:POWer[:RF]:SWPresel:STAT?`
Example	`:POW:SWPR:STAT 1` `:POW:SWPR:STAT?`
Dependencies	Only appears in N9041B, N9042B+V2050A, and VXT models M9410A/11A. Does not appear in all measurements
Couplings	Sweep Time is affected by SW Preselection. Also Auto Tune supports SW Preselection, so set SW Preselection state and then do Auto Tune
Preset	N9041B: OFF N9042B+V3050A: ON M9410A/11A: ON
State Saved	Saved in instrument state

SW Preselection Type

Specifies the algorithm used for software preselection.

Two hidden sweeps are taken in succession. The second sweep is offset in LO frequency by 2*IF/N. For each point in each trace, the smaller amplitude from the two traces is taken and placed in that point in the selected trace. The Peak detector is auto-selected to improve the image suppression effectiveness. Responses of each trace that lie on top of one another will remain and are valid signals. Other signals are images and are suppressed. The action of taking the smaller of the two traces will make the average noise level lower in all points that do not have an image, thus reducing the accuracy of the measurement of noise and noise-like signals.

- `NORMal` - mathematically removes all image and multiple responses of signals present at the input
- `ADVanced` - any trace processing (such as “max hold” or trace averaging) is performed on the points of both candidate traces before the “select minimum” operation occurs. This form of processing works better for non-stationary signals, such as pulsed-RF signals

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel NORMal | ADVanced` `[:SENSe]:POWer[:RF]:SWPResel?`
Example	`:POW:SWPR NORM` `:POW:SWPR?`
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed-out. Its grayout message is “Unavailable unless SW Presel enabled”
Preset	N9041B: `ADVanced` N9042B+V3050A: `NORMal`
State Saved	Saved in instrument state

SW Preselection BW

Specifies the effective bandwidth to be used for Software Preselection.

The choices are:

- `NORMal` – when making Swept measurements, a software preselection algorithm is used which takes up to 4 background acquisitions, then post-processes the result. This algorithm can remove images from signals with an occupied bandwidth up to around 3 GHz. (Default/Preset setting). When making FFT measurements, this algorithm is not used, instead the same algorithm is used as for `NARRow` (below)
- `NARRow`– a software preselection algorithm is used which takes two background acquisitions, then post-processes the result to detect and remove images from wideband signals with occupied bandwidths up to 2 GHz. This increases the risk of images failing to be rejected, but improves the measurement speed

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel:BW NORMal | NARRow` `[:SENSe]:POWer[:RF]:SWPResel:BW?`
Example	`:POW:SWPR:BW NARR`
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed out. Its grayout message is “Unavailable unless SW Presel enabled” For N9042B+V3050A the parameter is SCPI only and always set to `NARRow` when Software Preselection is enabled
Preset	N9041B: `NORMal` N9042B+V3050A: `NARRow`
State Saved	Saved in instrument state

High Freq Prefilter

Lets you set the state of Prefilter for Center Frequencies above 1310 MHz.

In VXT Models M9410A/11A, the Receiver RF path has a bank of filters that come after the RF Attenuator in the signal path. Since this bank of filters precedes the mixer they are known as the “Prefilter” bank. Their purpose is to eliminate unwanted in-band mixing products by filtering out all but the desired frequencies before the signals get to the mixer. There are 13 prefilter bands to cover the frequencies between 9 kHz and 6000 MHz. The Prefilter provides the necessary rejection of the unwanted signal.

Remote Command	`[:SENSe]:<measurement>:PFILter[:STATe] ON | OFF | 1 | 0` `[:SENSe]:<measurement>:PFILter[:STATe]?`

Example	For example, to enable High Freq Prefilter in IQ Analyzer Mode:
	For the Complex Spectrum Measurement:
	`:SPEC:PFIL ON`
	For the IQ Waveform Measurement:
	`:WAV:PFIL ON`
	`:`

Dependencies	This control only appears in VXT models M9410A/11A with center frequency above 1310 MHz
Preset	See “Prefilter Presets” below
State Saved	Saved in instrument state

Prefilter Presets

Meas	Mode	Preset
SPEC	BASIC	OFF
WAV	BASIC, WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
MON	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
RHO	WCDMA	OFF
CDP	WCDMA	OFF
PCON	WCDMA	OFF
EVMQ	WCDMA	OFF
CHP	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
OBW	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
ACP	WCDMA, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
SEM	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PST	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PVT	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF
EVM	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF

Meas	Mode	Preset
FLAT	WLAN	OFF
EVMM	WLAN	OFF
CEVM	LTEAFDD, LTEATDD	OFF
PAVT	5GNR, VMA	OFF
DDEM	VMA	OFF
OFDM	VMA	OFF
SAN	SA	ON
HARM	SA	ON

3.6.4 BW

The BW key opens the bandwidth menu, which contains controls for the Resolution Bandwidth functions of the instrument.

The Resolution BW functions control filter bandwidth and filter type. There are two filter types, Gaussian and Flattop. The Gaussian filters have a response curve that is parabolic on a log scale. The Flattop filter shape is a close approximation of a rectangular filter.

3.6.4.1 Settings

The Settings tab contains the basic Bandwidth functions. It is the only tab under Bandwidth.

Info BW

Enables you to specify the information bandwidth for the instrument. This is used to set the hardware filter of the ADC.

Remote Command	`[:SENSe]:EVMQpsk:BANDwidth[:RESolution] <freq>` `[:SENSe]:EVMQpsk:BANDwidth[:RESolution]?`
Example	`:EVMQ:BAND 1 kHz` `:EVMQ:BAND?`
Preset	6 MHz
State Saved	Yes
Min	1 kHz
Max	Hardware Dependent RF Input: – No Option = 10 MHz – WB (25 MHz) = 25 MHz

	– WB (wider than 25 MHz) = 30 MHz I/Q Input (for I+jQ): – No Option = 20 MHz – OptionB25 = 30 MHz
Backwards Compatibility SCPI	[:SENSe]:EVMQpsk:BWIDth[:RESolution]

Info BW Filter Type

Selects the type for the information bandwidth filters from either Gaussian or Flat Top filter shape, for varying measurement conditions.

For more information, see the RBW Filter Type control description for the Swept SA measurement.

Remote Command	[:SENSe]:EVMQpsk:BANDwidth:SHAPe GAUSsian | FLATtop [:SENSe]:EVMQpsk:BANDwidth:SHAPe?
Example	:EVMQ:BAND:SHAP GAUS :EVMQ:BAND:SHAP?
Notes	GAUSsian= Gaussian FLATtop = Flattop
Preset	Auto Couple chooses the preset value
State Saved	Saved in instrument state
Annotation	The annotation under RBW in the bottom left of the screen shows the type of filter or bandwidth that is being used. The following examples illustrate this:

–3 dB (Normal) filter BW:	Res BW 300 Hz
–6 dB filter BW:	Res BW (–6 dB) 422 Hz
Noise filter BW:	Res BW (Noise) 317 Hz
Impulse filter BW:	Res BW (Impulse) 444 Hz
CISPR filter BW:	Res BW (CISPR) 200 Hz
MIL filter BW:	Res BW (MIL) 1 kHz
Flattop filter type:	Res BW (Flattop) 300 Hz

Backwards Compatibility SCPI	[:SENSe]:EVMQpsk:BWIDth:SHAPe

3.6.5 Display

The Display Menu lets you configure display items for the current Mode, Measurement View or Window.

3.6.5.1 Meas Display

The Meas Display tab contains controls for setting up the display for the current Measurement, View or Window.

I/Q Polar Vec/Constln

Specifies the format of the polar vector graph display. The following display options are available:

– Vector and Constellation

– Vector Only

– Constellation Only

Remote Command	:DISPlay:EVMQpsk:WINDow2:TRACe:POLar VC | VECTor | CONStln :DISPlay:EVMQpsk:WINDow2:TRACe:POLar?
Example	:DISP:EVMQ:WIND2:TRAC:POL VECT :DISP:EVMQ:WIND2:TRAC:POL?
Notes	Allows to specify the format of the polar vector graph display by: – Vector and Constellation – Vector Only – Constellation Only
Preset	VC
State Saved	Yes
Range	Vec & Constln|Vector|Constellation
Backwards Compatibility SCPI	:DISPlay:EVMQpsk:VIEW[1]:WINDow2:TRACe:POLar

Chip Offset

Sets the chip offset number from the first chip in a measured signal.

Remote Command	`:DISPlay:EVMQpsk:WINDow2:TRACe:COFFset <integer>` `:DISPlay:EVMQpsk:WINDow2:TRACe:COFFset?`
Example	`:DISP:EVMQ:WIND2:TRAC:COFF 1001` `:DISP:EVMQ:WIND2:TRAC:COFF?`
Notes	The number of chip offset from the first chip in a measured signal
Preset	0
State Saved	Yes
Min/Max	0/Meas Interval – I/Q Chips
Backwards Compatibility SCPI	`:DISPlay:EVMQpsk:VIEW[1]:WINDow2:TRACe:COFFset`

I/Q Chips

Specifies the number of I/Q chips used to display the I/Q waveforms.

Remote Command	`:DISPlay:EVMQpsk:WINDow2:TRACe:IQCHips <integer>` `:DISPlay:EVMQpsk:WINDow2:TRACe:IQCHips?`
Example	`:DISP:EVMQ:WIND2:TRAC:IQCH 1001` `:DISP:EVMQ:WIND2:TRAC:IQCH?`
Couplings	This parameter is dependent on Meas Interval and cannot be set to a value greater than Meas Interval
Preset	WCDMA: 2560
State Saved	Yes
Min/Max	1/5120
Backwards Compatibility SCPI	`:DISPlay:EVMQpsk:VIEW[1]:WINDow2:TRACe:IQCHips`

Interpolation

Toggles the interpolation function from On to Off. If set to On, the vector lines between chip dots are converted into smooth curves by the interpolation function.

Remote Command	`:DISPlay:EVMQpsk:WINDow2:TRACe:INTPolation[:STATe] OFF | ON | 0 | 1` `:DISPlay:EVMQpsk:WINDow2:TRACe:INTPolation[:STATe]?`
Example	`:DISP:EVMQ:WIND2:TRAC:INTP ON` `:DISP:EVMQ:WIND2:TRAC:INTP?`
Notes	If set to ON, the vector lines between chip dots are converted into smoothened curves by the interpolation function
Preset	`OFF`

State Saved	Yes
Range	OFF|ON
Backwards Compatibility SCPI	:DISPlay:EVMQpsk:VIEW[1]:WINDow2:TRACe:INTPolation[:STATe]

+45° Rotation

Toggles the state of the rotation of the I/Q polar trace. If set to On, the I/Q polar trace is rotated by 45 degrees to provide a rectangular display.

Remote Command	:DISPlay:EVMQpsk:WINDow2:TRACe:ROTQpi[:STATe] OFF | ON | 0 | 1 :DISPlay:EVMQpsk:WINDow2:TRACe:ROTQpi[:STATe]?
Example	:DISP:EVMQ:WIND2:TRAC:ROTQ ON :DISP:EVMQ:WIND2:TRAC:ROTQ?
Notes	Enables you to toggle whether the I/Q polar trace is rotated by 45 degrees to provide a rectangular display
Preset	OFF
State Saved	Yes
Range	OFF|ON
Backwards Compatibility SCPI	:DISPlay:EVMQpsk:VIEW[1]:WINDow2:TRACe:ROTQpi[:STATe]

Full Vector

Toggles the gray background from On to Off when displaying the full measured trace or the selected vector on the display.

Remote Command	:DISPlay:EVMQpsk:WINDow2:TRACe:FVECtor[:STATe] OFF | ON | 0 | 1 :DISPlay:EVMQpsk:WINDow2:TRACe:FVECtor[:STATe]?
Example	:DISP:EVMQ:WIND2:TRAC:FVEC ON :DISP:EVMQ:WIND2:TRAC:FVEC?
Notes	This is useful when you want to observe the full vector and the selected vector set by I/Q Chips and Chip Offset simultaneously
Preset	OFF
State Saved	Yes
Range	OFF|ON
Backwards Compatibility SCPI	:DISPlay:EVMQpsk:VIEW[1]:WINDow2:TRACe:FVECtor[:STATe]

3.6.5.2 View

Contains controls for selecting the current **View**, and for editing User Views.

Views

The table below shows the Views and Windows used for this Measurement.

These Views are multiple-window Views and you select a window by touching it. The menu controls may sometimes change depending on which window is selected.

Whenever the View changes, the default menu is Frequency, unless otherwise specified in the View description.

View	Result
I/Q Measured Polar Graph	I/Q Measured Polar Graph
	Metrics
I/Q Error	Mag Error Graph
	Phase Error Graph
	EVM Graph
	Small-sized Metrics

The following remote commands are available for view selection:

View Selection by Name

Selects the format for the measurement results view.

Remote Command	`:DISPlay:EVMQpsk:VIEW[:SELect] POLar | ERRor` `:DISPlay:EVMQpsk:VIEW[:SELect]?`
Example	`:DISP:EVMQ:VIEW ERR` `:DISP:EVMQ:VIEW?`
Couplings	Changing parameter of "ViewNum" (`:DISPlay:EVMQpsk:VIEW:NSELect`) also changes this parameter
Preset	`POLar`
State Saved	Yes
Range	I/Q Measured Polar Graph|I/Q Error

View Selection by Number

Displays the numeric values of the measurement results.

Remote Command	`:DISPlay:EVMQpsk:VIEW:NSELect <integer>` `:DISPlay:EVMQpsk:VIEW:NSELect?`

Example	`:DISP:EVMQ:VIEW:NSEL 2` `:DISP:EVMQ:VIEW:NSEL?`
Couplings	Changing parameter of "View" (:DISPlay:EVMQpsk:VIEW[:SELect]) also changes this parameter
Preset	1
State Saved	Yes
Min/Max	1/2

I/Q Measured Polar Graph

Windows: "I/Q Measured Polar Graph" on page 713, "Metrics" on page 713

Combination view of the I/Q demodulated signals using vector lines to connect the chip dots.

Example	`:DISP:EVMQ:VIEW POL`

I/Q Error

Windows: "Mag Error Graph" on page 714, "Phase Error Graph" on page 714, "EVM Graph" on page 714, "Small-sized Metrics" on page 715

Provides a combination view. This view consists of the above four windows.

User View

Lets you choose a View from the saved User Views for the current measurement. This panel only appears if a User View exists for the current measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:SELect <alphanumeric>` `:DISPlay:VIEW:ADVanced:SELect?`
Example	Select Baseband as the current View `:DISP:VIEW:ADV:SEL “Baseband”`
Notes	You must be in the measurement whose View you are trying to set to send the command. You can only set Views for the current measurement using this command For predefined views, the parameter is derived from the view name that is shown in the View list in the user interface. For example, if you are trying to select the Trace Zoom view in the Swept SA measurement, you send: `:DISP:VIEW:ADV:SEL "Trace Zoom"` because “Trace Zoom” is the name of the View as seen in the Mode/Meas dialog or in the Display, View menu You *cannot* use the legacy View parameter (which in this case would be `TZOom`) with `:DISP:VIEW:ADV:SEL`

	<alphanumeric> is case insensitive; you can specify mixed case, however the name will be evaluated on a single case. Thus, both of the following forms work:
	`:DISP:VIEW:ADV:SEL "Trace Zoom"`
	`:DISP:VIEW:ADV:SEL "TRACE ZOOM"`
	If the specified view is not a valid View, the query returns the error message "-224, Illegal parameter value; View with the name <alphanumeric> does not exist"
	If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Backwards Compatibility SCPI	The legacy node `:DISPlay:VIEW[:SELect]` is retained for backwards compatibility, but it only supports predefined views

Restore Layout to Default

Restores the Layout to the default for Basic.

Modified Views are very temporary; if you exit the current measurement they are discarded, and they are not saved in State. To retain this View for later use, and to be able to return easily to your original Basic View, you can save your edited View as a "User View".

Save Layout as New View

Saves your new View as a User View. An alpha keyboard appears, which lets you name your new View; the default is the old View name plus a number.

Remote Command	`:DISPlay:VIEW:ADVanced:NAME <alphanumeric>`
Example	`:DISP:VIEW:ADV:NAME "Baseband"` Creates a new View named `Baseband` from the current View, and selects it as the current View
Notes	<alphanumeric> is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If <alphanumeric> name already exists as a View, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; User View SCPI cannot be used while Display is disabled" is generated

Re-Save User View

You can re-edit a User View; if you make changes, then an asterisk will appear next to the User View's name. You can then tap **Re-Save User View** to save it back to its existing name, or **Save Layout as New View** to add another, new User View.

This is a front panel function only, there is no remote command available to perform this function. To do this remotely, you must first perform **Save Layout as New View**, then delete the old User View and rename the new one with the name of the View you just deleted.

Rename User View

You can rename the current View by giving it a new unique name. Only User Views can be renamed, if the current View is a Predefined View, an error occurs.

Remote Command	`:DISPlay:VIEW:ADVanced:REName <alphanumeric>`
Example	`:DISP:VIEW:ADV:REN "Baseband"`
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the `<alphanumeric>` specifying the new name is already present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot rename a Predefined View" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete User View

You can delete the current View if it is a User View. The default view becomes the current view for the Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:DELete`
Example	`:DISP:VIEW:ADV:DEL`
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the `<alphanumeric>` is not present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> does not exist" is generated If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot delete a Predefined View" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete All User Views

Deletes all previously saved User Views. The default view becomes the current view for the Measurement if a User View was the current view when this command was executed.

Remote Command	`:DISPlay:VIEW:ADVanced:DELete:ALL`
Example	`:DISP:VIEW:ADV:DEL:ALL`
Notes	Disabled if there are no User Views

View Editor Remote Commands

The following remote commands help you manage Views and User Views. Note that the SCPI node for User Views handles both Predefined and User Views. The legacy nodes, `:DISPlay:VIEW[:SELect]` and `:DISPlay:VIEW:NSEL`, are retained for backwards compatibility, but they only support predefined views.

View Listing Query

Returns a string containing a comma-separated list of names for *all* the Views, including User Views, available for the current Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:CATalog?`
Example	`:DISP:VIEW:ADV:CAT?`
Notes	Returns a quoted string of the available Views for the current measurement, separated by commas. The list includes names for *all* the Views, including User Views, available for the current Measurement Example: `"Normal,Trace Zoom,Spectrogram,Baseband,myView1,yourView1"` No distinction is made between Predefined and User Views If you switch measurements with the display disabled (via `:DISP:ENAB OFF`), then query the list of available Views, the result is undefined

User View Listing Query

Returns a string containing a comma-separated list of names for *only* the User Views available for the current Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:USER:CATalog?`
Example	`:DISP:VIEW:ADV:USER:CAT?`
Notes	Returns a quoted string of the available User Views for the current measurement, separated by commas. Example: `"Baseband,myView1,yourView1"` If you switch measurements with the display disabled (see "Display Enable (Remote Command Only)" on page 1894), then query the list of available Views, the result is undefined

3.6.5.3 Annotation

Contains controls for setting up the annotation for the current Mode or Measurement.

Graticule

Turns the display graticule On or Off for all windows with graticules in all measurements in the current Mode. Also turns the graticule Y-Axis annotation on and off.

Remote Command	`:DISPlay:GRATicule[:STATe] OFF | ON | 0 | 1` `:DISPlay:GRATicule[:STATe]?`
Example	`:DISP:GRAT OFF`
Notes	The graticule is the set of horizontal and vertical lines that make up the grid/divisions for the X-Axis and Y-Axis
Preset	`ON`
State Saved	Saved in instrument state

Backwards Compatibility SCPI	`:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe] OFF | ON | 0 | 1`
	`:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe]?`
	This command is accepted for backwards compatibility with older instruments, but the `WINDow`, `TRACe` and `GRID` parameters are ignored

Screen Annotation

Controls the display of the annunciation and annotation around the graticule, including any annotation on lines (such as the display line, the threshold line, etc.) and the Y-Axis annotation, for all windows with screen annotation in all measurements in the current Mode.

This does *not* include marker annotation (or the N dB result). When `OFF`, the graticule expands to fill the entire graticule area, leaving only the 1.5% gap above the graticule, as described in the **Trace** section.

Remote Command	`:DISPlay:ANNotation:SCReen[:STATe] OFF | ON | 0 | 1` `:DISPlay:ANNotation:SCReen[:STATe]?`
Example	`:DISP:ANN:SCR OFF`
Dependencies	Grayed-out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Trace Annotation

Turns on and off the labels on the traces, showing their detector (or their Math Mode) as described in the **Trace** section, for all windows in all measurements in the current Mode for which Trace Annotation on/off is supported.

If Trace Math is being performed on a trace, then the Trace Math annotation replaces the detector annotation.

For measurements that support limit lines, this key also turns on and off the labels on the Limit Lines. The label is the Limit number annotation and Limit Comment displayed on the graph. If the length of the comment is greater than 20 characters, the first 8 characters and the last 8 characters are displayed, joined with ….

Remote Command	`:DISPlay:ANNotation:TRACe[:STATe] ON | OFF | 1 | 0` `:DISPlay:ANNotation:TRACe[:STATe]?`
Example	`:DISP:ANN:TRAC OFF`
Preset	`OFF`
State Saved	Saved in instrument state

Control Annotation

Turns on and off the display of values on the Active Function controls for all measurements in the current Mode. This is a security feature.

Remote Command	`:DISPlay:ACTivefunc[:STATe] ON | OFF | 1 | 0` `:DISPlay:ACTivefunc[:STATe]?`
Example	`:DISP:ACT OFF`
Dependencies	Grayed out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Meas Bar

Turns the Measurement Bar at the top of the screen on and off for all measurements in the current Mode. When `OFF`, the graticule area expands to fill the area formerly occupied by the Measurement Bar.

Remote Command	`:DISPlay:ANNotation:MBAR[:STATe] OFF | ON | 0 | 1` `:DISPlay:ANNotation:MBAR[:STATe]?`
Example	`:DISP:ANN:MBAR OFF`
Dependencies	Grayed out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`

Preset	ON This remains OFF through a Preset when **System Display Settings**, **Annotation** is set to OFF
State Saved	Saved in instrument state

Display Enable (Remote Command Only)

Turns the display on/off, including the display drive circuitry. The backlight stays lit to confirm that the instrument is on. The display enable setting is mode global. Theare three reasons for turning the display off:

1. To increase speed as much as possible by freeing the instrument from having to update the display
2. To reduce emissions from the display, drive circuitry
3. For security purposes

If you have turned off the display:

– and you are in local operation, the display can be turned back on by pressing any key or by sending `:SYSTem:DEFaults MISC` or `:DISPlay:ENABle ON` (neither `*RST` nor :SYSTem:PRESet enable the display)

– and you are in remote operation, the display can be turned back on by pressing the **Local** or **Esc** keys, or by sending `:SYSTem:DEFaults MISC` or `:DISPlay:ENABle ON` (neither `*RST` nor `:SYSTem:PRESet` enable the display)

– and you are using either the `:SYSTem:KLOCk` command or GPIB local lockout, then *no* front-panel key press will turn the display back on. You must turn it back on remotely.

If the display is `OFF`, many SCPI commands related to User Views and Multiscreen functionality do not work, and return the error messages "-221, Settings conflict; Screen SCPI cannot be used when Display is disabled" or "221, Settings conflict; View SCPI cannot be used while Display is disabled". These commands include:

Name	Command
Select User View	:DISPlay:VIEW:ADVanced:SELect
Rename User View	:DISPlay:VIEW:ADVanced:REName
Delete User View	:DISPlay:VIEW:ADVanced:DELete
Create User View	:DISPlay:VIEW:ADVanced:NAME
Select Screen	:INSTrument:SCReen:SELect
Delete Screen	:INSTrument:SCReen:DELete
Delete All But This Screen	:INSTrument:SCReen:DELete:ALL
Add Screen	:INSTrument:SCReen:CREate
Rename Screen	:INSTrument:SCReen:REName
Sequencer On/Off	:SYSTem:SEQuencer

Remote Command	:DISPlay:ENABle OFF | ON | 0 | 1 :DISPlay:ENABle?
Example	:DISP:ENAB OFF
Couplings	:DISP:ENAB OFF turns Backlight OFF and :DISP:ENAB ON turns Backlight ON, but changing Backlight settings does *not* change the state of :DISP:ENAB
Preset	ON Set by :SYST:DEF MISC, but not affected by *RST or :SYSTem:PRESet
State Saved	Not saved in instrument state
Backwards Compatibility Notes	:SYST:PRES no longer turns on :DISPlay:ENABle as it did in legacy analyzers

3.6.6 Freq

The Freq key opens the Frequency menu, which contains controls that allow you to control the Frequency and Channel parameters of the instrument.

Some features in the Frequency menu are the same for all measurements in the current Mode – they do not change as you change measurements. Settings like these are called "Meas Global" and are unaffected by Meas Preset. For example, the Center Freq setting is the same for all measurements - it does not change as you change measurements.

3.6.6.1 Settings

The Settings Tab contains controls that pertain to the X axis parameters of the measurement. These parameters control how data on the vertical (X) axis is displayed and control instrument settings that affect the horizontal axis.

Center Frequency

Sets the frequency that corresponds to the horizontal center of the graticule. While adjusting the Center Frequency the Span is held constant.

The center frequency setting is the same for all measurements within a mode, that is, it is Meas Global. Some modes are also able to share a Mode Global center frequency value. If this is the case, the Mode will have a Global tab in its Meas Setup menu.

The Center Freq function sets (and queries) the Center Frequency for the currently selected input. If your instrument has multiple inputs, and you select another input, the Center Freq changes to the value for that input. SCPI commands are available to directly set the Center Freq for a specific input.

Center Freq is remembered as you go from input to input. Thus you can set a Center Freq of 10 GHz with the RF Input selected, change to BBIQ and set a Center Freq of

20 MHz, then switch to External Mixing and set a Center Freq of 60 GHz, and when you go back to the RF Input the Center Freq will go back to 10 GHz; back to BBIQ and it is 20 MHz; back to External Mixing and it is 60 GHz.

– See "RF Center Freq" on page 778

– See "Ext Mix Center Freq" on page 779

– See "I/Q Center Freq" on page 780

– See "Center Frequency Presets" on page 776

Remote Command	`[:SENSe]:FREQuency:CENTer <freq>` `[:SENSe]:FREQuency:CENTer?`

Example	`:FREQ:CENT 50 MHz`
	sets Center Frequency to 50 MHz
	`:FREQ:CENT UP`
	increments the Center Frequency by the value of CF Step
	`:FREQ:CENT?`
	returns the current value of Center Frequency

Notes	This command sets the RF, External Mixing or I/Q Center Frequency depending on the selected input For RF input it is equivalent to `:FREQ:RF:CENT` For I/Q input it is equivalent to `:FREQ:IQ:CENT` For External Mixer it is equivalent to `:FREQ:EMIX:CENT` Preset and Max values are dependent on Hardware Options (5xx) If no terminator (e.g. MHz) is sent the terminator Hz is used. If a terminator with unit other than Frequency is used, an invalid suffix error message is generated
Preset	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 776 and "RF Center Freq" on page 778 and "Ext Mix Center Freq" on page 779 and "I/Q Center Freq" on page 780
State Saved	Saved in instrument state
Min	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 776 and "RF Center Freq" on page 778 and "Ext Mix Center Freq" on page 779 and "I/Q Center Freq" on page 780
Max	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 776 and "RF Center Freq" on page 778 and "Ext Mix Center Freq" on page 779 and "I/Q Center Freq" on page 780
Status Bits/OPC dependencies	Non-overlapped

Center Frequency Presets

The following table provides the Center Frequency Presets for the Spectrum Analyzer mode, and the Max Freq, for the various frequency options:

Freq Option	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
503 (all but CXA)	1.805 GHz	3.6 GHz	3.7 GHz
503 (CXA)	1.505 GHz	3.0 GHz	3.08 GHz
507 (all but CXA)	3.505 GHz	7.0 GHz	7.1 GHz
507 (CXA)	3.755 GHz	7.5 GHz	7.58 GHz
508 (all but MXE)	1.805 GHz	3.6 GHz	8.5 GHz
508 (MXE)	4.205 GHz	8.4 GHz	8.5 GHz
513	6.805 GHz	13.6 GHz	13.8 GHz
526 (except CXA and MXE)	13.255 GHz	26.5 GHz	27.0 GHz*
526 (CXA)	13.255 GHz	26.5 GHz	26.55 GHz
526 (MXE)	1.805 GHz	3.6 GHz	27.0 GHz
532	16.005 GHz	32.0 GHz	32.5 GHz
540	20.005 GHz	40.0 GHz	40.5 GHz
543	21.505 GHz	43.0 GHz	43.0 GHz
544	22.005 GHz	44.0 GHz	45.0 GHz
550	25.005 GHz	50.0 GHz	52 GHz
F03 (CXA-m)	1.505 GHz	3.0 GHz	3.08 GHz
F07 (CXA-m)	3.755 GHz	7.5 GHz	7.575 GHz
F13 (CXA-m)	6.805 GHz	13.6 GHz	13.8 GHz
F26 (CXA-m)	13.255 GHz	26.5 GHz	26.55 GHz
504 (M9420A/21A, M8920A)	2.145 GHz	3.88GHz	3.88 GHz
506 (M9420A/21A, M8920A)	3.245 GHz	6.08GHz	6.08 GHz
F06 (M9410A/11A)	1.0 GHz	6.08 GHz	6.08 GHz
F06 (M9415A)	1 GHz	1.08 GHz	6.6 GHz
F08 (M9415A)	1 GHz	1.08 GHz	8.6 GHz
F12 (M9415A)	1 GHz	1.08 GHz	12.9 GHz

*For option 526, the Max CF in RTSA is 26.999999995 GHz.

N9041B Center Freq Presets

Input	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
Input 1, all models	25.005 GHz	50.0 GHz	52 GHz
Input 2, opt 585	42.505 GHz	85.0 GHz	86 GHz
Input 2, opt 590	45.005 GHz	90.0 GHz	92 GHz
Input 2, opt 5CX	55.005 GHz	110.0 GHz	110 GHz

Input 2, CXA and MXE

Model	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
CXA opt C75	0.7505 GHz	1.5 GHz	1.58 GHz
MXE	505 MHz	1 GHz	1.000025 GHz

Tracking Generator Frequency Limits (CXA only)

Tracking Generator Option	Min Freq (clips to this freq when turn TG on and can't tune below while TG on)	If above this Freq, Stop Freq clipped to this Freq when TG turned on	Max Freq (can't tune above) while TG on
T03	9 kHz	3.0 GHz	3.08 GHz
T06	9 kHz	6.0 GHz	6.05 GHz

Tracking Generator Frequency Limits(CXA-m only)

Tracking Generator Option	Min Freq (clips to this freq when turn TG on and can't tune below while TG on)	If above this Freq, Stop Freq clipped to this Freq when TG turned on	Max Freq (can't tune above) while TG on
T03	2 MHz	3.08 GHz	3.08 GHz
T07	2 MHz	7.575 GHz	7.575 GHz
T13	2 MHz	13.8 GHz	13.8 GHz
T26	2 MHz	26.55 GHz	26.55 GHz

RF Center Freq

SCPI command for specifying the RF Center Frequency. This command will set the Center Frequency to be used when the RF input is selected, even if the RF input is not the input that is selected at the time the command is sent. Note that the Center Freq function in the Frequency menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:RF:CENTer <freq>` `[:SENSe]:FREQuency:RF:CENTer?`
Example	`:FREQ:RF:CENT 30 MHz` `:FREQ:RF:CENT?`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode
Dependencies	If the electronic/soft attenuator is enabled, any attempt to set Center Frequency such that the Stop Frequency would be >3.6 GHz fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a “-221, Settings conflict” warning
Preset	See table above

State Saved	Saved in instrument state
Min	-79.999995 MHz
Max	See the table above. Basically instrument maximum frequency - 5 Hz

Ext Mix Center Freq

SCPI command for specifying the External Mixer Center Frequency. This command will set the Center Frequency to be used when the External Mixer is selected, even if the External Mixer input is not the input which is selected at the time the command is sent. Note that the Center Freq function in the Frequency menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:EMIXer:CENTer <freq>` `[:SENSe]:FREQuency:EMIXer:CENTer?`
Example	`:FREQ:EMIX:CENT 60 GHz` `:FREQ:EMIX:CENT?`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode
Couplings	When returning to External Mixing after having been switched to one of the other inputs (e.g., RF), you will come back into the settings that you had when you left External Mixing. So you will come back to the band you were in with the Center Frequency that you had. However, Span is not an input-dependent parameter, therefore you will bring the span over from the other input. Therefore, the instrument comes back with the span from the previous input, limited as necessary by the current mixer setup
Preset	When a Mode Preset is performed while in External Mixing, the Start frequency of the current Mode is set to the nominal Min Freq of the lowest harmonic range in the Harmonic Table for the current mixer setup. Similarly, the Stop frequency of the current Mode is set to the nominal Max Freq of the highest harmonic range in the Harmonic Table. The Center Freq thus presets to the point arithmetically equidistant from these two frequencies Note that if the current measurement has a limited Span available to it, and cannot achieve the Span shown in the table (Span=Stop Freq – Start Freq), the instrument uses the maximum Span the measurement allows, and still sets the Center Freq to the midpoint of the Start and Stop Freq values in the Harmonic Table When Restore Input/Output Defaults is performed, the mixer presets to the 11970A, whose Start and Stop frequencies are 26.5 and 40 GHz respectively. The center of these two frequencies is 33.25 GHz Therefore, after a Restore Input/Output Defaults, if you go into External Mixing and do a Mode Preset while in the Spectrum Analyzer Mode, the resulting Center Freq is 33.25 GHz
State Saved	Yes
Min	The minimum frequency in the currently selected mixer band + 5 Hz
Max	The maximum frequency in the currently selected mixer band - 5 Hz

I/Q Center Freq

SCPI command for specifying the I/Q Center Frequency. This command will set the Center Frequency to be used when the I/Q input is selected, even if the I/Q input is not the input which is selected at the time the command is sent. Note that the Center Freq function in the Frequency menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:IQ:CENTer <freq>` `[:SENSe]:FREQuency:IQ:CENTer?`
Example	`:FREQ:IQ:CENT 30 MHz`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode
Preset	0 Hz
State Saved	Saved in instrument state
Min	-40.049995 MHz
Max	40.049995 MHz

CF Step

Changes the step size for the center frequency and start and stop frequency functions. Once a step size has been selected and the center frequency function is active, the step keys (and the UP|DOWN parameters for Center Frequency from remote commands) change the center frequency by the step-size value. The step size function is useful for finding harmonics and sidebands beyond the current frequency span of the instrument.

Note that the start and stop frequencies also step by the CF Step value.

Remote Command	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement] <freq>`
	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement]?`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO?`

Example	`:FREQ:CENT:STEP 500 MHz`
	`:FREQ:CENT UP`
	increases the current center frequency value by 500 MHz
	`:FREQ:CENT:STEP?`
	`:FREQ:CENT:STEP:AUTO ON`
	`:FREQ:CENT:STEP:AUTO?`

Notes	Preset and Max values are dependent on Hardware Options (5xx)

Dependencies	Span, RBW, Center frequency If the electronic/soft attenuator is enabled, any attempt to change the value of the center frequency >3.6 GHz by pressing the Up-arrow key, fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning
Couplings	When auto-coupled in a non-zero span, the center frequency step size is set to 10% of the span. When auto-coupled in zero span, the center frequency step size is set to the equivalent -3 dB RBW value
Preset	Auto ON
State Saved	Saved in instrument state
Min	– (the maximum frequency of the instrument). That is, 27 GHz max freq instrument has a CF step range of +/- 27 GHz. Note that this is the maximum frequency given the current settings of the instrument, so in External Mixing, for example, it is the maximum frequency of the current mixer band
Max	The maximum frequency of the instrument. That is, 27 GHz max freq instrument has a CF step range of +/- 27 GHz. Note that this is the maximum frequency given the current settings of the instrument, so in External Mixing, for example, it is the maximum frequency of the current mixer band
Status Bits/OPC dependencies	non-overlapped

3.6.7 Marker

Accesses a menu that enables you to select, set up and control the markers for the current measurement. If there are no active markers, Marker selects marker 1, sets it to Normal and places it at the center of the display. If the selected marker is Off, it is set to Normal and placed it at the center of the screen on the trace determined by the Marker Trace rules.

For more detailed information on the types of Markers and the interaction between Markers, see the Marker section of the Swept SA measurement.

3.6.7.1 Select Marker

Specifies the selected marker. The term "selected marker" is used throughout this document to specify which marker will be affected when you change marker settings, perform a Peak Search, etc.

The Select Marker control appears above the menu panel, indicating that it applies to all controls in the Marker menu panels. Select Marker is blanked if you select a tab whose controls do NOT depend on the selected marker (e.g., Counter).

On any menu tab for which **Select Marker** displays, the first control is always **Marker Frequency|Time**.

Notes	The selected marker is remembered even when not in the Marker menu and is used if a Search is done or a Band Function is turned on or for Signal Track or Continuous Peak
Preset	Marker 1

State Saved	The number of the selected marker is saved in instrument state
Annunciation	Appears in the marker results block label for Normal and Delta markers

3.6.7.2 Settings

The controls on the Settings tab include the Marker active function and a radio button selection of the marker control mode (Normal, Delta, or Off) for the selected marker, as well as additional functions that help you use markers.

Marker Chip Time

Marker Trace: I/Q Polar

Sets the marker Chip value in the current marker for the I/Q Polar trace. It has no effect if the control mode is **Off**, but if the control mode is Normal, this is the SCPI equivalent of entering a Chip value.

This command is valid only when Marker Trace ‘POLar’(I/Q Polar) is active. For any other Marker Trace, the command is ignored.

Remote Command	`:CALCulate:EVMQpsk:MARKer[1]|2|...|12:CHIP <real>` `:CALCulate:EVMQpsk:MARKer[1]|2|...|12:CHIP?`
Example	`:CALC:EVMQ:MARK3:CHIP 0` `:CALC:EVMQ:MARK3:CHIP?`
Notes	If no suffix is sent, ‘chips’ is used. If a suffix is sent that does not match ‘chips’, an error “Invalid suffix” is generated The query returns the marker’s ‘chips’ value in the trace if the control mode is Normal. The query is returned in ‘chips’. If the marker is Off the response is not a number (NAN)
Preset	Start point of the trace in the display window
State Saved	No
Min	-9.9E+37
Max	9.9E+37
Annotation	Mkr # <Chip Value>, <X value> and <Y value> upper right on graph.

Marker Trace: EVM, Mag Error, Phase Error

Sets the marker X Axis value in the current marker X Axis Scale unit. It has no effect if the control mode is Off, but is the SCPI equivalent of entering an X value if the control mode is Normal or Delta.

NOTE This command is not valid when Marker Trace is `POLar` and ignored. Marker Chip Time is supported instead.

Remote Command	`:CALCulate:EVMQpsk:MARKer[1]|2|...|12:X <real>` `:CALCulate:EVMQpsk:MARKer[1]|2|...|12:X?`
Example	`:CALC:EVMQ:MARK3:X 0.0` `:CALC:EVMQ:MARK3:X?`
Notes	If no suffix is sent, uses the fundamental units for the current marker X Axis Scale. If a suffix is sent that does not match the current marker X Axis Scale unit, an error “Invalid suffix” is generated The query returns the marker’s absolute X Axis value if the control mode is **Normal**, or the offset from the marker’s reference marker if the control mode is **Delta**. The query is returned in the fundamental units for the current marker X Axis scale: Hz for **Frequency** and **Inverse Time**, seconds for **Period** and **Time**. If the marker is **Off** the response is not a number
Preset	After a preset, all Markers are turned OFF, so Marker X Axis Value query returns a Not A Number (NAN)
State Saved	No
Min	–9.9E+37
Max	9.9E+37
Annotation	Mkr # <X value> and <Marker value> upper right on graph

Marker X Axis Position (Remote Command only)

Sets the marker X position in trace points. It has no effect if the control mode is **Off,** but is the SCPI equivalent of entering a value if the control mode is Normal or Delta - except in trace points rather than X Axis Scale units. The entered value is immediately translated into the current X Axis Scale units for setting the value of the marker.

Remote Command	`:CALCulate:EVMQpsk:MARKer[1]|2|...|12:X:POSition <real>` `:CALCulate:EVMQpsk:MARKer[1]|2|...|12:X:POSition?`
Example	`:CALC:EVMQ:MARK:X:POS 0.0` `:CALC:EVMQ:MARK10:X:POS?`
Notes	The query returns the marker’s absolute X Axis value in trace points if the control mode is Normal, or the offset from the marker’s reference marker in trace points if the control mode is Delta. The value is returned as a real number, not an integer, corresponding to the translation from X Axis Scale units to trace points. If the marker is **Off** the response is *Not A Number (NAN)* This command is not available when Marker Trace of the selected marker (`:CALCulate:EVMQpsk:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:TRACe?`) is set to POLar. In this case, this command is ignored
Preset	After a preset, all Markers are turned OFF, so Marker X Axis Value query returns a Not A Number (NAN)
State Saved	No
Min	-9.9E+37
Max	9.9E+37

Marker Y Axis Value (Remote Command only)

Queries the marker Y Axis value in the current marker Y Axis unit.

Remote Command	`:CALCulate:EVMQpsk:MARKer[1]|2|...|12:Y?`
Example	`:CALC:EVMQ:MARK11:Y?`
Notes	The query returns the marker Y-axis result if the control mode is Normal or **Delta**. If the marker is **Off**, the response is not a number (NAN)
Preset	Result dependent on markers setup and signal source
State Saved	No
Backwards Compatibility SCPI	`:CALCulate:EVMQpsk:MARKer[1]|2|...|12:FUNCtion:RESult?`

Marker Mode

Sets the marker control mode to Normal, Delta, or Off. All interactions and dependencies detailed under the control description are enforced when the remote command is sent. If the selected marker is Off, pressing Marker sets it to Normal and places it at the center of the screen on the trace determined by the Marker Trace rules. At the same time, Marker X Axis Value appears on the Active Function area.

The default active function is the active function for the currently selected marker control mode. If the current control mode is Off, there is no active function and the active function is turned off.

Remote Command	`:CALCulate:EVMQpsk:MARKer[1]|2|...|12:MODE POSition | DELTa | OFF` `:CALCulate:EVMQpsk:MARKer[1]|2|...|12:MODE?`
Example	`:CALC:EVMQ:MARK:MODE POS` `:CALC:EVMQ:MARK:MODE?`
Preset	`OFF`
State Saved	Saved in instrument state
Range	`POSition|DELTa|OFF`
Annotation	Mkr # <X value> and <Marker value> upper right on graph When Marker Trace is Polar in WCDMA mode: Mkr # <Symbol Value>, <X value> and <Y value> upper right on graph

Backward Compatibility SCPI Commands

Sets or queries the state of a marker. Setting a marker which is OFF to state ON or 1 puts it in Normal mode and places it at the center of the screen.

Remote	`:CALCulate:EVMQpsk:MARKer[1]|2|...|12:STATe OFF | ON | 0 | 1`

Command	:CALCulate:EVMQpsk:MARKer[1]|2|...|12:STATe?
Example	:CALC:EVMQ:MARK3:STAT ON :CALC:EVMQ:MARK3:STAT?
Preset	OFF
State Saved	Saved in instrument state
Range	OFF|ON

Delta Marker (Reset Delta)

Pressing this button is exactly the same as pressing the "Delta" selection on the Marker Mode radio button. The selected marker becomes a Delta Marker. If the selected marker is already a Delta marker, the reference marker is moved to the current position of the selected marker, thus resetting the Delta to zero.

Marker Settings Diagram

The Marker Settings Diagram lets you configure the Marker system using a visual utility.

All Markers Off

Turns off all markers.

Remote Command	:CALCulate:EVMQpsk:MARKer:AOFF
Example	:CALC:EVMQ:MARK:AOFF

Couple Markers

When this function is On, moving any marker causes an equal X Axis movement of every other marker which is not Fixed or Off. By "equal X Axis movement" we mean that we preserve the difference between each marker's X Axis value (in the fundamental x-axis units of the trace that marker is on) and the X Axis value of the marker being moved (in the same fundamental x-axis units).

When the marker is assigned to the Polar graph, a chip value is coupled instead of an X axis value.

This may result in markers going off screen.

Remote Command	:CALCulate:EVMQpsk:MARKer:COUPle[:STATe] ON | OFF | 1 | 0 :CALCulate:EVMQpsk:MARKer:COUPle[:STATe]?
Example	:CALC:EVMQ:MARK:COUP ON

	:CALC:EVMQ:MARK:COUP?
Preset	OFF Presets on Mode Preset and All Markers Off
State Saved	Saved in instrument state

3.6.7.3 Peak Search

The controls on the Peak Search tab allow you to move the marker to selected peaks of the signal, giving you enormous analysis capabilities, particularly when combined with the Delta Marker function.

NOTE Pressing the **Peak Search** hardkey automatically moves you to the **Peak Search** page of the **Marker** menu *and* performs a Peak Search.

Pressing the **Peak Search** tab once you are already *in* the **Marker** menu does *not* perform a Peak Search.

Marker Chip Time

The Marker Chip Time control is the fundamental control that you use to move a marker around on the trace. This is the same as the Marker Chip Time control on the Settings tab.

Peak Search

Pressing the **Peak Search** control moves the selected marker to the trace point which has the maximum y-axis value for that marker's trace.

NOTE Pressing the **Peak Search** hardkey automatically moves you to the **Peak Search** page of the **Marker** menu *and* performs a Peak Search.

Remote Command	:CALCulate:EVMQpsk:MARKer[1]|2|...|12:MAXimum
Example	:CALC:EVMQ:MARK2:MAX :SYST:ERR? can be used to query the errors to determine if a peak is found. The message "No peak found" will be returned after an unsuccessful search
Notes	Sending this command selects the subopcoded marker This command does not work when the selected marker is located on the polar trace. In this case, the command is ignored

Next Peak

Pressing Next Peak moves the selected marker to the peak that is next lower in amplitude than the current marker value. Only peaks which meet all enabled peak criteria are considered. If there is no valid peak lower than the current marker position, a “No peak found” message is generated and the marker is not moved.

If the selected marker was off, then it is turned on as a normal marker and a peak search is performed.

Remote Command	`:CALCulate:EVMQpsk:MARKer[1]|2|...|12:MAXimum:NEXT`
Example	`:CALC:EVMQ:MARK2:MAX:NEXT`
Notes	Sending this command selects the subopcoded marker
State Saved	Not part of saved state

Next Peak Right

Pressing Next Pk Right moves the selected marker to the nearest peak right of the current marker that meets all enabled peak criteria. If there is no valid peak to the right of the current marker position, a “No peak found” message is generated and the marker is not moved.

If the selected marker was off, then it is turned on as a normal marker and a peak search is performed.

Remote Command	`:CALCulate:EVMQpsk:MARKer[1]|2|...|12:MAXimum:RIGHt`
Example	`:CALC:EVMQ:MARK2:MAX:RIGH`
Notes	Sending this command selects the subopcoded marker
State Saved	Not part of saved state

Next Peak Left

Pressing Next Pk Left moves the selected marker to the nearest peak left of the current marker that meets all enabled peak criteria. If there is no valid peak to the left of the current marker position, a “No peak found” message is generated and the marker is not moved.

If the selected marker was off, then it is turned on as a normal marker and a peak search is performed.

Remote Command	`:CALCulate:EVMQpsk:MARKer[1]|2|...|12:MAXimum:LEFT`
Example	`:CALC:EVMQ:MARK2:MAX:LEFT`
State Saved	Not part of saved state

Minimum Peak

Moves the selected marker to the minimum y-axis value on the current trace. Minimum (negative) peak searches do not have to meet the peak search criteria. It just looks for the lowest y-axis value. If the selected marker is Off, it is turned on before the minimum search is performed.

Remote Command	`:CALCulate:EVMQpsk:MARKer[1]|2|...|12:MINimum`
Example	`:CALC:EVMQ:MARK:MIN`
Notes	Sending this command selects the subopcoded marker
State Saved	Not part of saved state

Pk-Pk Search

Finds and displays the amplitude and frequency (or time, if in zero span) differences between the highest and lowest y-axis value. It places the selected marker on the minimum value on its selected trace. And it places that marker’s reference marker on the peak of its selected trace.

This function turns on the reference marker and sets its mode to Normal if it is not already on. (These markers may be on two different traces.)

The rules for finding the maximum peak are exactly the same as for Peak Search, including the use of the peak criteria rules. However, the minimum trace value is not required to meet any criteria other than being the minimum y-axis value in the trace.

If the selected marker is off, a delta type marker is turned on and the peak-to-peak search is done. If the selected marker is on, but it is not a delta marker, then it is changed to delta which turns on the reference marker if needed, and then it performs the peak-to-peak function.

Remote Command	`:CALCulate:EVMQpsk:MARKer[1]|2|...|12:PTPeak`
Example	`:CALC:EVMQ:MARK:PTP`
Notes	Turns on the Marker D active function Sending this command selects the subopcoded marker
Dependencies	Pk-Pk Search is not available when Coupled Markers is on
Couplings	The selected marker becomes a delta marker if not already in delta mode
State Saved	Not part of saved state

Marker Delta

Pressing this button is exactly the same as pressing the “Delta” selection on the Marker Mode radio button on the Settings tab. The selected marker becomes a Delta Marker. If the selected marker is already a Delta marker, the reference marker is moved to the current position of the selected marker, thus resetting the Delta to zero.

The control is duplicated here in the Peak Search Menu to allow you to conveniently perform a peak search and change the marker's control mode to Delta without having to access two separate menus.

3.6.7.4 Properties

The controls on the Properties tab are used to set certain properties of the selected marker.

Marker Chip Time

The Marker Chip Time control is the fundamental control that you use to move a marker around on the trace. This is the same as the Marker Chip Time control on the Settings tab.

Relative To

Selects the marker to which the selected marker is relative (its reference marker).

Every marker has another marker to which it is relative. This marker is referred to as the "reference marker" for that marker. This attribute is set by the Marker, Properties, Relative To key. The marker must be a Delta marker to make this attribute relevant. If it is a Delta marker, the reference marker determines how the marker is controlled and how its value is displayed. A marker cannot be relative to itself.

Remote Command	`:CALCulate:EVMQpsk:MARKer[1]|2|...|12:REFerence <integer>` `:CALCulate:EVMQpsk:MARKer[1]|2|...|12:REFerence?`
Example	`:CALC:EVMQ:MARK:REF 5` `:CALC:EVMQ:MARK:REF?`
Notes	This command causes the marker specified with the subopcode to become selected Range (for SCPI command): 1 to 12. If the range is exceeded the value is clipped A marker cannot be relative to itself so that choice is not available, and if sent from SCPI generates error -221: "Settings conflict; marker cannot be relative to itself" When queried a single value is returned (the specified marker numbers relative marker)
Couplings	The act of specifying the selected marker's reference marker makes the selected marker a Delta marker If the reference marker is off it is turned on in Normal mode at the delta marker location
Preset	The preset default "Relative To" marker (reference marker) is the next higher numbered marker (current marker +1). For example, if marker 2 is selected, then it's default reference marker is marker 3. The exception is marker 12, which has a default reference of marker 1 Set to the defaults by using Restore Mode Defaults. This is not reset by Marker Off, All Markers Off, or Preset
State Saved	Saved in instrument state. Not affected by Marker Off and hence not affected by Preset or power cycle

Min	1
Max	12
Annunciation	Appears in the marker label of a **Delta** marker

Marker Trace

Assigns the specified marker to the designated trace.

Remote Command	`:CALCulate:EVMQpsk:MARKer[1]|2|...|12:TRACe POLar | EVM | PERRor | MERRor` `:CALCulate:EVMQpsk:MARKer[1]|2|...|12:TRACe?`
Example	`:CALC:EVMQ:MARK:TRAC MERR` `:CALC:EVMQ:MARK:TRAC?`
Notes	Assigns the specified marker to the designated trace
Preset	`POLar`
State Saved	Yes
Range	I/Q Polar|EVM|Phase Error|Mag Error

Marker Settings Diagram

The Marker Settings Diagram lets you configure the Marker system using a visual utility. This is the same as the"Marker Settings Diagram" on page 785 control on the Settings tab.

3.6.8 Meas Setup

The Meas Setup menu panel contains functions for setting up the measurement parameters.

3.6.8.1 Settings

This tab enables you to set measurement parameters.

Avg|Hold Number

Specifies the number of N averages that will be used for the measurement. After the specified number (average counts) have been averaged, the averaging mode (termination control) setting determines the averaging action.

Remote Command	`[:SENSe]:EVMQpsk:AVERage:COUNt <integer>` `[:SENSe]:EVMQpsk:AVERage:COUNt?`

Example	`:EVMQ:AVER:COUN 1001` `:EVMQ:AVER:COUN?`
Preset	10
State Saved	Yes
Min/Max	1/10000

Averaging On/Off

Turns averaging on or off.

Remote Command	`[:SENSe]:EVMQpsk:AVERage[:STATe] OFF | ON | 0 | 1` `[:SENSe]:EVMQpsk:AVERage[:STATe]?`
Example	`:EVMQ:AVER OFF` `:EVMQ:AVER?`
Preset	ON
State Saved	Yes
Range	OFF|ON

Averaging Mode

Toggles the averaging mode between Exp (exponential) and Repeat. This selection only affects the averaging result after the number of N averages is reached. The N is set using the control “Avg|Hold Number.”

EXPonential	Each successive data acquisition after the average count is reached, is exponentially weighted and then combined with the existing average
REPeat	After reaching the average count, the averaging is reset and a new average is started

Remote Command	`[:SENSe]:EVMQpsk:AVERage:TCONtrol EXPonential | REPeat` `[:SENSe]:EVMQpsk:AVERage:TCONtrol?`
Example	`:EVMQ:AVER:TCON REP` `:EVMQ:AVER:TCON?`
Notes	Selects the type of termination control used for averaging. This determines the averaging action after the specified number of frames (average count) is reached Exponential - Each successive data acquisition after the average count is reached, is exponentially weighted and combined with the existing average Repeat - After reaching the average count, the averaging is reset and a new average is started
Preset	REPeat

State Saved	Yes
Range	EXPonential|REPeat

IF Gain

In order to take full advantage of the RF dynamic range of the instrument, we will offer a switched IF amplifier with approximately 10 dB of gain. When it can be turned on without an overload, the dynamic range is always better with it on than off. The control “IF Gain” can be used to set the IF Gain function to Auto, or to On (the extra 10 dB) or Off. These settings affect sensitivity and IF overloads.

Sets the IF Gain function to Auto, Low Gain or High Gain. These settings affect sensitivity and IF overloads.

Remote Command	`[:SENSe]:EVMQpsk:IF:GAIN[:STATe] ON | OFF | 1 | 0`
	`[:SENSe]:EVMQpsk:IF:GAIN[:STATe]?`
	`[:SENSe]:EVMQpsk:IF:GAIN:AUTO[:STATe] ON | OFF | 1 | 0`
	`[:SENSe]:EVMQpsk:IF:GAIN:AUTO[:STATe]?`

Example	`:EVMQ:IF:GAIN ON`
	`:EVMQ:IF:GAIN?`
	`:EVMQ:IF:GAIN:AUTO OFF`
	`:EVMQ:IF:GAIN:AUTO?`

Notes	This only applies to the RF input. It does not apply to baseband I/Q input where: – ON = high gain – OFF = low gain
Dependencies	This control does not appear in VXT, M9393A, M9391A, or UXM
Couplings	Auto sets IF Gain to High Gain under any of the following conditions: 1. The input attenuator is set to 0 dB, *or*, 2. The preamp is turned on, *or*, 3. The Max Mixer Level is –20 dBm or lower For other settings, ‘auto’ sets IF Gain to ‘Low Gain’
Preset	OFF ON
State Saved	Yes
Range	Low Gain|High Gain

Meas Interval

Sets the length of the measurement interval (number of data points) that are used.

Remote Command	`[:SENSe]:EVMQpsk:SWEep:POINts <integer>` `[:SENSe]:EVMQpsk:SWEep:POINts?`
Example	`:EVMQ:SWE:POIN 1001` `:EVMQ:SWE:POIN?`
Preset	WCDMA: 2560
State Saved	Yes
Min/Max	128/5120

Advanced Setup

The Advanced Setup enables you to access advanced parameters in the **Meas Setup** menus on one screen.

Chip Rate

Changes the chip rate for the measurement.

Remote Command	`[:SENSe]:EVMQpsk:CRATe <freq>` `[:SENSe]:EVMQpsk:CRATe?`
Example	`:EVMQ:CRAT 2.5 MHz` `:EVMQ:CRAT?`
Notes	Enter a frequency value to set the chip rate
Preset	WCDMA: 3.84 MHz
State Saved	Yes
Min/Max	100 kHz/20 MHz

RRC Filter Control

Specifies the alpha value of the Root Raised Cosine (RRC) filter and changes its status (ON/OFF). This ON/OFF state change involves a measurement restart. This control is available only in the WCDMA mode and while employing an RRC filter.

Remote Command	`[:SENSe]:EVMQpsk:FILTer:ALPHa <real>`
	`[:SENSe]:EVMQpsk:FILTer:ALPHa?`
	`[:SENSe]:EVMQpsk:FILTer[:RRC][:STATe] OFF | ON | 0 | 1`
	`[:SENSe]:EVMQpsk:FILTer[:RRC][:STATe]?`

Example	:EVMQ:FILT:ALPH 0.5 :EVMQ:FILT:ALPH? :EVMQ:FILT ON :EVMQ:FILT?
Preset	0.22 ON
State Saved	Yes
Min/Max	0.01/0.5
Backwards Compatibility SCPI	[:SENSe]:EVMQpsk:ALPHa

Spectrum

Toggles the spectrum function between Normal and Invert. If set to Invert, this function conjugates the spectrum. It is equivalent to taking the negative of the quadrature component in demodulation.

Remote Command	[:SENSe]:EVMQpsk:SPECtrum NORMal | INVert [:SENSe]:EVMQpsk:SPECtrum?
Example	:EVMQ:SPEC NORM :EVMQ:SPEC?
Preset	NORMal
State Saved	Yes
Range	NORMal|INVert

EVM Result I/Q Offset

Toggles the I/Q Offset to be included or excluded in the measurement result. When it is set as "Standard" (ON), EVM is calculated without any compensation of I/Q offset. When it is set as "Exclude" (OFF), I/Q offset is compensated.

Remote Command	:CALCulate:EVMQpsk:IQOFfset:INCLude OFF | ON | 0 | 1 :CALCulate:EVMQpsk:IQOFfset:INCLude?
Example	:CALC:EVMQ:IQOF:INCL OFF :CALC:EVMQ:IQOF:INCL?
Preset	ON
State Saved	Yes
Range	Standard|Exclude

Spur Avoidance

Because the VXT models M9410A/11A/15A are direct-conversion (zero-IF) receivers, feedthrough leakage from the local oscillator appears as a spurious signal (spur) at the center frequency. The Spur Avoidance function is provided to eliminate this spur, at the expense of some measurement speed.

When Spur Avoidance is enabled (the default), the instrument uses a software algorithm to remove this spur from the displayed measurement data, but the algorithm only operates under certain conditions. Specifically, it only operates when the Info BW <= maxBW/2.5. See "More Information" on page 795.

You can disable this function to speed up your measurement by setting Spur Avoidance to “Disabled.”

Note that when Spur Avoidance is not in effect, either because you have disabled it or because the Info BW > maxBW/2.5, the following warning message will appear in the status bar: “Settings Alert;Spur Avoidance Off”. This is to alert you that measurement accuracy might be impacted by the fact that Spur Avoidance is not in effect.

Remote Command	`[:SENSe]:EVMQpsk:SAVoid[:STATe] ON | OFF | 0 | 1` `[:SENSe]:EVMQpsk:SAVoid[:STATe]?`
Example	`:EVMQpsk:SAVoid ON` `:EVMQpsk:SAVoid?`
Dependencies	This control only appears in VXT models M9410A/11A/15A
Preset	ON
State Saved	Saved in instrument state
Range	ON|OFF

More Information

Maximum digital IF BW is limited by both Option and Center frequency.

VXT models M9410A/11A

Option limitation

Option	Max Digital IF BW
B40	40 MHz
B3X	300 MHz
B6X	600 MHz
B12	1200 MHz

Center frequency limitation

Center Frequency	Max Digital IF BW
330 MHz ~ 380 MHz	(CF – 330 MHz) * 2
380 MHz ~ 550 MHz	100 MHz
550 MHz ~ 1310 MHz	200 MHz
1310 MHz ~ 2000 MHz (without Option EP6)	600 MHz
2000 MHz ~ 5480 MHz (without Option EP6)	1200 MHz
5480 MHz ~ 6080 MHz (without Option EP6)	(6080 MHz – CF) * 2
1310 MHz ~ 1900 MHz (Option EP6)	600 MHz
1900 MHz ~ 6000 MHz (Option EP6)	1200 MHz
6000 MHz ~ 6600 MHz (Option EP6)	(6600 MHz – CF) * 2

VXT model M9415A

Option limitation

Option	Max Digital IF BW
B4X	400 MHz
B8X	800 MHz
B12	1200 MHz

Center frequency limitation

Center Frequency	Max Digital IF BW
330 MHz ~ 380 MHz	(CF – 330 MHz) * 2
380 MHz ~ 550 MHz	100 MHz
550 MHz ~ 1310 MHz	200 MHz
1310 MHz ~ 2000 MHz	600 MHz
2000 MHz ~ 12300 MHz	1200 MHz
12300 MHz ~ 12900 MHz	(12900 MHz – CF) * 2

Auto Couple

Immediately puts all Auto/Man functions into Auto. The **Auto Couple** action is confined to the current measurement only. It does not affect other measurements in the mode.

In the Auto state, Auto/Man functions are said to be “coupled”, meaning their values change as you make changes to other values in the measurement. This helps ensure accurate measurements and optimum dynamic range. Auto Couple is an immediate action function, and when it is executed, all the Auto/Man controls for the current measurement are set to Auto, and all measurement settings coupled to the Auto/Man parameters are automatically set to their optimal value.

For further details of measurement-specific settings (if any), see "Measurement-Specific Details" on page 797 below.

Remote Command	`:COUPle ALL`
Example	`:COUP ALL`
Backwards Compatibility SCPI	`:COUPLE ALL | NONE`
Backwards Compatibility Notes	`:COUP:NONE` puts all Auto/Man parameters in manual mode, decoupling all the coupled instrument parameters. It is retained for backwards compatibility and is *not* recommended for making measurements or new designs

All Auto/Man parameter couplings in the measurement are set to Auto. This includes couplings that may be unavailable or grayed-out due to the current state. For example, in the Swept SA measurement, there is no Auto/Man coupling for RBW while in Zero Span. Nonetheless, if **Auto Couple** were executed while in Zero Span it would set RBW to Auto "behind the scenes" so that, on exit from Zero Span, it would be in Auto.

Any Auto/Man selection specific (local) to the other measurements in the current Mode will not be affected by **Auto Couple**. Any functions that are *not* coupled with other instrument parameters, such as ranging or leveling variables, such as "AutoRange" or "AutoScale", will not be affected.

Executing the **Auto Couple** command generates the informational message, "All Auto/Man functions have been set to Auto".

Each parameter, upon being set to Auto, selects and sets the appropriate auto-coupled value based on that parameter's coupling rules. The Dependency Resolver orchestrates the couplings for parameters that are dependent on one or more other parameters. The coupling and dependency rules for each parameter are defined in the chapter describing that parameter.

Executing the **Auto Couple** command *does not* affect markers, marker functions, trace or display attributes, or any other instrument setting other than those specifically mentioned above.

Measurement-Specific Details

TOI

Parameters affected by Auto Couple are:

- Center Frequency Step
- Resolution Bandwidth
- Span/RBW Ratio

– Sweep Time
– Video BandwidthVBW/RBW ratio
– Upper and Lower Tone (set to Sense
–)Zero span measurement Resolution Bandwidth
– Zero span measurement Dwell Time

Harmonics

For Harmonics, these parameters are:

– Resolution Bandwidth
– Fundamental Frequency
– Dwell Time
– Range Table Resolution Bandwidths
– Range Table Dwell Times

Meas Preset

Restores all the measurement parameters to their default values.

Remote Command	`:CONFigure:EVMQpsk`
Example	`:CONF:EVMQ`
Notes	Restore all defaults of parameters

3.6.8.2 Radio

The Radio tab contains controls to select the Radio Device, and enable or disable HSPA/HSPA+ options.

Radio Device

Allows you to specify the device to be used.

Remote Command	`[:SENSe]:RADio:STANdard:DEVice BTS | MS` `[:SENSe]:RADio:STANdard:DEVice?`
Example	`:RAD:STAN:DEV MS` `:RAD:STAN:DEV?`

Preset	BTS
State Saved	Saved in instrument state.
Range	BTS | MS
Backwards Compatibility SCPI	[:SENSe]:RADio:DEVice

HSPA Enable

Allows you to turn on or off the HSDPA/HSUPA option enable. This selection is necessary because some of the auto detection functions that expect an HSPA signal are less tolerant when the signal is noisy or distorted. When the HSPA signal is not expected, turn HSPA Enable off.

Remote Command	[:SENSe]:RADio:CONFigure:HSDPa[:STATe] 0 | 1 | OFF | ON [:SENSe]:RADio:CONFigure:HSDPa[:STATe]?
Example	:RAD:CONF:HSDP 0 :RAD:CONF:HSDP?
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

HSPA+ Enable

Allows you to turn on or off the HSPA+ option enable. This selection is necessary because some of the auto detection functions that expect an HSPA+ signal are less tolerant when the signal is noisy or distorted. When the HSPA+ signal is not expected, turn HSPA+ Enable off.

Remote Command	[:SENSe]:RADio:CONFigure:EHSPa[:STATe] OFF | ON | 0 | 1 [:SENSe]:RADio:CONFigure:EHSPa[:STATe]?
Example	:RAD:CONF:EHSP 0 :RAD:CONF:EHSP?
Notes	When HSPA enable is OFF, HSPA+ function is disabled too.
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

3.6.8.3 Limits

This tab enables you to change the RMS EVM and Frequency Error limits settings.

RMS EVM

Sets the limit for the RMS EVM measurement. This value is used to judge whether the measurement passes or fails the RMS EVM limit.

Remote Command	`:CALCulate:EVMQpsk:LIMit:RMS <real>` `:CALCulate:EVMQpsk:LIMit:RMS?`
Example	`:CALC:EVMQ:LIM:RMS 50` `:CALC:EVMQ:LIM:RMS?`
Notes	Sets the limits of RMS EVM which is used to judge the result of RMS EVM passes or fails If a measured RMS EVM value is not larger than the limit value, the result is PASS Otherwise, the result is FAIL
Preset	WCDMA: 17.5 1xEVDO: 100.0
Min/Max	0.0/100.0

Frequency Error

Sets the limit, in Hz, for the frequency error measurement. This value is used to judge whether the measurement passes or fails the Frequency Error limit.

Remote Command	`:CALCulate:EVMQpsk:LIMit:FERRor <freq>` `:CALCulate:EVMQpsk:LIMit:FERRor?`
Example	`:CALC:EVMQ:LIM:FERR 100` `:CALC:EVMQ:LIM:FERR?`
Notes	Sets the limits of the Frequency Error, which is used to judge the result of the Frequency Error, whether it passes or fails If the measured Frequency Error value is not larger than the limit value, the result is PASS. Otherwise, the result is FAIL
Preset	100.0
State Saved	Yes
Min/Max	0.0/300000

3.6.8.4 Global

The controls in this menu apply to all Modes in the instrument.

Some controls (e.g., Global center Freq) allow you to switch certain Meas Global parameters to a Mode Global state. These switches apply to all Modes that support global settings. For example, no matter what Mode you are in when you set the "Global Center Frequency" switch to on, it applies to all Modes that support Global Settings.

Other controls (e.g., Extend Low Band) are actually set in this menu but apply to all Modes.

Global Center Freq

The software maintains a Mode Global value called "Global Center Freq".

When the **Global Center Freq** control is switched to **On** in any mode, the current mode's center frequency is copied into the Global Center Frequency, and from then on all modes that support global settings use the Global Center Frequency. So you can switch between any of these modes and the Center Freq will remain unchanged.

Adjusting the Center Freq of any mode which supports Global Settings, while **Global Center Freq** is **On**, will modify the Global Center Frequency.

When **Global Center Freq** is turned **Off**, the Center Freq of the current mode is unchanged, but now the Center Freq of each mode is once again independent.

When **Mode Preset** is pressed while **Global Center Freq** is **On**, the Global Center Freq is preset to the preset Center Freq of the current mode.

This function is reset to Off when the Restore Defaults control is pressed in the Global Settings menu, or when **System**, **Restore Defaults**, **All Modes** is pressed.

Remote Command	`:INSTrument:COUPle:FREQuency:CENTer ALL | NONE` `:INSTrument:COUPle:FREQuency:CENTer?`
Example	`:INST:COUP:FREQ:CENT ALL` `:INST:COUP:FREQ:CENT?`
Preset	Set to Off on Global Settings, Restore Defaults and System, Restore Defaults, All Modes
Range	On|Off

Remote Command	`:GLOBal:FREQuency:CENTer[:STATe] 1 | 0 | ON | OFF` `:GLOBal:FREQuency:CENTer[:STATe]?`
Preset	Off

Extend Low Band

The software maintains a Mode Global value called "Extend Low Band."

Under the current sweep configuration crossing over two bands, when Extend Low Band is turned on, the analyzer checks whether one band can cover the whole sweep frequency range or not. If it's true, the analyzer locks the band; otherwise, does nothing (the band crossover occurs).

This function doesn't work when Band Lock under [System]-[Service]-[Lock Functions] is not -1 (no band lock). In that case, Band Lock takes priority of Extend Low Band.

This function is reset to Off when the Restore Defaults control is pressed in the Global Settings menu, or when **System**, **Restore Defaults**, **All Modes** is pressed.

This parameter is available for SA, RTSA, WCDMA, WIMAX OFDMA, LTEAFDD, LTEATDD modes.

Remote Command	`:INSTrument:COUPle:FREQuency:BAND:EXTend 0 | 1 | ON | OFF` `:INSTrument:COUPle:FREQuency:BAND:EXTend?`
Example	`:INST:COUP:FREQ:BAND:EXT 1` `:INST:COUP:FREQ:BAND:EXT?`
Dependencies	Only applies to UXA, PXA, MXA and EXA.
Preset	Set to Off by pressing Global Settings > Restore Defaults and System > Restore Defaults > All Modes
Range	On|Off

Restore Defaults

This control resets all of the functions in the Global Settings menu to Off. This also occurs when **System**, **Restore Defaults**, **All Modes** is pressed.

Remote Command	`:INSTrument:COUPle:DEFault`
Example	`:INST:COUP:DEF`
Backwards Compatibility SCPI	`:GLOBal:DEFault`

3.6.9 Sweep

The Sweep key contains controls which allow you to control the sweep and measurement functions of the instrument, such as the sweep or measurement time and whether in Single sweep/measure or Continuous sweep/measure mode.

3.6.9.1 Sweep/Control

Contains controls for the Sweep and Control functions of the instrument, such as Sweep Time and Continuous/Single.

Sweep/Measure

Allows you to toggle between Continuous and Single sweep or measurement operation. The Single/Continuous state is Meas Global, so the setting affects *all* measurements.

The front-panel key **Single/Cont** performs exactly the same function

NOTE In the `WAVeform` measurement, this control only appears in the Meas Bar, and not in the **Sweep/Control** tab.

See "More Information" on page 803

Remote Command	`:INITiate:CONTinuous OFF | ON | 0 | 1` `:INITiate:CONTinuous?`

Example	`:INIT:CONT 0`
	`:INIT:CONT OFF`
	puts instrument into Single measurement operation
	`:INIT:CONT 1`
	`:INIT:CONT ON`
	puts instrument into Continuous measurement operation

Preset	ON Note that `:SYST:PRES` sets `:INIT:CONT` to `ON` but `*RST` sets `:INIT:CONT` to `OFF`
State Saved	Saved in instrument state
Annunciation	The **Single/Continuous** icon in the Meas Bar changes depending on the setting: – A line with an arrow is Single – A loop with an arrow is Continuous

More Information

With **Avg/Hold Num** (in the **Meas Setup** menu) set to **Off** or set to **On** with a value of 1, a sweep is taken after the trigger condition is met; and the instrument continues to take new sweeps after the current sweep has completed and the trigger condition is again met. However, with **Avg/Hold Num** set to On with a value >1, multiple sweeps (data acquisitions) are taken for the measurement. The trigger condition must be met prior to each sweep. The sweep is not stopped when the average count k equals the number N set for Avg/Hold Num is reached, but the number k stops incrementing. A measurement average usually applies to all traces, marker results, and numeric results, but sometimes only applies to the numeric results.

If the instrument is in Single measurement, pressing the **Cont/Single** toggle control does not change k and does not cause the sweep to be reset; the only action is to put the instrument into Continuous measurement operation.

If it is already in Continuous sweep:

- the `:INIT:CONT 1` command has no effect
- the `:INIT:CONT 0` command will place the instrument in Single Sweep but will have no effect on the current sequence until k = N, at which point the current sequence will stop and the instrument will go to the idle state.

See "Restart" on page 1738 control description for details on the `:INIT:IMM` (Restart) function.

If you are already in Single sweep, the `:INIT:CONT OFF` command has no effect.

If you are already in Single Sweep, then pressing the **Cont/Single** toggle control in the middle of a sweep does not restart the sweep or sequence. Similarly, pressing the **Cont/Single** toggle control does not restart the sweep or sequence if the sweep is not in the idle state (for example, if you are taking a very slow sweep, or the instrument is waiting for a trigger). Even though pressing the **Cont/Single** toggle control in the middle of a sweep does *not* restart the sweep, sending `:INIT:IMM` *does* reset it.

Restart

The **Restart** function restarts the current sweep, or measurement, or set of averaged/held sweeps or measurements. In measurements that support pausing, if you are Paused, pressing **Restart** performs a **Resume**.

The Restart function is accessed in several ways:

- Pressing the **Restart** key
- Sending the remote command `:INIT:IMM`
- Sending the remote command `:INIT:REST`

See "More Information" on page 805

Remote Command	`:INITiate[:IMMediate]` `:INITiate:RESTart`
Example	`:INIT:IMM` `:INIT:REST`
Notes	`:INIT:REST` and `:INIT:IMM` and the front-panel **Restart** key perform exactly the same function
Couplings	Resets average/hold count k For the first sweep, overwrites all active (update=on) traces with new current data For application modes, resets other parameters as required by the measurement

Status Bits/OPC dependencies	This is an Overlapped command The `:STATus:OPERation` register bits 0 through 8 are cleared The `:STATus:QUEStionable` register bit 9 (INTegrity sum) is cleared The `SWEEPING` bit is set The `MEASURING` bit is set
Backwards Compatibility Notes	For Spectrum Analysis mode in ESA and PSA, the **Restart** hardkey and the `:INIT:REST` command restart trace averages (displayed average count reset to 1) for a trace in **Clear Write**, but did not restart **Max Hold** and **Min Hold** In the X-Series, the **Restart** hardkey and the `:INIT:REST` command restart not only **Trace Average**, but **Max Hold** and **Min Hold** traces as well For wireless comms modes in ESA and PSA, the **Restart** hardkey and the `:INIT:REST` command restarted every measurement, including all traces and numeric results. There is no change to this operation

More Information

The **Restart** function first aborts the current sweep or measurement as quickly as possible. It then resets the sweep and trigger systems, sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is in the process of aligning when a Restart is executed, the alignment finishes before the restart function is performed.

Even when set for Single operation, multiple sweeps may be taken when **Restart** is pressed (for example, when averaging/holding is on). Thus when we say that Restart "restarts a measurement," depending on the current settings, we may mean:

- It restarts the current sweep
- It restarts the current measurement
- It restarts the current set of sweeps if any trace is in Trace Average, Max Hold or Min Hold
- It restarts the current set of measurements if Averaging, or Max Hold, or Min Hold is on for the measurement

With Average/Hold Number (in Meas Setup menu) set to 1, or Averaging off, or no trace in Trace Average or Hold, a single sweep is equivalent to a single measurement. A single sweep is taken after the trigger condition is met; and the instrument stops sweeping once that sweep has completed. However, with Average/Hold Number >1 and at least one trace set to Trace Average, Max Hold, or Min Hold (SA Measurement) or Averaging on (most other measurements), multiple sweeps/data acquisitions are taken for a single measurement. The trigger condition must be met prior to each sweep. The sweep is stopped when the average count k equals the number N set for Average/Hold Number. A measurement average usually applies to all traces, marker results, and numeric results, but sometimes only applies to the numeric results.

Once the full set of sweeps has been taken, the instrument will go to the idle state. To take one more sweep without resetting the average count, increment the average count by 1, by pressing the step up key while Average/Hold Number is the active function, or by sending the remote command `:CALC:AVER:TCON UP`.

Pause/Resume

Pauses a measurement after the current data acquisition is complete.

When a measurement is paused:

- The label on this control changes to **Resume**. Pressing **Resume** un-pauses the measurement.
- Pressing **Restart** also performs a **Resume**.

Remote Command	`:INITiate:PAUSe` `:INITiate:RESume`
Example	`:INIT:PAUS` `:INIT:RES`
Dependencies	Not displayed in Modes that do not support pausing
Couplings	When Averaging is On, if the measurement is paused no more updates will occur until either a Resume or Restart occurs If the measurement is resumed, the averaging continues to use the traces from before the Pause occurred and continues to use the traces from the point where the Resume occurred. This still provides real-time traces, but they will no longer be gap free In a view with a Waterfall window, when the measurement is paused, the Waterfall stops updating. When Resume is selected, the Waterfall will retain the existing traces and continue updating using traces from the point at which Resume was selected. The time stamp of the individual Waterfall traces will show the time from the beginning of the measurement the trace relates to, showing there was a gap in the Waterfall capture In Density view, when the measurement is paused, the Density Display stops updating. When the measurement is resumed, if Persistence is `ON`, the persistence fading will continue from the point when the measurement was paused If a Restart occurs, the average counter is reset and all results are discarded. The measurement begins again, using traces after the Restart occurred

Abort (Remote Command Only)

This command stops the current measurement. It aborts the current measurement as quickly as possible, resets the sweep and trigger systems, and puts the measurement into an "idle" state. If the instrument is in the process of aligning when `:ABORt` is sent, the alignment finishes before the abort function is performed, so `:ABORt` does *not* abort an alignment.

If the instrument is set for Continuous measurement, it sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is set for Single measurement, it remains in the "idle" state until an `:INIT:IMM` command is received.

Remote Command	`:ABORt`
Example	`:ABOR`
Notes	If `:INIT:CONT` is `ON`, then a new continuous measurement will start immediately, with sweep (data acquisition) occurring once the trigger condition has been met If `:INIT:CONT` is `OFF`, then `:INIT:IMM` is used to start a single measurement, with sweep (data acquisition) occurring once the trigger condition has been met
Dependencies	For continuous measurement, `:ABORt` is equivalent to the **Restart** key Not all measurements support the abort command
Status Bits/OPC dependencies	The `:STATus:OPERation` register bits 0 through 8 are cleared The `:STATus:QUEStionable` register bit 9 (INTegrity sum) is cleared Since all the bits that feed into OPC are cleared by `:ABORt`, the `:ABORt` will cause the *OPC query to return true

3.6.9.2 X Scale

This tab accesses controls that enable you to set the horizontal scale parameters.

Ref Value

Controls the reference value of the X scale of the current measurement

Remote Command	`:DISPlay:EVMQpsk:WINDow3|4|5:TRACe:X[:SCALe]:RLEVel <real>`
	`:DISPlay:EVMQpsk:WINDow3|4|5:TRACe:X[:SCALe]:RLEVel?`
	Window numbers are as follows:
	– Mag Error: 3
	– Phase Error: 4
	– EVM: 5

Example	3-Mag Error
	`:DISP:EVMQ:WIND3:TRAC:X:RLEV 0`
	4-Phase Error
	`:DISP:EVMQ:WIND4:TRAC:X:RLEV 0`
	5-EVM
	`:DISP:EVMQ:WIND5:TRAC:X:RLEV 0`

Notes	This parameter is for control of the reference value of the X scale of the focused window

Couplings	When this parameter has been set, XScaleAuto turns off
Preset	0
State Saved	Yes
Min/Max	-5000000/5000000

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now only Window number is sent. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command
Mag Error	DISP:EVMQ:VIEW2:WIND:TRAC:X:RLEV 0.0	DISP:EVMQ:WIND3:TRAC:X:RLEV 0.0
Phase Error	DISP:EVMQ:VIEW2:WIND2:TRAC:X:RLEV 0.0	DISP:EVMQ:WIND4:TRAC:X:RLEV 0.0
EVM	DISP:EVMQ:VIEW2:WIND3:TRAC:X:RLEV 0.0	DISP:EVMQ:WIND5:TRAC:X:RLEV 0.0

X Scale/Div

Sets the horizontal scale by changing a value per division.

Remote Command	`:DISPlay:EVMQpsk:WINDow3|4|5:TRACe:X[:SCALe]:PDIVision <real>`
	`:DISPlay:EVMQpsk:WINDow3|4|5:TRACe:X[:SCALe]:PDIVision?`
	Window numbers are as follows:
	– Mag Error: 3
	– Phase Error: 4
	– EVM: 5

Example	3-Mag Error
	`:DISP:EVMQ:WIND3:TRAC:X:PDIV 1001`
	4-Phase Error
	`:DISP:EVMQ:WIND4:TRAC:X:PDIV 1001`
	5-EVM
	`:DISP:EVMQ:WIND5:TRAC:X:PDIV 1001`

Couplings	When this parameter has been set, XScaleAuto turns off
Preset	256
State Saved	Yes
Min/Max	1/500000

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now only Window number is sent. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command
Mag Error	DISP:EVMQ:VIEW2:WIND:TRAC:X:PDIV 1001	DISP:EVMQ:WIND3:TRAC:X:PDIV 1001
Phase Error	DISP:EVMQ:VIEW2:WIND2:TRAC:X:PDIV 1001	DISP:EVMQ:WIND4:TRAC:X:PDIV 1001
EVM	DISP:EVMQ:VIEW2:WIND3:TRAC:X:PDIV 1001	DISP:EVMQ:WIND5:TRAC:X:PDIV 1001

X Ref Position

Sets the reference position of the X axis on the display. The reference position can be set to Left, Ctr (center) or Right.

Remote Command	`:DISPlay:EVMQpsk:WINDow3|4|5:TRACe:X[:SCALe]:RPOSition LEFT | CENTer | RIGHt`
	`:DISPlay:EVMQpsk:WINDow3|4|5:TRACe:X[:SCALe]:RPOSition?`
	Window numbers are as follows:
	– Mag Error: 3
	– Phase Error: 4
	– EVM: 5

Example	3-Mag Error
	`:DISP:EVMQ:WIND3:TRAC:X:RPOS CENT`
	4-Phase Error
	`:DISP:EVMQ:WIND4:TRAC:X:RPOS CENT`
	5-EVM
	`:DISP:EVMQ:WIND5:TRAC:X:RPOS CENT`

Couplings	If X Scale Auto Mag is On and the parameter is changed, X Scale Ref Mag changes to automatically adjust the trace to one that is most suitable for the window
Preset	LEFT
State Saved	Yes
Range	LEFT|CENTer|RIGHt

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now only Window number is sent. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command
Mag Error	DISP:EVMQ:VIEW2:WIND:TRAC:X:RPOS CENT	DISP:EVMQ:WIND3:TRAC:X:RPOS CENT
Phase Error	DISP:EVMQ:VIEW2:WIND2:TRAC:X:RPOS CENT	DISP:EVMQ:WIND4:TRAC:X:RPOS CENT
EVM	DISP:EVMQ:VIEW2:WIND3:TRAC:X:RPOS CENT	DISP:EVMQ:WIND5:TRAC:X:RPOS CENT

Auto Scaling

Determines the scale per division and reference value for the X axis based on the current measurement results.

Remote Command	`:DISPlay:EVMQpsk:WINDow3|4|5:TRACe:X[:SCALe]:COUPle ON	OFF	0	1` `:DISPlay:EVMQpsk:WINDow3|4|5:TRACe:X[:SCALe]:COUPle?` Window numbers are as follows: – Mag Error: 3 – Phase Error: 4 – EVM: 5

Example	3-Mag Error
	`:DISP:EVMQ:WIND3:TRAC:X:COUP ON`
	4-Phase Error
	`:DISP:EVMQ:WIND4:TRAC:X:COUP ON`
	5-EVM
	`:DISP:EVMQ:WIND5:TRAC:X:COUP ON`

Notes	When On, the Scale/Div, Ref Value, and Ref Position are reset to the default value
Couplings	Upon pressing the Restart front-panel key, the scale coupling function automatically determines the scale per division and reference values based on the measurement results if this parameter is set to On. When you set a value to either Scale/Div or Ref Value manually, Scale Coupling automatically changes to Off
Preset	ON
State Saved	Yes
Range	ON|OFF

Backwards Compatibility SCPI

Window Numbers used to be a combination of View and Window, now only Window number is sent. For backwards compatibility the old View and Window numbers are honored as below:

Window	Old SCPI Command	New SCPI Command
Mag Error	DISP:EVMQ:VIEW2:WIND:TRAC:X:COUP ON	DISP:EVMQ:WIND3:TRAC:X:COUP ON
Phase Error	DISP:EVMQ:VIEW2:WIND2:TRAC:X:COUP ON	DISP:EVMQ:WIND4:TRAC:X:COUP ON
EVM	DISP:EVMQ:VIEW2:WIND3:TRAC:X:COUP ON	DISP:EVMQ:WIND5:TRAC:X:COUP ON

3.6.10 Trace

Trace is not supported in the QPSK EVM Measurement.

3.7 Channel Power Measurement

The Channel Power measurement is used to find the total power present in a specified bandwidth. The power spectral density (the power in the signal normalized to 1 Hz) is also reported.

When in WLAN mode, or when WLAN radio standard is selected in SA mode, the peak power spectral density for 1 MHz is reported.

Channel Power Measurement Commands

The table below lists the measurement commands and their responses for the Channel Power measurement

Command	Return Value
:FETCh:CHPower[n]? :MEASure:CHPower[n]? :READ:CHPower[n]?	The results returned depend on the currently-selected Mode and the value of n Refer to the mode-specific Measurement Results tables below
:FETCh:CHPower:CHPower? :MEASure:CHPower:CHPower? :READ:CHPower:CHPower?	Returns the Channel Power (dBm) (Backwards compatibility functionality)
:FETCh:CHPower:DENSity? :MEASure:CHPower:DENSity? :READ:CHPower:DENSity?	Returns the Power Spectral Density (dBm/Hz) (Backwards compatibility functionality)

The results returned by the queries depend on the currently-selected Mode and the value of n (where required). The sections below provide mode-specific details for each Mode.

SA Mode Measurement Results

n	Results Returned
n=1 (or not specified)	Returns scalar results: 1. Channel Power is a floating point number representing the total channel power in the specified integration bandwidth 2. PSD (Power Spectral Density) is the power in the specified unit bandwidth. The unit bandwidth is selected by the PSD Unit parameter in either dBm/Hz or dBm/MHz
2	Returns floating point numbers that are the captured trace data of the power (in dBm/resolution BW) of the signal for Trace 1. The frequency span of the captured trace data is specified by the Span control
3	n/a
4	n/a
5	Returns floating point numbers that are the captured trace data of the power (in

n	Results Returned
	dBm/resolution BW) of the signal for Trace 2. The frequency span of the captured trace data is specified by the Span control
6	Returns floating point numbers that are the captured trace data of the power (in dBm/resolution BW) of the signal for Trace 3. The frequency span of the captured trace data is specified by the Span control

MSR Mode Measurement Results

n	Results Returned
n=1 (or not specified)	Returns scalar results: 1. Channel Power is a floating point number representing the total channel power in the specified integration bandwidth 2. PSD (Power Spectral Density) is the power in the specified unit bandwidth. The unit bandwidth is selected by the PSD Unit parameter in either dBm/Hz or dBm/MHz
2	Returns floating point numbers that are the captured trace data of the power (in dBm/resolution BW) of the signal for Trace 1. The frequency span of the captured trace data is specified by the Span control
3	Returns [Carriers] comma-separated scalar results, in the following order – Total Power of Carrier 1 (dBm) – Total Power of Carrier 2 (dBm) – ... – [Carriers]. Total Power of Carrier [Carriers] (dBm) If the result is not available, NaN (9.91E+37) is returned. Number of returned values might be changed in future releases
4	Returns comma-separated scalar results, in the following order 1. Total Power of LTE FDD carriers (dBm) 2. Total Power of W-CDMA carriers (dBm) 3. Total Power of GSM/EDGE carriers (dBm) 4. Total Power of cdma2000 carriers (dBm) 5. Total Power of 1xEV-DO carriers (dBm) 6. ... The number of results is incremented by one when a new format is supported If the result is not available, NaN (9.91E+37) is returned. Number of returned values will be changed in future releases if the number of supported radio format is increased
5	Returns floating point numbers that are the captured trace data of the power (in dBm/resolution BW) of the signal for Trace 2. The frequency span of the captured

n	Results Returned
	trace data is specified by the Span control
6	Returns floating point numbers that are the captured trace data of the power (in dBm/resolution BW) of the signal for Trace 3. The frequency span of the captured trace data is specified by the Span control

LTE-Advanced FDD/TDD Mode Measurement Results

n	Results Returned
n=1 (or not specified)	Returns scalar results: 1. Channel Power is a floating point number representing the total channel power in the specified integration bandwidth 2. PSD (Power Spectral Density) is the power in the specified unit bandwidth. The unit bandwidth is selected by the PSD Unit parameter in either dBm/Hz or dBm/MHz
2	Returns floating point numbers that are the captured trace data of the power (in dBm/resolution BW) of the signal for Trace 1. The frequency span of the captured trace data is specified by the Span control
3	Returns comma-separated scalar results, in the following order 1. Total Power of Component Carrier 0 (dBm) 2. Total Power of Component Carrier 1 (dBm) 3. Total Power of Component Carrier 2 (dBm) 4. Total Power of Component Carrier 3 (dBm) 5. Total Power of Component Carrier 4 (dBm) If the result is not available, NaN (9.91E+37) is returned
4	Returns comma-separated scalar results, in the following order. The unit bandwidth is selected by the PSD Unit parameter in either dBm/Hz or dBm/MHz 1. Total Power Spectral Density of Component Carrier 0 (PSD Unit) 2. Total Power Spectral Density of Component Carrier 1 (PSD Unit) 3. Total Power Spectral Density of Component Carrier 2 (PSD Unit) 4. Total Power Spectral Density of Component Carrier 3 (PSD Unit) 5. Total Power Spectral Density of Component Carrier 4 (PSD Unit) If the result is not available, NaN (9.91E+37) is returned
5	Returns floating point numbers that are the captured trace data of the power (in dBm/resolution BW) of the signal for Trace 2. The frequency span of the captured trace data is specified by the Span control
6	Returns floating point numbers that are the captured trace data of the power (in dBm/resolution BW) of the signal for Trace 3. The frequency span of the captured trace data is specified by the Span control

5G NR Mode Measurement Results

n	Results Returned
n=1 (or not specified)	Returns scalar results: 1. Channel Power is a floating point number representing the total channel power in the specified integration bandwidth 2. PSD (Power Spectral Density) is the power in the specified unit bandwidth. The unit bandwidth is selected by the PSD Unit parameter in either dBm/Hz or dBm/MHz
2	Returns floating point numbers that are the captured trace data of the power (in dBm/resolution BW) of the signal for Trace 1. The frequency span of the captured trace data is specified by the Span control
3	Returns comma-separated scalar results, in the following order – Total Power of Component Carrier 0 (dBm) – Total Power of Component Carrier 1 (dBm) – Total Power of Component Carrier 2 (dBm) – ... – 16. Total Power of Component Carrier 15 (dBm) If the result is not available, NaN (9.91E+37) is returned
4	Returns comma-separated scalar results, in the following order. The unit bandwidth is selected by the PSD Unit parameter in either dBm/Hz or dBm/MHz – Total Power Spectral Density of Component Carrier 0 (PSD Unit) – Total Power Spectral Density of Component Carrier 1 (PSD Unit) – Total Power Spectral Density of Component Carrier 2 (PSD Unit) – ... – 16. Total Power Spectral Density of Component Carrier 5 (PSD Unit) If the result is not available, NaN (9.91E+37) is returned
5	Returns floating point numbers that are the captured trace data of the power (in dBm/resolution BW) of the signal for Trace 2. The frequency span of the captured trace data is specified by the Span control
6	Returns floating point numbers that are the captured trace data of the power (in dBm/resolution BW) of the signal for Trace 3. The frequency span of the captured trace data is specified by the Span control

WLAN Channel Power Measurement Results

n	Results Returned
n=1 (or not	Returns scalar results:

n	Results Returned
specified)	When the radio standard is NOT 802.11ac 80 + 80 MHz or 802.11ax 80 + 80 MHz: Channel Power is a floating point number representing the total channel power in the specified integration bandwidth Peak PSD (Power Spectral Density) is the peak PSD over the integration bandwidth. The unit bandwidth is selected by the PSD Unit parameter in either dBm/Hz or dBm/MHz Mean PSD (Power Spectral Density) is the mean PSD over the integration bandwidth. The unit bandwidth is selected by the PSD Unit parameter in either dBm/Hz or dBm/MHz When the radio standard is 802.11ac 80 + 80 MHz or 802.11ax 80 + 80 MHz: 1. Channel Power of the carrier of which the center frequency is indicated by Freq Segment 1 is a floating point number representing the total channel power of the first segment in the specified integration bandwidth Peak PSD (Power Spectral Density) of the carrier of which the center frequency is indicated by Freq Segment 1 is the power in the specified unit bandwidth of the first segment. The unit bandwidth is selected by the PSD Unit parameter in either dBm/Hz or dBm/MHz Channel Power of the carrier of which the center frequency is indicated by Freq Segment 2is a floating point number representing the total channel power of the second segment in the specified integration bandwidth Peak PSD (Power Spectral Density) of the carrier of which the center frequency is indicated by Freq Segment 2 is the power in the specified unit bandwidth of the second segment. The unit bandwidth is selected by the PSD Unit parameter in either dBm/Hz or dBm/MHz Mean PSD (Power Spectral Density) of the carrier of which the center frequency is indicated by Freq Segment 1 is the power in the specified unit bandwidth of the first segment. The unit bandwidth is selected by the PSD Unit parameter in either dBm/Hz or dBm/MHz 6. Mean PSD (Power Spectral Density) of the carrier of which the center frequency is indicated by Freq Segment 2 is the power in the specified unit bandwidth of the second segment. The unit bandwidth is selected by the PSD Unit parameter in either dBm/Hz or dBm/MHz
2	Returns floating point numbers that are the captured trace data of the power (in dBm/resolution BW) of the signal for Trace 1. The frequency span of the captured trace data is specified by the Span control
3	n/a
4	n/a
5	Returns floating point numbers that are the captured trace data of the power (in dBm/resolution BW) of the signal for Trace 2. The frequency span of the captured trace data is specified by the Span control
6	Returns floating point numbers that are the captured trace data of the power (in dBm/resolution BW) of the signal for Trace 3. The frequency span of the captured trace data is specified by the Span control

Additionally, WLAN Mode supports an n parameter for the following queries:

`:FETCh:CHPower:DENSity[n]?`

`:MEASure:CHPower:DENSity[n]?`

`:READ:CHPower:DENSity[n]?`

For these queries *in WLAN Mode only*, the results returned depend on the value of n as follows:

n	Radio Standard	Results Returned
1 (or not specified)	*Not* 802.11ac 80 +80 MHz or 802.11ax80 +80 MHz	Peak PSD (Power Spectral Density) is the peak PSD over the integration bandwidth. The unit bandwidth is selected by the PSD Unit parameter in either dBm/Hz or dBm/MHz
	802.11ac 80 +80 MHz or 802.11ax80 +80 MHz	The first value is the peak PSD for segment 1, the second value is the peak PSD for segment 2
2	*Not* 802.11ac 80 +80 MHz or 802.11ax80 +80 MHz	Mean PSD (Power Spectral Density) is the Mean PSD over the integration bandwidth. The unit bandwidth is selected by the PSD Unit parameter in either dBm/Hz or dBm/MHz
	802.11ac 80 +80 MHz or 802.11ax80 +80 MHz	The first value is the mean PSD for segment 1, the second value is the mean PSD for segment 2

3.7.1 Views

In the SA mode, there is only one Predefined view for the Channel Power measurement.

In the MSR, LTE-Advanced FDD/TDD, and 5G NR modes, there are two Predefined views:

1. Normal View

2. Carrier Info View

If you have modified the current View, using the "View Editor" on page 128, an asterisk appears next to that View in the radio button panel. You can save the modified View as a User View (see "Save Layout as New View" on page 1890).

View selection by name (MSR, LTEAFDD, LTEATDD, 5GNR)

Selects the results view. The following SCPI command allows you to select the desired measurement view by enumeration.

Remote Command	`:DISPlay:CHPower:VIEW[:SELect] PRESult | CINFormation` `:DISPlay:CHPower:VIEW[:SELect]?`
Example	`:DISP:CHP:VIEW PRES` `:DISP:CHP:VIEW?`
Preset	`PRESult`
State Saved	Saved in instrument state
Range	Power Results|Carrier Info

View selection by number (MSR, LTEAFDD, LTEATDD, 5GNR)

Selects the results view. The following command allows you to select the desired measurement view by enumeration.

Remote Command	`:DISPlay:CHPower:VIEW:NSELect <integer>` `:DISPlay:CHPower:VIEW:NSELect?`
Example	`:DISP:CHP:VIEW:NSEL 1` `:DISP:CHP:VIEW:NSEL?`
Preset	1
State Saved	Saved in instrument state
Min/Max	1/2

3.7.1.1 Normal

Windows: "Graph" on page 818, "Metrics" on page 819

Dual window view of the Channel Power graph and the Channel Power metrics.

Example	`:DISP:CHP:VIEW PRES`

3.7.2 Windows

This section describes the windows that are available in the Channel Power measurement.

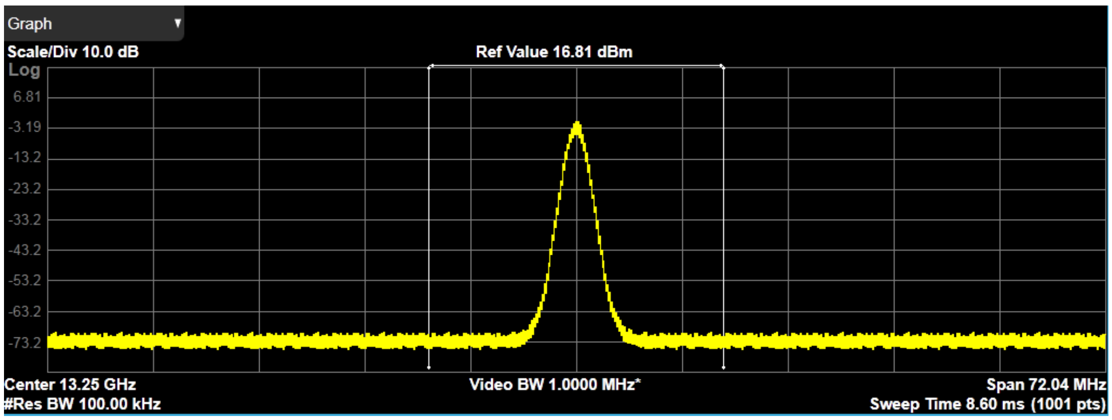
3.7.2.1 Graph

The Graph window is used to display the spectrum trace and power bars.

The results of the measurement can be displayed as a single spectrum trace view or displayed with a Bar Graph trace on the spectrum trace. The Bar Graph appears between the markers that indicate the measured output power level. The bar graph is activated when the “Bar Graph” control is set to ON under the Display menu. The Graph window appears in the following views.

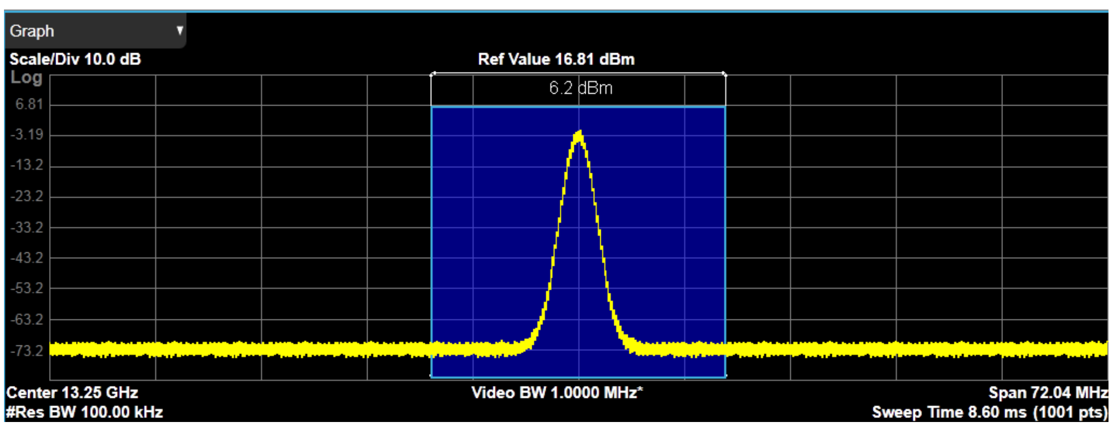
View	Size	Position
Normal	Two thirds, full width	Top
Gate View	One third, full width	Middle

Spectrum View with Bar Graph off



Spectrum View with Bar Graph on

This View is the same as the ‘Spectrum’ view, but has a blue bar between the markers that indicates the measured output power level. The bar graph is activated when the “Bar Graph” control is set to ON under the Display hardkey. The actual measured output power level is displayed on the display at the top of the bar.



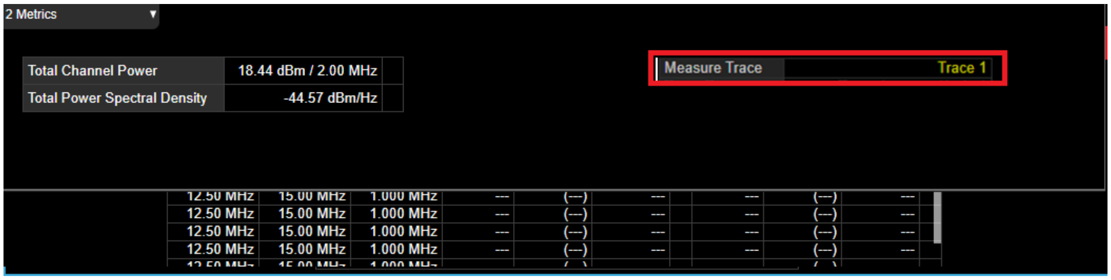
If the current mode is WLAN and the format is WLAN 802.11ac 80+80 MHz, the spectrum view is changed a little so that the results of both carrier segments can be displayed.

3.7.2.2 Metrics

The actual measured output power level is displayed in the Metrics window

The Metrics window appears in the following Views.

View	Size	Position
Normal	One third, full width	Bottom
Gate View	One third, full width	Bottom



Measure Trace

See "Measure Trace" on page 940

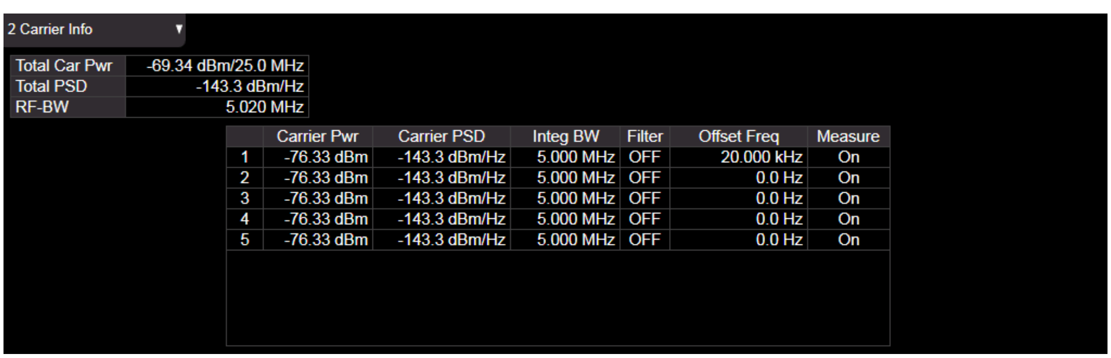
Power Results

Total carrier power, total PSD and total format carrier power are displayed in the lower window. Total format carrier power is total power of carriers of the same Radio Format. If there is no carrier of the corresponding format, it is not displayed. Thus items in the total format power table changes depending on the carrier configuration. Since the metrics window of MSR, LTE-Advanced FDD/TDD and 5G NR is slightly denser than that for common CHP, the vertical positions of total power and power spectral density are raised.

Carrier Info

LTE-Advanced FDD/TDD and 5G NR

The following diagram shows the Metrics Window in the Carrier Info view for LTE-Advanced FDD/TDD and 5G NR. The Power Results window is replaced by the carrier info table.


2 Carrier Info

Total Car Pwr	-69.34 dBm/25.0 MHz
Total PSD	-143.3 dBm/Hz
RF-BW	5.020 MHz

	Carrier Pwr	Carrier PSD	Integ BW	Filter	Offset Freq	Measure
1	-76.33 dBm	-143.3 dBm/Hz	5.000 MHz	OFF	20.000 kHz	On
2	-76.33 dBm	-143.3 dBm/Hz	5.000 MHz	OFF	0.0 Hz	On
3	-76.33 dBm	-143.3 dBm/Hz	5.000 MHz	OFF	0.0 Hz	On
4	-76.33 dBm	-143.3 dBm/Hz	5.000 MHz	OFF	0.0 Hz	On
5	-76.33 dBm	-143.3 dBm/Hz	5.000 MHz	OFF	0.0 Hz	On

The text window displays the following results:

Total Carrier Power

This is the total power of all the carriers with carrier measure state setting to On. The power is calculated by integrating across the bandwidth declared by the Carrier Integ Bw parameter for each carrier and then totaling the sums. The total integration bandwidth is shown as part of the result. This will be the total of the Carrier Integ Bw of the carriers used in calculating the total carrier power. If the RRC Filter is on, then the integration bandwidth used is (1 + alpha)/T where T = 1/(Carrier Integ Bw) multiplied by the number of carriers with carrier measure state setting to yes.

RF-BW

Displays the total bandwidth from the lowest carrier to the highest carrier, whether their measurement states are on or off.

Carrier Power

This is the power in all the currently defined carriers. If the carrier is with measurement state being on, the power will be absolute. If the carrier is defined as not having power present, the power will be shown up as dash. The power is calculated by integrating across the bandwidth declared by the Carrier Integ Bw parameter. The integration bandwidth is shown as part of the result. This is the value of the Carrier Integ Bw for the carrier unless the RRC Filter is on, then the integration.

Integration Bandwidth

It displays the channel bandwidth of each carrier.

Filter

It displays whether RRC filter is used or not.

Offset Frequency

It shows the offset frequency from the carrier reference frequency in multi-carrier measurements. The carrier frequency display type determines whether the relative frequency or absolute frequency will be displayed.

Sub-block (LTE-Advanced FDD/TDD only)

For intra-band non-contiguous spectrum operation, the sub-block concept is introduced, which refers to one contiguous allocated block of spectrum for transmission and reception in the intra-band non-contiguous aggregation mode. We support two sub-blocks. It displays which sub-block the carrier belongs to in the intra-band non-contiguous aggregation mode. The column is displayed when the carrier allocation mode is non-contiguous.

Measure

Shows whether the carrier power presents or not.

The highlighted row changes as either Carrier Result or Select Carrier is changed. The highlighted row and these keys are not coupled.

MSR

The text window displays the following results:

Total Carrier Power

This is the total power of all the carriers with carrier measure state setting to On. The power is calculated by integrating across the bandwidth declared by the Carrier Integ Bw parameter for each carrier and then totaling the sums. The total integration bandwidth is shown as part of the result. This will be the total of the Carrier Integ Bw of the carriers used in calculating the total carrier power. If the RRC Filter is on, then the integration bandwidth used is (1 + alpha)/T where T = 1/(Carrier Integ Bw) multiplied by the number of carriers with carrier measure state setting to yes.

RF-BW

Displays the total bandwidth from the lowest carrier to the highest carrier, whether their measurement states are on or off.

Carrier Power

This is the power in all the currently defined carriers. If the carrier is with measurement state being on, the power will be absolute. If the carrier is defined as not having power present, the power will be shown up as dash. The power is calculated by integrating across the bandwidth declared by the Carrier Integ Bw parameter. The integration bandwidth is shown as part of the result. This is the value of the Carrier Integ Bw for the carrier unless the RRC Filter is on, then the integration.

Integration Bandwidth

Displays the channel bandwidth of each carrier.

Filter

Displays whether RRC filter is used or not.

Offset Frequency

It shows the offset frequency from the carrier reference frequency in multi-carrier measurements. The carrier frequency display type determines whether the relative frequency or absolute frequency will be displayed.

Sub-block

For intra-band non-contiguous spectrum operation, the sub-block concept is introduced, which refers to one contiguous allocated block of spectrum for transmission and reception in the intra-band non-contiguous aggregation mode. We support two sub-blocks. It displays which sub-block the carrier belongs to in the intra-band non-contiguous aggregation mode. The column is displayed when the carrier allocation mode is non-contiguous.

Measure

Shows whether the carrier power presents or not.

The highlighted row changes according to whether Carrier Result or Select Carrier is changed. The highlighted row and these keys are not coupled.

Parameter Set

Displays which format parameter set is selected.

3.7.2.3 Gate

Turning on Gate View shows the Gate Window, which allows you to see your Gating signal at the same time as the measured data. See the description under Gate View in the Trigger, Gate Settings section.

View	Size	Position
Gate View	One third, full width	Top

3.7.3 Amplitude

Activates the **Amplitude** menu and selects **Reference Level** or **Reference Value** as the active function, depending on the measurement.

Some features in this menu apply to multiple measurements. Some other features apply only to specific measurements and their controls are blanked or grayed-out in measurements that do not support the feature.

3.7.3.1 Y Scale

The Y Scale Tab contains controls that pertain to the Y axis parameters of the measurement. These parameters control how data on the vertical (Y) axis is displayed and control instrument settings that affect the vertical axis.

Ref Value

Sets the value for the absolute power reference. The reference line is at the top, center, or bottom of the graticule, depending on the value of the Ref Position function.

Remote Command	`:DISPlay:CHPower:WINDow[1]:TRACe:Y[:SCALe]:RLEVel <real>` `:DISPlay:CHPower:WINDow[1]:TRACe:Y[:SCALe]:RLEVel?`
Example	`:DISP:CHP:WIND:TRAC:Y:RLEV 10 dBm` `:DISP:CHP:WIND:TRAC:Y:RLEV?`
Couplings	When Auto Scaling is On (default), this value is automatically determined by the measurement result. When you set a value manually, Auto Scaling changes to Off Attenuation is not coupled to Ref Value
Preset	10.00 dBm

State Saved	Saved in instrument state
Min/Max	-250.00 dBm / 250.00 dBm
Annotation	Ref <value> top left of graph
Backwards Compatibility SCPI	`:DISPlay:CHPower:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:RLEVel`

Scale/Div

For measurements that support a logarithmic Y-Axis, Scale/Div sets the height of one division of the graticule in the current Y-Axis unit.

Scale/Div also determines the displayed amplitude range in the log plot graph. Since there are usually 10 vertical graticule divisions on the display, the total amplitude range of the graph is typically 10x this amount. For example, if Scale/Div is 10 dB, then the total range of the graph is 100 dB.

Remote Command	`:DISPlay:CHPower:WINDow[1]:TRACe:Y[:SCALe]:PDIVision <rel_ampl>` `:DISPlay:CHPower:WINDow[1]:TRACe:Y[:SCALe]:PDIVision?`
Example	`:DISP:CHP:WIND:TRAC:Y:PDIV 5` `:DISP:CHP:WIND:TRAC:Y:PDIV?`
Couplings	When the Auto Scaling is On, this value is automatically determined by the measurement result. When you set a value manually, Auto Scaling automatically changes to Off
Preset	10.00 dB / Div
State Saved	Saved in instrument state
Min	0.10 dB
Max	20 dB
Annotation	<value> dB/ left upper of graph
Backwards Compatibility SCPI	`:DISPlay:CHPower:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:PDIVision`

Ref Position

Positions the reference level at the top, center, or bottom of the Y Scale display. Changing the reference position does not change the reference level value.

Remote Command	`:DISPlay:CHPower:WINDow[1]:TRACe:Y[:SCALe]:RPOSition TOP | CENTer | BOTTom` `:DISPlay:CHPower:WINDow[1]:TRACe:Y[:SCALe]:RPOSition?`
Example	`:DISP:CHP:WIND:TRAC:Y:RPOS CENT` `:DISP:CHP:WIND:TRAC:Y:RPOS?`

Preset	TOP
State Saved	Saved in instrument state
Range	TOP|CENTer|BOTTom
Annotation	The greater than (>) and less than (<) symbols are displayed on both sides of the graph to indicate the Reference Position
Backwards Compatibility SCPI	:DISPlay:CHPower:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:RPOSition

Auto Scaling

Toggles the Auto Scaling function between On and Off.

Remote Command	:DISPlay:CHPower:WINDow[1]:TRACe:Y[:SCALe]:COUPle 0 | 1 | OFF | ON :DISPlay:CHPower:WINDow[1]:TRACe:Y[:SCALe]:COUPle?
Example	:DISP:CHP:WIND:TRAC:Y:COUP OFF :DISP:CHP:WIND:TRAC:Y:COUP?
Couplings	When Auto Scaling is ON, and the **Restart** front-panel key is pressed, this function automatically sets the scale per division to 10 dB and determines the reference values based on the measurement results When you set a value to either Scale/Div or Ref Value manually, Auto Scaling automatically changes to OFF
Preset	1
State Saved	Saved in instrument state
Range	OFF|ON
Backwards Compatibility SCPI	:DISPlay:CHPower:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:COUPle

3.7.3.2 Attenuation

Controls the attenuator functions and interactions between the attenuation system components.

There are two attenuator configurations in the X-Series. One is a Dual-Attenuator configuration consisting of a mechanical attenuator and an optional electronic attenuator. The other configuration uses a single attenuator with combined mechanical and electronic sections thatcontrols all the attenuation functions. Different models in the X-Series come with different configurations.

- See "Dual-Attenuator Configurations" on page 826
- See "Single-Attenuator Configuration" on page 827

Most attenuation settings are the same for all measurements – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset.

This tab is only available when the hardware set includes an input attenuator, which is typically only the case when using Keysight’s box instruments. For example, this tab does not appear in:

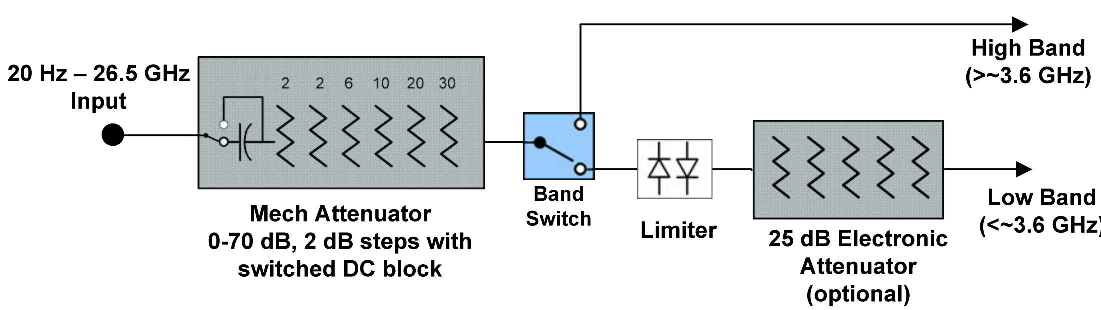
- VXT models M9420A/21A/10A/11A
- E7760
- M9391A
- M9393A

This tab also does not appear in UXM. In UXM all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

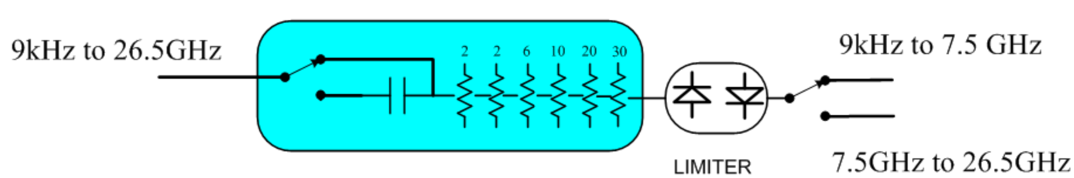
Dependencies	In measurements that support the I/Q inputs, this tab is unavailable when I/Q is the selected input, and is replaced by the Range tab in that case

Dual-Attenuator Configurations

Configuration 1: Mechanical attenuator + optional electronic attenuator

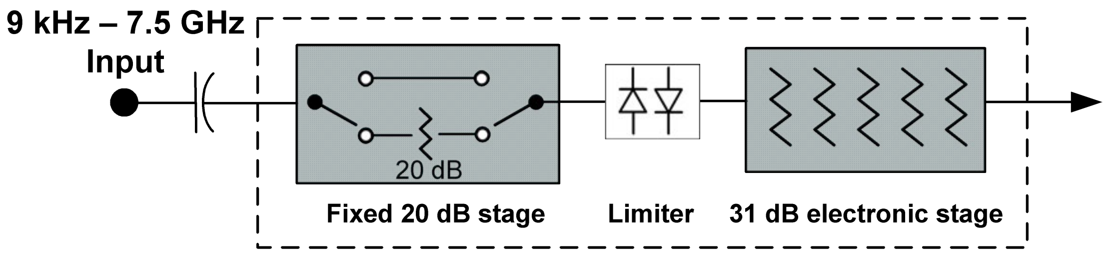


Configuration 2: Mechanical attenuator, no optional electronic attenuator



(note that Configuration 2 is not strictly speaking a dual-section attenuator, since there is no electronic section available. However, it behaves exactly like Configuration 1 without the Electronic Attenuator option EA3, therefore for the sake of this document it is grouped into the “Dual-Attenuator” configuration)

Single-Attenuator Configuration



You can tell which attenuator configuration you have by pressing the Attenuation tab, which (in most Modes) opensthe Attenuation menu. If the first control in the Attenuation menu says **Mech Atten** you have the Dual-Attenuator configuration. If the first control says **Atten** you have the Single-Attenuator configuration.

Dual Attenuator **Single Attenuator**

(Note that depending on the measurement, there may be no Auto/Man functionality on the Mech Atten control).

In the Single-Attenuator configuration, youcontrol the attenuation with a single control, as the fixed stage has only two states. In the Dual-Attenuator configuration, both stages have significant range so you are given separate control of the mechanical and electronic attenuator stages.

When you have the Dual-Attenuator configuration, you may still have only a Single-Attenuator, because unless option EA3 (the Electronic Attenuator option) is available, and you purchase it, you will have only the mechanical attenuator.

Full Range Atten

The **Full Range Atten** control and **Attenuator Summary** only appear in N9041B, when the RF input is selected and the RF Input Port is set to RF Input 2, and the Full Range Attenuator is installed. The Full Range Attenuator adds a second input attenuator at the beginning of the RF Input 2, which enhances the protection and optimizes the performance of the extra internal mixers used by RF Input 2.

Remote Command	`[:SENSe]:POWer[:RF]:FRATten <rel_ampl>` `[:SENSe]:POWer[:RF]:FRATten?`
Example	`:POW:FRAT 14` `:POW:FRAT?`
Notes	When you enter an amplitude value that falls between valid values, the value will be incremented to the

	next smallest valid value
Dependencies	Only appears if input RF is selected, and RF Input Port 2 is selected, and the Full Range Attenuator exists
Couplings	This value is never changed by any coupling, however other couplings use this value. See the **Reference Level** and "Mech Atten" on page 1750 command descriptions
Preset	20 dB
State Saved	Saved in instrument state
Min	0 dB
Max	Only valid values are 0, 6, 14, 20 dB
Annotation	When the Input is RF, and the Input Port is RF Input 2, and the Full Range Attenuator is installed: On the Meas Bar, the field “Atten” displays as follows: – If the sweep is entirely < 50 GHz, the value shown after “Atten:” is equal to Mech Atten + Elec Atten + Full Range Atten – If the sweep is entirely > 50 GHz, the value shown after “Atten:” is equal to Full Range Atten – If the sweep straddles 50 GHz, the value shown after “Atten:” is preceded by the symbol “>=” and is equal to Full Range Atten In the **Amplitude**, "Attenuation" on page 1747 menu, and the Atten Meas Bar dropdown menu panel, a summary is displayed as follows: “Total Atten below 50 GHz” followed by the value of Full Range Atten + Mech Atten + Elec Atten “Total Atten above 50 GHz” followed by the value of Full Range Atten For example, if Mech Atten = 6 dB, Elec Atten = 4 dB, and Full Range Atten = 20 dB, the summary below is shown: – Attenuator summary: – Total Atten below 50 GHz: 30 dB – Total Atten above 50 GHz: 20 dB

Mech Atten

This control is labeled **Mech Atten** in Dual-Attenuator models and **Atten** in Single-Attenuator models. In the Dual-Attenuator configuration, this control only affects the mechanical attenuator.

This control lets you modify the attenuation applied to the RF input signal path. This value is normally auto coupled to the Ref Level, the Internal Preamp Gain, any External Gain that is entered, and the Max Mixer Level, as described in the table below.

See "Attenuator Configurations and Auto/Man" on page 830

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation <rel_ampl>` `[:SENSe]:POWer[:RF]:ATTenuation?`

	`[:SENSe]:POWer[:RF]:ATTenuation:AUTO OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:ATTenuation:AUTO?`

Example	`:POW:ATT 20`
	Dual-Attenuator configuration: sets the mechanical attenuator to 20 dB
	Single-Attenuator mode: sets the main attenuation to 20 dB (see below for definition of "main" attenuation)
	In either case, if the attenuator was in Auto, it is set to Manual
	`:POW:ATT:AUTO ON`
	Turn Auto Mech Atten ON

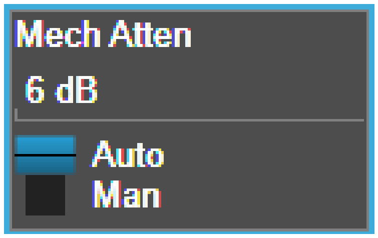
Dependencies	Some measurements do not support the Auto setting of "Mech Atten" on page 828. In these measurements, the Auto/Man selection is not available, and the Auto/Man toggle function is not available In Dual-Attenuator configurations, when the electronic attenuator is enabled, the mechanical attenuator has no auto setting and the Auto/Man toggle function is not available. The state of Auto/Man is remembered and restored when the electronic attenuator is once again disabled. This is described in more detail in "Elec Atten" on page 1753 See "Attenuator Configurations and Auto/Man" on page 830 for more information on the Auto/Man functionality `:POW:ATT:AUTO` is only available in measurements that support Mech Atten Auto, such as Swept SA
Couplings	If the RF Input Port is the RF Input: – If the USB Preamp is connected to USB, use 0 dB for Mech Atten – Otherwise compute the auto-selected value of Mech Atten based on **Reference Level**, Int Preamp, External Gain, Ref Level Offset, Max Mixer Level, µW Path Control and IF Gain settings. Limit this value to be no less than 6 dB (total attenuation below 6 dB can never be chosen by Auto) – In the N9041B, if the RF Input Port is RF Input 2, use the formula above and subtract the Full Range Atten value from the result to determine the Mech Atten. Limit the value so that it is never lower than 0 dB and so that total attenuation, including Full Range Atten, is never less than 6 dB (total attenuation, including Full Range Atten below 6 dB, can never be chosen by Auto) In External Mixingand BBIQ, where the Attenuator is not in the signal path, the Attenuator setting changes as described above when "Mech Atten" on page 828 is in Auto, but no changes are made to the actual attenuator hardware setting until the input is changed back to the RF Input For CXA-m with option FSA (Fine-Step Attenuator or 2 dB steps), the FSA-like behavior is only available when the frequency setting is <= 7.5GHz. So, when the frequency is changed from below 7.5GHz to above 7.5GHz, the attenuation setting will be changed to a multiple of 10dB which will be no smaller than the previous setting. For example, 4dB attenuation will be changed to 10dB
Preset	The preset for Mech Attenuation is "Auto" The Auto value of attenuation is 10 dB ON
State Saved	Saved in instrument state
Min	0 dB The attenuation set by this control cannot be decreased below 6 dB with the knob or step keys. Values below 6 dB must be directly entered from the keypad or via SCPI. This protects against setting a

	dangerously small attenuation value, which can put the instrument at risk of damage to input circuitry. If the current mechanical attenuation is below 6 dB, it can be increased with the knob and step keys, but not decreased
Max	CXA Option 503 or 507: 50 dB EXA: 60 dB All other models: 70 dB Note that in the Single-Attenuator configuration, the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB.
Annotation	The current value for Total Atten is displayed in the Measurement Bar at the top of the display. A value appears for Electronic Attenuation only if the Electronic Attenuator is enabled. The annotation appears as Atten: <total> dB (e<elec>) The e letter is in amber in Single-Attenuator configurations For example: Dual-Attenuator configuration: Atten: 24 dB (e14) Indicating the total attenuation is at 24 dB and the electronic attenuation is at 14 dB Single-Attenuator configuration: A: 24 dB (e14) Indicating the total attenuation is at 24 dB and the “soft” attenuation is at 14 dB (see below for definition of “soft” attenuation) When in Manual, a # sign appears in front of Atten in the annotation

Attenuator Configurations and Auto/Man

As described in "Attenuation" on page 1747 , there are two distinct attenuator configurations available in the X-Series, the single attenuator and Dual-Attenuator configurations. In Dual-Attenuator configurations, we have the mechanical attenuation and the electronic attenuation, and the current total attenuation is the sum of the electronic + mechanical attenuation. In Single-Attenuator configurations, we refer to the attenuation set using "Mech Atten" on page 828 (or `:POW:ATT`) as the “main” attenuation; and the attenuation that is set by `:POW:EATT` as the “soft” attenuation (`:POW:EATT` is honored even in the Single-Attenuator configuration, for compatibility purposes). Then the current total attenuation is the sum of the main + soft attenuation. See "Elec Atten" on page 1753 for more on “soft” attenuation.

NOTE: In some measurements, the **Mech Atten** control has an Auto/Man function. In these measurements, an Auto/Man switch is shown on the **Mech Atten** control:



Note that in configurations that include an Electronic Attenuator, this switch is only shown when the Electronic Attenuator is disabled.

In other measurements, **Mech Atten** has no Auto/Man function. In these measurements, no switch is shown on the **Mech Atten** control:

Mech Atten also appears with no switch, as above, in configurations that include an Electronic Attenuator but when the Electronic Attenuator is enabled.

Elec Atten

Controls the Electronic Attenuator in Dual-Attenuator configurations. This control does not appear in Single-Attenuator configurations, as the control of both the mechanical and electronic stages of the Single-Attenuator is integrated into the single **Atten** control.

This control includes an Enable/Disable toggle switch; it is only possible to enter a value for the Electronic Attenuator when this switch is in the “Enable” position.

See "More Information" on page 832

Remote Command	`[:SENSe]:POWer[:RF]:EATTenuation <rel_ampl>`
	`[:SENSe]:POWer[:RF]:EATTenuation?`
	`[:SENSe]:POWer[:RF]:EATTenuation:STATe OFF | ON | 0 | 1`
	`[:SENSe]:POWer[:RF]:EATTenuation:STATe?`

Example	`:POW:EATT 10`
	`:POW:EATT?`
	`:POW:EATT:STAT ON`
	`:POW:EATT:STAT?`

Notes	Electronic Attenuation’s specification is defined only when Mechanical Attenuation is 6 dB
Dependencies	This control only appears in Dual-Attenuator models with an Electronic Attenuator installed and licensed. It does not appear in models with the Single-Attenuator configuration, as in the Single-Attenuator configuration there is no “electronic attenuator” there is only a single integrated attenuator

	(which has both a mechanical and electronic stage). However, in the Single-Attenuator configuration, EATT SCPI commands are accepted for compatibility with other X-series instruments and set a “soft” attenuation as described in . The “soft” attenuation is treated as an addition to the “main” attenuation value set by the Atten control or the POW:ATT SCPI command and affects the total attenuation displayed on the Atten control and the Meas Bar The electronic attenuator (and the “soft” attenuation function provided in Single-Attenuator configurations) is unavailable above the low band (0-3.6 GHz, 0-3.4 GHz 0-3GHz, depending on the model). If the low band ranges from 0-3.6GHz, and Stop Frequency of the instrument is > 3.6 GHz, then the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed out If the Internal Preamp is on, meaning it is set to Low Band or Full, the electronic attenuator (and the “soft” attenuation function provided in Single-Attenuator configurations) is unavailable. In this case the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed out If either of the above is true, if the SCPI command is sent, an error indicating that the electronic attenuator is unavailable will be sent If both of the above are true, pressing the control will generate error message -221, in other words, the frequency range lockout takes precedence If the electronic/soft Attenuator is enabled, then the Stop Freq of the instrument is limited to 3.6 GHz and the Internal Preamp is unavailable The SCPI-only “soft” electronic attenuation for the single-attenuator configuration is not available in all measurements; in particular, it is not available in the Swept SA measurement
Couplings	Enabling and disabling the Electronic Attenuator affects the setting of the Mechanical Attenuator (in Dual-Attenuator configurations). This is described in more detail below and in the section "Attenuator Configurations and Auto/Man" on page 1752
Preset	`OFF` (Disabled) for Swept SA measurement `ON` (Enabled) for all other measurements that support the electronic attenuator
State Saved	Saved in instrument state
Min	0 dB
Max	Dual-Attenuator configuration: 24 dB Single-Attenuator configuration: the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB
Annotation	See Annotation under the **Mech Atten** control description

More Information

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear. These advantages primarily aid in remote operation and are negligible for front panel use. See "Using the Electronic Attenuator: Pros and Cons" on page 833 for a detailed discussion of the pros and cons of using the electronic attenuator.

For the Single-Attenuator configuration, for SCPI backwards compatibility, the “soft” attenuation feature replaces the Dual-Attenuator configuration’s electronic attenuator. All the same couplings and limitations apply. See "Attenuator Configurations and Auto/Man" on page 1752

Mechanical Attenuator Transition Rules

When the Electronic Attenuator is enabled, the Mechanical Attenuator transitions to a state that has no Auto function. Below are the rules for transitioning the Mechanical Attenuator. Note that the information below ONLY applies to the Dual-Attenuator configurations, and ONLY when the Electronic Attenuator is installed:

When the Electronic Attenuation is enabled from a disabled state:

The Mechanical Attenuator is initialized to 10 dB (this is its optimal performance setting). You can then set it as desired with SCPI, numeric keypad, step keys, or knob, and it behaves as it normally would in manual mode

The Auto/Man state of (Mech) Atten is saved

The Auto/Man toggle on the (Mech) Atten control disappears and the auto rules are disabled

The Electronic Attenuator is set to 10 dB less than the previous value of the Mechanical Attenuator, within the limitation that it must stay within the range of 0 to 24 dB of attenuation

Examples in the Dual-Attenuator configuration:

Mech Atten at 20 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 10 dB. New total attenuation equals the value before Elec Atten enabled

Mech Atten at 0 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 0 dB. New total attenuation does not equal the value before Elec Atten enabled

Mech Atten at 40 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 24 dB. New total attenuation does not equal the value before Elec Atten enabled

When the Electronic Attenuation is disabled from an enabled state:

The Elec Atten control is grayed out

- The Auto/Man state of (Mech) Atten is restored

If now in Auto, (Mech) Atten recouples

If now in Man, (Mech) Atten is set to the value of total attenuation that existed before the Elec Atten was disabled. The resulting value is rounded up to the smallest value possible given the (Mech) Atten Step setting - (That is, 57 dB changes to 58 dB when (Mech) Atten Step is 2 dB)

Using the Electronic Attenuator: Pros and Cons

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear.

The “finer steps” advantage of the electronic attenuator is beneficial in optimizing the alignment of the instrument dynamic range to the signal power in the front panel as well as remote use. Thus, you can achieve improved relative signal measurement accuracy. Compared to a mechanical attenuator with 2 dB steps, the 1 dB resolution

of the electronic attenuator only gives better resolution when the odd-decibel steps are used. Those odd-decibel steps are less accurately calibrated than the even-decibel steps, so one tradeoff for this superior relative accuracy is reduced absolute amplitude accuracy.

Another disadvantage of the electronic attenuator is that the spectrum analyzer loses its “Auto” setting, making operation less convenient.

Also, the relationship between the dynamic range specifications (TOI, SHI, compression, and noise) and instrument performance are less well-known with the electrical attenuator. With the mechanical attenuator, TOI, SHI, and compression threshold levels increase dB-for-dB with increasing attenuation, and the noise floor does as well. With the electronic attenuator, there is an excess attenuation of about 1 to 3 dB between 0 and 3.6 GHz, making the effective TOI, SHI, and so forth, less well known. Excess attenuation is the actual attenuation relative to stated attenuation. Excess attenuation is accounted for in the instrument calibration

Adjust Atten for Min Clipping

Sets the combination of mechanical and electronic attenuation and gain based on the current measured signal level so that clipping will be at a minimum.

This is an "immediate action" function, that is, it executes once, when the control is pressed.

The algorithms that are used for the adjustment are documented under "Pre-Adjust for Min Clipping" on page 1757.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate`
Example	`:POW:RANG:OPT IMM`
Notes	Executing Adjust Atten for Min Clipping initiates the measurement.
Dependencies	Does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum measurements For the Waveform measurement, this control is available only in 5G NR Mode

Adjust Atten

Allows you to select;

– Electric attenuator only

– Combination of Electric attenuator and Mechanical attenuator

when the command `[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate` is executed.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize:TYPE EONLy | COMBined` `[:SENSe]:POWer[:RF]:RANGe:OPTimize:TYPE?`

Example	:POW:RANG:OPT:TYPE EONL :POW:RANG:OPT:TYPE?
Dependencies	Does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum measurements For the Waveform measurement, this control is available only in 5G NR Mode
Preset	COMBined
State Saved	Saved in instrument state

Pre-Adjust for Min Clipping

If this function is ON, it applies the adjustment described under "Adjust Atten for Min Clipping" on page 1756 each time a measurement restarts. Therefore, in Continuous measurement mode, it only executes before the first measurement.

In Dual-Attenuator models, you can set **Elec+Mech Atten**, in which case both attenuators participate in the autoranging, or **Elec Atten Only**, in which case the mechanical attenuator does not participate in the autoranging. This latter case results in less wear on the mechanical attenuator and is usually faster.

See "Adjustment Algorithm" on page 836

Selection	Example	Note
Off	:POW:RANGe:OPT:ATT OFF	This is the default setting
Elec Atten Only	:POW:RANGe:OPT:ATT ELEC	Selects only the electric attenuator to participate in auto ranging. This offers less wear on the mechanical attenuator and is usually faster
Mech + Elec Atten	:POW:RANGe:OPT:ATT COMB	In Dual-Attenuator models, this selects both attenuators to participate in the autoranging

Remote Command	[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation OFF | ON | ELECtrical | COMBined [:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation?
Example	:POW:RANG:OPT:ATT OFF :POW:RANG:OPT:ATT?
Notes	The parameter option ELECtrical sets this function to ON in Single-Attenuator models The parameter option COMBined is mapped to ELECtrical in Single-Attenuator models. If you send COMBined, it sets the function to ON and returns ELEC to a query For SCPI compatibility with models that do not have an input attenuator, the ON parameter is honored and mapped to COMBined
Dependencies	This control only appears in Dual-Attenuator models with an Electronic Attenuator installed In instruments with Dual-Attenuator model, when **Enable** "Elec Atten" on page 1753 is OFF or grayed-out, "Pre-Adjust for Min Clipping" on page 835 is grayed-out This control does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum

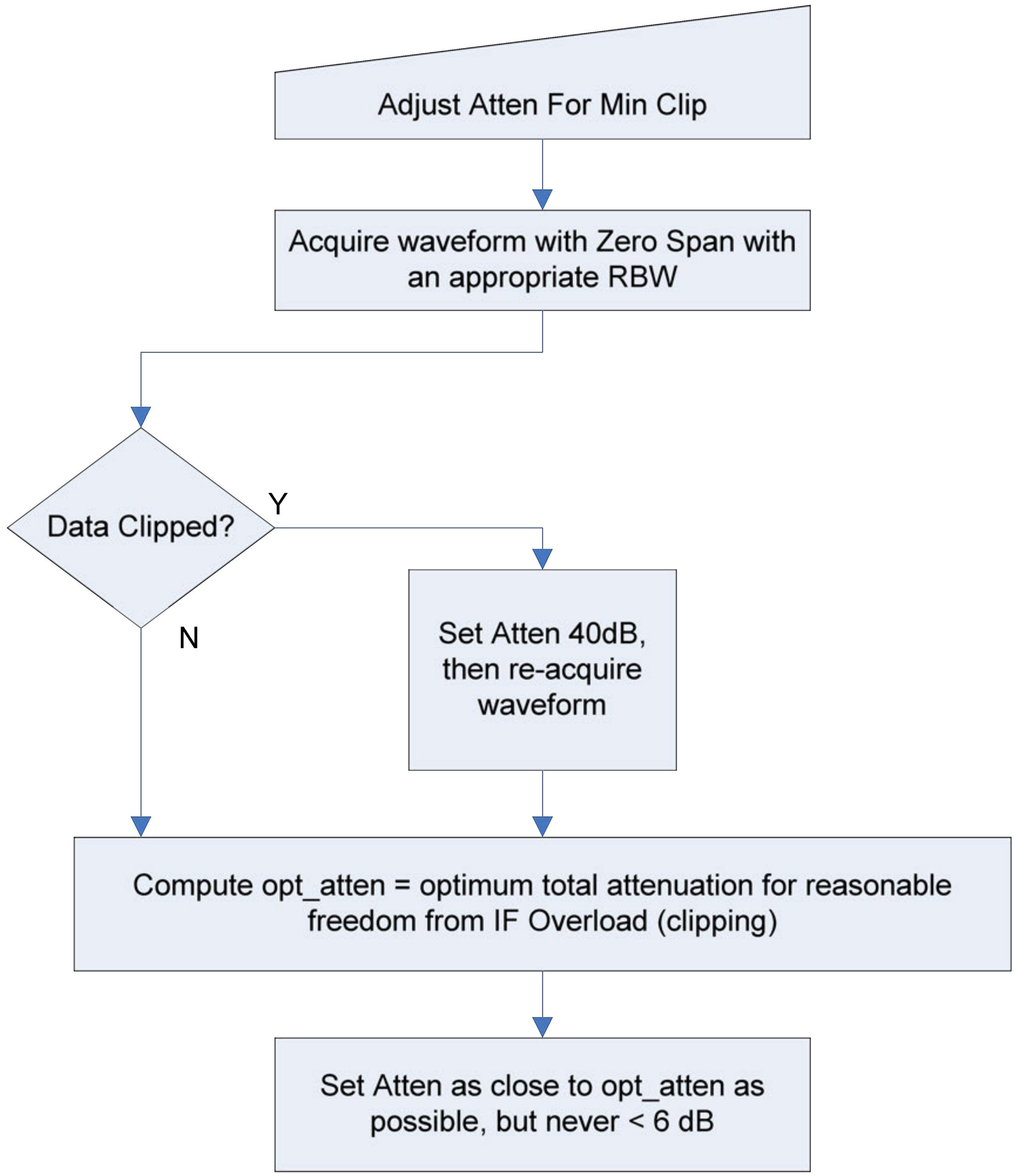
	measurements For the Waveform measurement, this control is available only in 5G NR Mode
Preset	OFF when Elec Atten is Disabled at preset, otherwise ELEC
State Saved	Saved in instrument state
Range	Dual-Attenuator models: Off | Elec Atten Only | Mech + Elec Atten Single-Attenuator models: Off | On

Notes	ON aliases to "Elec Atten Only" (:POW:RANG:OPT:ATT ELEC) OFF aliases to "Off" (:POW:RANG:OPT:ATT OFF) :POW:RANG:AUTO? returns true if :POW:RANG:OPT:ATT is not OFF
Backwards Compatibility SCPI	[:SENSe]:POWer[:RF]:RANGe:AUTO ON | OFF | 1 | 0 [:SENSe]:POWer[:RF]:RANGe:AUTO?

Adjustment Algorithm

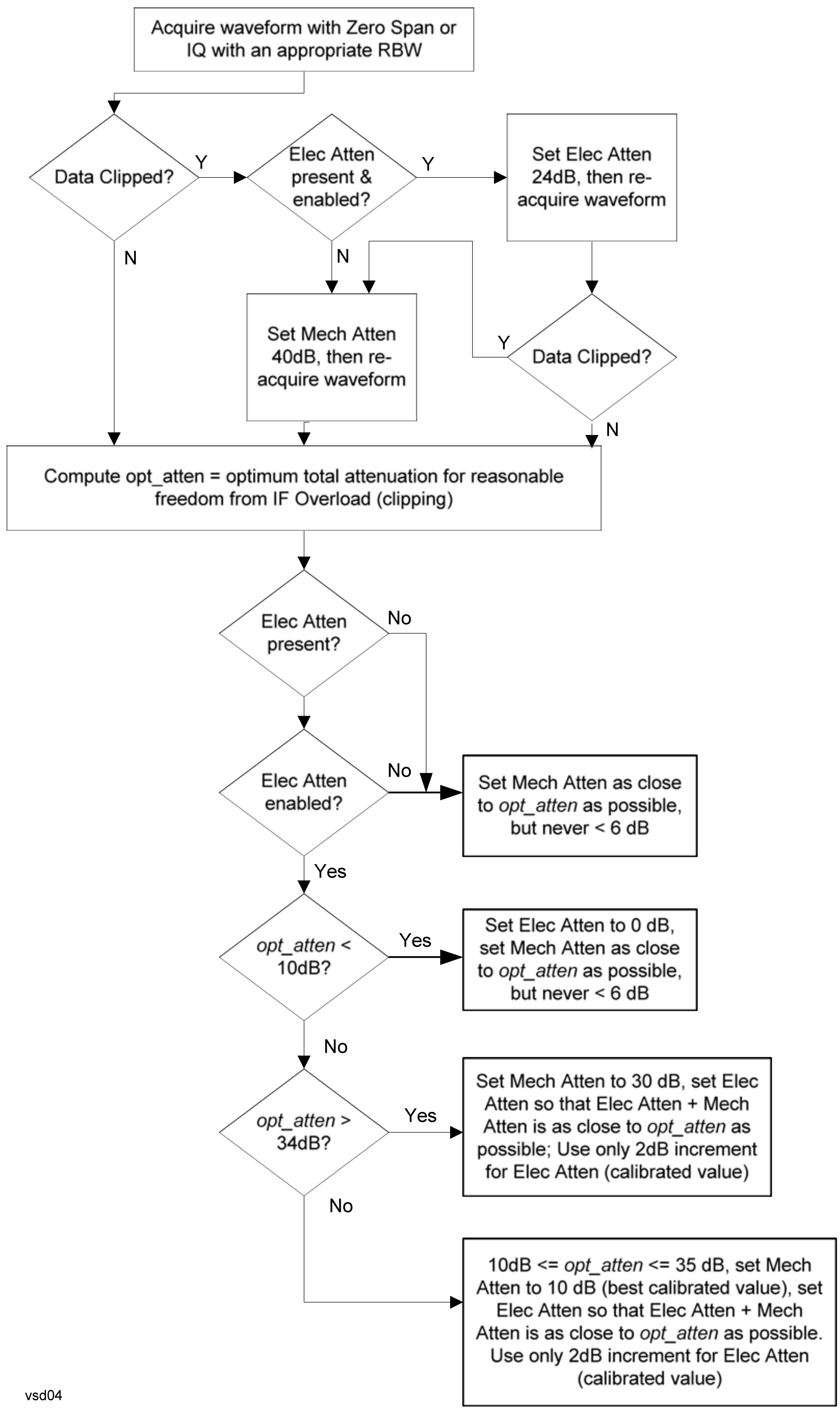
The algorithms for the adjustment are documented below:

Single-Attenuator Models

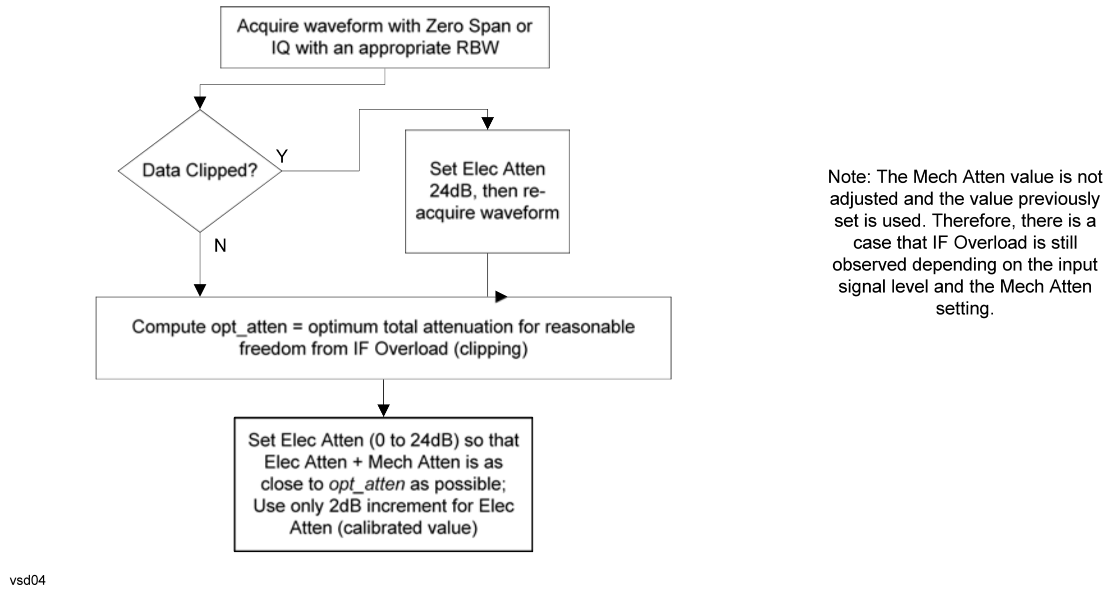


Dual-Attenuator models

"Adjust Atten for Min Clipping" on page 1756 or "Pre-Adjust for Min Clipping" on page 835 selection is Mech + Elec Atten:


Acquire waveform with Zero Span or IQ with an appropriate RBW
Data Clipped?
Y
N
Elec Atten present & enabled?
Y
N
Set Elec Atten 24dB, then re-acquire waveform
Set Mech Atten 40dB, then re-acquire waveform
Y
Data Clipped?
N
Compute opt_atten = optimum total attenuation for reasonable freedom from IF Overload (clipping)
Elec Atten present?
No
Elec Atten enabled?
No
Set Mech Atten as close to opt_atten as possible, but never < 6 dB
Yes
opt_atten < 10dB?
Yes
Set Elec Atten to 0 dB, set Mech Atten as close to opt_atten as possible, but never < 6 dB
No
opt_atten > 34dB?
Yes
Set Mech Atten to 30 dB, set Elec Atten so that Elec Atten + Mech Atten is as close to opt_atten as possible; Use only 2dB increment for Elec Atten (calibrated value)
No
10dB <= opt_atten <= 35 dB, set Mech Atten to 10 dB (best calibrated value), set Elec Atten so that Elec Atten + Mech Atten is as close to opt_atten as possible. Use only 2dB increment for Elec Atten (calibrated value)
vsd04

"Pre-Adjust for Min Clipping" on page 835 selection is Elec Only:



Mech Atten Step

Controls thestep size used when making adjustments to the input attenuation.

This control is labeled **Mech Atten Step** in Dual-Attenuator models and **Atten Step** in Single-Attenuator models. In the Dual-Attenuator configuration, this control only affects the step size of the mechanical attenuator.

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement] 10 dB | 2 dB` `[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement]?`
Example	`:POW:ATT:STEP 2` `:POW:ATT:STEP?`
Notes	This feature has a toggle choice from the front panel, but it takes a specific value (in dB) when used remotely. The only valid values are 2 and 10
Dependencies	Blanked in EXA, CXA and CXA-m if option FSA (2 dB steps) is not present. If blanked, attempts to set it via SCPI yield an error
Couplings	When the attenuation step size changes, the current mechanical attenuation value is adjusted (if necessary) to be quantized to the new step size. That is, if step is set to 10 dB, mech atten is increased if necessary so it is a multiple of 10 dB
Preset	EXA, CXA and CXA-m: 10 dB (2 dB with option FSA) All other models: 2 dB
State Saved	Saved in instrument state

3.7.3.3 Range (Non-attenuator models)

This tab is only available for Keysight's modular signal analyzers and certain other Keysight products. Examples include:

- VXT
- E7760
- M9391A
- M9393A

This tab also does not appear in UXM. In UXM, all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

State Saved	No

Range

Represents the amplitude of the largest sinusoidal signal that could be present within the IF without being clipped by the ADC. For signals with high peak-to-average ratios, the range may need to exceed the rms signal power by a significant amount to avoid clipping.

This is a measurement global setting.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe <real>` `[:SENSe]:POWer[:RF]:RANGe?`
Example	`:POW:RANG 10 dBm` `:POW:RANG?`
Notes	The MIN and MAX values are affected by the External Gain parameters, and by the **Center Frequency** The hardware compensates for frequency response and alters the Range setting
Preset	0 dBm
State Saved	Yes
Min	-100
Max	100
Annotation	Meas Bar

Adjust Range for Min Clipping

Sets the combination of attenuation and gain based on the current measured signal level so that clipping will be at a minimum.

This is an "immediate action" function, that is, it executes once, when the key is pressed.

This key does not appear in measurements that do not support this functionality.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate`
Notes	Executing Adjust Range for Min Clipping initiates the measurement
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760

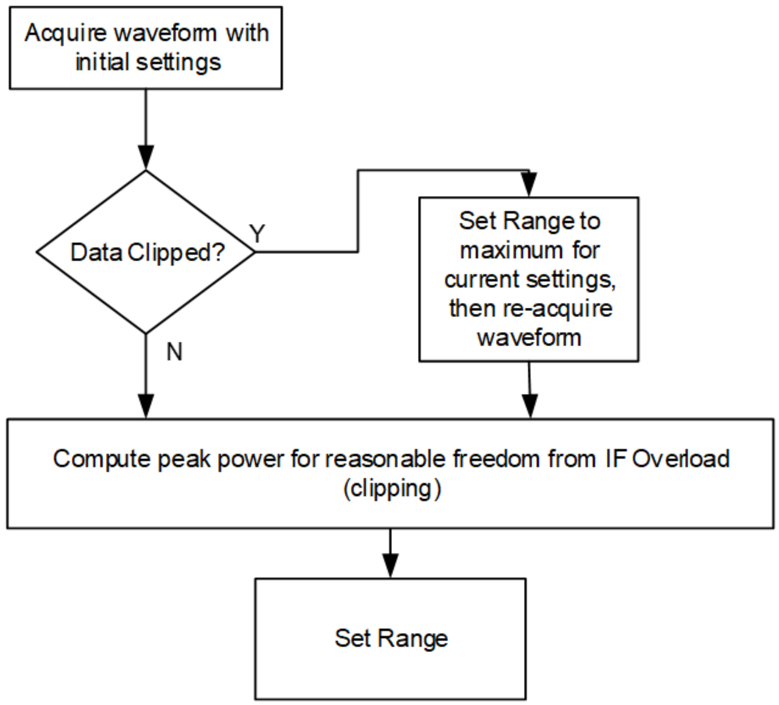
Pre-Adjust for Min Clipping

If this function is `ON`, it applies the adjustment described under Adjust Range For Min Clipping each time a measurement restarts. Therefore, in Continuous measurement mode, it only executes before the first measurement.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation OFF | ON | ELECtrical | COMBined` `[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation?`
Notes	Because there is no attenuator control available in these models, the control displays only `ON` and `OFF` choices. However, for SCPI compatibility with other platforms, all three parameters (`ELECtrical`, `COMBined`, and `ON`) are honored and all are mapped to `ELECtrical`, so if any of these three parameters is sent, a subsequent query will return `ELEC`
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760
Preset	`OFF` for Swept SA measurement; `ON` for all other measurements that support **Pre-Adjust for Min Clipping**
State Saved	Saved in instrument state

Adjustment Algorithm

The algorithm for the adjustment is documented below:



Peak-to-Average Ratio

Used with "Range (Non-attenuator models)" on page 1864 to optimize the level control in the instrument. The value is the ratio, in dB, of the peak power to the average power of the signal to be measured. A ratio of 0 should be used for sinusoidal signals; for 802.11g OFDM signals use 9 dB.

All Applications (Modes) show the current value of Peak-to-Average ratio on the control. However, some applications do not permit changing the value. In these situations, the control is grayed-out.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:PARatio <real>` `[:SENSe]:POWer[:RF]:RANGe:PARatio?`
Example	`:POW:RANG:PAR 12 dB`
Notes	In some Applications (Modes) this parameter is read-only; meaning the value will appear on the control and query via SCPI, but is not changeable. In such applications the control is grayed-out. Attempting to change the value via SCPI will be ignored but no error message will be generated
Dependencies	This control does not appear in Spectrum Analyzer Mode
Preset	10 dB VXT Models M9410A/11A: 0 dB
State Saved	Saved in instrument state
Min	0 dB
Max	20 dB

	VXT Models M9410A/11A: 50 dB

Mixer Lvl Offset

This is an advanced setting to adjust target Range at the input mixer, which in turn affects the signal level in the instrument's IF. This setting can be used when additional optimization is needed after setting "Peak-to-Average Ratio" on page 1866. Positive values of offset optimize noise performance over distortion, negative values optimize distortion performance over noise.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet <real>` `[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet?`
Example	`:POW:RANG:MIX:OFFS -5 dB`
Preset	0 dB
State Saved	Saved in instrument state
Min	-35 dB VXT Models M9410A/11A: -34 dB
Max	30 dB

3.7.3.4 Signal Path

Contains controls that pertain to the routing of the signal through the frontend of the instrument.

In general, this tab only appears in instruments whose hardware supports this signal routing. For example, this tab does not appear in many of the modular instrument products, including VXT Models M9420/21A. It also does not appear in UXM.

This tab *does* appear in VXT Models M9410A/11A because the Software Preselection control is in this tab, and VXT Models M9410A/11A implement a version of Software Preselection.

Presel Center

Pressing this control adjusts the centering of the preselector filter to optimize the amplitude accuracy at the frequency of the selected marker. If the selected marker is not on when **Presel Center** is pressed, the instrument turns on the selected marker, performs a peak search, and then performs centering on the marker's center frequency. If the selected marker is already on and between the start and stop frequencies of the instrument, the instrument performs the preselector calibration on that marker's frequency. If the selected marker is already on, but outside the frequency range between Start Freq and Stop Freq, the instrument first performs a peak search, and then performs centering on the marker's center frequency.

The value displayed on "Preselector Adjust" on page 1869 will change to reflect the new preselector tuning.

A number of considerations should be observed to ensure proper operation. See "Proper Preselector Operation" on page 844.

Remote Command	`[:SENSe]:POWer[:RF]:PCENter`
Example	`:POW:PCEN`
Notes	Note that the rules outlined above under the control description apply for the remote command as well as the key. The result of the command is dependent on marker position, etc. Any message shown by the control press is also shown in response to the remote command
Dependencies	Does not appear in CXA-m Does not appear in VXT Models M9410A/11A Grayed-out if the microwave preselector is off – If the selected marker's frequency is below Band 1, an advisory message is generated "Preselector not used in this frequency range" and no action is taken – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz – Blank in models that do not include a preselector, such as option 503. If the remote command is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View
Couplings	The active marker position determines where the centering will be attempted If the instrument is in a measurement such as averaging when centering is initiated, the act of centering the preselector restarts averaging, but the first average trace will not be taken until the centering is completed The offset applied to do the centering reads out on the "Preselector Adjust" on page 1869 control
Status Bits/OPC dependencies	When centering the preselector, `*OPC` will not return true until the process is complete and a subsequent measurement has completed, nor will results be returned to `:READ` or `:MEASure` queries The Measuring bit should remain set while this command is operating and should not go false until the subsequent sweep/measurement has completed

Proper Preselector Operation

A number of considerations should be observed to ensure proper operation:

1 If the selected marker is off, the instrument turns on a marker, performs a peak search, and adjusts the preselector using the selected marker's frequency. It uses the "highest peak" peak search method unqualified by threshold or excursion, so that there is no chance of a 'no peak found' error. It continues with that peak, even if it is the peak of just noise. Therefore, for this operation to work properly, there should be a signal on screen in a preselected range for the peak search to find

2 If the selected marker is already on, the instrument attempts the centering at that marker's frequency. There is no preselector for signals below about 3.6 GHz, so if the marker is on a signal below 3.6 GHz, no centering will be attempted and an advisory message generated

3 In some models, the preselector can be bypassed. If it is bypassed, no centering will be attempted in that range and a message will be generated

Preselector Adjust

Allows you to manually adjust the preselector filter frequency to optimize its response to the signal of interest. This function is only available when "Presel Center" on page 1868is available.

For general purpose signal analysis, using **Presel Center** is recommended. Centering the filter minimizes the impact of long-term preselector drift. **Preselector Adjust** can be used instead to manually optimize the preselector. One application of manual optimization would be to peak the preselector response, which both optimizes the signal-to-noise ratio and minimizes amplitude variations due to small (short-term) preselector drifting.

When **Presel Center** is performed, the offset applied to do the centering becomes the new value of **Preselector Adjust**.

Remote Command	`[:SENSe]:POWer[:RF]:PADJust <freq>` `[:SENSe]:POWer[:RF]:PADJust?`
Example	`:POW:PADJ 100KHz` `:POW:PADJ?`
Notes	The value on the control reads out to 0.1 MHz resolution
Dependencies	– Does not appear in CXA-m – Does not appear in VXT Models M9410A/11A – Grayed-out if microwave preselector is off – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz – Blank in models that do not include a preselector, such as option 503. If the SCPI is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View
Preset	0 MHz
State Saved	The **Preselector Adjust** value set by "Presel Center" on page 1868, or by manually adjusting **Preselector Adjust** It is not saved in instrument state, and does not survive a Preset or power cycle
Min	-500 MHz
Max	500 MHz
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PADJust` `[:SENSe]:POWer[:RF]:MMW:PADJust`

Notes	PSA had multiple preselectors, and you could select which preselector to adjust. Since the X-Series has only one mm/uW preselector, the preselector selection control is no longer available. However, to provide backward compatibility, we accept the legacy remote commands The command form has no effect, the query always returns MWAVe
Backwards Compatibility SCPI	[:SENSe]:POWer[:RF]:PADJust:PRESelector MWAVe | MMWave | EXTernal [:SENSe]:POWer[:RF]:PADJust:PRESelector?

Internal Preamp

Accesses a menu of controls for the internal preamps. Turning on the preamp gives a better noise figure, but a poorer inter-modulation distortion (TOI) to noise floor dynamic range. You can optimize this setting for your particular measurement.

The instrument takes the preamp gain into account as it sweeps. If you sweep outside of the range of the preamp, the instrument will also account for that. The displayed result always reflects the correct gain.

For some measurements, when the preamp is on and any part of the displayed frequency range is below the lowest frequency for which the preamp has specifications, a warning condition message appears in the status line. For example, for a preamp with a 9 kHz lowest specified frequency: "Preamp: Accy unspec'd below 9 kHz".

Selection	Example	Note
Off	:POW:GAIN OFF	
Low Band	:POW:GAIN ON :POW:GAIN:BAND LOW	Sets the internal preamp to use only the low band. The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Low Band selection in the dropdown
Full Range	:POW:GAIN ON :POW:GAIN:BAND FULL	Sets the internal preamp to use its full range. The low band (0-3.6 GHz, 0-3.4 GHz, 0-3GHz, depending on the model) is supplied by the low band preamp and the frequencies above low band are supplied by the high band preamp The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Full Range selection in the dropdown. If the high band option is not installed the Full Range selection does not appear

Remote Command	[:SENSe]:POWer[:RF]:GAIN:BAND LOW | FULL [:SENSe]:POWer[:RF]:GAIN:BAND?

	`[:SENSe]:POWer[:RF]:GAIN[:STATe] OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:GAIN[:STATe]?`

Example	`:POW:GAIN:BAND LOW`
	`:POW:GAIN:BAND?`
	`:POW:GAIN OFF`
	`:POW:GAIN?`

Dependencies	Preamp is not available on all hardware platforms. If the preamp is not present or is unlicensed, the control is not shown Does not appear in VXT Models M9410A/11A/15A If `:POW:GAIN:BAND FULL` is sent when a low band preamp is available, the preamp band parameter is set to `LOW` instead of `FULL`, and an "Option not installed" message is generated The preamp is not available when the electronic/soft attenuator is enabled
Preset	`LOW` `OFF`
State Saved	Saved in instrument state
Annotation	When the USB Preamp is not connected to USB, the Preamp annotation in the Meas Bar says "Off" if the preamp is off and displays the frequency range of the low band or full range preamp depending on the setting. For example, if the Preamp is set to Low Band and the Low Band is 3.6 GHz the annotation says "3.6 GHz". If it is a 13.6 GHz preamp and it is set to Full Range the annotation says "13.6 GHz" When the USB Preamp is connected to USB, the Preamp annotation says "Preamp: USB" if the internal preamp is off or "Preamp: USB, Int" if the internal preamp is on (only for measurements that support the USB preamp)

LNA

Lets you turn the Low Noise Amplifier (**LNA**) on or off.

The LNA is an additional preamplifier that provides superior DANL and frequency range compared to the Internal Preamp. The LNA provides lower system noise figure, especially at frequencies above 100 MHz, and can be operated up to the full range of 50 GHz instruments.

For best possible sensitivity, the LNA can be turned on together with the "Internal Preamp" on page 1870, although if you operate both preamps together, note that the TOI (distortion) specifications are impacted. The sensitivity improvement of this combination is substantial when operating in high band (frequencies above 3.6 GHz).

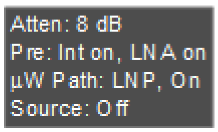
See "More Information" on page 848

Remote Command	`[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe] OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe]?`
Example	`:POW:GAIN:LNA ON`
Dependencies	Requires option LNA

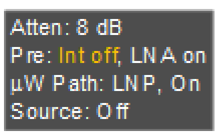
	Option LNA is not required by VXT model M9415A Does not appear in VXT models M9420A/21A/10A/11A May not appear in some measurements
Preset	OFF
State Saved	Saved in State

More Information

When the LNA is installed, the preamp annotation changes to show the state of both the LNA and the Internal Preamp. Below is an example:



Note that when operating entirely in the low band (below about 3.6 GHz), if the LNA is on, the Internal Preamp is switched off (even if you have its switch set to ON). This is because the noise performance is actually degraded in low band if both preamps are on. In this case, the annotation reflects the actual state of the two preamps, but the Internal Preamp annotation displays in amber, to warn you that the actual state of the Internal Preamp does not match the **Internal Preamp** switch control display:



µW Path Control

Options for this control include **µW Preselector Bypass** (Option MPB), **Low Noise Path** (Option LNP) and **Full Bypass Enable** in the High Band path circuits.

When the µW Preselector is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. When **Low Noise Path Enable** is selected, the instrument automatically bypasses certain circuitry in the high frequency bands that can contribute to noise, when it is appropriate based on other instrument settings.

For most applications, the preset state is **Standard Path**, which provides the best remote-control throughput, minimizes acoustic noise from switching and minimizes the risk of wear in the hardware switches, particularly in remote test scenarios where both low band and high band setups will follow in rapid succession. In this path, the bypass of the low band/high band switch and microwave preamp is never activated, which can cause some noise degradation but preserves the life of the bypass switch.

For applications that utilize the wideband IF paths, the preset state is **µW Preselector Bypass**, if option MPB is present. This is because, when using a wideband IF such as

the 140 MHz IF, the µW Preselector's bandwidth can be narrower than the available IF bandwidth, causing degraded amplitude flatness and phase linearity, so it is desirable to bypass the preselector in the default case.

You may choose **Low Noise Path Enable** for a lower noise floor, especially in the 21-26.5 GHz region, though without improving many measures of dynamic range, and without giving the best possible noise floor. The preamp, if purchased and used, gives better noise floor than does **Low Noise Path Enable**, but the preamp's compression threshold and third-order intercept are much poorer than that of **Low Noise Path Enable**.

A fourth choice is **Full Bypass Enable**, which combines **µW Preselector Bypass** and **Low Noise Path Enable**. Because this can bypass most of the circuitry between the input and the first mixer, care should be taken when using this setting to avoid damaging the mixer. **Full Bypass Enable** is only available if both options LNP and MPB are present, as well as option FBP.

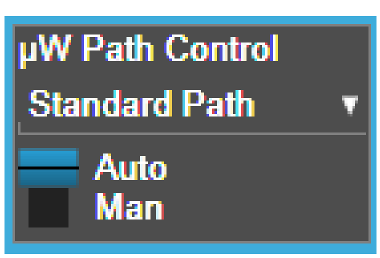
Path	Example	Note
Standard Path	:POW:MW:PATH STD	Normal setting for most measurements. µW Preselector in circuit, Low Noise Path disabled
Low Noise Path Enable	:POW:MW:PATH LNP	See "Low Noise Path Enable" on page 853
µW Preselector Bypass	:POW:MW:PATH MPB	See "µW Preselector Bypass" on page 854
Full Bypass Enable	:POW:MW:PATH FULL	See "Full Bypass Enable" on page 855

Remote Command	[:SENSe]:POWer[:RF]:MW:PATH STD | LNPath | MPBypass | FULL [:SENSe]:POWer[:RF]:MW:PATH?
Example	:POW:MW:PATH LNP Enables the Low Noise path :POW:MW:PATH?
Notes	If "Presel Center" on page 1868 is performed, the instrument will momentarily switch to the Standard Path, regardless of the setting of **µW Path Control** The DC Block will always be switched in when the low noise path is switched in, to protect succeeding circuitry from DC. Note that this does not mean "when the low noise path is enabled" but when, based on the Low Noise Path rules, the path is actually switched in. This can happen when the selection is **Low Noise Path Enable** or **Full Bypass Enable.** In the case where the DC Block is switched in the instrument is now AC coupled. However, if you selected DC coupling, the UI would still behave as though it were DC coupled, including all annunciation, warnings, status bits, and responses to SCPI queries. This is because, based on other settings, the instrument could switch out the low noise path at any time and hence go back to being DC coupled Alignment switching ignores the settings in this menu, and restores them when finished
Dependencies	Does not appear in CXA-m Does not appear in VXT Models M9410A/11A Does not appear in BBIQ and External Mixing

	The **Low Noise Path Enable** selection does not appear unless Option LNP is present and licensed The **µW Preselector Bypass** selection does not appear unless Option MPB is present and licensed The **Full Bypass Enable** selection does not appear unless options LNP and MPB are both present as well as option FBP In any of these cases, if the required options are not present and the SCPI command is sent, error -241, "Hardware missing; Option not installed" is generated **Low Noise Path Enable** and **Full Bypass Enable** are grayed-out if the current measurement does not support them **Low Noise Path Enable** and **Full Bypass Enable** are not supported in Avionics and MMR Modes. In any of these cases (that is, the feature is not supported in either measurement or mode), if the SCPI command is sent, the following error is generated: -221, “Setting Conflict; Feature not supported for this measurement”
Preset	All except modes specified below: `STD` IQ Analyzer, VXA, Pulse and Avionics mode: – MPB option present and licensed: `MPB` – MPB option not present and licensed: `STD`
State Saved	Save in instrument state
Range	Standard Path|Low Noise Path Enable|µW Presel Bypass|Full Bypass Enable
Annotation	In the Meas Bar, if the Standard path is chosen, it says: µW Path: Standard If Low Noise Path is enabled but the LNP switch is not thrown, it shows: µW Path: LNP,Off If the Low Noise Path is enabled and the LNP switch IS thrown, it shows: µW Path: LNP,On If the preselctor is bypassed, it says: µW Path: Bypass If Full Bypass Enable is selected but the LNP switch is not thrown, it shows: µW Path: FByp,Off If Full Bypass Enable is selected and the LNP switch IS thrown, it shows: µW Path: FByp,On

µW Path Control Auto [Mode: VMA, WLAN, NR5G, CQM]

In VMA, WLAN, 5G NR, CQM modes, an Auto/Man switch is added to **µW Path Control**:



This allows the function to automatically switch based on certain Auto Rules as shown below:

VMA Mode

Measurement	When µW Path Control is in Auto:
Digital Demod	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Custom OFDM	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Presel Bypass
SEM	Always Presel Bypass
Spurious Emissions	Always Standard Path

WLAN Mode

Measurement	When µW Path Control is in Auto:
Modulation Analysis	Always Presel Bypass
Spectral Flatness	Always Presel Bypasss
Power vs Time	Always Presel Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Always Presel Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Always Presel Bypass
SEM	1. For 11be 320M, when 'Enabled Wideband IF for FFT' is OFF or 'Sweep Type Rule' is Best Dynamic Range, auto µW path is standard. 2. For other cases, auto µW path is presel bypass if presel bypass is enabled, auto µW path is standard if presel bypass is not enabled.
Spurious Emissions	Always Standard Path

5G NR Mode

Measurement	When µW Path Control is in Auto:
Modulation	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in

Measurement	When µW Path Control is in Auto:
Analysis	which case choose Full Bypass if conditions warrant(FBP Option is available and "Allow Full Bypass in Auto" is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and "Allow Full Bypass in Auto" is On), otherwise choose Preselector Bypass
Channel Power	Always Standard Path
Occupied BW	Always Standard Path
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Standard Path
SEM	Always Standard Path
Spurious Emissions	Always Standard Path
Transmit On|Off Power	Use Standard Path unless tuned frequency > 3.6 GHz and Info BW > 15 MHz, in which case choose Preselector Bypass

Channel Quality Mode

Measurement	When µW Path Control is in Auto:
Group Delay	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and "Allow Full Bypass in Auto" is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass

Remote Command	`[:SENSe]:POWer[:RF]:MW:PATH:AUTO ON | OFF | 1 | 0` `[:SENSe]:POWer[:RF]:MW:PATH:AUTO?`
Example	`:POW:MW:PATH:AUTO ON` `:POW:MW:PATH:AUTO?`
Dependencies	Only appears in VMA, WLAN, 5G NR and CQM modes
Couplings	See the tables above
Preset	ON
Range	ON|OFF

Low Noise Path Enable

You may select **Low Noise Path Enable**, which gives a lower noise floor under some circumstances, particularly when operating in the 21-26.5 GHz region. With the Low Noise Path enabled, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

- The instrument is not in the Low Band, meaning:
- the start frequency is above 3.5 GHz and
- the stop frequency is above 3.6 GHz
- the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Low Noise Path Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Low Noise Path Enable** is selected in the user interface. The only time the Low Noise Path is used is when **Low Noise Path Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

For measurements that use IQ acquisition, the low noise path is used when **Center Frequency** is in High Band (> 3.6 GHz) and no preamp is in use. In other words, the rules above are modified to use only the center frequency to qualify which path to switch in. This is not the case for FFTs in the Swept SA measurement; they use the same rules as swept measurements.

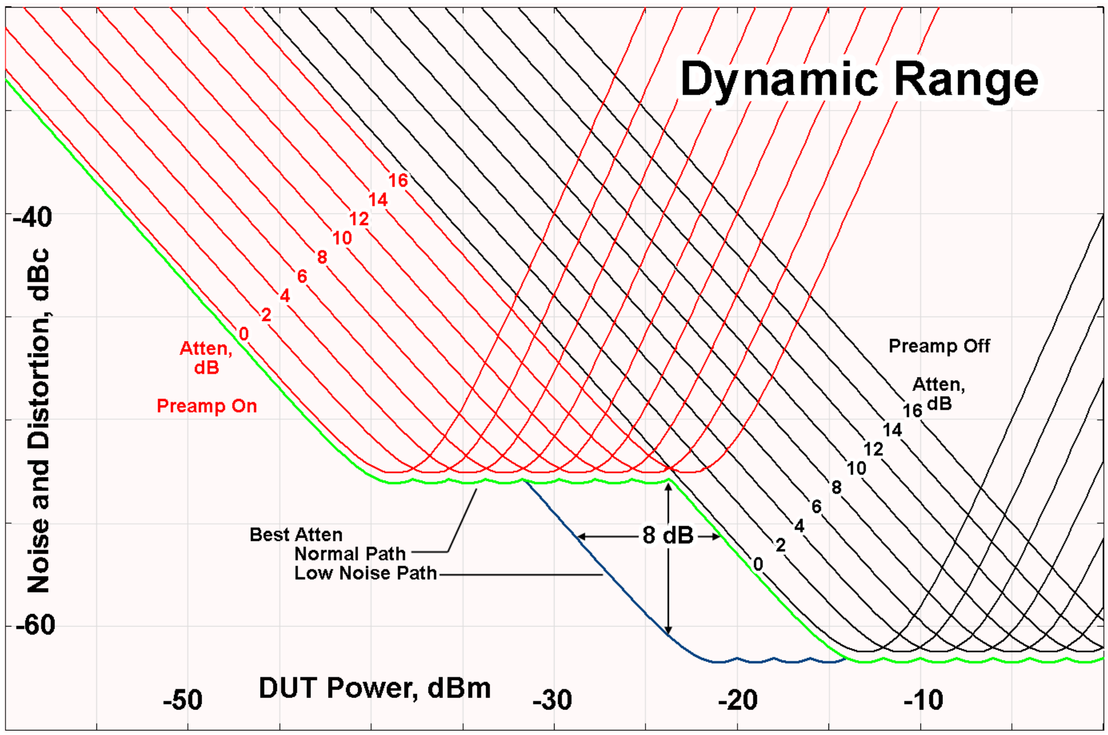
Note that the Low Noise Path, while giving improved DANL, has the disadvantage of decreased TOI performance and decreased gain compression performance relative to the standard path.

Note also that the bypass switch is a mechanical switch and has finite life, so if the **Low Noise Path Enable** is selected, it is possible to cause frequent cycling of this switch by frequently changing instrument settings such that the above conditions hold true only some of the time. A user making tests of this nature should consider opting for the **Standard Path**, which will never throw the bypass switch, at the expense of some degraded noise performance.

The low noise path is useful for situations where the signal level is so low that the instrument performance is dominated by noise even with 0 dB attenuation, but still high enough that the preamp option would have excessive third-order intermodulation or compression. The preamp, if purchased and used, gives better noise floor than does the “Low Noise Path.” However, its compression threshold and third-order intercept are much poorer than that of the non-preamp path.

There are some applications, typically for signals around –30 dBm, for which the third-order dynamic range of the standard path is good enough, but the noise floor is not low enough even with 0 dB input attenuation. When the third-order dynamic range of the preamp path is too little and the noise floor of the standard path is too high, the Low Noise Path can provide the best dynamic range

The graph below illustrates the concept. It shows, in red, the performance of an instrument at different attenuation settings, both with the preamp on and off, in a measurement that is affected by both instrument noise and instrument TOI. The green shows the best available dynamic range, offset by 0.5 dB for clarity. The blue shows how the best available dynamic range improves for moderate signal levels with the low noise path switched in. In this illustration, the preamp improves the noise floor by 15 dB while degrading the third-order intercept by 30 dB, and the low noise path reduces loss by 8 dB. The attenuator step size is 2 dB.



There are other times where selecting the low noise path improves performance, too. Compression-limited measurements such as finding the nulls in a pulsed-RF spectrum can profit from the low noise path in a way similar to the TOI-limited measurement illustrated. Accuracy can be improved when the low noise path allows the optimum attenuation to increase from a small amount like 0, 2 or 4 dB to a larger amount, giving better return loss at the instrument input. Harmonic measurements, such as second and third harmonic levels, are much improved using the low noise path because of the superiority of that path for harmonic (though not intermodulation) distortion performance.

µW Preselector Bypass

Toggles the preselector bypass switch for band 1 and higher. When the microwave presel is on, the signal path is preselected. When the microwave preselector is off, the signal path is not preselected. The preselected path is the normal path for the instrument.

The preselector is a tunable bandpass filter which prevents signals away from the frequency of interest from combining in the mixer to generate in-band spurious signals (images). The consequences of using a preselector filter are its limited bandwidth, the amplitude and phase ripple in its passband, and any amplitude and phase instability due to center frequency drift.

Option MPB or pre-selector bypass provides an unpreselected input mixer path for certain X-Series signal analyzers with frequency ranges above 3.6 GHz. This signal path allows a wider bandwidth and less amplitude variability, which is an advantage when doing modulation analysis and broadband signal analysis. The disadvantage is that, without the preselector, image signals will be displayed. Another disadvantage of bypassing the preselector is increased LO emission levels at the front panel input port.

Image responses are separated from the real signal by twice the 1st IF. For IF Paths of 10 MHz and 25 MHz, the 1st IF is 322.5 MHz, so the image response and the real signal will be separated by 645 MHz. The 1st IF will be different for other IF Path settings. When viewing a real signal and its corresponding image response in internal mixing, the image response will be to the left of the real signal.

Also, the image response and the real signal typically have the same amplitude and exhibit the same shape factor.

However, if Option FS1, Fast Sweep Capability, is enabled, the image response in the Swept SA measurement appears lower in amplitude and has a much wider shape factor compared to the real signal.

Full Bypass Enable

With **Full Bypass Enable** selected, the microwave preselector is bypassed. In addition, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

– The instrument is not in the Low Band, meaning:

– the start frequency is above 3.5 GHz and

– the stop frequency is above 3.6 GHz.

– the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. The only time the Low Noise Path is used is when **Full Bypass Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

CAUTION When **Full Bypass Enable** is selected, and "Attenuation" on page 1747 is set to 0 dB, there will be a direct AC connection between the input and the first converter

when the Low Noise Path switches in (when Start Freq >3.6 GHz and the Preamp is either not licensed, set to Low Band, or Off). This puts the first converter at high risk to be damaged by high AC power. Consequently, whenever **Full Bypass Enable** is selected, a warning message appears in the status bar:

Full Bypass Enabled, maximum safe input power reduced

Microwave Preselector Bypass Backwards Compatibility

Example	`:POW:MW:PRES OFF` Bypasses the microwave preselector
Notes	Included for Microwave Preselector Bypass backwards compatibility The `ON` parameter sets the `STD` path (`:POW:MW:PATH STD`) The `OFF` parameter sets path `MPB` (`:POW:MW:PATH MPB`)
Preset	`ON`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe] ON | OFF | 0 | 1` `[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe]?`

Frequency Extender Preselection Bypass

Frequency Extender Preselection Bypass only applies to the high frequency path of the Frequency Extender and only if the Frequency Extender allows it. For example, the V3050A high frequency path is 50 – 110 GHz and does allow control of the preselector bypass.

When the Frequency Extender's preselection is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. For bandwidths greater than 2.5 [GHz], it is recommended that the signal bypass the Frequency Extender Preselector since the max bandwidth of the Preselector can be as narrow as 2.5 [GHz].

For most applications, the preset state is `OFF`, which gives the best remote-control throughput, minimizes acoustic noise from switching, minimizes out of band spurs, and minimizes the risk of wear in the hardware switches.

Coupling with Microwave Preselector Control

The control of whether to apply or bypass the Frequency Extender's preselection is dependent on the Microwave Path Control setting.

The coupling between the Microwave Path Control and Frequency Extender Preselector Bypass is described below.

UW PATH CTRL	UW PRESELECTOR	VIKING PRESELECTOR
Standard Path	On	**On**
Low Noise Path Enable	On	**On**
uW Presel Bypass	Off	**Off**
Full Bypass Enable	Off	**Off**

In other words…

uW Path Ctrl == Standard
uW Path Ctrl == Low Noise → Viking PreselBypass == Off

uW Path Ctrl == Bypass
uW Path Ctrl == Full Bypass → Viking PreselBypass == On

For the Frequency Extender Preselector Bypass to take effect, it requires a Frequency Extender device (such as V3050A) be connected and External RF (ERFIN) selected as the input.

The Frequency Extender Preselector is applied or bypassed depending on the Microwave Path Control setting only when the acquisition is above 50 [GHz]. Hence, it will be bypassed only when the acquisition is above 50 [GHz].

Preselector and Bandwidth Conflict

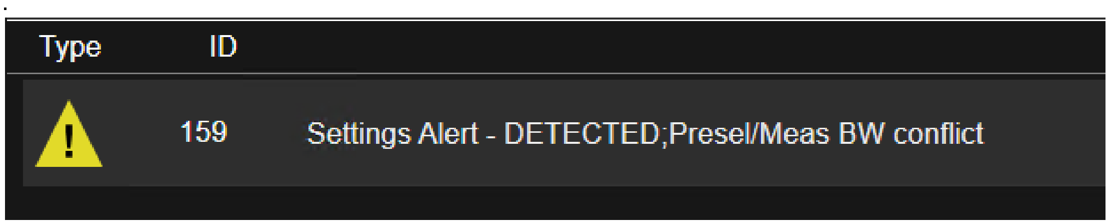
When the Frequency Extender Preselector is applied and the signal bandwidth is greater than 2.5 [GHz], then a settings alert message will show to warn the user that the signal may be distorted due to the limitation of the Frequency Extender Preselector bandwidth.

An example of the settings alert message is shown below.

Settings Alert message in the Status Bar at the bottom of the display.

Settings Alert message in the error queue

.



Software Preselection

Software Preselection is provided in some instruments, either to compensate for issues with provided hardware preselection or to provide the preselection function when there is no hardware preselector.

N9041B

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 50 GHz, software preselection must be used to suppress and separate images above 50 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

In the N9041B, Software Preselection only applies for frequencies above 50 GHz, therefore it is only used for RF Input 2. Even if it is turned on, it will not be used for other inputs and never for frequencies below 50 GHz. This is why the label of this control contains the parenthetical note “(>~50 GHz)”.

Note that in the N9041B, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

N9042B+V3050A

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 88 GHz, software preselection must be used to suppress and separate images above 88 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

For N9042B+V3050A, Software Preselection only applies for frequencies above 88 GHz, therefore it is only used for External RF. Even if it is turned on, it will not be used for other inputs and never for frequencies below 88 GHz. This is why the label of this control contains the parenthetical note “(>~88 GHz)”.

Note that for N9042B+V3050A, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

VXT models M9410A/11A

Software Preselection is used to provide the preselection function, as there is no hardware preselector in these models. Two background traces are taken and compared point by point, and the point with the lowest amplitude from the two traces is used. This provides a method to reduce spurs that are internally generated within the VXT, but the user should note the following when using Software

Preselection:

- There is some speed cost due to the need to take multiple captures
- Taking the point with the lowest amplitude in each trace will make the average noise level lower at all points that do not have a spur. This can reduce the accuracy of the measurement of noise and noise-like signals.

Because of the difficulty in identifying spurs manually, you are encouraged to leave Software Preselection ON at all times in VXT models M9410A/11A. If you turn it off in order to speed up your measurement or improve noise accuracy, be aware of unwanted onscreen spurs.

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel:STATe 0 | 1 | ON | OFF` `[:SENSe]:POWer[:RF]:SWPresel:STAT?`
Example	`:POW:SWPR:STAT 1` `:POW:SWPR:STAT?`
Dependencies	Only appears in N9041B, N9042B+V2050A, and VXT models M9410A/11A. Does not appear in all measurements
Couplings	Sweep Time is affected by SW Preselection. Also Auto Tune supports SW Preselection, so set SW Preselection state and then do Auto Tune
Preset	N9041B: OFF N9042B+V3050A: ON M9410A/11A: ON
State Saved	Saved in instrument state

SW Preselection Type

Specifies the algorithm used for software preselection.

Two hidden sweeps are taken in succession. The second sweep is offset in LO frequency by 2*IF/N. For each point in each trace, the smaller amplitude from the two traces is taken and placed in that point in the selected trace. The Peak detector is auto-selected to improve the image suppression effectiveness. Responses of each trace that lie on top of one another will remain and are valid signals. Other signals are images and are suppressed. The action of taking the smaller of the two traces will make the average noise level lower in all points that do not have an image, thus reducing the accuracy of the measurement of noise and noise-like signals.

- `NORMal` - mathematically removes all image and multiple responses of signals present at the input
- `ADVanced` - any trace processing (such as “max hold” or trace averaging) is performed on the points of both candidate traces before the “select minimum” operation occurs. This form of processing works better for non-stationary signals, such as pulsed-RF signals

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel NORMal | ADVanced` `[:SENSe]:POWer[:RF]:SWPResel?`
Example	`:POW:SWPR NORM` `:POW:SWPR?`
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed-out. Its grayout message is "Unavailable unless SW Presel enabled"
Preset	N9041B: `ADVanced` N9042B+V3050A: `NORMal`
State Saved	Saved in instrument state

SW Preselection BW

Specifies the effective bandwidth to be used for Software Preselection.

The choices are:

- `NORMal` – when making Swept measurements, a software preselection algorithm is used which takes up to 4 background acquisitions, then post-processes the result. This algorithm can remove images from signals with an occupied bandwidth up to around 3 GHz. (Default/Preset setting). When making FFT measurements, this algorithm is not used, instead the same algorithm is used as for `NARRow` (below)
- `NARRow`– a software preselection algorithm is used which takes two background acquisitions, then post-processes the result to detect and remove images from wideband signals with occupied bandwidths up to 2 GHz. This increases the risk of images failing to be rejected, but improves the measurement speed

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel:BW NORMal | NARRow` `[:SENSe]:POWer[:RF]:SWPResel:BW?`
Example	`:POW:SWPR:BW NARR`
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed out. Its grayout message is "Unavailable unless SW Presel enabled" For N9042B+V3050A the parameter is SCPI only and always set to `NARRow` when Software Preselection is enabled
Preset	N9041B: `NORMal` N9042B+V3050A: `NARRow`
State Saved	Saved in instrument state

High Freq Prefilter

Lets you set the state of Prefilter for Center Frequencies above 1310 MHz.

In VXT Models M9410A/11A, the Receiver RF path has a bank of filters that come after the RF Attenuator in the signal path. Since this bank of filters precedes the mixer they are known as the “Prefilter” bank. Their purpose is to eliminate unwanted in-band mixing products by filtering out all but the desired frequencies before the signals get to the mixer. There are 13 prefilter bands to cover the frequencies between 9 kHz and 6000 MHz. The Prefilter provides the necessary rejection of the unwanted signal.

Remote Command	`[:SENSe]:<measurement>:PFILter[:STATe] ON | OFF | 1 | 0` `[:SENSe]:<measurement>:PFILter[:STATe]?`

Example	For example, to enable High Freq Prefilter in IQ Analyzer Mode:
	For the Complex Spectrum Measurement:
	`:SPEC:PFIL ON`
	For the IQ Waveform Measurement:
	`:WAV:PFIL ON`
	`:`

Dependencies	This control only appears in VXT models M9410A/11A with center frequency above 1310 MHz
Preset	See “Prefilter Presets” below
State Saved	Saved in instrument state

Prefilter Presets

Meas	Mode	Preset
SPEC	BASIC	OFF
WAV	BASIC, WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
MON	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
RHO	WCDMA	OFF
CDP	WCDMA	OFF
PCON	WCDMA	OFF
EVMQ	WCDMA	OFF
CHP	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
OBW	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
ACP	WCDMA, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
SEM	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PST	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PVT	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF
EVM	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF

Meas	Mode	Preset
FLAT	WLAN	OFF
EVMM	WLAN	OFF
CEVM	LTEAFDD, LTEATDD	OFF
PAVT	5GNR, VMA	OFF
DDEM	VMA	OFF
OFDM	VMA	OFF
SAN	SA	ON
HARM	SA	ON

3.7.4 BW

The BW key opens the bandwidth menu, which contains controls for the Resolution Bandwidth and Video Bandwidth functions of the instrument.

The Resolution BW functions control filter bandwidth and filter type. There are two filter types, Gaussian and Flattop. The Gaussian filters have a response curve that is parabolic on a log scale. The Flattop filter shape is a close approximation of a rectangular filter.

3.7.4.1 Settings

The **Settings** tab contains the basic Bandwidth functions. In most measurements it is the only tab under Bandwidth.

Res BW

Activates the resolution bandwidth active function, which allows you to manually set the resolution bandwidth (RBW) of the instrument.

Normally, **Res BW** (Auto) selects automatic coupling of the Res BW to Span using the ratio set by the Span:3 dB RBW control (some measurements do not have a Span:3 dB RBW control, in which case the measurement chooses the optimal ratio). To decouple the resolution bandwidth, press the **Auto/Man** toggle on the **Res BW** control, or simply enter a different value for **Res BW**.

When the **Res BW** is manually selected, it may be returned to the coupled state by pressing the **Auto/Man** toggle on the **Res BW** control. This may also be done by pressing Auto Couple or by performing a **Preset**.

See:

"RBW Presets" on page 863

"More Information" on page 864.

Remote Command	`[:SENSe]:CHPower:BANDwidth[:RESolution] <bandwidth>`
	`[:SENSe]:CHPower:BANDwidth[:RESolution]?`
	`[:SENSe]:CHPower:BANDwidth[:RESolution]:AUTO ON | OFF | 1 | 0`
	`[:SENSe]:CHPower:BANDwidth[:RESolution]:AUTO?`

Example	`:CHP:BAND 5 MHz`
	`:CHP:BAND?`
	`:CHP:BAND:AUTO ON`
	`:CHP:BAND:AUTO?`

Notes	For numeric entries, all RBW Types choose the nearest (arithmetically, on a linear scale, rounding up) available RBW to the value entered The setting and querying of values depend on the current bandwidth type This parameter is preset by the Meas Method selection. Preset values are as follows: IBW: 100 kHz IBWR: 27 kHz FAST (WCDMA): 390 kHz When Meas Method is "Fast Power" and Fast Power RBW mode is "Speed," RBW is calculated as follows: RBW = Span × 2.442 × 10^{-3}
Couplings	Sweep time is coupled to the RBW. As the RBW changes, the sweep time (if set to Auto) is changed to maintain amplitude calibration Video bandwidth (VBW) is coupled to the RBW. As the resolution bandwidth changes, the video bandwidth (if set to Auto) changes to maintain the ratio of VBW/RBW (10:1) When the Res BW is set to Auto, the resolution bandwidth is auto-coupled to the span. The ratio of Span/RBW is approximately 106:1 when auto coupled. When Res BW is set to Man, and the bandwidths are entered manually, these bandwidths are used regardless of other instrument settings
Preset	Auto (unless noted in the table below)
State Saved	Saved in instrument state
Min	1 Hz
Max	8 MHz is the max equivalent –3 dB RBW, which means that the named RBW (the one shown on the control etc.) can actually exceed 8 MHz if using a filter other than –3 dB Gaussian
Annotation	A "#" mark appears before "RBW" in the annotation when it is switched from Auto to Manual coupling
Backwards Compatibility Notes	For backwards compatibility this command obeys both the `BANDwidth` and `BWIDth` forms For ESA, the maximum Res BW was 5 MHz; on X-Series it is 8 MHz

RBW Presets

Unless noted in the table below, the Preset value of RBW is Auto.

Mode	Preset Value
WCDMA	240 kHz

Mode	Preset Value
WLAN	100 kHz
MSR	100 kHz

More Information

When **Res BW** is set to **Auto**, the bandwidth selected depends on the Filter Type (see “Filter Type” below).

Only certain discrete resolution bandwidths are available. The available bandwidths are dependent on the **Filter Type** or the **EMC Standard**. If an unavailable bandwidth is entered with the numeric keypad, the closest available bandwidth is selected.

In some Power Suite measurements, in the LTE-Advanced applications (both FDD and TDD), when Res BW is in Auto, the resolution bandwidth is predefined based on the corresponding bandwidth of the single LTE carrier, as shown in the table below. In the Multi-carrier case, the narrowest RBW among the active carriers is used.

LTE-A FDD/TDD

Carrier BW	Auto RBW, kHz	
	CHP	ACP
1.4 MHz	20	51
3 MHz	43	51
5 MHz	68	100
10 MHz	150	100
15 MHz	220	100
20 MHz	270	100
200 kHz (NB-IoT, only available in FDD)	10	10

5G NR

Bandwidth	Auto RBW, kHz
5 MHz	68
10 MHz	150
15 MHz	220
20 MHz	270
25 MHz	360
30 MHz	430
40 MHz	560
50 MHz	680
60 MHz	820
70 MHz	1000
80 MHz	1100

Bandwidth	Auto RBW, kHz
90 MHz	1300
100 MHz	1500
200 MHz	2700
400 MHz	3000

Video BW

Lets you change the instrument post-detection filter (VBW or “video bandwidth”) from 1 Hz to 8 MHz in approximately 10% steps. In addition, a wide-open video filter bandwidth may be chosen by selecting 50 MHz. The VBW is annotated at the bottom of the display, in the center.

Normally, **Video BW (Auto)** selects automatic coupling of the Video BW to RBW using the ratio set by the VBW:3 dB RBW control. To decouple the resolution bandwidth, press the **Auto/Man** toggle on the **Video BW** control, or simply enter a different value for **Video BW**.

When the **Video BW** is manually selected, it may be returned to the coupled state by pressing the **Auto/Man** toggle on the **Video BW** control. This may also be done by pressing Auto Couple or by performing a **Preset**.

Remote Command	`[:SENSe]:CHPower:BANDwidth:VIDeo <bandwidth>`
	`[:SENSe]:CHPower:BANDwidth:VIDeo?`
	`[:SENSe]:CHPower:BANDwidth:VIDeo:AUTO ON | OFF | 1 | 0`
	`[:SENSe]:CHPower:BANDwidth:VIDeo:AUTO?`

Example	`:CHP:BAND:VID 2.4 MHz`
	`:CHP:BAND:VID?`
	`:CHP:BAND:VID:AUTO OFF`
	`:CHP:BAND:VID:AUTO?`

Notes	For numeric entries, the instrument chooses the nearest (arithmetically, on a linear scale, rounding up) available VBW to the value entered. The 50 MHz VBW is defined to mean “wide open” The values shown in this table reflect the conditions after a Mode Preset
Dependencies	Sometimes the displayed Video BW is not actually used to process the trace data: When the Average Detector is selected and **Sweep Type** is set to **Swept,** the video bandwidth filter cannot be used, because it uses the same hardware as the Average Detector When the Quasi-Peak, EMI Average or RMS Average detector is selected the VBW is implemented by the digital IF as part of the detector When this is the case, the VBW still acts to change the Sweep Time, if Sweep Time is in Auto, and still affects the data on other traces for which this is not the case
Couplings	Video bandwidth (VBW) is normally coupled to RBW. If **VBW** is set to Auto, then the VBW is changed as the RBW changes, to maintain the ratio set by the VBW:3 dB RBW control (usually 10:1 for measurements that do not have a VBW:3 dB RBW control)

Preset	Auto (unless noted in table below) ON
State Saved	Saved in instrument state
Min	1 Hz
Max	50 MHz
Annunciation	A "#" mark appears before "VBW" in the annotation when it is not coupled
Annotation	In the bottom center of the screen, "VBW <value> <units>" indicates the current video bandwidth value. Note that for some detectors this is not the value actually used for VBW (see above)
Backwards Compatibility Notes	For backwards compatibility this command obeys both the `BANDwidth` and `BWIDth` forms

VBW Presets

Unless noted in the table below, the Preset value of VBW is **Auto**.

Mode	Preset Value
WCDMA	2.40 MHz

RBW Filter Type

Selects the type for the resolution bandwidth filters. Historically, the Res BW filters in HP/Agilent/Keysight spectrum instruments were Gaussian filters, specified using the –3 dB bandwidth of the filter. That is, a 10 MHz Res BW filter was a Gaussian shape with its –3 dB points 10 MHz apart. In the X-Series, the **RBW Filter BW** menu lets you choose between a Gaussian and Flat Top filter shape, for varying measurement conditions.

Filter Type	SCPI Example
Gaussian	`:BAND:SHAP GAUS`
Flattop	`:BAND:SHAP FLAT`

For more information, see the RBW Filter Type control description for the Swept SA measurement.

Remote Command	`[:SENSe]:CHPower:BANDwidth:SHAPe GAUSsian | FLATtop` `[:SENSe]:CHPower:BANDwidth:SHAPe?`
Example	`:CHP:BAND:SHAP GAUS` `:CHP:BAND:SHAP?`
Notes	`GAUSsian`= Gaussian `FLATtop` = Flattop We use `SHAPe` instead of `TYPE` (even though the control name uses Type) because `TYPE` is used for backwards compatibility

Preset	Auto Couple chooses the preset value
State Saved	Saved in instrument state
Annotation	The annotation under RBW in the bottom left of the screen shows the type of filter or bandwidth that is being used. The following examples illustrate this:

–3 dB (Normal) filter BW:	Res BW 300 Hz
–6 dB filter BW:	Res BW (–6 dB) 422 Hz
Noise filter BW:	Res BW (Noise) 317 Hz
Impulse filter BW:	Res BW (Impulse) 444 Hz
CISPR filter BW:	Res BW (CISPR) 200 Hz
MIL filter BW:	Res BW (MIL) 1 kHz
Flattop filter type:	Res BW (Flattop) 300 Hz

Backwards Compatibility SCPI	`[:SENSe]:CHPower:BWIDth:SHAPe`

3.7.5 Display

The Display key opens the Display Menu, which lets you configure display items for the current Mode, Measurement View or Window.

3.7.5.1 Meas Display

The Meas Display tab contains controls for setting up the display for the current Measurement, View or Window.

Bar Graph On/Off

Turns the Bar Graph On and Off.

Remote Command	`:DISPlay:CHPower:WINDow[1]:BGRaph ON | OFF | 1 | 0` `:DISPlay:CHPower:WINDow[1]:BGRaph?`
Example	`:DISP:CHP:WIND:BGR ON` `:DISP:CHP:WIND:BGR?`
Preset	`OFF`
State Saved	Saved in instrument state
Range	`ON|OFF`
Backwards Compatibility SCPI	`:DISPlay:CHPower:VIEW[1]:WINDow[1]:BGRaph`

3.7.5.2 View

Contains controls for selecting the current **View**, and for editing User Views.

User View

Lets you choose a View from the saved User Views for the current measurement. This panel only appears if a User View exists for the current measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:SELect <alphanumeric>` `:DISPlay:VIEW:ADVanced:SELect?`
Example	Select Baseband as the current View `:DISP:VIEW:ADV:SEL “Baseband”`

Notes	You must be in the measurement whose View you are trying to set to send the command. You can only set Views for the current measurement using this command
	For predefined views, the parameter is derived from the view name that is shown in the View list in the user interface. For example, if you are trying to select the Trace Zoom view in the Swept SA measurement, you send:
	`:DISP:VIEW:ADV:SEL "Trace Zoom"`
	because “Trace Zoom” is the name of the View as seen in the Mode/Meas dialog or in the Display, View menu
	You *cannot* use the legacy View parameter (which in this case would be `TZOom`) with `:DISP:VIEW:ADV:SEL`
	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case. Thus, both of the following forms work:
	`:DISP:VIEW:ADV:SEL "Trace Zoom"`
	`:DISP:VIEW:ADV:SEL "TRACE ZOOM"`
	If the specified view is not a valid View, the query returns the error message “-224, Illegal parameter value; View with the name <alphanumeric> does not exist”
	If the display is disabled (via `:DISP:ENAB OFF`) then the error message “-221, Settings conflict; View SCPI cannot be used while Display is disabled” is generated

Backwards Compatibility SCPI	The legacy node `:DISPlay:VIEW[:SELect]` is retained for backwards compatibility, but it only supports predefined views

Restore Layout to Default

Restores the Layout to the default for Basic.

Modified Views are very temporary; if you exit the current measurement they are discarded, and they are not saved in State. To retain this View for later use, and to be able to return easily to your original Basic View, you can save your edited View as a "User View".

Save Layout as New View

Saves your new View as a User View. An alpha keyboard appears, which lets you name your new View; the default is the old View name plus a number.

Remote Command	`:DISPlay:VIEW:ADVanced:NAME <alphanumeric>`
Example	`:DISP:VIEW:ADV:NAME "Baseband"` Creates a new View named `Baseband` from the current View, and selects it as the current View
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If `<alphanumeric>` name already exists as a View, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; User View SCPI cannot be used while Display is disabled" is generated

Re-Save User View

You can re-edit a User View; if you make changes, then an asterisk will appear next to the User View's name. You can then tap **Re-Save User View** to save it back to its existing name, or **Save Layout as New View** to add another, new User View.

This is a front panel function only, there is no remote command available to perform this function. To do this remotely, you must first perform **Save Layout as New View**, then delete the old User View and rename the new one with the name of the View you just deleted.

Rename User View

You can rename the current View by giving it a new unique name. Only User Views can be renamed, if the current View is a Predefined View, an error occurs.

Remote Command	`:DISPlay:VIEW:ADVanced:REName <alphanumeric>`
Example	`:DISP:VIEW:ADV:REN "Baseband"`
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the `<alphanumeric>` specifying the new name is already present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot rename a Predefined View" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete User View

You can delete the current View if it is a User View. The default view becomes the current view for the Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:DELete`
Example	`:DISP:VIEW:ADV:DEL`
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the `<alphanumeric>` is not present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> does not exist" is generated If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot delete a Predefined View" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete All User Views

Deletes all previously saved User Views. The default view becomes the current view for the Measurement if a User View was the current view when this command was executed.

Remote Command	`:DISPlay:VIEW:ADVanced:DELete:ALL`
Example	`:DISP:VIEW:ADV:DEL:ALL`
Notes	Disabled if there are no User Views

View Editor Remote Commands

The following remote commands help you manage Views and User Views. Note that the SCPI node for User Views handles both Predefined and User Views. The legacy nodes, `:DISPlay:VIEW[:SELect]` and `:DISPlay:VIEW:NSEL`, are retained for backwards compatibility, but they only support predefined views.

View Listing Query

Returns a string containing a comma-separated list of names for *all* the Views, including User Views, available for the current Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:CATalog?`
Example	`:DISP:VIEW:ADV:CAT?`

Notes	Returns a quoted string of the available Views for the current measurement, separated by commas. The list includes names for *all* the Views, including User Views, available for the current Measurement Example: `"Normal,Trace Zoom,Spectrogram,Baseband,myView1,yourView1"` No distinction is made between Predefined and User Views If you switch measurements with the display disabled (via `:DISP:ENAB OFF`), then query the list of available Views, the result is undefined

User View Listing Query

Returns a string containing a comma-separated list of names for *only* the User Views available for the current Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:USER:CATalog?`
Example	`:DISP:VIEW:ADV:USER:CAT?`
Notes	Returns a quoted string of the available User Views for the current measurement, separated by commas. Example: `"Baseband,myView1,yourView1"` If you switch measurements with the display disabled (see "Display Enable (Remote Command Only)" on page 1894), then query the list of available Views, the result is undefined

3.7.5.3 Annotation

Contains controls for setting up the annotation for the current Mode or Measurement.

Graticule

Turns the display graticule On or Off for all windows with graticules in all measurements in the current Mode. Also turns the graticule Y-Axis annotation on and off.

Remote Command	`:DISPlay:GRATicule[:STATe] OFF | ON | 0 | 1` `:DISPlay:GRATicule[:STATe]?`
Example	`:DISP:GRAT OFF`
Notes	The graticule is the set of horizontal and vertical lines that make up the grid/divisions for the X-Axis and Y-Axis
Preset	`ON`
State Saved	Saved in instrument state
Backwards Compatibility	`:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe] OFF | ON | 0 | 1` `:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe]?`

SCPI	This command is accepted for backwards compatibility with older instruments, but the WINDow, TRACe and GRID parameters are ignored

Screen Annotation

Controls the display of the annunciation and annotation around the graticule, including any annotation on lines (such as the display line, the threshold line, etc.) and the Y-Axis annotation, for all windows with screen annotation in all measurements in the current Mode.

This does *not* include marker annotation (or the N dB result). When OFF, the graticule expands to fill the entire graticule area, leaving only the 1.5% gap above the graticule, as described in the **Trace** section.

Remote Command	:DISPlay:ANNotation:SCReen[:STATe] OFF | ON | 0 | 1 :DISPlay:ANNotation:SCReen[:STATe]?
Example	:DISP:ANN:SCR OFF
Dependencies	Grayed-out and forced to OFF when **System Display Settings**, **Annotation** is OFF
Preset	ON This remains OFF through a Preset when **System Display Settings**, **Annotation** is set to OFF
State Saved	Saved in instrument state

Trace Annotation

Turns on and off the labels on the traces, showing their detector (or their Math Mode) as described in the **Trace** section, for all windows in all measurements in the current Mode for which Trace Annotation on/off is supported.

If Trace Math is being performed on a trace, then the Trace Math annotation replaces the detector annotation.

For measurements that support limit lines, this key also turns on and off the labels on the Limit Lines. The label is the Limit number annotation and Limit Comment displayed on the graph. If the length of the comment is greater than 20 characters, the first 8 characters and the last 8 characters are displayed, joined with ….

Remote Command	:DISPlay:ANNotation:TRACe[:STATe] ON | OFF | 1 | 0 :DISPlay:ANNotation:TRACe[:STATe]?
Example	:DISP:ANN:TRAC OFF
Preset	OFF
State Saved	Saved in instrument state

Control Annotation

Turns on and off the display of values on the Active Function controls for all measurements in the current Mode. This is a security feature.

Remote Command	`:DISPlay:ACTivefunc[:STATe] ON | OFF | 1 | 0` `:DISPlay:ACTivefunc[:STATe]?`
Example	`:DISP:ACT OFF`
Dependencies	Grayed out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Meas Bar

Turns the Measurement Bar at the top of the screen on and off for all measurements in the current Mode. When `OFF`, the graticule area expands to fill the area formerly occupied by the Measurement Bar.

Remote Command	`:DISPlay:ANNotation:MBAR[:STATe] OFF | ON | 0 | 1` `:DISPlay:ANNotation:MBAR[:STATe]?`
Example	`:DISP:ANN:MBAR OFF`
Dependencies	Grayed out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Display Enable (Remote Command Only)

Turns the display on/off, including the display drive circuitry. The backlight stays lit to confirm that the instrument is on. The display enable setting is mode global. Theare three reasons for turning the display off:

1. To increase speed as much as possible by freeing the instrument from having to update the display
2. To reduce emissions from the display, drive circuitry
3. For security purposes

If you have turned off the display:

- and you are in local operation, the display can be turned back on by pressing any key or by sending :SYSTem:DEFaults MISC or :DISPlay:ENABle ON (neither *RST nor :SYSTem:PRESet enable the display)
- and you are in remote operation, the display can be turned back on by pressing the **Local** or **Esc** keys, or by sending :SYSTem:DEFaults MISC or :DISPlay:ENABle ON (neither *RST nor :SYSTem:PRESet enable the display)
- and you are using either the :SYSTem:KLOCk command or GPIB local lockout, then *no* front-panel key press will turn the display back on. You must turn it back on remotely.

If the display is OFF, many SCPI commands related to User Views and Multiscreen functionality do not work, and return the error messages "-221, Settings conflict; Screen SCPI cannot be used when Display is disabled" or "221, Settings conflict; View SCPI cannot be used while Display is disabled". These commands include:

Name	Command
Select User View	:DISPlay:VIEW:ADVanced:SELect
Rename User View	:DISPlay:VIEW:ADVanced:REName
Delete User View	:DISPlay:VIEW:ADVanced:DELete
Create User View	:DISPlay:VIEW:ADVanced:NAME
Select Screen	:INSTrument:SCReen:SELect
Delete Screen	:INSTrument:SCReen:DELete
Delete All But This Screen	:INSTrument:SCReen:DELete:ALL
Add Screen	:INSTrument:SCReen:CREate
Rename Screen	:INSTrument:SCReen:REName
Sequencer On/Off	:SYSTem:SEQuencer

Remote Command	:DISPlay:ENABle OFF | ON | 0 | 1 :DISPlay:ENABle?
Example	:DISP:ENAB OFF
Couplings	:DISP:ENAB OFF turns Backlight OFF and :DISP:ENAB ON turns Backlight ON, but changing Backlight settings does *not* change the state of :DISP:ENAB
Preset	ON Set by :SYST:DEF MISC, but not affected by *RST or :SYSTem:PRESet
State Saved	Not saved in instrument state
Backwards Compatibility Notes	:SYST:PRES no longer turns on :DISPlay:ENABle as it did in legacy analyzers

3.7.6 Freq

The **Freq** key opens the Frequency menu, which contains controls that allow you to control the Frequency and Channel parameters of the instrument.

Some features in the Frequency menu are the same for all measurements in the current Mode – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset. For example, the Center Freq setting is the same for all measurements - it does not change as you change measurements.

3.7.6.1 Settings

The Settings Tab contains controls that pertain to the X axis parameters of the measurement. These parameters control how data on the vertical (X) axis is displayed and control instrument settings that affect the horizontal axis.

Center Frequency

Sets the frequency that corresponds to the horizontal center of the graticule. While adjusting the Center Frequency the Span is held constant.

The center frequency setting is the same for all measurements within a mode, that is, it is Meas Global. Some modes are also able to share a Mode Global center frequency value. If this is the case, the Mode will have a **Global** tab in its **Meas Setup** menu.

The **Center Freq** function sets (and queries) the Center Frequency for the currently selected input. If your instrument has multiple inputs, and you select another input, the Center Freq changes to the value for that input. SCPI commands are available to directly set the Center Freq for a specific input.

Center Freq is remembered as you go from input to input. Thus you can set a Center Freq of 10 GHz with the RF Input selected, change to BBIQ and set a Center Freq of 20 MHz, then switch to External Mixing and set a Center Freq of 60 GHz, and when you go back to the RF Input the Center Freq will go back to 10 GHz; back to BBIQ and it is 20 MHz; back to External Mixing and it is 60 GHz.

See:

"RF Center Freq" on page 878

"Ext Mix Center Freq" on page 879

"I/Q Center Freq" on page 880

"Center Frequency Presets" on page 876

"VXT Models with Radio Heads/CIU Frequency Range" on page 878

Remote Command	`[:SENSe]:FREQuency:CENTer <freq>`

	`[:SENSe]:FREQuency:CENTer?`

Example	`:FREQ:CENT 50 MHz`
	sets Center Frequency to 50 MHz
	`:FREQ:CENT UP`
	increments the Center Frequency by the value of CF Step
	`:FREQ:CENT?`
	returns the current value of Center Frequency

Notes	This command sets the RF, External Mixing or I/Q Center Frequency depending on the selected input For RF input it is equivalent to `:FREQ:RF:CENT` For I/Q input it is equivalent to `:FREQ:IQ:CENT` For External Mixer it is equivalent to `:FREQ:EMIX:CENT` Preset and Max values are dependent on Hardware Options (5xx) If no terminator (e.g. MHz) is sent the terminator Hz is used. If a terminator with unit other than Frequency is used, an invalid suffix error message is generated
Dependencies	Not available in the MSR, LTE-Advanced FDD/TDD and 5G NR modes.
Preset	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 876 and "RF Center Freq" on page 878 and "Ext Mix Center Freq" on page 879 and "I/Q Center Freq" on page 880 and "VXT Models with Radio Heads/CIU Frequency Range" on page 878
State Saved	Saved in instrument state
Min/Max	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 876 and "RF Center Freq" on page 878 and "I/Q Center Freq" on page 880 and "VXT Models with Radio Heads/CIU Frequency Range" on page 878
Annotation	Center <value> appears in the lower left corner of the display
Status Bits/OPC dependencies	Non-overlapped

Center Frequency Presets

The following table provides the Center Frequency Presets for the Spectrum Analyzer mode, and the Max Freq, for the various frequency options:

Freq Option	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
503 (all but CXA)	1.805 GHz	3.6 GHz	3.7 GHz
503 (CXA)	1.505 GHz	3.0 GHz	3.08 GHz
507 (all but CXA)	3.505 GHz	7.0 GHz	7.1 GHz
507 (CXA)	3.755 GHz	7.5 GHz	7.58 GHz
508 (all but MXE)	1.805 GHz	3.6 GHz	8.5 GHz

Freq Option	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
508 (MXE)	4.205 GHz	8.4 GHz	8.5 GHz
513	6.805 GHz	13.6 GHz	13.8 GHz
526 (except CXA and MXE)	13.255 GHz	26.5 GHz	27.0 GHz*
526 (CXA)	13.255 GHz	26.5 GHz	26.55 GHz
526 (MXE)	1.805 GHz	3.6 GHz	27.0 GHz
532	16.005 GHz	32.0 GHz	32.5 GHz
540	20.005 GHz	40.0 GHz	40.5 GHz
543	21.505 GHz	43.0 GHz	43.0 GHz
544	22.005 GHz	44.0 GHz	45.0 GHz
550	25.005 GHz	50.0 GHz	52 GHz
F03 (CXA-m)	1.505 GHz	3.0 GHz	3.08 GHz
F07 (CXA-m)	3.755 GHz	7.5 GHz	7.575 GHz
F13 (CXA-m)	6.805 GHz	13.6 GHz	13.8 GHz
F26 (CXA-m)	13.255 GHz	26.5 GHz	26.55 GHz
504 (M9420A/21A, M8920A)	2.145 GHz	3.88GHz	3.88 GHz
506 (M9420A/21A, M8920A)	3.245 GHz	6.08GHz	6.08 GHz
F06 (M9410A/11A)	1.0 GHz	6.08 GHz	6.08 GHz
F06 (M9415A)	1 GHz	1.08 GHz	6.6 GHz
F08 (M9415A)	1 GHz	1.08 GHz	8.6 GHz
F12 (M9415A)	1 GHz	1.08 GHz	12.9 GHz

*For option 526, the Max CF in RTSA is 26.999999995 GHz.

N9041B Center Freq Presets

Input	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
Input 1, all models	25.005 GHz	50.0 GHz	52 GHz
Input 2, opt 585	42.505 GHz	85.0 GHz	86 GHz
Input 2, opt 590	45.005 GHz	90.0 GHz	92 GHz
Input 2, opt 5CX	55.005 GHz	110.0 GHz	110 GHz

Input 2, CXA and MXE

Model	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
CXA opt C75	0.7505 GHz	1.5 GHz	1.58 GHz
MXE	505 MHz	1 GHz	1.000025 GHz

Tracking Generator Frequency Limits (CXA only)

Tracking Generator Option	Min Freq (clips to this freq when turn TG on and can't tune below while TG on)	If above this Freq, Stop Freq clipped to this Freq when TG turned on	Max Freq (can't tune above) while TG on
T03	9 kHz	3.0 GHz	3.08 GHz
T06	9 kHz	6.0 GHz	6.05 GHz

Tracking Generator Frequency Limits(CXA-m only)

Tracking Generator Option	Min Freq (clips to this freq when turn TG on and can't tune below while TG on)	If above this Freq, Stop Freq clipped to this Freq when TG turned on	Max Freq (can't tune above) while TG on
T03	2 MHz	3.08 GHz	3.08 GHz
T07	2 MHz	7.575 GHz	7.575 GHz
T13	2 MHz	13.8 GHz	13.8 GHz
T26	2 MHz	26.55 GHz	26.55 GHz

VXT Models with Radio Heads/CIU Frequency Range

The following table shows the Center Frequency Presets and Range for VXT modes with Radio Heads/CIU.

Products with Radio Heads/CIU	Preset	Start frequency	Stop frequency
M9421A + CIU	6 GHz	5.9 GHz	12 GHz
M9410A + CIU	6 GHz	5.9 GHz	12 GHz
M9410A + CIU + RRH	25 GHz	24.25 GHz	43.5 GHz

RF Center Freq

SCPI command for specifying the RF Center Frequency. This command sets the Center Frequency to be used when the RF input is selected, even if the RF input is not the input that is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel *always* applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:RF:CENTer <freq>` `[:SENSe]:FREQuency:RF:CENTer?`
Example	`:FREQ:RF:CENT 30 MHz` `:FREQ:RF:CENT?`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode
Dependencies	If the electronic/soft attenuator is enabled, any attempt to set Center Frequency such that the Stop Frequency would be >3.6 GHz fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning

Preset	See table above
State Saved	Saved in instrument state
Min	-79.999995 MHz
Max	26.999999995 GHz See table above. Basically instrument maximum frequency - 5 Hz If the knob or step keys are being used, also depends on the value of Span

Ext Mix Center Freq

SCPI command for specifying the External Mixer Center Frequency. This command sets the Center Frequency to be used when the External Mixer is selected, even if the External Mixer input is not the input which is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel *always* applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:EMIXer:CENTer <freq>` `[:SENSe]:FREQuency:EMIXer:CENTer?`
Example	`:FREQ:EMIX:CENT 60 GHz` `:FREQ:EMIX:CENT?`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode
Couplings	When returning to External Mixing after having been switched to one of the other inputs (e.g., RF), you will return to the settings that you had when you left External Mixing. So you will return to the band you were in, with the Center Frequency that you had. However, Span is not an input-dependent parameter, so you will retain the span from the other input. Therefore, the instrument comes back with the span from the previous input, limited as necessary by the current mixer setup
Preset	When a Mode Preset is performed while in External Mixing, the Start frequency of the current Mode is set to the nominal Min Freq of the lowest harmonic range in the Harmonic Table for the current mixer setup. Similarly, the Stop frequency of the current Mode is set to the nominal Max Freq of the highest harmonic range in the Harmonic Table. The Center Freq thus presets to the point arithmetically equidistant from these two frequencies Note that, if the current measurement has a limited Span available to it, and cannot achieve the Span shown in the table (Span=Stop Freq – Start Freq), the instrument uses the maximum Span the measurement allows, and still sets the Center Freq to the midpoint of the Start and Stop Freq values in the Harmonic Table When Restore Input/Output Defaults is performed, the mixer presets to the 11970A, whose Start and Stop frequencies are 26.5 and 40 GHz respectively. The center of these two frequencies is 33.25 GHz Therefore, after a Restore Input/Output Defaults, if you go into External Mixing and do a Mode Preset while in the Spectrum Analyzer Mode, the resulting Center Freq is 33.25 GHz
State Saved	Yes
Min	The minimum frequency in the currently selected mixer band + 5 Hz If the knob or step keys are being used, also depends on Span
Max	The maximum frequency in the currently selected mixer band - 5 Hz If the knob or step keys are being used, also depends on Span

I/Q Center Freq

SCPI command for specifying the I/Q Center Frequency. This command will set the Center Frequency to be used when the I/Q input is selected, even if the I/Q input is not the input which is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:IQ:CENTer <freq>` `[:SENSe]:FREQuency:IQ:CENTer?`
Example	`:FREQ:IQ:CENT 30 MHz`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode
Preset	0 Hz
State Saved	Saved in instrument state
Min	-40.049995 MHz
Max	40.049995 MHz

Span

Changes the displayed frequency range symmetrically about the center frequency. While adjusting the Span, the Center Frequency is held constant, which means that both Start Frequency and Stop Frequency will change.

If the Span is set to a value greater than the maximum allowable span of the instrument, an error message is generated indicating the data is out of range and was clipped to upper limit.

The default (and minimum) Span is calculated using the number of carriers and the carrier width where;

Span = (Upper Carrier Freq + (max offset IBW * (1 + alpha)) / 2) - (Lower Carrier Freq - (max offset IBW * (1 + alpha)) / 2)

If the RRC Filter in on, then the span is increased by a factor of 1 + Filter Alpha.

See "Span Presets" on page 882

Remote Command	`[:SENSe]:CHPower:FREQuency:SPAN <freq>` `[:SENSe]:CHPower:FREQuency:SPAN?`
Example	`:CHP:FREQ:SPAN 10 MHz` `:CHP:FREQ:SPAN?`
Dependencies	If the electrical attenuator is enabled, any attempt to set Span such that the Stop Frequency would be >3.6 GHz results in an error In instruments with an RF Preselector, such as MXE, you cannot sweep across the band break at 3.6 GHz while the RF Preselector is on in Continuous sweep, as there is a mechanical switch which

	bypasses the RF Preselector above 3.6 GHz. See the Stop Frequency control description for details of this limitation For the MSR mode, this control is not shown For WLAN 802.11ac (80 MHz + 80 MHz), the control is not enabled and its value is coupled with the spacing between the center frequencies of the two carriers Span = | Center Frequency 1 – Center Frequency 2| + Integ BW + 40 MHz Margin When the calculated span is over 1 GHz, it's still coupled to its maximum value, which is 1 GHz
Couplings	Span affects RBW, sweeptime, FFT & Sweep choice (including FFT Width, Phase Noise Optimization and ADC Dither auto couplings) Any value of the Center Frequency or Span that is within the frequency range of the instrument is allowed when the value is being set through the front panel numeric key pad or the SCPI command. The other parameter is forced to a different value if needed, to keep the Start and the Stop Frequencies within the instrument's frequency range When using the knob or the step up/down keys or the UP |DOWN keywords in SCPI, the value that is being changed i.e. the Center Frequency or Span, is limited so that the other parameter is not forced to a new value When Res BW is set to Auto, the resolution bandwidth is auto-coupled to span. The ratio of span /RBW is approximately 106:1. When the Res BW is set to Man, bandwidths are entered by the user, and these bandwidths are used regardless of other instrument settings Since Span is coupled to Integ BW in the factory default condition, if you change the Integ BW setting, the span setting changes by a proportional amount until a limit value is reached. However, the span can be individually set. The minimum value of the span is coupled with the integration bandwidth Span cannot be set less than the Integ BW value. When Span is changed, the ratio of Span/Integ BW is set, and retained when Integ BW is changed
Preset	Depends on instrument maximum frequency, mode, measurement, and selected input See "Span Presets" on page 882
State Saved	Saved in instrument state
Min	100 Hz
Max	Depends on instrument maximum frequency, mode, measurement, and selected input. See "Span Presets" on page 882 If the knob or step keys are being used, depends on the value of the other three interdependent parameters Center Frequency, Start Frequency, Stop Frequency
Annunciation	Data out of range, value clipped to upper limit
Annotation	Span <value> appears on the first line of the annotation in the lower right corner of display

LTE, 5G NR only:

Remote Command	`[:SENSe]:CHPower:FREQuency:SPAN:AUTO ON | OFF | 1 | 0` `[:SENSe]:CHPower:FREQuency:SPAN:AUTO?`
Example	`:CHP:FREQ:SPAN:AUTO OFF` `:CHP:FREQ:SPAN:AUTO?`
Notes	The span value is adjusted when the relevant carrier parameters such as bandwidth, integration bandwidth, number of component carriers etc., are changed, whatever the span state (Auto or Man) When in Man state, if the input value is less than the required sum of total integration bandwidths and

	gaps of the multi-carriers, the required span value is set
Dependencies	This is only available in LTE/LTE-Advanced FDD/TDD and 5G NR CHP measurement
Preset	ON
State Saved	Saved in instrument state
Range	Auto|Man

Span Presets

The following table provides the Max Span, for the various frequency options:

Freq Option	Max Span (can't set higher than this)
503 (all but CXA)	3.7 GHz
503, F03 (CXA, CXA-m)	3.08 GHz
507 (all but CXA)	7.1 GHz
507 (CXA, CXA-m)	7.575 GHz
508 (all but MXE)	8.5 GHz
508 (MXE)	8.5 GHz
513, F13	13.8 GHz
526 (all but CXA and MXE)	27.0 GHz
526 (MXE)	27.0 GHz
526, F26 (CXA, CXA-m)	26.55 GHz
544	44.5 GHz
550	52 GHz
F06 (VXT models M9410A/11A)	5.75 GHz
F06 & EP6 (VXT models M9410A/11A)	6.27 GHz
F06 & LFE & EP6 (VXT models M9411A)	6.5999935 GHz
M9415A-F06	6.27 GHz

Freq Option	Max Span (can't set higher than this)
M9415A-F08	8.27 GHz
M9415A-F12	12.57 GHz

Input 2:

Model	Max Span (can't set higher than this)
CXA opt C75	1.58 GHz
MXE	1.000025 GHz

Note that if you are in External Mixing, the maximum Span will be equal to the Maximum Stop Frequency – Minimum Start Frequency for the currently selected mixer.

Span Presets by Mode

Mode	Radio Std	Preset Value
SA		3 MHz
WCDMA		7.5 MHz
LTE		7.5 MHz
LTETDD		7.5 MHz
5G NR		150 MHz
WLAN	802.11a/g(OFDM/DSSS-OFDM)	30 MHz
	802.11b	37.5 MHz
	802.11n/ac/ax/be 20MHz	30 MHz
	802.11n/ac/ax/be 40MHz	60 MHz
	802.11n/ac/ax/be 80 MHz	120 MHz
	802.11n/ac/ax/be 160 MHz	240 MHz
	802.11n/ac/ax/be 80 MHz + 80 MHz	360 MHz
	802.11be 320 MHz	480MHz
	802.11be 160MHz + 160MHz	440MHz

CF Step

Changes the step size for the center frequency and start and stop frequency functions. Once a step size has been selected and the center frequency function is active, the step keys (and the UP|DOWN parameters for Center Frequency from remote commands) change the center frequency by the step-size value. The step size function is useful for finding harmonics and sidebands beyond the current frequency span of the instrument.

Note that the start and stop frequencies also step by the CF Step value.

Remote Command	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement] <freq>`
	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement]?`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO?`

Example	`:FREQ:CENT:STEP 500 MHz`
	`:FREQ:CENT UP`
	increases the current center frequency value by 500 MHz
	`:FREQ:CENT:STEP?`
	`:FREQ:CENT:STEP:AUTO ON`
	`:FREQ:CENT:STEP:AUTO?`

Notes	Preset and Max values are depending on Hardware Options
Dependencies	If the electronic/soft attenuator is enabled, any attempt to change the value of the center frequency >3.6 GHz by pressing the Up-arrow key, fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning Not available in the MSR, LTE-A FDD/TDD and 5G NR modes
Couplings	When auto-coupled, the center frequency step size is set to 10% of the span
Preset	Auto
State Saved	Saved in instrument state
Min	– (the maximum frequency of the instrument). That is, 27 GHz max freq instrument has a CF step range of ±27 GHz. Note that this is the maximum frequency given the current settings of the instrument, so in External Mixing, for example, it is the maximum frequency of the current mixer band
Max	The maximum frequency of the instrument. That is, 27 GHz max freq instrument has a CF step range of ±27 GHz. Note that this is the maximum frequency given the current settings of the instrument, so in External Mixing, for example, it is the maximum frequency of the current mixer band
Status Bits/OPC dependencies	non-overlapped

Full Span (Remote Command Only)

Changes the span to show the full frequency range of the spectrum analyzer. It maximizes the span within a range not changing the center frequency.

Remote Command	`[:SENSe]:CHPower:FREQuency:SPAN:FULL`
Example	`:CHP:FREQ:SPAN:FULL`
Couplings	Selecting full span changes the measurement span value

3.7.7 Marker

Accesses a menu that enables you to select, set up and control the markers for the current measurement. If there are no active markers, **Marker** selects marker 1, sets it to Normal and places it at the center of the display. If the selected marker is Off, it is set to Normal and placed it at the center of the screen on the trace determined by the **Marker Trace** rules.

For more detailed information on the types of Markers and the interaction between Markers, see the Marker section of the Swept SA measurement.

3.7.7.1 Select Marker

Specifies the *selected marker*. The term “selected marker” is used throughout this document to specify which marker will be affected when you change marker settings, perform a Peak Search, etc.

The Select Marker control appears above the menu panel, indicating that it applies to all controls in the Marker menu panels. Select Marker is blanked if you select a tab whose controls do *not* depend on the selected marker (e.g., Counter).

On any menu tab for which Select Marker displays, the first control is always **Marker Frequency|Time**.

Notes	The selected marker is remembered even when not in the Marker menu and is used if a Search is done or a Band Function is turned on or for Signal Track or Continuous Peak
Preset	Marker 1
State Saved	The number of the selected marker is saved in instrument state
Annunciation	Appears in the marker results block label for **Normal, Delta** and **Fixed** markers

3.7.7.2 Settings

The controls on the Settings tab include the Marker active function and a radio button selection of the marker control mode (Normal, Delta, or Off) for the selected marker, as well as additional functions that help you use markers.

Marker Frequency

Sets the marker X Axis value in the current marker X Axis Scale unit. It has no effect if the control mode is **Off,** but is the SCPI equivalent of entering an X value if the control mode is **Normal** or **Delta**.

Remote Command	`:CALCulate:CHPower:MARKer[1]|2|...|12:X <freq>` `:CALCulate:CHPower:MARKer[1]|2|...|12:X?`
Example	`:CALC:CHP:MARK3:X 0`

	:CALC:CHP:MARK3:X?
Notes	If no suffix is sent, uses the fundamental units for the current marker X Axis Scale. If a suffix is sent that does not match the current marker X Axis Scale unit, an error "Invalid suffix" is generated The query returns the marker's absolute X Axis value if the control mode is **Normal**, or the offset from the marker's reference marker if the control mode is **Delta**. The query is returned in the fundamental units for the current marker X Axis scale: Hz for **Frequency** and Inverse Time, seconds for Period and Time
Preset	After a preset, all markers are turned OFF, so Marker X-Axis Value query returns a not a number (NAN)
State Saved	Saved in instrument state
Min	-9.9E+37
Max	9.9E+37
Annotation	Mkr # <X value> and <Marker value> upper right on graph

Marker X Axis Position (Remote Command Only)

Sets the marker X-Axis Scale position in trace points. This setting has no effect if the control mode is **Off,** but is the SCPI equivalent of entering a value if the control mode is **Normal** or **Delta**, except in trace points rather than X-Axis Scale units. The entered value is immediately translated into the current X-Axis Scale units for setting the value of the marker.

Remote Command	:CALCulate:CHPower:MARKer[1]|2|...|12:X:POSition <real> :CALCulate:CHPower:MARKer[1]|2|...|12:X:POSition?
Example	:CALC:CHP:MARK10:X:POS 0 :CALC:CHP:MARK10:X:POS?
Notes	The query returns the marker's absolute X-Axis value in trace points if the control mode is **Normal**, or the offset from the marker's reference marker in trace points if the control mode is **Delta**. The value is returned as a real number, not an integer, corresponding to the translation from X-Axis Scale units to trace points . When a Marker is turned on, it is placed center of the screen on the trace. Therefore the default value depends on instrument condition. If the marker is Off the response is Not A Number
Preset	After a preset, all markers are turned OFF, so Marker X-Axis Value query returns a not a number (NAN)
State Saved	Saved in instrument state
Min	-9.9E+37
Max	9.9E+37

Marker Y Axis Value (Remote Command only)

Returns the marker Y Axis value in the current marker Y-Axis unit.

Remote Command	:CALCulate:CHPower:MARKer[1]|2|...|12:Y?
Example	:CALC:CHP:MARK11:Y?
Notes	The query returns the marker Y-Axis result if the control mode is **Normal** or **Delta** If the marker is **Off**, then the response is Not A Number

Preset	Result dependent on Markers setup and signal source
State Saved	No
Backwards Compatibility SCPI	:CALCulate:CHPower:MARKer[1]|2|...|12:FUNCtion:RESult?

Marker Mode

Sets the marker control mode to POSition (Normal), DELTa, or OFF. All interactions and dependencies detailed under the control description are enforced when the remote command is sent. If the selected marker is OFF, pressing Marker sets it to POSition and places it at the center of the screen on the trace determined by the Marker Trace rules. At the same time, Marker X Axis Value appears on the Active Function area.

The default active function is the active function for the currently selected marker control mode. If the current control mode is OFF, there is no active function and the active function is turned off.

Remote Command	:CALCulate:CHPower:MARKer[1]|2|...|12:MODE POSition | DELTa | OFF :CALCulate:CHPower:MARKer[1]|2|...|12:MODE?
Example	:CALC:CHP:MARK3:MODE POS :CALC:CHP:MARK3:MODE?
Preset	OFF
State Saved	Saved in instrument state
Range	POSition|DELTa|OFF
Annotation	Mkr # <X value> and <Marker value> upper right on graph When Marker Trace is Polar in WCDMA mode: Mkr # <Chip Value (RHO & QPSKEVM)/Symbol Value (CDP)>, <X value> and <Y value> upper right on graph

Backward Compatibility SCPI Commands

Sets or queries the state of a marker. Setting a marker that is OFF to ON (1) puts it in POSition (Normal) mode and places it at the center of the screen.

Remote Command	:CALCulate:CHPower:MARKer[1]|2|...|12:STATe OFF | ON | 0 | 1 :CALCulate:CHPower:MARKer[1]|2|...|12:STATe?
Example	:CALC:CHP:MARK3:STAT ON :CALC:CHP:MARK3:STAT?
Preset	OFF

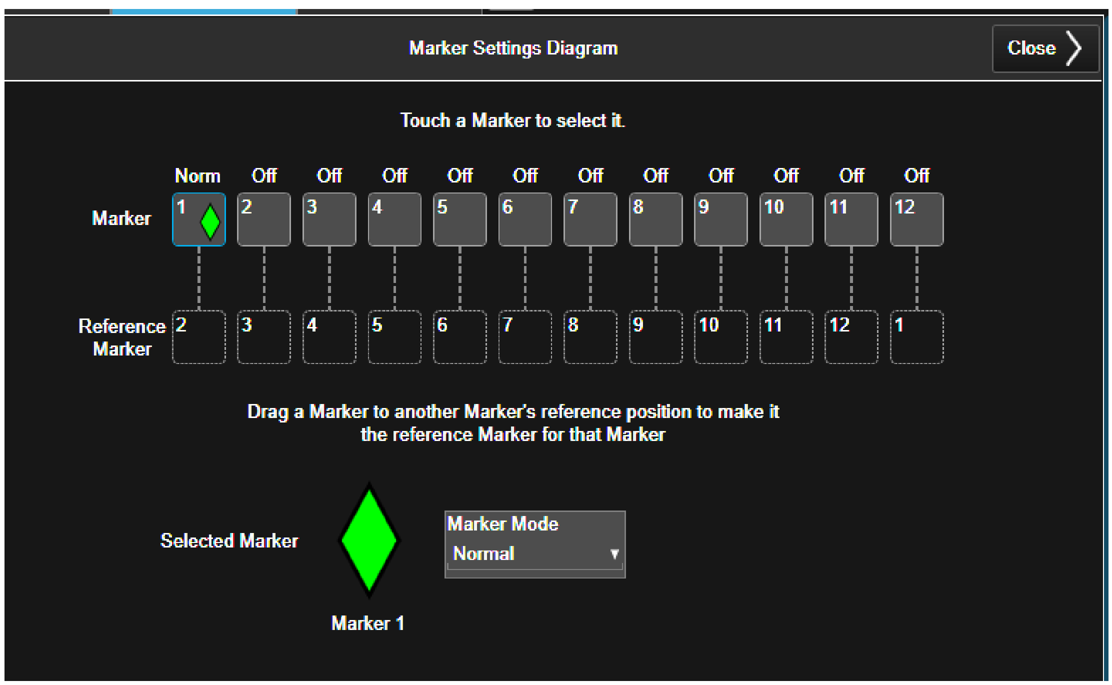
State Saved	Saved in instrument state
Range	OFF|ON

Delta Marker (Reset Delta)

The effect of pressing this button is exactly the same as pressing the **Delta** selection on the **Marker Mode** radio button. The selected marker becomes a Delta Marker. If the selected marker is already a Delta marker, the reference marker is moved to the current position of the selected marker, thus resetting the Delta to zero.

Marker Settings Diagram

The Marker Settings Diagram lets you configure the Marker system using a visual utility.



All Markers Off

Turns off all markers.

Remote Command	:CALCulate:CHPower:MARKer:AOFF
Example	:CALC:CHP:MARK:AOFF

3.7.7.3 Peak Search

The controls on the **Peak Search** tab allow you to move the marker to selected peaks of the signal, giving you enormous analysis capabilities, particularly when combined with the Delta Marker function.

NOTE
Pressing the **Peak Search** hardkey automatically moves you to the **Peak Search** page of the **Marker** menu *and* performs a Peak Search.

Pressing the **Peak Search** tab once you are already *in* the **Marker** menu does *not* perform a Peak Search.

Marker Frequency

The **Marker Frequency** control is the fundamental control that you use to move a marker around on the trace. This is the same as the **Marker Frequency** control on the **Settings** tab.

Peak Search

Pressing the **Peak Search** control moves the selected marker to the trace point which has the maximum Y-Axis value for that marker's trace.

NOTE
Pressing the **Peak Search** hardkey automatically moves you to the **Peak Search** page of the **Marker** menu *and* performs a Peak Search.

Remote Command	`:CALCulate:CHPower:MARKer[1]|2|...|12:MAXimum`

Example	`:CALC:CHP:MARK2:MAX`
	`:SYST:ERR?`
	can be used to query the errors to determine if a peak is found. The message "No peak found" will be returned after an unsuccessful search

Notes	Sending this command selects the subopcoded marker In the W-CDMA mode, this command does not work when the selected marker is located on the polar trace. In this case, the command is ignored

Marker Delta

Pressing this button has exactly the same effect as pressing the **Delta** selection on the **Marker Mode** radio button on the **Settings** tab. The selected marker becomes a Delta Marker. If the selected marker is already a Delta marker, the reference marker is moved to the current position of the selected marker, thus resetting the Delta to zero.

The control is duplicated here in the **Peak Search** Menu to allow you to conveniently perform a peak search and change the marker's control mode to Delta without having to access two separate menus.

3.7.7.4 Properties

The controls on the Properties tab are used to set certain properties of the selected marker.

Marker Frequency

The **Marker Frequency** control is the fundamental control that you use to move a marker around on the trace. This is the same as the **Marker Frequency** control on the **Settings** tab.

Relative To

Selects the marker to which the selected marker is relative (its reference marker).

Every marker has another marker to which it is relative. This marker is referred to as the "reference marker" for that marker. This attribute is set by the **Marker, Properties, Relative To** key. The marker must be a **Delta** marker to make this attribute relevant. If it is a **Delta** marker, the reference marker determines how the marker is controlled and how its value is displayed. A marker cannot be relative to itself.

Remote Command	`:CALCulate:CHPower:MARKer[1]|2|...|12:REFerence <integer>` `:CALCulate:CHPower:MARKer[1]|2|...|12:REFerence?`
Example	`:CALC:CHP:MARK:REF 5` `:CALC:CHP:MARK:REF?`
Notes	This command causes the marker specified with the subopcode to become selected Range (for SCPI command): 1 to 12. If the range is exceeded the value is clipped A marker cannot be relative to itself so that choice is not available, and if sent from SCPI generates error -221: "Settings conflict; marker cannot be relative to itself" When queried a single value is returned (the specified marker numbers relative marker)
Couplings	The act of specifying the selected marker's reference marker makes the selected marker a Delta marker If the reference marker is off, it is turned on in **Normal** mode at the delta marker location
Preset	The preset default "Relative To" marker (reference marker) is the next higher numbered marker (current marker +1). For example, if marker 2 is selected, then it's default reference marker is marker 3. The exception is marker 12, which has a default reference of marker 1 Set to the defaults by using **Restore Mode Defaults.** This is not reset by **Marker Off**, **All Markers Off**, or **Preset**
State Saved	Saved in instrument state. Not affected by Marker Off and hence not affected by Preset or power cycle
Min	1

Max	12
Annunciation	Appears in the marker label of a **Delta** marker

Marker Trace

Selects the trace on which you want your marker placed. A marker is associated with one and only one trace. This trace is used to determine the placement, result, and X-Axis Scale of the marker. All markers have an associated trace; it is from that trace that they determine their attributes and behaviors, and it is to that trace that they go when they become Normal or Delta markers.

Specifying a Marker Trace manually or with this command associates the marker with the specified trace. If the marker is not OFF, it moves the marker from the trace it was on to the new trace. If the marker is OFF it stays off but is now associated with the specified trace.

The query returns the number of the trace on which the marker is currently placed.

Remote Command	`:CALCulate:CHPower:MARKer[1]|2|...|12:TRACe 1	2	3` `:CALCulate:CHPower:MARKer[1]|2|...|12:TRACe?`
Example	`:CALC:CHP:MARK2:TRAC 2` `:CALC:CHP:MARK2:TRAC?`
Notes	A marker may be placed on a blanked and/or inactive trace, even though the trace is not visible and/or updating. An application may register a trace name to be displayed on the control instead of a trace number.
Couplings	The state of **Marker Trace** is not affected by the "Auto Couple" on page 1718 key Sending the remote command causes the addressed marker to become selected.
Preset	1
State Saved	Saved in instrument state
Min	1
Max	3

Marker Settings Diagram

The Marker Settings Diagram lets you configure the Marker system using a visual utility. This is the same as the "Marker Settings Diagram" on page 888 control on the **Settings** tab.

3.7.8 Meas Setup

The **Meas Setup** menu panel contains functions for setting up the measurement parameters and also contains functions for setting up parameters global to all measurements in the Mode.

3.7.8.1 Settings

The **Settings** tab contains frequently used Meas Setup functions to which you will want the fastest access.

Avg/Hold Number

Specifies the number of measurement averages used to calculate the measurement result. The average is displayed at the end of each sweep. After the specified number of average counts, the averaging mode (terminal control) setting determines the averaging action.

Remote Command	`[:SENSe]:CHPower:AVERage:COUNt <integer>` `[:SENSe]:CHPower:AVERage:COUNt?`
Example	`:CHP:AVER:COUN 15` `:CHP:AVER:COUN?`
Preset	SA, WLAN: 10 WCDMA, LTE, LTETDD, LTEAFDD, LTEATDD, 5G NR, MSR: 200
State Saved	Saved in instrument state
Min/Max	1/10000
Annotation	The average count is displayed in the measurement bar on the front panel display. The annotation appears in the format n/N where n is the current average and N is the average count

Averaging On/Off

Turns averaging on or off for the Channel Power measurement.

NOTE: In this measurement, the **Average Type** is preset to the `Log-Pwr Avg (Video)` method. Other averaging methods are not available.

Remote Command	`[:SENSe]:CHPower:AVERage[:STATe] ON | OFF | 1 | 0` `[:SENSe]:CHPower:AVERage[:STATe]?`
Example	`:CHP:AVER ON` `:CHP:AVER?`
Preset	`ON`
State Saved	Yes
Range	`ON|OFF`

Avg Mode

Allows you to select the type of termination control used for the averaging function. This determines the averaging action after the specified number of data acquisitions (average count) is reached. Options are:

– EXPonential: The measurement averaging continues using the specified number of averages to compute each exponentially-weighted averaged value. The average is displayed at the end of each sweep

– REPeat: The measurement resets the average counter each time the specified number of averages is reached

Remote Command	[:SENSe]:CHPower:AVERage:TCONtrol EXPonential | REPeat [:SENSe]:CHPower:AVERage:TCONtrol?
Example	:CHP:AVER:TCON EXP :CHP:AVER:TCON?
Preset	EXP
State Saved	Yes
Range	EXPonential|REPeat

Integ BW

Specifies the range of integration used in calculating the power in the channel. The integration bandwidth (IBW) is displayed on the trace as two markers connected by an arrow.

Remote Command	[:SENSe]:CHPower:BANDwidth:INTegration <bandwidth> [:SENSe]:CHPower:BANDwidth:INTegration?
Example	:CHP:BAND:INT 10MHz :CHP:BAND:INT?
Dependencies	For the LTE-Advanced FDD/TDD, 5G NR and MSR modes, this control is not shown In order to keep backwards compatible with the legacy LTE FDD/TDD, the SCPI command is supported in LTE & LTE-A converged application
Couplings	The minimum value of the span is coupled with Integ BW When you change Integ BW, the span changes accordingly by keeping the same ratio of Span/Integ BW
Preset	

Mode	Radio Std	Integ BW
SA		2 MHz
WCDMA		5 MHz
LTE, LTETDD, LTEAFDD, LTEATDD		5 MHz

	Mode	Radio Std	Integ BW
	WLAN	802.11a/g(OFDM/DSSS-OFDM)	20 MHz
		802.11b	25 MHz
		802.11n/ac/ax/be (20MHz)	20 MHz
		802.11n/ac/ax/be (40MHz)	40 MHz
		802.11n/ac/ax/be (80MHz)	80 MHz
		802.11ax/be (80 MHz + 80 MHz)	80 MHz
		802.11ac/ax/be (160 MHz)	160 MHz
		802.11be (160 MHz + 160MHz)	160 MHz
		802.11be (320MHz)	320 MHz
State Saved	Saved in instrument state		
Min/Max	100 Hz/Hardware Maximum Span		
Backwards Compatibility SCPI	`[:SENSe]:CHPower:BWIDth:INTegration`		

PSD Unit

Sets the unit bandwidth for Power Spectral Density. The available units are dBm/Hz and dBm/MHz.

Remote Command	`:UNIT:CHPower:POWer:PSD DBMHZ | DBMMHZ` `:UNIT:CHPower:POWer:PSD?`
Example	`:UNIT:CHP:POW:PSD DBMMHZ` `:UNIT:CHP:POW:PSD?`
Couplings	When the PSD unit is changed, the PSD result of the "`:MEAS|READ|FETCH:CHP1?`" is also changed by the PSD unit basis (in either dBm/Hz or dBm/MHz)
Preset	WLAN mode or SA mode with WLAN radio standard: `DBMMHZ` Otherwise: `DBMHZ`
State Saved	Saved in instrument state
Range	dBm/Hz|dBm/MHz

IF Gain

Sets the IF Gain function to Auto, Low Gain or High Gain. These settings affect sensitivity and IF overloads.

Remote Command	`[:SENSe]:CHPower:IF:GAIN[:STATe] ON | OFF | 1 | 0`

	[:SENSe]:CHPower:IF:GAIN[:STATe]? [:SENSe]:CHPower:IF:GAIN:AUTO[:STATe] ON | OFF | 1 | 0 [:SENSe]:CHPower:IF:GAIN:AUTO[:STATe]?
Example	:CHP:IF:GAIN ON :CHP:IF:GAIN? :CHP:IF:GAIN:AUTO ON :CHP:IF:GAIN:AUTO?
Notes	ON = high gain OFF = low gain
Dependencies	The IF Gain controls (FFT IF Gain and Swept IF Gain) have no effect when the U7227A USB Preamplifier is connected. This is not annotated or reflected on any control; there are no controls grayed out nor any SCPI locked out. The instrument simply behaves as though both FFT IF Gain and Swept IF Gain are set to Low regardless of the setting on the controls This control is not available in VXT models M9420A/21A, EXM, or UXM This control is not available in the E7760, M9393A or M9391A
Couplings	Auto sets IF Gain to High Gain under any of the following conditions: – The input attenuator is set to 0 dB, or the preamp is turned on and the frequency range is under 3.6 GHz For other conditions, Auto sets IF Gain to Low Gain
Preset	OFF OFF
State Saved	Saved in instrument state
Range	Low Gain|High Gain

Spur Avoidance

Because the VXT models M9410A/11A/15A are direct-conversion (zero-IF) receivers, feedthrough leakage from the local oscillator appears as a spurious signal (spur) at the center frequency. The **Spur Avoidance** function is provided to eliminate this spur, at the expense of some measurement speed.

When **Spur Avoidance** is enabled (the default), the instrument uses a software algorithm to remove this spur from the displayed measurement data, but the algorithm only operates under certain conditions. Specifically, it only operates in the multiple capture case.

You can disable this function to speed up your measurement by setting Spur Avoidance to “Disabled.”

Note that when Spur Avoidance is not in effect, either because you have disabled it or because you are not in multiple capture, the following warning message will appear in the status bar:

`Settings Alert;Spur Avoidance Off`

This is to alert you that measurement accuracy might be impacted by the fact that Spur Avoidance is not in effect.

Remote Command	[:SENSe]:CHPower:SAVoid[:STATe] ON | OFF | 0 | 1 [:SENSe]:CHPower:SAVoid[:STATe]?
Example	:CHP:SAV ON :CHP:SAV?
Dependencies	This control only appears in VXT models M9410A/11A/15A
Preset	OFF
State Saved	Saved in instrument state
Range	ON|OFF

Meas Setup Summary Table

The Meas Setup Summary Table lets you view and access many of the parameters in the **Meas Setup** menus on one screen.

Auto Couple

Immediately puts all Auto/Man functions into Auto. The **Auto Couple** action is confined to the current measurement only. It does not affect other measurements in the mode.

In the Auto state, Auto/Man functions are said to be “coupled”, meaning their values change as you make changes to other values in the measurement. This helps ensure accurate measurements and optimum dynamic range. Auto Couple is an immediate action function, and when it is executed, all the Auto/Man controls for the current measurement are set to Auto, and all measurement settings coupled to the Auto/Man parameters are automatically set to their optimal value.

For further details of measurement-specific settings (if any), see "Measurement-Specific Details" on page 897 below.

Remote Command	:COUPle ALL
Example	:COUP ALL
Backwards Compatibility SCPI	:COUPLE ALL | NONE
Backwards Compatibility Notes	:COUP:NONE puts all Auto/Man parameters in manual mode, decoupling all the coupled instrument parameters. It is retained for backwards compatibility and is *not* recommended for making measurements or new designs

All Auto/Man parameter couplings in the measurement are set to Auto. This includes couplings that may be unavailable or grayed-out due to the current state. For example, in the Swept SA measurement, there is no Auto/Man coupling for RBW while in Zero Span. Nonetheless, if **Auto Couple** were executed while in Zero Span it would set RBW to Auto "behind the scenes" so that, on exit from Zero Span, it would be in Auto.

Any Auto/Man selection specific (local) to the other measurements in the current Mode will not be affected by **Auto Couple**. Any functions that are *not* coupled with other instrument parameters, such as ranging or leveling variables, such as "AutoRange" or "AutoScale", will not be affected.

Executing the **Auto Couple** command generates the informational message, "All Auto/Man functions have been set to Auto".

Each parameter, upon being set to Auto, selects and sets the appropriate auto-coupled value based on that parameter's coupling rules. The Dependency Resolver orchestrates the couplings for parameters that are dependent on one or more other parameters. The coupling and dependency rules for each parameter are defined in the chapter describing that parameter.

Executing the **Auto Couple** command *does not* affect markers, marker functions, trace or display attributes, or any other instrument setting other than those specifically mentioned above.

Measurement-Specific Details

TOI

Parameters affected by Auto Couple are:

- Center Frequency Step
- Resolution Bandwidth
- Span/RBW Ratio
- Sweep Time
- Video BandwidthVBW/RBW ratio
- Upper and Lower Tone (set to Sense
-)Zero span measurement Resolution Bandwidth
- Zero span measurement Dwell Time

Harmonics

For Harmonics, these parameters are:

- Resolution Bandwidth
- Fundamental Frequency

- Dwell Time
- Range Table Resolution Bandwidths
- Range Table Dwell Times

Meas Preset

Restores all the measurement parameters to their default values.

Remote Command	:CONFigure:CHPower
Example	:CONF:CHP

3.7.8.2 Radio

The Radio tab contains controls to select the Radio Device, and enable or disable HSPA/HSPA+ options.

Radio Device

Allows you to specify the device to be used.

Remote Command	[:SENSe]:RADio:STANdard:DEVice BTS | MS [:SENSe]:RADio:STANdard:DEVice?
Example	:RAD:STAN:DEV MS :RAD:STAN:DEV?
Preset	BTS
State Saved	Saved in instrument state.
Range	BTS | MS
Backwards Compatibility SCPI	[:SENSe]:RADio:DEVice

HSPA Enable

Allows you to turn on or off the HSDPA/HSUPA option enable. This selection is necessary because some of the auto detection functions that expect an HSPA signal are less tolerant when the signal is noisy or distorted. When the HSPA signal is not expected, turn HSPA Enable off.

Remote Command	[:SENSe]:RADio:CONFigure:HSDPa[:STATe] 0 | 1 | OFF | ON

	[:SENSe]:RADio:CONFigure:HSDPa[:STATe]?
Example	:RAD:CONF:HSDP 0 :RAD:CONF:HSDP?
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

HSPA+ Enable

Allows you to turn on or off the HSPA+ option enable. This selection is necessary because some of the auto detection functions that expect an HSPA+ signal are less tolerant when the signal is noisy or distorted. When the HSPA+ signal is not expected, turn HSPA+ Enable off.

Remote Command	[:SENSe]:RADio:CONFigure:EHSPa[:STATe] OFF | ON | 0 | 1 [:SENSe]:RADio:CONFigure:EHSPa[:STATe]?
Example	:RAD:CONF:EHSP 0 :RAD:CONF:EHSP?
Notes	When HSPA enable is OFF, HSPA+ function is disabled too.
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

3.7.8.3 Meas Method

This tab allows you to choose between Integration Bandwidth and RRC Weighted methods of making the measurement, and to set certain other relevant parameters. In MSR, LTE-A FDD/TDD and 5G NR modes, this feature is not supported.

Meas Method

Select between the Integration BW and RRC Weighted methods. Selecting the RRC Weighted method turns the Root Raised Cosine (RRC) filter On. The a value (roll off) for the filter is set to the value of the RRC Filter Alpha parameter, and the RRC filter bandwidth is set to the RRC Filter BW parameter.

Remote Command	[:SENSe]:CHPower:FILTer[:RRC][:STATe] OFF | ON | 0 | 1 [:SENSe]:CHPower:FILTer[:RRC][:STATe]?

Example	`:CHP:FILT OFF` `:CHP:FILT?`
Notes	This parameter is normally used when TETRA is selected as the Radio Std
Dependencies	For WLAN 802.11 ac (80 + 80 MHz), RRC Weighted is not supported In order to maintain backwards compatibility with the legacy LTE FDD/TDD modes, the SCPI command is supported in the LTE & LTE-A converged applications
Preset	`OFF`
State Saved	Saved in instrument state
Range	Integration BW|RRC Weighted

RRC Filter Alpha

Inputs the alpha value for the Root Raised Cosine (RRC) filter.

Remote Command	`[:SENSe]:CHPower:FILTer[:RRC]:ALPHa <real>` `[:SENSe]:CHPower:FILTer[:RRC]:ALPHa?`
Example	`:CHP:FILT:ALPH 0.5` `:CHP:FILT:ALPH?`
Notes	This parameter is normally used when TETRA is selected as the Radio Std
Dependencies	In order to maintain backwards compatibility with the legacy LTE FDD/TDD modes, the SCPI command is supported in the LTE & LTE-A converged applications
Preset	0.22
State Saved	Saved in instrument state
Min/Max	0.01/1.00

RRC Filter BW

Inputs the Root Raised Cosine (RRC) filter bandwidth. Normally, the filter bandwidth is the same as the symbol rate of the signal.

Remote Command	`[:SENSe]:CHPower:FILTer[:RRC]:BANDwidth <real>` `[:SENSe]:CHPower:FILTer[:RRC]:BANDwidth?`
Example	`:CHP:FILT:BAND 10MHz` `:CHP:FILT:BAND?`
Notes	This parameter is normally used when TETRA is selected as the Radio Std
Dependencies	

	In order to maintain backwards compatibility with the legacy LTE FDD/TDD modes, the SCPI command is supported in the LTE & LTE-A converged applications
Preset	SA, WCDMA, LTE, LTETDD: 3.84MHz WLAN:

Radio Std	Value
802.11a/g (OFDM/DSSS-OFDM)	16.6 MHz
802.11b	22 MHz
802.11n (20MHz)	17.8 MHz
802.11n (40MHz	36.6 MHz

State Saved	Saved in instrument state
Min/Max	100 Hz/100 MHz
Backwards Compatibility SCPI	`[:SENSe]:CHPower:FILTer[:RRC]:BWIDth`

3.7.8.4 Limits

Accesses the Limits menu that allows you to set up the test limit for channel power or power spectral density.

When DVB-T radio standard is selected in SA mode, this functionality is disabled, and the input signal is instead compared against a pre-defined spectrum mask.

In LTE-A FDD/TDD and 5G NR modes, this feature is not supported.

In MSR mode, this feature is not supported because the power of each carrier may be different.

Power Limit

If Power Limit is on, it is used as threshold to determine whether the real measured channel power can be passed or not. If real measured channel power exceeds Power Limit, channel power test fails, otherwise, it passes.

If Power Limit is off, channel power test is always passed.

Remote Command	`:CALCulate:CHPower:LIMit:POWer <ampl>`
	`:CALCulate:CHPower:LIMit:POWer?`
	`:CALCulate:CHPower:LIMit:POWer:STATe OFF | ON | 0 | 1`
	`:CALCulate:CHPower:LIMit:POWer:STATe?`

Example	`:CALC:CHP:LIM:POW 16.00` `:CALC:CHP:LIM:POW?`

	:CALC:CHP:LIM:POW:STAT ON :CALC:CHP:LIM:POW:STAT?

Notes	This parameter and PSD Limit can determine Pass/Fail criteria
	If ((power limit = On) and (PSD limit= Off))
	– Pass if (power test passes)
	– Fail if (power test fails)
	If ((power limit = On) and (PSD limit= On))
	– Pass if (both power test and PSD test pass)
	– Fail if (either of power test or PSD test fails)
	If ((power limit = Off) and (PSD limit= On))
	– Pass if (PSD test passes)
	– Fail if (PSD test fails)
	If ((power limit = Off) and (PSD limit= Off))
	– Always Pass
	For WLAN 802.11ac (80 MHz + 80 MHz), the power test and the PSD test are performed to both carriers. Which means the power (or PSD) readouts of both carriers should be compared with the power (or PSD) limit individually, and the test passes only when both values are lower than the limit

Dependencies	In order to maintain backwards compatibility with the legacy LTE FDD/TDD modes, the SCPI command is supported in the LTE & LTE-A converged applications
Preset	16.00 All modes other than WLAN: OFF WLAN: ON
State Saved	Saved in instrument state Yes
Range	OFF|ON
Min/Max	-200.0/200.0

PSD Limit

If PSD (power spectral density) Limit is ON, PSD Limit is used as threshold to determine whether the real measured PSD can be passed or not. If real measured PSD exceeds PSD Limit, PSD test fails, otherwise, it passes.

If PSD is off, PSD test is always passed.

Remote Command	:CALCulate:CHPower:LIMit:PSDensity <real> :CALCulate:CHPower:LIMit:PSDensity?

	`:CALCulate:CHPower:LIMit:PSDensity:STATe OFF | ON | 0 | 1` `:CALCulate:CHPower:LIMit:PSDensity:STATe?`

Example	`:CALC:CHP:LIM:PSD 4.00`
	`:CALC:CHP:LIM:PSD?`
	`:CALC:CHP:LIM:POW:STAT ON`
	`:CALC:CHP:LIM:POW:STAT?`

Notes	This parameter and Power Limit can determine Pass/Fail criteria
	If ((power limit = On) and (PSD limit= Off))
	– Pass if (power test passes)
	– Fail if (power test fails)
	If ((power limit = On) and (PSD limit= On))
	– Pass if (both power test and PSD test pass)
	– Fail if (either of power test or PSD test fails)
	If ((power limit = Off) and (PSD limit= On))
	– Pass if (PSD test passes)
	– Fail if (PSD test fails)
	If ((power limit = Off) and (PSD limit= Off))
	– Always Pass
	For WLAN 802.11ac (80 MHz + 80 MHz), the power test and the PSD test are performed to both carriers. Which means the PSD (or power) readouts of both carriers should be compared with the PSD (or power) limit individually, and the test passes only when both values are lower than the limit

Dependencies	In order to maintain backwards compatibility with the legacy LTE FDD/TDD modes, the SCPI command is supported in the LTE & LTE-A converged applications
Couplings	The value is automatically converted when PSD Unit is changed
Preset	WLAN mode or SA mode with WLAN radio standard: 4.00 dBm/MHz Otherwise: 4.00 dBm/Hz All modes other than WLAN: `OFF` WLAN: `ON`
State Saved	Saved in instrument state Yes
Range	`OFF | ON`
Min/Max	-200.0/200.0

Power Limit Fail (remote command only)

The command is query-only, and is used to query whether a power test passes or fails. When DVB-T radio standard is selected in SA mode, the result of this query has no meaning.

Remote Command	`:CALCulate:CHPower:LIMit:POWer:FAIL?`
Example	`:CALC:CHP:LIM:POW:FAIL?`
Notes	Query only When Power Limit is off, the returned value is always 0 (pass) When Power Limit is on, the returned value is 0(pass) while power test passes and 1(fail) while power test fails
Dependencies	In order to maintain backwards compatibility with the legacy LTE FDD/TDD modes, the SCPI command is supported in the LTE & LTE-A converged applications

PSD Limit Fail (Remote Command only)

The command is query only, and used to query whether PSD test passes or fails. When DVB-T radio standard is selected in SA mode, the result of this query has no meaning.

Remote Command	`:CALCulate:CHPower:LIMit:PSD:FAIL?`
Example	`:CALC:CHP:LIM:PSD:FAIL?`
Notes	Query only When PSD Limit is off, the returned value is always 0 (pass) When PSD Limit is on, the returned value is 0 (pass) while PSD test passes and 1(fail) while PSD test fails
Dependencies	In order to maintain backwards compatibility with the legacy LTE FDD/TDD modes, the SCPI command is supported in the LTE & LTE-A converged applications

3.7.8.5 Advanced

The Advanced tab contains controls for setting advanced functions of the instrument.

– This tab does not appear in EXM or VXT

– This tab does not appear in the M9393A or M9391A

Phase Noise Optimization

Allows you to select the LO (local oscillator) phase noise behavior for various operating conditions. When in Auto, selects the LO (local oscillator) phase noise behavior to optimize dynamic range and speed for various instrument operating conditions.

For full details, see "Parameter Options, Installed Options & Ranges" on page 905 below.

Remote Command	`[:SENSe]:CHPower:FREQuency:SYNThesis[:STATe] 1 | ... | 5`
	For the meaning of each numeric option value, see "Parameter Options, Installed Options & Ranges" on page 905 below
	`[:SENSe]:CHPower:FREQuency:SYNThesis[:STATe]?`
	`[:SENSe]:CHPower:FREQuency:SYNThesis:AUTO[:STATe] OFF | ON | 0 | 1`
	`[:SENSe]:CHPower:FREQuency:SYNThesis:AUTO[:STATe]?`

Example	`:CHP:FREQ:SYNT 1`
	`:CHP:FREQ:SYNT?`
	`:CHP:FREQ:SYNT:AUTO 1`
	`:CHP:FREQ:SYNT:AUTO?`

Dependencies	Does not appear in all models. For models in which the control is not displayed, the SCPI command is accepted for compatibility (although no action is taken)
Preset	3 `OFF`
State Saved	Saved in instrument state
Range	See "Ranges" on page 910 below
Annotation	**EP0:** Balanced | Best Wide | Fast | Best Close | Best Spurs **Other than EP0:** Best Close | Best Wide | Fast Found in the Meas Bar under **PNO** When not in Auto, label changes to **#PNO**

Parameter Options, Installed Options & Ranges

The Phase Noise Optimization control lets you optimize the setup and behavior of the Local Oscillator (LO) depending on your specific measurement conditions. You may wish to trade off noise and speed, for example, to make a measurement faster without regard to noise or with optimum noise characteristics without regard to speed.

Parameter Values Summary

Option	#	Description
"Balanced" on page 907	1	– In instruments with EP0, balances close-in phase noise with spur avoidance – In instruments without EP0 optimizes phase noise for small

Option	#	Description
		frequency offsets from the carrier
"Best Wide-offset" on page 907	2	Optimizes phase noise for wide frequency offsets from the carrier
"Fast Tuning" on page 907	3	Optimizes LO for tuning speed
"Best Close-in" on page 906	4 or 1*	– In instruments with EP0, emphasizes close-in phase noise performance without regard to spur avoidance – In instruments without EP0, this setting is accepted but no action is taken
"Best Spurs" on page 907	5	– In instruments with EP0, emphasizes spur avoidance over close-in phase noise performance – In instruments without EP0, this setting is accepted but no action taken
Auto	-	Automatically selects LO (local oscillator) phase noise behavior to optimize dynamic range and speed for various instrument operating conditions

*Dependent on Option EP0 installation. See "Best Close-in" on page 906 below.

The actual behavior varies somewhat depending on model number and option; for example, you always get Fast Tuning by choosing Option #3, but in some models, "Fast Tuning" on page 907 is identical in effect to "Best Close-in" on page 906.

Best Close-in

Without option EP0

`:FREQ:SYNT 1`

The LO phase noise is optimized for smaller offsets from the carrier, at the expense of phase noise farther out.

The actual frequency offset within which noise is optimized is shown with in square brackets, as this can vary depending on the hardware set in use. For example, in some instruments this annotation appears as [offset <20 kHz]

With option EP0

`:FREQ:SYNT 4`

In instruments with Option EP0, the LO is configured for the best possible close-in phase noise (offsets up to 600 kHz from the carrier), regardless of spurious products that occur with some center frequencies. Because this is generally less desirable for close-in measurements than the "Balanced" on page 907 setting, parameter 1 selects "Balanced" on page 907 in EP0 instruments, in the interests of optimizing code compatibility across the family. Parameter 4 selects "Best Close-in" on page 906, which is usually not as good a choice as "Balanced" on page 907.

Balanced

`:FREQ:SYNT 1`

In instruments with EP0, the LO is configured for the best possible phase noise at offsets up to 600 kHz from the carrier whenever there are no significant spurs within the span observed with an on-screen carrier. When there will be such a spur, the LO is reconfigured in a way that allows the phase noise to increase by 7 dB mostly within ±1 octave around 400 kHz offset. The spurs will always be below –70 dBc.

Best Spurs

`:FREQ:SYNT 5`

In instruments with EP0, the LO is configured for better phase noise than the "Best Wide-offset" on page 907 case close to the carrier, but the configuration has 11 dB worse phase noise than the "Best Close-in" on page 906 case mostly within ±1 octave around 300 kHz offset. Spurs are even lower than in the "Balanced" on page 907 case at better than –90 dBc, whether or not the carrier is on-screen.

This setting is never selected when Phase Noise Optimization is in Auto, you must select it manually.

Best Wide-offset

`:FREQ:SYNT 2`

The LO phase noise is optimized for wider offsets from the carrier. Optimization is especially improved for offsets from 70 kHz to 300 kHz. Closer offsets are compromised and the throughput of measurements (especially remote measurements where the center frequency is changing rapidly), is reduced.

The actual frequency offset beyond which noise is optimized is shown with in square brackets, as this can vary depending on the hardware set in use. For example, in some instruments this annotation appears as [offset >30 kHz]

In instruments with Option EP0, the LO is configured for the best possible phase noise at offsets up to 600 kHz from the carrier whenever there are no significant spurs within the span observed with an on-screen carrier. When there will be such a spur, the LO is reconfigured in a way that allows the phase noise to increase by 7 dB mostly within ±1 octave around 400 kHz offset. The spurs will always be below –70 dBc.

Fast Tuning

`:FREQ:SYNT 3`

In this mode, the LO behavior compromises phase noise at many offsets from the carrier in order to allow rapid measurement throughput when changing the center frequency or span. The term "Fast Tuning" on page 907 refers to the time it takes to move the local oscillator to the start frequency and begin a sweep; this setting does not impact the actual sweep time in any way.

In instruments with EP1, the LO behavior compromises phase noise at offsets below 4 MHz in order to improve measurement throughput. The throughput is especially affected when moving the LO more than 2.5 MHz and up to 10 MHz from the stop frequency to the next start frequency.

In instruments with Option EP0, this is the same configuration as "Best Spurs" on page 907. It is available with the "Fast Tuning" on page 907 label for convenience, and to make the user interface more consistent with other X-Series instrument family members.

(In models whose hardware does not provide for a "Fast Tuning" on page 907 option, the settings for "Best Close-in" on page 906 are used if "Fast Tuning" on page 907 is selected. This gives the fastest possible tuning for that hardware set.)

Auto

```
:FREQ:SYNT:AUTO ON
```

Selects the LO (local oscillator) phase noise behavior to optimize dynamic range and speed for various instrument operating conditions. The selection rules are as follows.

Auto Optimization Rules

X-Series instruments have several grades of LO, offering different configurations when in the Auto Mode. The rules for Auto selection are as follows:

Models with Option	Conditions	Selection
EP0 Models with option EP0 have a two stage local oscillator, which switches to a single loop for fast tuning (available in UXA)	Center frequency is < 699.9 kHz	"Balanced" on page 907
	Span > 114.1 MHz, *or* RBW > 800 kHz	"Fast Tuning" on page 907
	RBW > 290 kHz, *or* Span > 4.2 MHz	"Best Wide-offset" on page 907
	Other conditions	"Balanced" on page 907
EP1 Models with option EP1 have a two-loop local oscillator, which switches to a single loop for fast tuning (available in PXA)	Span > 44.44 MHz, *or* RBW > 1.9 MHz, *or* Source Mode is set to "Tracking"	"Fast Tuning" on page 907
	Center frequency is < 195 kHz, *or* CF >= 1 MHz *and* Span <= 1.3 MHz *and* RBW <= 75 kHz	"Best Close-in" on page 906
	All other conditions	"Best Wide-offset" on page 907
EP2	CF < 130 kHz , *or*	"Best Close-in"

Models with Option	Conditions	Selection
Models with option EP2 use a different loop bandwidth for the fast-tuning choice, which is a compromise between tuning speed and phase noise, giving good tuning speed at all offsets. Although not as good as for "Best Close-in" on page 906; this is useful when you have to look across a wide range of spans (available, for example, in MXA for excellent phase noise)	CF > 12 MHz *and* Span < 495 kHz *and* RBW < 40 kHz	on page 906
	Span > 22 MHz, *or* RBW > 400 kHz, *or* CF ≤ 12 MHz *and* Span < 495 kHz *and* RBW < 23 kHz	"Fast Tuning" on page 907
	All other conditions	"Best Wide-offset" on page 907
EP4 (available in CXA for improved phase noise)	Span > 101 MHz *or* RBW > 1.15 MHz *or* Source Mode is set to "Tracking"	"Fast Tuning" on page 907
	CF is < 109 kHz *or* CF >= 4.95 MHz *and* Span <= 666 kHz *and* RBW < 28 kHz	"Best Close-in" on page 906
	All other conditions	"Best Wide-offset" on page 907
All Other Models Note that in these models, the hardware does not actually provide for an extra-fast tuning option, so the settings for "Fast Tuning" on page 907 are actually the same as "Best Close-in" on page 906, but the rules are implemented this way so that the user who doesn't care about phase noise but does care about tuning speed doesn't have to remember which of the other two settings gives faster tuning	Span > 12.34 MHz, *or* RBW > 250 kHz, *or* Source Mode is set to "Tracking"	"Fast Tuning" on page 907
	Center frequency is < 25 kHz, *or* CF >= 1 MHz *and* Span <= 141.4 kHz *and* RBW <= 5 kHz	"Best Close-in" on page 906
	All other conditions	"Best Wide-offset" on page 907

In all the above cases:

– The RBW to be used in the calculations is the equivalent –3 dB bandwidth of the current RBW filter

– The rules apply whether in swept spans, zero span, or FFT spans

Ranges

Option	Option #	Phase Noise Option	Range
No EPx Option	1	Best Close-in	[offset < 20 kHz]
	2	Best Wide-offset	[offset > 30 kHz]
	3	Fast Tuning	[same as Best Close-In]
EP0	4	Best Close-in	[offset < 600 kHz]
	1	Balanced	[offset < 600 kHz]
	5	Best Spurs	[offset < 600 kHz]
	2	Best Wide-offset	[offset > 800 kHz]
	3	Fast Tuning	[same as Best Close-In]
EP1	1	Best Close-in	[offset < 140 kHz]
	2	Best Wide-offset	[offset > 160 kHz]
	3	Fast Tuning	[single loop]
EP2, EP3, EP5	1	Best Close-in	[offset < 70 kHz]
	2	Best Wide-offset	[offset > 100 kHz]
	3	Fast Tuning	[medium loop bw]
EP4	1	Best Close-in	[offset < 90 kHz]
	2	Best Wide-offset	[offset > 130 kHz]
	3	Fast Tuning	[same as Best Close-In]

Noise Floor Extension

Allows you to turn on/configure the **Noise Floor Extension** (NFE) function. Some Modes (such as Spectrum Analyzer Mode), support two states of NFE, Full and Adaptive. The `ON` state (in Modes which do not support Adaptive NFE) matches the `FULL` state (in Modes that *do* support Adaptive NFE).

In `ON` or `FULL` NFE, the expected noise power of the instrument (derived from a factory calibration) is subtracted from the trace data. This will usually reduce the apparent noise level by about 10 dB in low band, and 8 dB in high band (>~3.6 GHz).

In Adaptive NFE, there is not the same dramatic visual impact on the noise floor as there is in Full NFE. Adaptive NFE controls the amount of correction that is applied based on other instrument settings like RBW, averaging and sweep time. Adaptive NFE controls the degree of potential improvement in the noise floor to give more improvement for those instrument settings that can make good use of the potential improvement, such as settings that provide more averaging. The result is that when not much averaging is being performed, the signal displays more like the NFE-off case; and when lots of averaging is being performed, the signal displays more like the full-NFE case.

Adaptive NFE (in Modes which support it) is recommended for general-purpose use. For fully ATE (automatic test equipment) applications, where the distraction of a person using the instrument is not a risk, Full NFE is recommended.

NFE works with any RBW, VBW, detector, any setting of Average Type, any amount of trace averaging, and any signal type. It is ineffective when the trace is not smoothed (smoothing processes include narrow VBWs, trace averaging, and long sweep times with the detector set to Average or Peak). It works best with extreme amounts of smoothing, and with the average detector, with the Average Type set to Power.

In those cases where the cancellation is ineffective, it nonetheless has no undesirable side-effects. There is no significant speed impact to having Noise Floor Extension on.

The best accuracy is achieved when substantial smoothing occurs in each point before trace averaging. Thus, when using the average detector, results are better with long sweep times and fewer trace averages. When using the sample detector, the VBW filter should be set narrow with less trace averaging, instead of a wide VBW filter with more trace averaging.

NOTE

Noise Floor Extension has no effect unless the RF Input is selected, so it does nothing when External Mixing is selected.

In Modes that support Adaptive NFE, the default state of NFE is Adaptive. In Modes that do not support Adaptive NFE, the default state of NFE is OFF. Prior to the introduction of Adaptive NFE (firmware version A.18.00), the default state of NFE was OFF for all Modes.

With the introduction of Adaptive NFE, the menu control is changed from On|Off to Full|Adaptive|Off. For SCPI Backwards Compatibility, the existing SCPI command to turn NFE on and off was retained, and a new command was added to set the state to turn Adaptive On and Off

`[:SENSe]:CORRection:NOISe:FLOor ON|OFF|1|0` is retained, default changed to On for modes that support Adaptive NFE

`[:SENSe]:CORRection:NOISe:FLOor:ADAPtive ON|OFF|1|0` is added (for certain Modes), default=On

FULL = `:CORRection:NOISe:FLOor ON` plus `:CORRection:NOISe:FLOor:ADAPtive ON`

See "More Information" on page 912

Remote Command	`[:SENSe]:CORRection:NOISe:FLOor ON | OFF | 1 | 0` `[:SENSe]:CORRection:NOISe:FLOor?`
Example	`:CORR:NOIS:FLO ON`
Dependencies	This control only appears in instruments with the NFE or NF2 license installed. In all others, the control does not appear, however the SCPI command will be accepted without error (but will have no effect)
Couplings	When NFE is enabled in any mode manually, a prompt will be displayed reminding you to perform the Characterize Noise Floor operation if it is needed. If NFE is enabled through SCPI and a Characterize

	Noise Floor operation is needed, an error will be entered in the system error queue
Preset	Unaffected by Mode Preset. Turned ON at startup and by Restore Mode Defaults in Modes that support Adaptive. Turned OFF at startup and by Restore Mode Defaults in Modes that do not support Adaptive
State Saved	No

Remote Command	`[:SENSe]:CORRection:NOISe:FLOor:ADAptive ON | OFF | 1 | 0` `[:SENSe]:CORRection:NOISe:FLOor:ADAptive?`

Example	`:CORR:NOIS:FLO ON`
	First turn NFE on, this is Full mode
	`:CORR:NOIS:FLO:ADAP ON`
	Then set it to Adaptive

Dependencies	Only available in Modes that support Adaptive NFE Only appears in instruments with the NFE or NF2 license installed. In all others, the control does not appear, but the SCPI command is accepted without error (but has no effect)
Couplings	For backwards compatibility, sending `:CORR:NOIS:FLO ON` turns NFE Adaptive OFF. To turn Adaptive ON, you must issue the commands in the proper order, as shown in the example above
Preset	Not affected by Mode Preset, but set to ON at startup and by Restore Mode Defaults
State Saved	No

More Information

The instrument is characterized in the factory (or during a field calibration) with a model of the noise, referred to the input mixer, versus frequency in each band and path combination. Bands are 0 (low band) and 1 through 4 (high band) in a 26.5 GHz instrument, for example. Paths include normal paths, preamp paths, the electronic attenuator, etc.

In most band/path combinations, the noise can be well characterized based on just two parameters and the instrument frequency response before compensation for frequency-dependent losses.

After the noise density at the input mixer is estimated, the effects of the input attenuator, RBW, detector, etc. are computed to get the estimated input-port-referred noise level.

In the simplest case, the measured power (signal plus instrument noise) in each display point (bucket) is compensated by subtracting the estimated noise power, leaving just the signal power. This is the operation when the detector is Average and the Average Type is set to Power.

In other cases, operation is often not quite as good but still highly effective. With peak detection, the noise floor is estimated based on the RBW and the duration of the bucket using the same equations used in the noise marker function. The voltage of the noise is subtracted from the voltage of the observed signal-plus-noise measurement to compute the estimated signal voltage. The peak detector is one example of processing that varies with detector to give good estimates of the signal level without the instrument noise.

For best operation, the average detector and the power scale are recommended, as already stated. Peak detection for pulsed-RF can still give excellent effectiveness. FFT analysis does not work well, and does not do NFE well, with pulsed-RF signals, so this combination is not recommended. Negative peak detection is not very useful, either. Sample detection works well, but is never better than the average detector because it doesn’t smooth as well. The Normal detector is a combination of peak and negative peak behaviors, and works about as well as these.

For best operation, extreme smoothing is desirable, as already stated. Using narrow VBWs works well, but using very long bucket durations and the average detector works best. Reducing the number of trace points will make the buckets longer.

For best operation, the power scale (Average Type = Power) is optimum. When making CW measurements in the presence of noise without NFE, averaging on the decibel scale has the advantage of reducing the effect of noise. When using NFE, the NFE does an even better job than using the log scale ever could. Using NFE with the log scale is not synergistic, though; NFE with the power scale works a little better than NFE with log averaging type.

The results from NFE with internal preamp can often be lower than the theoretical noise in a signal source at room temperature, a noise density of -174 dBm/Hz. This is expected and useful behavior, because NFE is designed to report the amount of input signal that is in excess of the thermal noise, not the amount that includes the thermal noise. This can be a useful behavior because thermal noise often interferes with what you want to measure, instead of being part of what you want to measure. Note that NFE is not adequately accurate to always be able to read below kTB.

Adaptive NFE provides an alternative to fully-on and -off NFE. Fully-on NFE can, notably in cases with little or no averaging of the spectrum, result in a display that is distractingly unfamiliar in the variability in response to low level signals. Fully-off NFE fails to achieve the potential improvement in dynamic range and associated accuracy of measurement of low level signals. Adaptive NFE controls the degree of potential improvement in the noise floor to give more improvement for those instrument settings that can make good use of the potential improvement—those settings with high degrees of variance reduction through some variant of averaging. When the potential improvement is small, the display acts like the NFE-off case, and when it is high, it acts like the fully-on case, and in-between, application is a compromise between attractiveness and effectiveness.

On instruments with the NF2 license installed, the calibrated Noise Floor used by Noise Floor Extensions should be refreshed periodically. Keysight recommends that the **Characterize Noise Floor** operation be performed after the first 500 hours of operation, and once every calendar year. The control to perform this is located in the **System, Alignments, Advanced** menu. If you have not done this yourself at the recommended interval, then when you turn on Noise Floor Extensions, the instrument will prompt you to do so with a dialog that says:

"This action will take several minutes to perform. Please disconnect all cables from the RF input and press Enter to proceed. Press ESC to cancel, or Postpone to postpone for a week"

If you **Cancel**, you will be prompted again the next time you turn NFE `ON`. If you **Postpone**, you will be prompted again after a week passes and you then turn NFE `ON`.

3.7.8.6 Global

The controls in this menu apply to all Modes in the instrument.

Some controls (for example, **Global Center Freq**) allow you to switch certain Meas Global parameters to a Mode Global state. These switches apply to all Modes that support global settings. For example, no matter what Mode you are in when you set **Global Center Freq** to `ON`, it applies to all Modes that support Global Settings.

Other controls (for example, **Extend Low Band**) are actually set in this menu, but apply to all Modes.

Global Center Freq

The software maintains a Mode Global value called **Global Center Freq**.

When **Global Center Freq** is switched `ON`, the current Mode's center frequency is copied into the **Global Center Frequency**, and from then on all Modes that support global settings use the **Global Center Frequency**, so you can switch between any of these Modes and the Center Freq will remain unchanged.

Adjusting the Center Freq of any Mode that supports Global Settings, while **Global Center Freq** is `ON`, modifies the Global Center Frequency.

When **Global Center Freq** is switched `OFF`, the Center Freq of the current Mode is unchanged, but now the Center Freq of each Mode is once again independent.

When **Mode Preset** is pressed while **Global Center Freq** is `ON`, the Global Center Freq is preset to the preset Center Freq of the current Mode.

This function is reset to `OFF` when "Restore Defaults" on page 1737 (in this tab) is pressed, or when **System**, **Restore Defaults**, **All Modes** is pressed.

Remote Command	`:INSTrument:COUPle:FREQuency:CENTer ALL | NONE` `:INSTrument:COUPle:FREQuency:CENTer?`
Example	`:INST:COUP:FREQ:CENT ALL` `:INST:COUP:FREQ:CENT?`
Preset	Set to `OFF` on **Global** Settings, **Restore Defaults** and **System, Restore Defaults, All Modes**
Range	`ALL|NONE`

Preset	OFF
Backwards Compatibility SCPI	:GLOBal:FREQuency:CENTer[:STATe] 1 | 0 | ON | OFF :GLOBal:FREQuency:CENTer[:STATe]?

Global EMC Std

When this control is switched ON, the current Mode's EMC Std is copied into the **Global EMC Std**, and from then on all Modes that support global settings use the Global EMC Std, so you can switch between any of these Modes and the EMC Std will remain unchanged.

Adjusting the EMC Std of any Mode that supports Global Settings, while Global EMC Std is ON, will modify the **Global EMC Std**.

When **Global EMC Std** is switched OFF, the EMC Std of the current Mode is unchanged, but now the EMC Std of each Mode is once again independent. When **Mode Preset** is pressed while **Global EMC Std** is ON, the Global EMC Std is preset to the preset EMC Std of the current Mode.

This function is reset to OFF when "Restore Defaults" on page 1737 (in this tab) is pressed, or when **System, Restore Defaults, All Modes** is pressed.

Remote Command	:INSTrument:COUPle:EMC:STANdard ALL | NONE :INSTrument:COUPle:EMC:STANdard?
Example	:INST:COUP:EMC:STAN ALL :INST:COUP:EMC:STAN?
Dependencies	Only available if option EMC is installed
Preset	Set to OFF on **Global** Settings, **Restore Defaults** and **System, Restore Defaults, All Modes**
Range	ALL|NONE

Extend Low Band

The software maintains a Mode Global value called **Extend Low Band**.

Under the current sweep configuration crossing over two bands, when **Extend Low Band** is turned ON, the instrument checks whether one band can cover the whole sweep frequency range or not. If it can, then the instrument locks the band; otherwise, it does nothing (the band crossover occurs).

This function does *not* work when **Band Lock** under **System > Service > Lock Functions** is not -1 (no Band Lock). In that case, **Band Lock** takes priority over **Extend Low Band**.

This function is reset to OFF when "Restore Defaults" on page 1737 (in this tab) is pressed, or when **System**, **Restore Defaults**, **All Modes** is pressed.

This parameter is available for SA, RTSA, WCDMA, WIMAX OFDMA, LTEAFDD, LTEATDD Modes.

Remote Command	`:INSTrument:COUPle:FREQuency:BAND:EXTend 0 | 1 | ON | OFF` `:INSTrument:COUPle:FREQuency:BAND:EXTend?`
Example	`:INST:COUP:FREQ:BAND:EXT 1` `:INST:COUP:FREQ:BAND:EXT?`
Dependencies	Only applies to UXA, PXA, MXA and EXA
Preset	Set to `OFF` by **Global** Settings > **Restore Defaults** and **System** > **Restore Defaults** > **All Modes**
Range	`ON|OFF`

Restore Defaults

Resets all of the functions in the **Global** Settings menu to `OFF`. This also occurs when **System**, **Restore Defaults**, **All Modes** is pressed.

Remote Command	`:INSTrument:COUPle:DEFault`
Example	`:INST:COUP:DEF`
Backwards Compatibility SCPI	`:GLOBal:DEFault`

3.7.9 Sweep

The **Sweep** key accesses controls that enable you configure and control the acquisition of data and the X-axis parameters of the instrument. These controls might include Sweep Time, Continuous/Single, Pause/Resume, X Scale and number of Points.

3.7.9.1 Sweep/Control

Contains controls for the Sweep and Control functions of the instrument, such as Sweep Time and Continuous/Single.

Sweep Time

Controls the time the instrument takes to sweep the current frequency span in swept measurements, displays the sweep time in swept measurements, and displays the equivalent Sweep Time in FFT measurements.

NOTE In instruments without sweeping hardware, this control may be labeled "Acquisition Time"

When Sweep Time is in Auto, the instrument computes a time that will give accurate measurements based on other settings, such as RBW and VBW.

You can choose a shorter sweep time to improve the measurement throughput (with some potential unspecified accuracy reduction), but the Meas Uncal indicator will come on if the sweep time you set is less than the calculated Auto Sweep time.

You can also select a longer sweep time, which can be useful (for example) for obtaining accurate insertion loss measurements on very narrowband filters.

In the ACP measurements, use [:SENSe]:ACP:OFFSet:LIST:SWEep:TIME to set the number of points used for measuring the offset channels for Basic and cdmaOne. For cdma2000, 1xEVDO and W-CDMA, this command sets the sweep time when using the sweep mode.

NOTE: Significantly faster sweep times are available with Option FS1.

NOTE: The Meas Uncal (measurement uncalibrated) warning is given in the Status Bar at the bottom of the screen when the manual Sweep time entered is faster than the time computed by the instrument's Sweep time equations, that is, the Auto Sweep Time. The instrument's computed Sweep time will give accurate measurements; if you sweep faster than this your measurements may be inaccurate. A Meas Uncal condition may be corrected by returning the Sweep Time to Auto; by entering a longer Sweep Time; or by choosing a wider RBW and/or VBW.

Remote Command	[:SENSe]:CHPower:SWEep:TIME <time> [:SENSe]:CHPower:SWEep:TIME? [:SENSe]:CHPower:SWEep:TIME:AUTO OFF | ON | 0 | 1 [:SENSe]:CHPower:SWEep:TIME:AUTO?
Example	:CHP:SWE:TIME 25ms :CHP:SWE:TIME? :CHP:SWE:TIME:AUTO OFF :CHP:SWE:TIME:AUTO?
Dependencies	In certain instruments without sweeping hardware, such as VXT models M9420A/21A, the Sweep Time control is grayed out, and the Auto/Man toggle disappears
Couplings	Sweep Time is coupled to RBW when Sweep Time is set to Auto; in this case the sweep time is changed as the RBW changes, to maintain amplitude calibration Sweep Time is also coupled to the Video Bandwidth (VBW). As the VBW is changed, the sweep time (when set to Auto) is changed to maintain amplitude calibration. This occurs because of common hardware between the two circuits
Preset	Automatically Calculated unless noted below WCDMA: 1.0 ms, CDMA2K: 9.4ms, 1xEVDO: 2.66ms ON unless noted below

	WCDMA: OFF
State Saved	Saved in instrument state
Min	Typically: 1 ms
Max	In swept spans: 4000 s
Annotation	The sweep time is displayed in the lower-right corner of the screen. The number of points is displayed parenthetically, as: Sweep 13.3 ms (1001 points) A "#" mark appears before "Sweep" in the annotation when it is switched from Auto to Manual coupling
Status Bits/OPC dependencies	Meas Uncal is Bit 0 in the STATus:QUEStionable:INTegrity:UNCalibrated register

Sweep/Measure

Allows you to toggle between Continuous and Single sweep or measurement operation. The Single/Continuous state is Meas Global, so the setting affects *all* measurements.

The front-panel key **Single/Cont** performs exactly the same function

NOTE **In the WAVeform measurement, this control only appears in the Meas Bar, and not in the Sweep/Control tab.**

See "More Information" on page 919

Remote Command	:INITiate:CONTinuous OFF | ON | 0 | 1 :INITiate:CONTinuous?
Example	:INIT:CONT 0 :INIT:CONT OFF puts instrument into Single measurement operation :INIT:CONT 1 :INIT:CONT ON puts instrument into Continuous measurement operation
Preset	ON Note that :SYST:PRES sets :INIT:CONT to ON but *RST sets :INIT:CONT to OFF
State Saved	Saved in instrument state
Annunciation	The **Single/Continuous** icon in the Meas Bar changes depending on the setting: – A line with an arrow is Single – A loop with an arrow is Continuous

More Information

With **Avg/Hold Num** (in the **Meas Setup** menu) set to **Off** or set to **On** with a value of 1, a sweep is taken after the trigger condition is met; and the instrument continues to take new sweeps after the current sweep has completed and the trigger condition is again met. However, with **Avg/Hold Num** set to On with a value >1, multiple sweeps (data acquisitions) are taken for the measurement. The trigger condition must be met prior to each sweep. The sweep is not stopped when the average count k equals the number N set for Avg/Hold Num is reached, but the number k stops incrementing. A measurement average usually applies to all traces, marker results, and numeric results, but sometimes only applies to the numeric results.

If the instrument is in Single measurement, pressing the **Cont/Single** toggle control does not change k and does not cause the sweep to be reset; the only action is to put the instrument into Continuous measurement operation.

If it is already in Continuous sweep:

– the `:INIT:CONT 1` command has no effect

– the `:INIT:CONT 0` command will place the instrument in Single Sweep but will have no effect on the current sequence until k = N, at which point the current sequence will stop and the instrument will go to the idle state.

See "Restart" on page 1738 control description for details on the `:INIT:IMM` (Restart) function.

If you are already in Single sweep, the `:INIT:CONT OFF` command has no effect.

If you are already in Single Sweep, then pressing the **Cont/Single** toggle control in the middle of a sweep does not restart the sweep or sequence. Similarly, pressing the **Cont/Single** toggle control does not restart the sweep or sequence if the sweep is not in the idle state (for example, if you are taking a very slow sweep, or the instrument is waiting for a trigger). Even though pressing the **Cont/Single** toggle control in the middle of a sweep does *not* restart the sweep, sending `:INIT:IMM` *does* reset it.

Restart

The **Restart** function restarts the current sweep, or measurement, or set of averaged/held sweeps or measurements. In measurements that support pausing, if you are Paused, pressing **Restart** performs a **Resume**.

The Restart function is accessed in several ways:

– Pressing the **Restart** key

– Sending the remote command `:INIT:IMM`

– Sending the remote command `:INIT:REST`

See "More Information" on page 920

Remote Command	`:INITiate[:IMMediate]` `:INITiate:RESTart`
Example	`:INIT:IMM` `:INIT:REST`
Notes	`:INIT:REST` and `:INIT:IMM` and the front-panel **Restart** key perform exactly the same function
Couplings	Resets average/hold count k For the first sweep, overwrites all active (update=on) traces with new current data For application modes, resets other parameters as required by the measurement
Status Bits/OPC dependencies	This is an Overlapped command The `:STATus:OPERation` register bits 0 through 8 are cleared The `:STATus:QUEStionable` register bit 9 (INTegrity sum) is cleared The `SWEEPING` bit is set The `MEASURING` bit is set
Backwards Compatibility Notes	For Spectrum Analysis mode in ESA and PSA, the **Restart** hardkey and the `:INIT:REST` command restart trace averages (displayed average count reset to 1) for a trace in **Clear Write**, but did not restart **Max Hold** and **Min Hold** In the X-Series, the **Restart** hardkey and the `:INIT:REST` command restart not only **Trace Average**, but **Max Hold** and **Min Hold** traces as well For wireless comms modes in ESA and PSA, the **Restart** hardkey and the `:INIT:REST` command restarted every measurement, including all traces and numeric results. There is no change to this operation

More Information

The **Restart** function first aborts the current sweep or measurement as quickly as possible. It then resets the sweep and trigger systems, sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is in the process of aligning when a Restart is executed, the alignment finishes before the restart function is performed.

Even when set for Single operation, multiple sweeps may be taken when **Restart** is pressed (for example, when averaging/holding is on). Thus when we say that Restart "restarts a measurement," depending on the current settings, we may mean:

- It restarts the current sweep
- It restarts the current measurement
- It restarts the current set of sweeps if any trace is in Trace Average, Max Hold or Min Hold

– It restarts the current set of measurements if Averaging, or Max Hold, or Min Hold is on for the measurement

With Average/Hold Number (in Meas Setup menu) set to 1, or Averaging off, or no trace in Trace Average or Hold, a single sweep is equivalent to a single measurement. A single sweep is taken after the trigger condition is met; and the instrument stops sweeping once that sweep has completed. However, with Average/Hold Number >1 and at least one trace set to Trace Average, Max Hold, or Min Hold (SA Measurement) or Averaging on (most other measurements), multiple sweeps/data acquisitions are taken for a single measurement. The trigger condition must be met prior to each sweep. The sweep is stopped when the average count k equals the number N set for Average/Hold Number. A measurement average usually applies to all traces, marker results, and numeric results, but sometimes only applies to the numeric results.

Once the full set of sweeps has been taken, the instrument will go to the idle state. To take one more sweep without resetting the average count, increment the average count by 1, by pressing the step up key while Average/Hold Number is the active function, or by sending the remote command `:CALC:AVER:TCON UP`.

Pause/Resume

Pauses a measurement after the current data acquisition is complete.

When a measurement is paused:

– The label on this control changes to **Resume**. Pressing **Resume** un-pauses the measurement.

– Pressing **Restart** also performs a **Resume**.

Remote Command	`:INITiate:PAUSe` `:INITiate:RESume`
Example	`:INIT:PAUS` `:INIT:RES`
Dependencies	Not displayed in Modes that do not support pausing
Couplings	When Averaging is On, if the measurement is paused no more updates will occur until either a Resume or Restart occurs If the measurement is resumed, the averaging continues to use the traces from before the Pause occurred and continues to use the traces from the point where the Resume occurred. This still provides real-time traces, but they will no longer be gap free In a view with a Waterfall window, when the measurement is paused, the Waterfall stops updating. When Resume is selected, the Waterfall will retain the existing traces and continue updating using traces from the point at which Resume was selected. The time stamp of the individual Waterfall traces will show the time from the beginning of the measurement the trace relates to, showing there was a gap in the Waterfall capture In Density view, when the measurement is paused, the Density Display stops updating. When the

	measurement is resumed, if Persistence is ON, the persistence fading will continue from the point when the measurement was paused If a Restart occurs, the average counter is reset and all results are discarded. The measurement begins again, using traces after the Restart occurred

Abort (Remote Command Only)

This command stops the current measurement. It aborts the current measurement as quickly as possible, resets the sweep and trigger systems, and puts the measurement into an "idle" state. If the instrument is in the process of aligning when `:ABORt` is sent, the alignment finishes before the abort function is performed, so `:ABORt` does *not* abort an alignment.

If the instrument is set for Continuous measurement, it sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is set for Single measurement, it remains in the "idle" state until an `:INIT:IMM` command is received.

Remote Command	`:ABORt`
Example	`:ABOR`
Notes	If `:INIT:CONT` is `ON`, then a new continuous measurement will start immediately, with sweep (data acquisition) occurring once the trigger condition has been met If `:INIT:CONT` is `OFF`, then `:INIT:IMM` is used to start a single measurement, with sweep (data acquisition) occurring once the trigger condition has been met
Dependencies	For continuous measurement, `:ABORt` is equivalent to the **Restart** key Not all measurements support the abort command
Status Bits/OPC dependencies	The `:STATus:OPERation` register bits 0 through 8 are cleared The `:STATus:QUEStionable` register bit 9 (INTegrity sum) is cleared Since all the bits that feed into OPC are cleared by `:ABORt`, the `:ABORt` will cause the *OPC query to return true

3.7.9.2 Sweep Config

This tab accesses controls that enable you to configure the Sweep and Control functions of the instrument, such as Sweep Rules.

Sweep Time Rules

Switches the instrument between `NORMal` and `ACCuracy` sweep states.

Setting **Auto Sweep Time** to `ACCuracy` results in slower sweep times, usually about three times as long, but yields better amplitude accuracy for CW signals. The instrument amplitude accuracy specifications only apply when **Auto Sweep Time** is set to `ACCuracy`.

Additional amplitude errors that occur when **Auto Sweep Time** is set to `NORMal` are usually well under 0.1 dB, though this is not guaranteed. Because of the faster sweep times and still low errors, `NORMal` is the preferred setting of **Auto Sweep Time**. **Auto Sweep Time** is set to `NORMal` on a **Preset** or **Auto Couple**. This means that in the Preset or Auto Coupled state, instrument amplitude accuracy specifications do not apply.

Remote Command	`[:SENSe]:CHPower:SWEep:TIME:AUTO:RULes NORMal | ACCuracy` `[:SENSe]:CHPower:SWEep:TIME:AUTO:RULes?`
Example	`:CHP:SWE:TIME:AUTO:RUL NORM` `:CHP:SWE:TIME:AUTO:RUL?`
Dependencies	This control does not appear in Spectrum Analyzer Mode in VXT models M9420A/21A This control is not available in E7760
Couplings	Set to `NORMal` when **Auto Couple** is pressed or sent remotely
Preset	`NORMal`
State Saved	Saved in instrument state
Range	`NORMal|ACCuracy`

Points

Sets the number of points taken per sweep, and displayed in the traces. The current value of points is displayed parenthetically, next to the sweep time in the lower-right corner of the display. Using more points provides greater resolution. Using fewer points compacts the data and decreases the time required to access a trace over the remote interface.

Increasing the number of points does not increase the sweep time. However, it can slightly impact the trace processing time and therefore the overall measurement speed. Decreasing the number of points does not decrease the sweep time, but it may speed up the measurement, depending on the other sweep settings (for example, in FFT sweeps). Fewer points will always speed up the I/O.

Due to minimum sweep rate limitations of the hardware, the minimum sweep time available to the user will increase above its normal value of 1 ms as the number of sweep points increases above 15001.

Changing the number of sweep points has several effects on the instrument.Since markers are read at the point location, the marker reading may change.The sweep time resolution will change. Trace data for all the traces will be cleared and, if **Sweep** is in **Cont**, a new trace taken. If any trace is in average or hold, the averaging starts over.

Due to sweep time quantization issues, the knob and up/down keys cannot be used to adjust the number of points.

When in a split screen display each window may have its own value for points.

When sweep points is changed, an informational message is displayed, "Sweep points changed, all traces cleared."

Remote Command	`[:SENSe]:CHPower:SWEep:POINts <integer>` `[:SENSe]:CHPower:SWEep:POINts?`
Example	`:CHP:SWE:POIN 501` `:CHP:SWE:POIN?`
Dependencies	This function is not available when Signal ID is set to On in External Mixing Neither the knob nor the step keys can be used to change this value. If it is tried, a warning is given Not displayed in modes that do not support Swept
Couplings	Whenever the number of sweep points change: All trace data is erased Any traces with Update Off will also go to Display Off (like going from View to Blank in the older instruments) Sweep time is re-quantized Any limit lines that are on will be updated If averaging/hold is on, averaging/hold starts over The resolution of setting the sweep time depends on the number of points selected
Preset	1001
State Saved	Saved in instrument state
Min	101
Max	100,001
Annotation	On second line of annotations, in lower right corner in parenthesis behind the sweep annotation

IF Dithering

This control lets you turn **IF Dithering** on and off. IF Dithering is a technique used in unpreselected instruments (such as Keysight's modular instruments) to enhance the rejection of images and internally-generated spurious signals.

Remote Command	`[:SENSe]:SWEep:IF:DITHer OFF | ON | 0 | 1` `[:SENSe]:SWEep:IF:DITHer?`
Dependencies	This control only appears in Spectrum Analyzer Mode in VXT
Preset	`OFF`
State Saved	Saved in instrument state

Image Protection

This control lets you turn IF Protection on and off. IF Protection is a technique used in unpreselected instruments (such as Keysight's modular instruments) to detect and suppress images and spurs that may be present in non-preselected hardware.

IF Protection takes two sweeps and by correlating the data between them, provides a single, correct power-versus-frequency trace.

Remote Command	`[:SENSe]:SWEep:IMAGeprot OFF | ON | 0 | 1` `[:SENSe]:SWEep:IMAGeprot?`
Dependencies	This control only appears in Spectrum Analyzer Mode in VXT
Preset	ON
State Saved	Saved in instrument state

3.7.10 Trace

The **Trace** menu lets you control the acquisition, display, storage, detection and manipulation of trace data for the available traces. The Trace Control tab of this menu contains radio-button selections for the trace type (**Clear/Write, Trace Average, Max Hold, Min Hold**) and **View/Blank** setting for the selected trace.

3.7.10.1 Select Trace

Specifies the *selected trace*, which is the trace that will be affected when you change trace settings.

The **Select Trace** control appears above the menu panel, indicating that it applies to *all* controls in the menu panel. **Select Trace** is blanked if you select a tab whose controls do *not* depend on the selected trace (for example, **Trace Function**).

Notes	The selected trace is remembered even when not in the **Trace** menu
Preset	Trace 1
State Saved	Yes

3.7.10.2 Trace Control

The controls on the Trace Control tab allow you to set the type of the Trace and its update mode.

There are four trace Types: **Clear/Write, Trace Average, Max Hold** and **Min Hold.** Each type handles data in a different way.

Each trace also has two values that determine whether it is being written or not and whether it is being displayed or not. These values, **Update** and **Display,** are described more fully in the **View/Blank** control description, but suffice it to say that when **Update** is On a trace is updating and when **Update** is Off it is not; and when **Display** is On it is visible and when **Display** is Off it is not. These terms are used throughout the descriptions below.

When Trace Annotation (see Display menu) is On, each non-blanked trace is labeled on the trace with the detector used to take it.

For slower sweeps a visual indicator exists on the trace where the new data is being written, a green “caret” or ^ symbol, which moves across the bottom of the graticule showing the current trace point.

Trace Type

Allows you to select the type of trace you want to you use for the current measurement. There are four trace Types: Clear/Write, Trace Average, Max Hold and Min Hold.

Besides the **Trace Type**, the **View/Blank** state must be set to **Active** (**Update** On, **Display** On) for a trace to be updating and visible. Selecting any **Trace Type** automatically makes the trace **Active**. See also the **View/Blank** menu description.

Remote Command	`:TRACe[1]|2|3:CHPower:TYPE WRITe	AVERage	MAXHold	MINHold` `:TRACe[1]|2|3:CHPower:TYPE?`
Example	`:TRAC:CHP:TYPE WRIT` `:TRAC:CHP:TYPE?`
Notes	Available options are: Clear Write — `WRITe` — Each trace update replaces the old data in the trace with new data Average — `AVERage` — The instrument maintains and displays an average trace, which represents the cumulative average on a point-by-point basis of the new trace data and previous averaged trace data Maximum Hold — `MAXHold` — The instrument maintains and displays a max hold trace, which represents the maximum data value on a point-by-point basis of the new trace data and previous trace data Minimum Hold — `MINHold` — The instrument maintains and displays a min hold trace, which represents the minimum data value on a point-point basis of the new trace data and previous trace data
Couplings	When Detector setting is “Auto” (`[:SENSe]:CHPower:DETector:AUTO?`), Detector (`[:SENSe]:CHPower:DETector[:FUNCtion]?`) switches aligning with the switch of this parameter: “`NORMal`” with `WRITe` (Clear Write), “`AVERage`” with `AVERage`, “`POSitive` (peak)” with `MAXHold`, and “`NEGative` (peak)” with `MINHold`
Preset	`AVERage`
State Saved	Saved in instrument state
Range	ClearWrite|Average|MaxHold|MinHold

Clear and Write | Restart Averaging | Restart Max/Min Hold

Starts the trace writing as though the trace type had just been selected. Pressing this control has exactly the same effect as selecting the current trace type again – the control is provided because it may not be obvious that re-selecting the current selection from a radio button menu will take an action.

This button displays different labels depending on the **Trace Type**:

– Clear/Write: Clear and Write

– Trace Average: Restart Averaging

– Max Hold: Restart Max Hold

– Min Hold: Restart Min Hold

View/Blank

Lets you set the state of the two trace values, **Update** and **Display**. The four choices available are:

Active	Update and Display both ON
View	Update OFF, Display ON
Blank	Update OFF, Display OFF
Background	Update ON, Display OFF This allows a trace to be blanked and continue to update “in the background”, which was not possible in the past

See the tables below for details onthe SCPI remote commands to control these two variables.

Preset	Trace On
State Saved	Saved in instrument state
Range	Trace On|Blank

Trace Update State On/Off

Toggles a trace Update state between On and Off. The OFF selection makes the trace inactive. This does not affect whether the trace is visible or not. To change the trace visibility, see "Trace Display State On/Off" on page 928

Remote Command	`:TRACe[1]|2|3:CHPower:UPDate[:STATe] ON | OFF | 0 | 1` `:TRACe[1]|2|3:CHPower:UPDate[:STATe]?`
Example	`:TRAC:CHP:UPD ON` `:TRAC:CHP:UPD?`
Couplings	Whenever you set **Update** to ON for any trace, the **Display** is set to ON for that trace
Preset	1|0|0 (ON for Trace 1; OFF for 2 &3)
State Saved	Saved in instrument state

Trace Display State On/Off

Toggles a trace Display state between On and Off. The OFF selection makes the trace not visible. This does not affect whether the trace is updating or not.

Even when not visible, traces may be queried, and markers may be placed on them.

Remote Command	:TRACe[1]|2|3:CHPower:DISPlay[:STATe] ON | OFF | 0 | 1 :TRACe[1]|2|3:CHPower:DISPlay[:STATe]?
Example	:TRAC:CHP:DISP ON :TRAC:CHP:DISP?
Couplings	Whenever you set **Update** to ON for any trace, the **Display** is set to ON for that trace
Preset	1|0|0 (ON for Trace 1; OFF for 2 &3)
State Saved	Saved in instrument state

3.7.10.3 Detector

The Detector tab lets you choose and configure detectors for the selected trace.

Detector

Selects a detector to be used by the instrument for the current measurement. The following choices are available:

- Auto- the detector selected depends on marker functions, trace functions, average type, and the trace averaging function
- Normal-the detector determines the peak of the CW-like signals, and it yields alternating maximums and minimums of noise-like signals. This is also referred to as Rosenfell detection
- Average-the detector determines the average of the signal within the sweep points, using RMS averaging
- Peak (Positive)-the detector determines the maximum of the signal within the sweep points
- Sample-the detector indicates the instantaneous level of the signal at the center of the sweep points represented by each display point
- Negative Peak-the detector determines the minimum of the signal within the sweep points

Because they may not find a spectral component's true peak, neither average nor sample detectors measure amplitudes of CW signals as accurately as peak or normal, but they do measure noise without the biases of peak detection.

Remote	[:SENSe]:CHPower:DETector[:FUNCtion] NORMal | AVERage | POSitive |

Command	SAMPle | NEGative | RMS [:SENSe]:CHPower:DETector[:FUNCtion]?
Example	:CHP:DET NORM :CHP:DET? :CHP:DET RMS Sets the detector to Average. Average uses RMS averaging, so this is equivalent to selecting an RMS detector
Notes	The query returns a name that corresponds to the detector type as shown below The RMS selection sets the detector type to AVERage with RMS averaging. Therefore if RMS has been selected, the query will return AVER

String Returned	Definition
NORM	Normal
AVER	Average (RMS)
POS	Peak
SAMP	Sample
NEG	Negative Peak

Couplings	When Detector setting is “Auto” ([:SENSe]:CHPower:DETector:AUTO?), Detector ([:SENSe]:CHPower:DETector[:FUNCtion]?) switches aligning with the switch of this parameter: “NORMal” with Clear Write, “AVERage” with AVERage, “POSitive (peak)” with MAXHold, and “NEGative (peak)” with MINHold
Preset	AVERage
State Saved	Saved in instrument state
Range	NORMal|AVERage|POSitive|SAMPle|NEGative|RMS

Detector Select Auto/Man

Sets the Detector mode to Auto or Manual. In Auto, the proper detector is chosen based on rules that take into account the measurement settings and other instrument settings.

When any detector is selected by the user, this toggles automatically set to Man (manual).

Remote Command	[:SENSe]:CHPower:DETector:AUTO ON | OFF | 1 | 0 [:SENSe]:CHPower:DETector:AUTO?
Example	:CHP:DET:AUTO ON :CHP:DET:AUTO?
Couplings	When Detector setting is “Auto” ([:SENSe]:CHPower:DETector:AUTO?), Detector ([:SENSe]:CHPower:DETector[:FUNCtion]?) switches aligning with the switch of this

	parameter: "NORMal" with Clear Write, "AVERage" with AVERage, "POSitive (peak)" with MAXHold, and "NEGative (peak)" with MINHold
Preset	ON
State Saved	Yes

3.7.10.4 Math

The Math tab lets you turn on and configure trace math functions.

Math Function

Trace math functions perform mathematical operations between traces and, in some cases, user-specified offsets. When in a trace math function, the indicated function is performed during the sweep with the math function used in place of a detector.

The trace operands for the math function are set using the **Trace Operands** control.

See also "More Information" on page 931 and "How trace math is processed" on page 934.

Remote Command	`:CALCulate:CHPower:MATH TRACe1 | TRACe2 | TRACe3, PDIFference | PSUM | LOFFset | LDIFference | OFF, TRACe1 | TRACe2 | TRACe3,TRACe1 | TRACe2 | TRACe3, <real>,<real>` `:CALCulate:CHPower:MATH? TRACe1 | TRACe2 | TRACe3`

Example	`:CALC:CHP:MATH TRAC1,PDIF,TRAC2,TRAC3,0,0`
	Sets Trace 1 to Power Diff trace math function, and sets the First Trace operand (for Trace 1) to Trace 2 and the Second Trace operand (for Trace 1) to Trace 3
	`:CALC:CHP:MATH TRAC1,PSUM,TRAC2,TRAC3,0,0`
	Sets Trace 1 to Power Sum trace math function and sets the First Trace operand (for Trace 1) to Trace 2 and the Second Trace operand (for Trace 1) to Trace 3
	`:CALC:CHP:MATH TRAC1,LOFF,TRAC3,TRAC2,-6.00,0`
	Sets Trace 1 to Log Offset trace math function, sets the First Trace operand (for Trace 1) to Trace 3, leaves the Second Trace operand (for Trace 1) unchanged (it is irrelevant for this function) and sets the Log Offset (for Trace 1) to -6 dB
	`:CALC:CHP:MATH TRAC1,LDIF,TRAC2,TRAC3,0,-6.00`
	Sets Trace 1 to Log Diff trace math function, sets the First Trace operand (for Trace 1) to Trace 2, sets the Second Trace operand (for Trace 1) to Trace 3, and sets the Log Difference reference for Trace 1 to -6 dBm
	`:CALC:CHP:MATH TRAC1,OFF,TRAC2,TRAC3,0,0`
	Turns off trace math for trace 1

Notes	**Math Function** has 6 main sets of parameters:

	Set	Defines the "result trace"	TRACe1|TRACe2|TRACe3
	Set 2	Defines the "function"	PDIFference|PSUM|LOFFset|LDIFference|OFF
	Set 3	A "trace operand" (1)	TRACe1|TRACe2|TRACe3
	Set 4	A "trace operand" (2)	TRACe1|TRACe2|TRACe3
	Set 5	Defines the "Log Offset" (in dB)	
	Set 6	Defines the "Log Difference Reference" (in dBm)	

Note that the Trace Math mode is an enumeration; that is, when a math function is set for a trace, it turns off any math function that is on for that trace and sets the new math function.

The parameters sent in the command are reflected in the values in the control menu. There is no default for any parameter; all 6 parameters must be sent to satisfy the parser. Failure to specify a parameter results in a missing parameter message

Remote command examples are included in each section below

Dependencies	None of the trace operands can be the destination trace. If any of the three trace math commands is sent with a destination trace number matching one of the operands, a warning is generated and the function does not turn on
Couplings	Whenever a math function other than OFF is selected for a trace, that trace is set to Display=ON and Update=ON
Preset	OFF,TRACe2,TRACe3,0,0 | OFF,TRACe3,TRACe1,0,0 | OFF,TRACe1,TRACe2,0,0
State Saved	The trace math function for each trace is saved in instrument state
Range	Power Difference|Power Sum|Log Offset|Log Difference|Off
Annunciation	The function is annotated on the trace if Trace Annotation is ON
Status Bits/OPC dependencies	*OPC can be used to detect the completion of a sweep, which will also correspond to the completion of the math operation, since all math takes place during the sweep

More Information

IMPORTANT

To generate a trace math result, *you must take a sweep*. The trace math engine, described below, operates in concert with the sweep engine in the instrument. Until a sweep has been taken, even if the constituent traces are not in Update mode, no result is generated.

Note that certain events can affect the trace in ways that affects all points at once. This can happen in any number of ways, including:

- A trace clear taking place
- A trace being loaded from the file system
- Trace data being sent in from the remote interface
- A copy or exchange of trace data

You should try to avoid these occurrences during a sweep, as they will tend to invalidate the math result being accumulated.

The Trace Math functions are:

Power Diff (Op1 - Op2)

Calculates a power difference between the `First Trace` operand and the `Second Trace` operand and puts the result in the destination trace.

During the sweep, the following formula is executed for each point in the trace operands, and the corresponding point is generated for the destination trace:

```
DestinationTrace = 10 log(10(1/10)(FirstTrace) – 10(1/10)(SecondTrace))
```

The values of the trace points are assumed to be in a decibel scale, as they are internally stored.

If a point in `FirstTrace` is equal to `maxtracevalue`, the resultant point is also `maxtracevalue`.

Otherwise, if the result of the subtraction is less than or equal to 0, the resultant point is `mintracevalue`.

Power Sum (Op1 + Op2)

Calculates a power sum between the `First Trace` operand and the `Second Trace` operand and puts the result in the destination trace.

During the sweep, the following formula is executed for each point in the trace operands, and the corresponding point is generated for the destination trace.

```
DestinationTrace = 10 log(10(1/10)(FirstTrace) + 10(1/10)(SecondTrace))
```

The values of the trace points are assumed to be in a decibel scale, as they are internally stored.

If a point in either trace operand is equal to `maxtracevalue`, the resultant point is also `maxtracevalue`.

Log Offset (Op1 + Offset)

Calculates a log offset from the `First Trace` operand and puts the result in the destination trace. This is like the B-DL function in some older instruments. The offset is entered on the `Offset` control, which only appears when this math function is in force for the selected trace. Each destination trace has its own offset.

During the sweep, the following formula is executed for each point in the trace operand, and the corresponding point is generated for the destination trace.

```
DestinationTrace = FirstTrace + Offset
```

The values of the trace points are assumed to be in dBm (as they are internally stored) and the offset is in dB.

If a point in the trace operand is equal to `maxtracevalue`, the resultant point is also `maxtracevalue`.

If a point in the trace operand is equal to `mintracevalue`, the resultant point is also `mintracevalue`.

Example: If offset is 25 dB, then our destination trace will be higher than the operand trace by 25 dB.

Note that the `Second Trace` operand is not used for this function.

Log Diff (Op1 - Op2 + Ref)

Offsets the difference between the `First Trace` operand and the `Second Trace` operand by a reference and puts the result in the destination trace. This is like the A-B+DL function in some older instruments. The Reference is entered on the **Reference** control, which only appears when this math function is in force for the selected trace. Each destination trace has its own reference.

Offsets the difference between the `First Trace` operand and the `Second Trace` operand by a reference and puts the result in the destination trace. This is like the A-B+DL function in some older instruments. The Reference is entered on the **Reference** control, which only appears when this math function is in force for the selected trace. Each destination trace has its own reference.

During the sweep, the following formula is executed for each point in the trace operands, and the corresponding point is generated for the destination trace.

```
DestinationTrace = (FirstTrace - SecondTrace) + Reference
```

The values of the operand trace points are assumed to be in decibel units (as they are internally stored) and the reference is in dBm so the result is in dBm.

Example: If the first operand trace 1 is at 5 dBm, the second operand trace 2 is at –5 dBm, and the reference is –25 dBm, then the destination trace will be –15 dBm.

Example: If the first operand trace1 is at 60 dBuV, the second operand trace 2 is at 50 dBuV, and the reference is 35 dBuV, then the destination trace will be 45 dBuV.

If a point in `FirstTrace` is equal to `maxtracevalue`, the resultant point is also `maxtracevalue`.

If a point in `FirstTrace` is equal to `mintracevalue`, the resultant point is also `mintracevalue`.

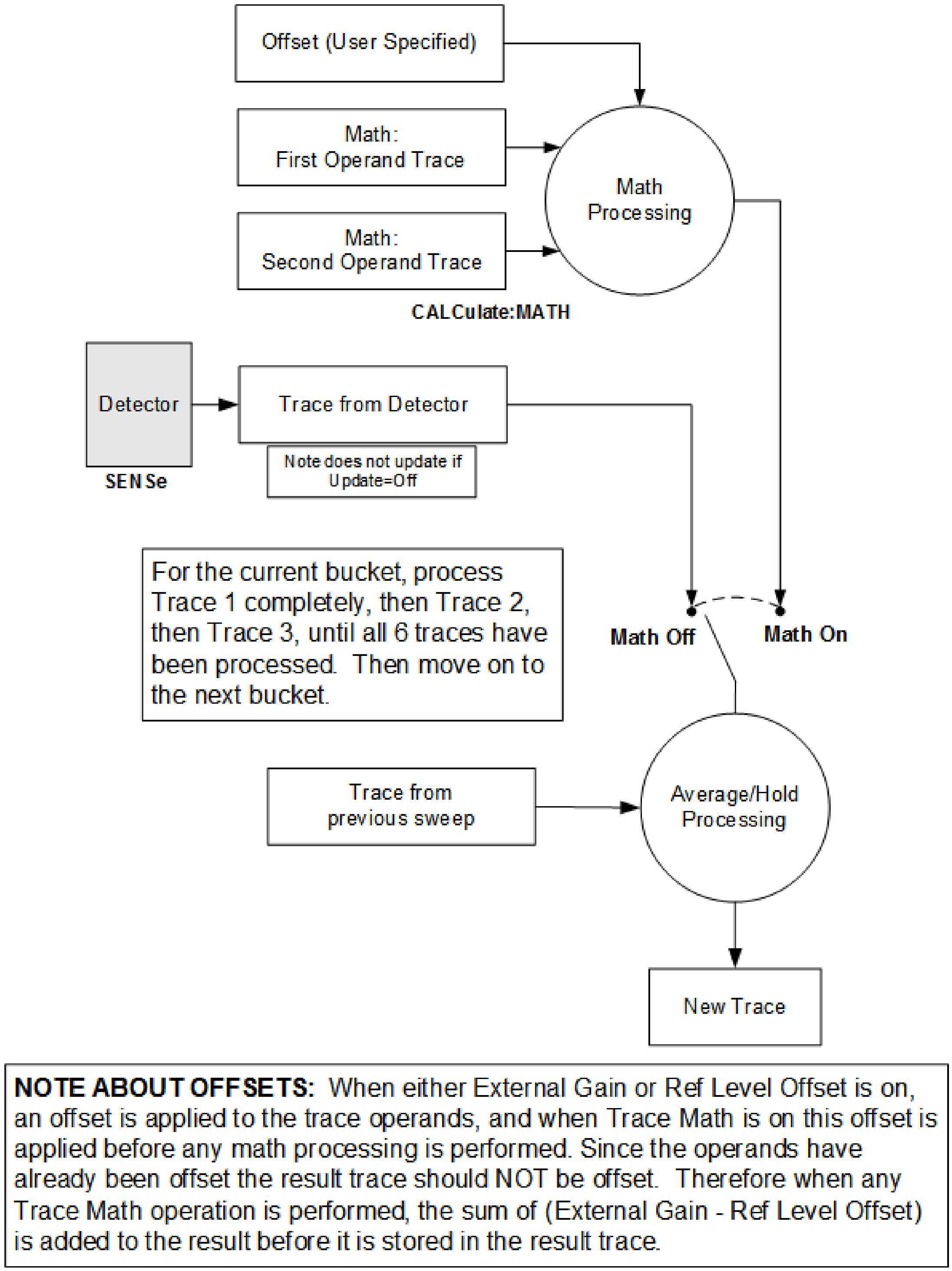
If neither of the above is true for a given point, then:

- If that point in `SecondTrace` is equal to `maxtracevalue`, the resultant point is `mintracevalue`.
- If that point in `SecondTrace` is equal to `mintracevalue`, the resultant point is `maxtracevalue`.

How trace math is processed

Whenever a trace math function is turned on, or the parameters and/or operands of an existing trace math function are changed, the destination trace is cleared. After the trace is cleared, all x-axis values in the trace, and the domain of the trace, are set to match the X-Axis settings of the first trace operand. When this is complete, a new sweep is initiated.

The process of acquiring data, processing it using the math and Average/Hold functions, and presenting it as trace data, consists of several functional blocks, as shown below:



For each active trace, the current trace point is processed for `Trace 1`, then `Trace 2`, then `Trace 3`, etc. Trace data is taken from either the detector for that trace, or from the mathematical result of up to two other traces and an offset, depending on whether trace math is on or not. The resultant data is then fed to the Average/Hold processing block, where (if the trace type is **Average**, **Max Hold**, or **Min Hold**) it is processed with previous trace data. The new trace data resulting from this process is then available for display, storage or remote output.

When the processing is complete for `Trace 1`, `Trace 2` is processed, and so on until all six traces have been processed. This allows a downstream trace to use as one of its math components a fully processed upstream trace. In other words, if math is `ON` for `Trace 4`, and its operand traces are `Trace 2` and `Trace 3`, then all detector, math, average and hold processing for Traces 2 and 3 is completed before the math is performed for `Trace 4`. When the current trace point is completed for all traces, the instrument moves on to the next trace point.

This allows very flexible and powerful math functions to be configured. For example, `Trace 1` can be an average trace, which can be fed with an offset to `Trace 2`, which can also be in **Max Hold**, allowing you to obtain the **Max Hold** of an Average trace.

Note that none of this processing is performed on inactive traces.

Note also that for any active trace with math `ON`, the Operand traces should have *lower* numbers than the trace (for example, using `Trace 4` as an operand for `Trace 1` will cause the data coming from `Trace 4` to be delayed by one sweep).

Operand 1/2

Selects the first and second trace operands, respectively, to be used for the trace math functions for the destination trace.

The operands are common to all math functions for a given trace. The most recently sent `:CALCulate:MATH` command for a given trace sets the operands for that trace, and will be reflected on the trace operand controls for that trace.

Example	The following examples are for the Swept SA measurement.
	1) Set Trace 3 to Power Diff trace math function. Set the First Trace operand (for Trace 3) to Trace 1 and the Second Trace operand (for Trace 3) to Trace 2
	`:CALC:MATH TRACE3,PDIF,TRACE1,TRACE2,0,0`
	
	2) Set Trace 3 to Log Offset trace math function. Set the First Trace operand (for Trace 3) to Trace 1, leave the Second Trace operand (for Trace 3) unchanged (it is irrelevant for this function) and set the Log Offset (for Trace 3) to -6 dB
	`:CALC:MATH TRACE3,LOFF,TRACE1,TRACE2,-6.00,0`

Notes	See the Math Function section for how to specify Operand 1 and Operand 2 using the `:CALCulate:MATH` SCPI command
Dependencies	The destination trace cannot be an operand. The destination trace number is gray on the dropdown
Preset	**Operand 1**: Trace number minus 2 (wraps at 1) For example, for Trace 1, Operand 1 presets to Trace 5; for Trace 6, it presets to Trace 4 **Operand 2**: Trace number minus 1 (wraps at 1) For example, for Trace 1, Operand 2 presets to Trace 6; for Trace 6, it presets to Trace 5
State Saved	Operand 1 and Operand 2 for each trace are stored in instrument state

Offset

The Offset value is used by the Log Offset math function.

Example	The following example is for the Swept SA measurement. `:CALC:MATH TRACE3,LOFF,TRACE1,TRACE2,-6.00,0` Sets Trace 3 to Log Offset trace math function, sets the First Trace operand (for Trace 3) to Trace 1, leaves the Second Trace operand (for Trace 3) unchanged (it is irrelevant for this function) and sets the Log Offset (for Trace 3) to -6 dB
State Saved	The Log Offset value for each trace is saved in Instrument State
Min	–100 dB
Max	100 dB

Reference

The Reference value is used by the Log Diff math function.

Example	The following example is for the Swept SA measurement. `:CALC:MATH TRACE3,LDIF,TRACE1,TRACE2,0,-6.00` Sets Trace 3 to Log Diff trace math function, sets the First Trace operand (for Trace 3) to Trace 1, sets the Second Trace operand (for Trace 3) to Trace 2, and sets the Log Difference reference (for Trace 3) to -6 dBm
State Saved	The Log Difference reference value for each trace is saved in instrument state
Min/Max	Same as reference level

3.7.10.5 Trace Function

The Trace Function includes controls to:

– Copy and Exchange traces

– Preset or Clear all traces

From Trace

Selects the trace to be copied to or exchanged with the **To Trace** when a "Copy" on page 1553 or "Exchange" on page 1553 is performed

Preset	1

To Trace

Selects the trace to be copied from or exchanged with the **From Trace** when a "Copy" on page 1553 or "Exchange" on page 1553 is performed

Preset	2

Copy

This button executes a Trace Copy based on the From Trace and To Trace parameters. The Copy is done from the From Trace to the To Trace. The action is performed once.

The X-Axis settings and domain of a trace go with it when it is copied.

Remote Command	For Swept SA Measurement (in SA Mode):
	`:TRACe:COPY TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6, TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6`
	
	For all other measurements:
	`:TRACe:<meas>:COPY TRACe1 | TRACe2 | TRACe3, TRACe1 | TRACe2 | TRACe3`
	where:
	<meas> is the identifier for the current measurement.
	Note that the format of the TRACe<n> parameter differs from that for the Swept SA Measurement.

Example	`:TRAC:COPY TRACE1,TRACE3` Copies Trace 1 to Trace 3 and puts Trace 3 in Update=Off, Display=On
Notes	The `:TRACe:COPY` command is of the form: `:TRACe:COPY <source_trace>,<dest_trace>`
Dependencies	When Signal ID is on, this key is grayed out
Couplings	The destination trace is put in View (Update=Off, Display=On) after the copy

Preset	For Swept SA Measurement (in SA Mode):
	`TRACE1, TRACE2`
	For all other measurements:
	`TRACe1, TRACe2`

Exchange

This button executes a Trace Exchange based on the From Trace and To Trace parameters. The From Trace and To Trace are exchanged with each other. The action is performed once.

The X-Axis settings and domain of a trace go with it when it is exchanged with another trace.

Remote Command	For Swept SA Measurement (in SA Mode):
	`:TRACe:EXCHange TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6, TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6`
	
	For all other measurements:
	`:TRACe:<meas>:EXCHange TRACe1 | TRACe2 | TRACe3, TRACe1 | TRACe2 | TRACe3`
	where:
	<meas> is the identifier for the current measurement.
	Note that the format of the TRACe<n> parameter differs from that for the Swept SA Measurement.

Example	`:TRAC:EXCH TRACE1,TRACE2` Exchanges Trace 1 and Trace 2 and puts both traces in Update=Off, Display=On
Notes	The `TRACe[:<meas>]:EXCHange` command is of the form: `:TRACe[:<meas>]:EXCHange <trace_1>,<trace_2>`
Couplings	Both traces are put in View (Update=Off, Display=On) after the exchange
Backwards Compatibility Notes	The copy and exchange operations menu in ESA and PSA is replaced with the more general purpose Trace Function menu. The remote commands are unaffected, as they were already general

Preset All Traces

Turns on Trace 1 and blanks all other traces. Useful when you have many traces on and you want to go back to having only Trace 1 on the display. Does not affect the trace type, detector or any other aspect of the trace system.

Remote Command	`:TRACe[:<meas>]:PRESet:ALL`
Example	`:TRAC:PRES:ALL`
Dependencies	When Signal ID is on, this key is grayed out

Clear All Traces

Clears all traces. Does not affect the state of any function or variable in the instrument. Loads `mintracevalue` into all of the points all traces, except traces in **Min Hold** in which case it loads `maxtracevalue`. Does so even if Update=Off.

Remote Command	`:TRACe[:<meas>]:CLEar:ALL`
Example	`:TRAC:CLE:ALL` Clears all traces
Dependencies	When Signal ID is on, this key is grayed out

3.7.10.6 Advanced

The **Advanced** tab contains controls for setting advanced functions of the instrument.

Measure Trace

Specifies which trace's scalar results are displayed in the Metrics window, and retrieved by sending a `:READ` or `:FETCh` command:

- Trace 1
- Trace 2
- Trace 3

Remote Command	`:CALCulate:CHPower:MTRace TRACe1 | TRACe2 | TRACe3` `:CALCulate:CHPower:MTRace?`
Example	`:CALC:CHP:MTR TRAC1` `:CALC:CHP:MTR?`
Dependencies	Trace 2 and Trace 3 are grayed out when no trace data is available
Preset	`TRACe1`
State Saved	No
Range	Trace 1 | Trace 2 | Trace 3

3.8 Occupied BW Measurement

The Occupied BW measurement computes and displays the bandwidth occupied by a given percentage of the total mean power of a signal.

Occupied BW Measurement Commands

The following commands and queries can be used to retrieve the measurement results:

:CONFigure:OBWidth

:CONFigure:OBWidth:NDEFault

:INITiate:OBWidth

:FETCh:OBWidth[n]?

:MEASure:OBWidth[n]?

:READ:OBWidth[n]?

Backwards Compatibility Commands

Command	Return Value
:FETCh:OBWidth:OBWidth? :MEASure:OBWidth:OBWidth? :READ:OBWidth:OBWidth?	Returns the Occupied Bandwidth (Hz)
:FETCh:OBWidth:FERRor? :MEASure:OBWidth:FERRor? :READ:OBWidth:FERRor?	Returns the Transmit Frequency Error (Hz)
:FETCh:OBWidth:XDB? :MEASure:OBWidth:XDB? :READ:OBWidth:XDB?	Returns the xdB Bandwidth (Hz)

Remote Command Results for Occupied Bandwidth Measurement

The following table describes the results returned by the :FETCh:OBWidth[n]?, :MEASure:OBWidth[n]?, and :READ:OBWidth[n]? queries listed above, according to the index value n.

n	Results Returned
1, *or* not specified	Returns 7 scalar results, in the following order: 1. Occupied Bandwidth – Hz 2. Total Power or OBW Power – dBm (Power reference type can be changed with the Power Ref control in Meas Setup

n	Results Returned
	3. Span - Hz 4. Spectrum Trace Points - points 5. Res BW – Hz 6. Transmit Frequency Error Hz 7. 7. x dB Bandwidth - Hz
2	Returns the frequency-domain spectrum trace (data array) for the entire frequency range being measured for Trace 1
3	1. Number of active carriers
Mode = LTEAFDD, LTEATDD, 5GNR	Returns number of active carriers within Span in Auto detected mode, otherwise the command is out of scope
4	Returns OBW Boundaries table results in the following order: 1. Occupied bandwidth – Hz 2. Total Power or OBW Power – dBm (Power reference type is changed with the Power Ref control in Meas Setup) 3. x dB Reference Power – dBm 4. x dB Reference Power Frequency - offset frequency [Hz] 5. x dB Reference Power Frequency – absolute frequency [Hz] 6. NaN (9.91E+37) 7. NaN (9.91E+37) 8. NaN (9.91E+37) 9. Lower OBW boundary - offset frequency [Hz] 10. Lower OBW boundary - absolute frequency [Hz] 11. Lower OBW boundary - absolute power [dBm] 12. Lower OBW boundary - relative power [dBc] 13. Upper OBW boundary - offset frequency [Hz] 14. Upper OBW boundary - absolute frequency [Hz] 15. Upper OBW boundary - absolute power [dBm] 16. Upper OBW boundary - relative power [dBc] 17. Lower x dB BW boundary - offset frequency [Hz] 18. Lower x dB BW boundary - absolute frequency [Hz] 19. Lower x dB BW boundary - absolute power [dBm] 20. NaN (9.91E+37) 21. Upper x dB BW boundary - offset frequency [Hz] 22. Upper x dB BW boundary - absolute frequency [Hz] 23. Upper x dB BW boundary - absolute power [dBm] 24. NaN (9.91E+37) Results 6, 7, 8, 20 and 24 always return NaN (9.91E+37)
5	Returns the frequency-domain spectrum trace (data array) for the entire

n	Results Returned
	frequency range being measured for Trace 2
6	Returns the frequency-domain spectrum trace (data array) for the entire frequency range being measured for Trace 3

3.8.1 Views

The Occupied BW measurement has two Predefined views: the OBW Result View and the OBW Boundaries View.

These Views are multiple-window Views. When in a multiple window View, you select a window by touching it. The menu controls may sometimes change depending on which window is selected.

Whenever the View changes, the default menu is **Frequency**, unless otherwise specified in the View description.

If you have modified the current View, using the "View Editor" on page 128, an asterisk appears next to that View in the radio button panel. You can save the modified View as a User View (see "Save Layout as New View" on page 1890).

View Selection by Name

Remote Command	`:DISPlay:OBWidth:VIEW[:SELect] OBWResults | BOUNdaries` `:DISPlay:OBWidth:VIEW[:SELect]?`
Example	`:DISP:OBW:VIEW OBWR` `:DISP:OBW:VIEW?`
Preset	`OBWResults`
State Saved	Saved in instrument state
Range	`OBWResults|BOUNdaries`

View Selection by Number

Remote Command	`:DISPlay:OBWidth:VIEW:NSELect <integer>` `:DISPlay:OBWidth:VIEW:NSELect?`
Example	`:DISP:OBW:VIEW:NSEL 2` `:DISP:OBW:VIEW:NSEL?`
Preset	1
State Saved	Saved in instrument state
Min/Max	1/2

3.8.1.1 OBW Results

Windows: "Graph" on page 944, "Metrics - OBW Results" on page 945

The spectrum trace is displayed in the upper window. Measurement results such as Occupied Bandwidth or Power are displayed in the lower window.

Example	`:DISP:OBW:VIEW OBWR`

3.8.1.2 OBW Boundaries

Windows: "Graph" on page 944, "Metrics - OBW Boundaries" on page 947

The spectrum trace is displayed in the upper window. The lower window of OBW Results view is replaced by the OBW boundaries table in this view. Occupied bandwidth and X dB bandwidth for both lower and upper boundaries are displayed.

Example	`:DISP:OBW:VIEW BOUN`

3.8.2 Windows

There are three windows available in the OBW measurement. The Gate window is available only when Gate View is turned on in the Gate Settings menu under Trigger.

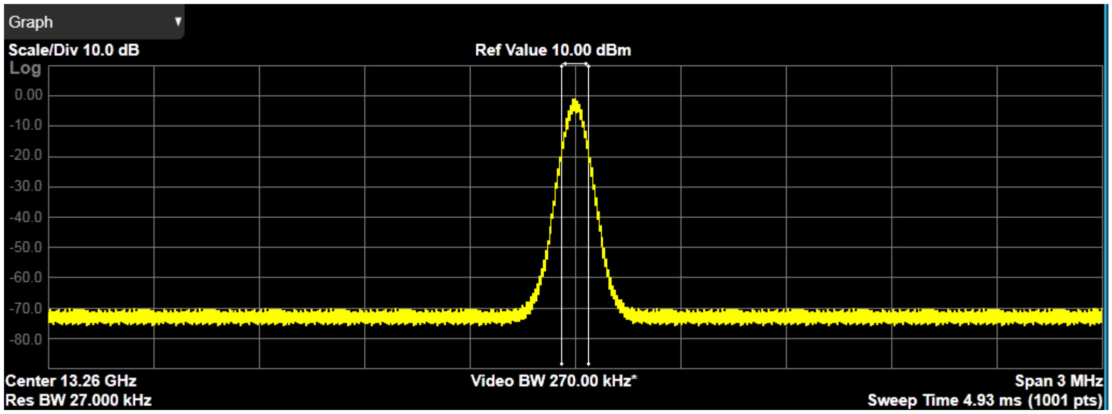
3.8.2.1 Graph

The Graph window appears in two Views, as follows:

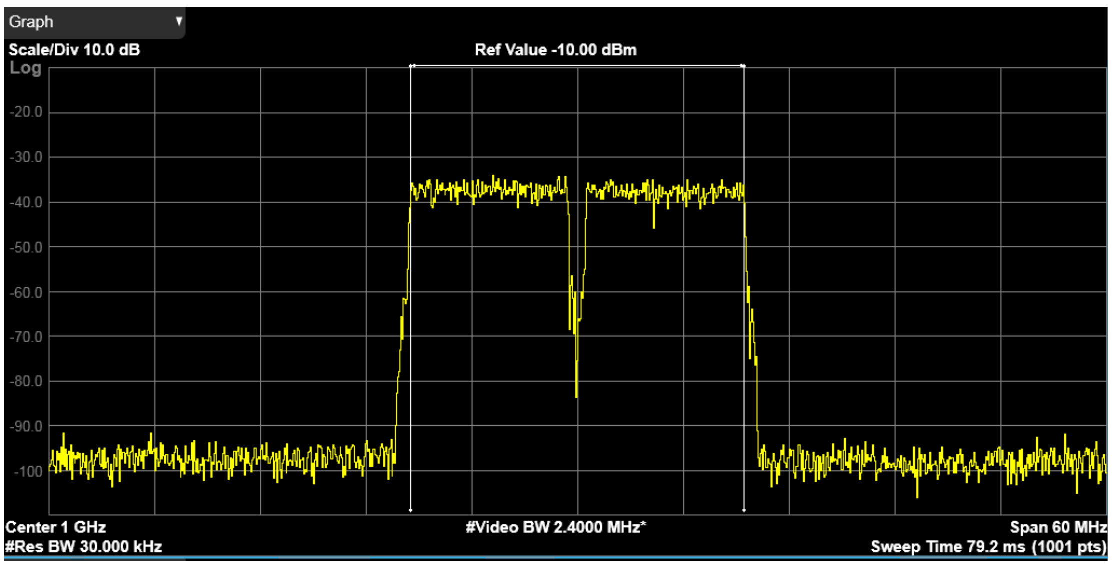
View	Size	Position
OBW Results	Three fifth, full width	Top
OBW Boundaries	Half, full width	Top
Gate View	One third, full width	Middle

Spectrum View

For SA, WCDMA, WLAN mode:



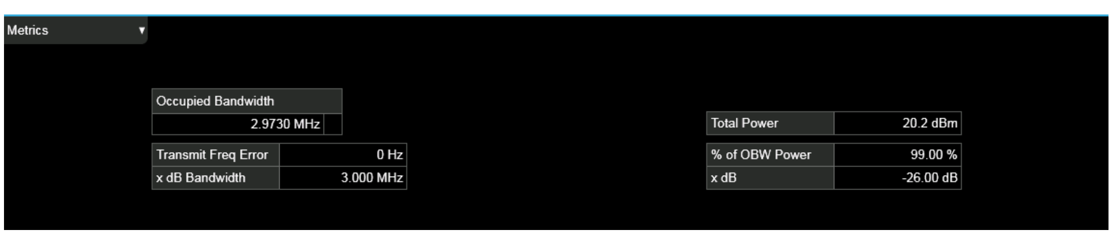
For LTE-Advanced FDD/TDD mode only:



3.8.2.2 Metrics - OBW Results

The OBW Results window displays the textual results of the Occupied BW measurement.

View	Size	Position
OBW Results	Two fifth, full width	Bottom
Gate View	One third, full width	Bottom



For the LTE-Advanced FDD/TDD and 5G NR modes, the metric result is shown as below:

Occupied Bandwidth

The occupied bandwidth result is $f_2 - f_1$, where f_1 and f_2 are the lower and upper carrier boundary point. f_1 and f_2 are calculated with a Occupied Bandwidth algorithms.

Total Power or OBW Power

The total power is the power integrated in the specified span setting. The OBW power is calculated from multiplying the total power by OBW percent power. The user can select the total power or the OBW power with the Power Ref control in Meas Setup.

Transmit Freq Error

The transmit freq error (transmit frequency error) result is calculated as the difference between $(f_2+f_1)/2$ and the tuned center frequency of the signal, where f_1 and f_2 are the lower and upper carrier boundary point.

x dB Bandwidth

The x dB result is a bandwidth measured between two points on the signal which are a certain number of dBs down from the highest signal point within the OBW Span. For example, If the 'x dB' parameter is set to –26 dB, and the 'Occupied BW Span' is set to 10 MHz, then the maximum signal power level is first determined from the 10 MHz wide trace sweep. Next, the two furthest frequencies below (xdb_f_1) and above (xdb_f_2) the frequency of the maximum level occurrence are found where the signal level is 26 dB below the peak level. This calculation also uses linear interpolation to find the lower and upper carrier boundary point within the width of a sweep point (the span divided by the number of sweep points).

The x dB bandwidth is calculated to be xdb_f2 – xdb_f_1.

% of OBW Power

This is the setting parameter. See "% of OBW Power" on page 1016

x dB

This is the setting parameter. See "x dB" on page 1017.

Active Carriers

In the LTE-Advanced FDD/TDD and 5G NR modes, the number of active carriers is displayed to show how many carriers are identified as active in auto detected mode of span, otherwise “-” is displayed to indicate that it is out of scope. When there is one active carrier, Transmit Freq Error is displayed. Otherwise, “---“ is displayed.

Measure Trace

See "Measure Trace" on page 1054

3.8.2.3 Metrics - OBW Boundaries

The OBW Boundaries window displays occupied bandwidth and X dB bandwidth for both lower and upper boundaries.

View	Size	Position
OBW Boundaries	Half, full width	Bottom
Gate View	One third, full width	Bottom

Occupied Bandwidth

The occupied bandwidth result is $f_2 – f_1$, where f_1 and f_2 are the lower and upper carrier boundary point. f_1 and f_2 are calculated with a Occupied Bandwidth algorithms.

Total Power or OBW Power

The total power is the power integrated in the specified span setting. The OBW power is calculated from multiplying the total power by OBW percent power. The user can select the total power or the OBW power with the Power Ref control in Meas Setup.

x dB

This is the setting parameter. See "x dB" on page 1017.

x dB Ref Pwr

The x dB reference power result shows the power of the highest signal point within the OBW Span.

x dB At Freq

The x dB reference power frequency result shows the frequency of the highest signal point within the OBW Span. The frequency display type, either Offset or Absolute, can be selected with the Boundary Frequency control under Display.

OBW Boundary Results

Name	Corresponding Results
Lower OBW boundary - offset frequency [Hz]	Offset frequency of the lower OBW boundary from center frequency
Lower OBW boundary - absolute power [dB]	Absolute power on the point of lower OBW boundary
Lower OBW boundary - relative power [dBc]	Relative power on the point of lower OBW boundary
Upper OBW boundary - offset frequency [Hz]	Offset frequency of the upper OBW boundary from center frequency
Upper OBW boundary - absolute power [dB]	Absolute power on the point of upper OBW boundary
Upper OBW boundary - relative power [dBc]	Relative power on the point of upper OBW boundary
Lower x dB BW boundary - offset frequency [Hz]	Offset frequency of the lower x dB BW boundary from center frequency
Lower x dB BW boundary - absolute power [dB]	Absolute power on the point of lower x dB BW boundary
Upper x dB BW boundary - offset frequency [Hz]	Offset frequency of the lower x dB BW boundary from center frequency
Upper x dB BW boundary - absolute power [dB]	Absolute power on the point of lower x dB BW boundary

3.8.2.4 Gate

Turning on Gate View shows the Gate Window, which allows you to see your Gating signal at the same time as the measured data. See the description under Gate View in the Trigger, Gate Settings section.

Views in which the Gate window appears:

View	Size	Position
Gate View	One third, full width	Top

3.8.3 Amplitude

Activates the **Amplitude** menu and selects **Reference Level** or **Reference Value** as the active function, depending on the measurement.

Some features in this menu apply to multiple measurements. Some other features apply only to specific measurements and their controls are blanked or grayed-out in measurements that do not support the feature.

3.8.3.1 Y Scale

The Y Scale Tab contains controls that pertain to the Y axis parameters of the measurement. These parameters control how data on the vertical (Y) axis is displayed and control instrument settings that affect the vertical axis.

Ref Value

Sets the value for the absolute power reference. The reference line is at the top, center, or bottom of the graticule, depending on the value of the Ref Position function.

Remote Command	`:DISPlay:OBWidth:WINDow[1]:TRACe:Y[:SCALe]:RLEVel <real>` `:DISPlay:OBWidth:WINDow[1]:TRACe:Y[:SCALe]:RLEVel?`
Example	`:DISP:OBW:WIND:TRAC:Y:RLEV 125` `:DISP:OBW:WIND:TRAC:Y:RLEV?`
Couplings	When Auto Scaling is On (default), this value is automatically determined by the measurement result. When you set a value manually, Auto Scaling changes to Off Attenuation is not coupled to Ref Value
Preset	10.00 dBm
State Saved	Saved in instrument state
Min/Max	-250.00 dBm / 250.00 dBm
Annotation	Ref <value> top left of graph
Backwards Compatibility SCPI	`:DISPlay:OBWidth:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:RLEVel`

Scale/Div

For measurements that support a logarithmic Y-Axis, Scale/Div sets the height of one division of the graticule in the current Y-Axis unit.

Scale/Div also determines the displayed amplitude range in the log plot graph. Since there are usually 10 vertical graticule division on the display, the total amplitude range of the graph is typically 10x this amount. For example, if Scale/Div is 10 dB, then the total range of the graph is 100 dB.

Remote Command	`:DISPlay:OBWidth:WINDow[1]:TRACe:Y[:SCALe]:PDIVision <rel_ampl>` `:DISPlay:OBWidth:WINDow[1]:TRACe:Y[:SCALe]:PDIVision?`
Example	`:DISP:OBW:WIND:TRAC:Y:PDIV 5` `:DISP:OBW:WIND:TRAC:Y:PDIV?`
Couplings	When the Auto Scaling is On, this value is automatically determined by the measurement result. When

	you set a value manually, Auto Scaling automatically changes to Off
Preset	10.00 dB / Div
State Saved	Saved in instrument state
Min	0.10 dB
Max	20 dB
Annotation	<value> dB/ left upper of graph
Backwards Compatibility SCPI	:DISPlay:OBWidth:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:PDIVision

Ref Position

Positions the reference level at the top, center, or bottom of the Y Scale display. Changing the reference position does not change the reference level value.

Remote Command	:DISPlay:OBWidth:WINDow[1]:TRACe:Y[:SCALe]:RPOSition TOP | CENTer | BOTTom :DISPlay:OBWidth:WINDow[1]:TRACe:Y[:SCALe]:RPOSition?
Example	:DISP:OBW:WIND:TRAC:Y:RPOS CENT :DISP:OBW:WIND:TRAC:Y:RPOS?
Preset	TOP
State Saved	Saved in instrument state
Range	TOP|CENTer|BOTTom
Annotation	The greater than (>) and less than (<) symbols are displayed on both sides of the graph to indicate the Reference Position
Backwards Compatibility SCPI	:DISPlay:OBWidth:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:RPOSition

Auto Scaling

Toggles the Auto Scaling function between On and Off.

Remote Command	:DISPlay:OBWidth:WINDow[1]:TRACe:Y[:SCALe]:COUPle 0 | 1 | OFF | ON :DISPlay:OBWidth:WINDow[1]:TRACe:Y[:SCALe]:COUPle?
Example	:DISP:OBW:WIND:TRAC:Y:COUP OFF :DISP:OBW:WIND:TRAC:Y:COUP?
Couplings	When Auto Scaling is On, and the Restart front-panel key is pressed, this function automatically sets the scale per division to 10 dB and determines the reference values based on the measurement results When you set a value to either Scale/Div or Ref Value manually, Auto Scaling automatically changes to Off

Preset	1
State Saved	Saved in instrument state
Range	OFF|ON
Backwards Compatibility SCPI	:DISPlay:OBWidth:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:COUPle

3.8.3.2 Attenuation

Controls the attenuator functions and interactions between the attenuation system components.

There are two attenuator configurations in the X-Series. One is a Dual-Attenuator configuration consisting of a mechanical attenuator and an optional electronic attenuator. The other configuration uses a single attenuator with combined mechanical and electronic sections thatcontrols all the attenuation functions. Different models in the X-Series come with different configurations.

- See "Dual-Attenuator Configurations" on page 951
- See "Single-Attenuator Configuration" on page 952

Most attenuation settings are the same for all measurements – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset.

This tab is only available when the hardware set includes an input attenuator, which is typically only the case when using Keysight’s box instruments. For example, this tab does not appear in:

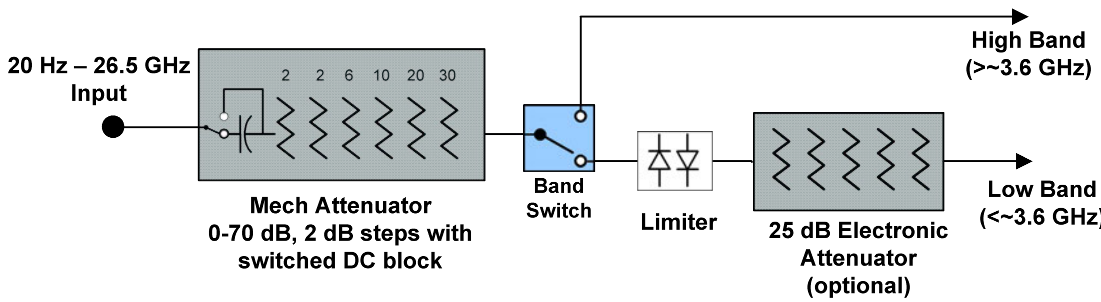
- VXT models M9420A/21A/10A/11A
- E7760
- M9391A
- M9393A

This tab also does not appear in UXM. In UXM all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

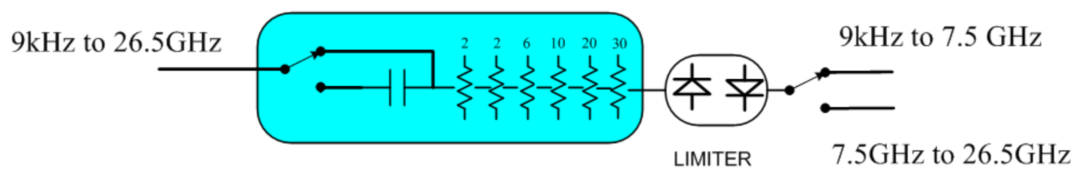
Dependencies	In measurements that support the I/Q inputs, this tab is unavailable when I/Q is the selected input, and is replaced by the Range tab in that case

Dual-Attenuator Configurations

Configuration 1: Mechanical attenuator + optional electronic attenuator

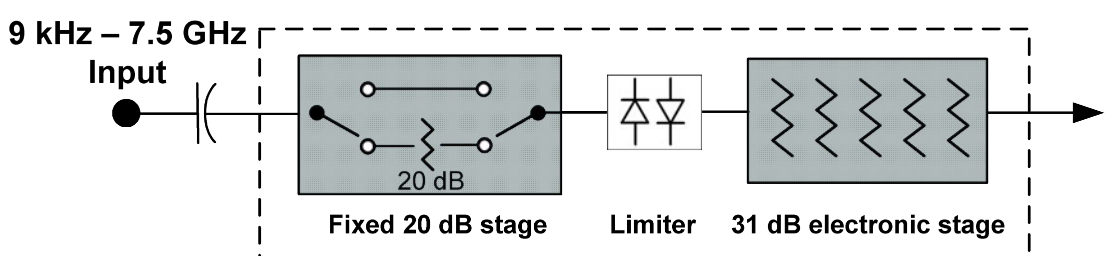


Configuration 2: Mechanical attenuator, no optional electronic attenuator

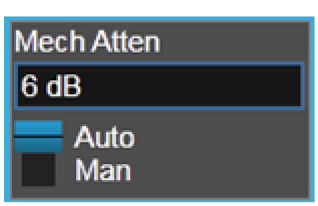


(note that Configuration 2 is not strictly speaking a dual-section attenuator, since there is no electronic section available. However, it behaves exactly like Configuration 1 without the Electronic Attenuator option EA3, therefore for the sake of this document it is grouped into the "Dual-Attenuator" configuration)

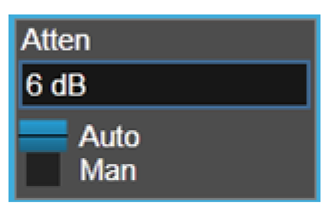
Single-Attenuator Configuration



You can tell which attenuator configuration you have by pressing the Attenuation tab, which (in most Modes) opensthe Attenuation menu. If the first control in the Attenuation menu says Mech Atten you have the Dual-Attenuator configuration. If the first control says Atten you have the Single-Attenuator configuration.



Dual Attenuator



Single Attenuator

(Note that depending on the measurement, there may be no Auto/Man functionality on the Mech Atten control).

In the Single-Attenuator configuration, youcontrol the attenuation with a single control, as the fixed stage has only two states. In the Dual-Attenuator configuration, both stages have significant range so you are given separate control of the mechanical and electronic attenuator stages.

When you have the Dual-Attenuator configuration, you may still have only a Single-Attenuator, because unless option EA3 (the Electronic Attenuator option) is available, and you purchase it, you will have only the mechanical attenuator.

Full Range Atten

The **Full Range Atten** control and **Attenuator Summary** only appear in N9041B, when the RF input is selected and the RF Input Port is set to RF Input 2, and the Full Range Attenuator is installed. The Full Range Attenuator adds a second input attenuator at the beginning of the RF Input 2, which enhances the protection and optimizes the performance of the extra internal mixers used by RF Input 2.

Remote Command	`[:SENSe]:POWer[:RF]:FRATten <rel_ampl>` `[:SENSe]:POWer[:RF]:FRATten?`
Example	`:POW:FRAT 14` `:POW:FRAT?`
Notes	When you enter an amplitude value that falls between valid values, the value will be incremented to the next smallest valid value
Dependencies	Only appears if input RF is selected, and RF Input Port 2 is selected, and the Full Range Attenuator exists
Couplings	This value is never changed by any coupling, however other couplings use this value. See the **Reference Level** and "Mech Atten" on page 1750 command descriptions
Preset	20 dB
State Saved	Saved in instrument state
Min	0 dB
Max	Only valid values are 0, 6, 14, 20 dB
Annotation	When the Input is RF, and the Input Port is RF Input 2, and the Full Range Attenuator is installed: On the Meas Bar, the field “Atten” displays as follows: – If the sweep is entirely < 50 GHz, the value shown after “Atten:” is equal to Mech Atten + Elec Atten + Full Range Atten – If the sweep is entirely > 50 GHz, the value shown after “Atten:” is equal to Full Range Atten – If the sweep straddles 50 GHz, the value shown after “Atten:” is preceded by the symbol “>=” and is equal to Full Range Atten In the **Amplitude**, "Attenuation" on page 1747 menu, and the Atten Meas Bar dropdown menu panel, a summary is displayed as follows:

	"Total Atten below 50 GHz" followed by the value of Full Range Atten + Mech Atten + Elec Atten "Total Atten above 50 GHz" followed by the value of Full Range Atten For example, if Mech Atten = 6 dB, Elec Atten = 4 dB, and Full Range Atten = 20 dB, the summary below is shown: – Attenuator summary: – Total Atten below 50 GHz: 30 dB – Total Atten above 50 GHz: 20 dB

Mech Atten

This control is labeled **Mech Atten** in Dual-Attenuator models and **Atten** in Single-Attenuator models. In the Dual-Attenuator configuration, this control only affects the mechanical attenuator.

This control lets you modify the attenuation applied to the RF input signal path. This value is normally auto coupled to the Ref Level, the Internal Preamp Gain, any External Gain that is entered, and the Max Mixer Level, as described in the table below.

See "Attenuator Configurations and Auto/Man" on page 956

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation <rel_ampl>`
	`[:SENSe]:POWer[:RF]:ATTenuation?`
	`[:SENSe]:POWer[:RF]:ATTenuation:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:POWer[:RF]:ATTenuation:AUTO?`

Example	`:POW:ATT 20`
	Dual-Attenuator configuration: sets the mechanical attenuator to 20 dB
	Single-Attenuator mode: sets the main attenuation to 20 dB (see below for definition of "main" attenuation)
	In either case, if the attenuator was in Auto, it is set to Manual
	`:POW:ATT:AUTO ON`
	Turn Auto Mech Atten ON

Dependencies	Some measurements do not support the Auto setting of "Mech Atten" on page 954. In these measurements, the Auto/Man selection is not available, and the Auto/Man toggle function is not available In Dual-Attenuator configurations, when the electronic attenuator is enabled, the mechanical attenuator has no auto setting and the Auto/Man toggle function is not available. The state of Auto/Man is remembered and restored when the electronic attenuator is once again disabled. This is described in more detail in "Elec Atten" on page 1753 See "Attenuator Configurations and Auto/Man" on page 956 for more information on the Auto/Man functionality `:POW:ATT:AUTO` is only available in measurements that support Mech Atten Auto, such as Swept SA

Couplings	If the RF Input Port is the RF Input: – If the USB Preamp is connected to USB, use 0 dB for Mech Atten – Otherwise compute the auto-selected value of Mech Atten based on **Reference Level**, Int Preamp, External Gain, Ref Level Offset, Max Mixer Level, µW Path Control and IF Gain settings. Limit this value to be no less than 6 dB (total attenuation below 6 dB can never be chosen by Auto) – In the N9041B, if the RF Input Port is RF Input 2, use the formula above and subtract the Full Range Atten value from the result to determine the Mech Atten. Limit the value so that it is never lower than 0 dB and so that total attenuation, including Full Range Atten, is never less than 6 dB (total attenuation, including Full Range Atten below 6 dB, can never be chosen by Auto) In External Mixingand BBIQ, where the Attenuator is not in the signal path, the Attenuator setting changes as described above when "Mech Atten" on page 954 is in Auto, but no changes are made to the actual attenuator hardware setting until the input is changed back to the RF Input For CXA-m with option FSA (Fine-Step Attenuator or 2 dB steps), the FSA-like behavior is only available when the frequency setting is <= 7.5GHz. So, when the frequency is changed from below 7.5GHz to above 7.5GHz, the attenuation setting will be changed to a multiple of 10dB which will be no smaller than the previous setting. For example, 4dB attenuation will be changed to 10dB
Preset	The preset for Mech Attenuation is “Auto” The Auto value of attenuation is 10 dB ON
State Saved	Saved in instrument state
Min	0 dB The attenuation set by this control cannot be decreased below 6 dB with the knob or step keys. Values below 6 dB must be directly entered from the keypad or via SCPI. This protects against setting a dangerously small attenuation value, which can put the instrument at risk of damage to input circuitry. If the current mechanical attenuation is below 6 dB, it can be increased with the knob and step keys, but not decreased
Max	CXA Option 503 or 507: 50 dB EXA: 60 dB All other models: 70 dB Note that in the Single-Attenuator configuration, the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB.
Annotation	The current value for Total Atten is displayed in the Measurement Bar at the top of the display. A value appears for Electronic Attenuation only if the Electronic Attenuator is enabled. The annotation appears as Atten: <total> dB (e<elec>) The e letter is in amber in Single-Attenuator configurations For example: Dual-Attenuator configuration: Atten: 24 dB (e14) Indicating the total attenuation is at 24 dB and the electronic attenuation is at 14 dB Single-Attenuator configuration: A: 24 dB (e14)

Indicating the total attenuation is at 24 dB and the “soft” attenuation is at 14 dB (see below for definition of “soft” attenuation)

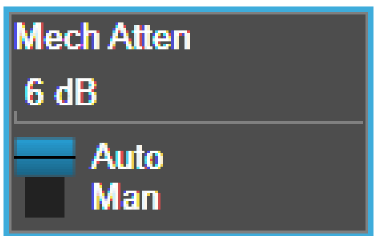
When in Manual, a # sign appears in front of Atten in the annotation

Attenuator Configurations and Auto/Man

As described in "Attenuation" on page 1747 , there are two distinct attenuator configurations available in the X-Series, the single attenuator and Dual-Attenuator configurations. In Dual-Attenuator configurations, we have the mechanical attenuation and the electronic attenuation, and the current total attenuation is the sum of the electronic + mechanical attenuation. In Single-Attenuator configurations, we refer to the attenuation set using "Mech Atten" on page 954 (or `:POW:ATT`) as the “main” attenuation; and the attenuation that is set by `:POW:EATT` as the “soft” attenuation (`:POW:EATT` is honored even in the Single-Attenuator configuration, for compatibility purposes). Then the current total attenuation is the sum of the main + soft attenuation. See "Elec Atten" on page 1753 for more on “soft” attenuation.

NOTE

In some measurements, the **Mech Atten** control has an Auto/Man function. In these measurements, an Auto/Man switch is shown on the **Mech Atten** control:



Note that in configurations that include an Electronic Attenuator, this switch is only shown when the Electronic Attenuator is disabled.

In other measurements, **Mech Atten** has no Auto/Man function. In these measurements, no switch is shown on the **Mech Atten** control:

Mech Atten also appears with no switch, as above, in configurations that include an Electronic Attenuator but when the Electronic Attenuator is enabled.

Elec Atten

Controls the Electronic Attenuator in Dual-Attenuator configurations. This control does not appear in Single-Attenuator configurations, as the control of both the mechanical and electronic stages of the Single-Attenuator is integrated into the single **Atten** control.

This control includes an Enable/Disable toggle switch; it is only possible to enter a value for the Electronic Attenuator when this switch is in the “Enable” position.

See "More Information" on page 958

Remote Command	`[:SENSe]:POWer[:RF]:EATTenuation <rel_ampl>`
	`[:SENSe]:POWer[:RF]:EATTenuation?`
	`[:SENSe]:POWer[:RF]:EATTenuation:STATe OFF | ON | 0 | 1`
	`[:SENSe]:POWer[:RF]:EATTenuation:STATe?`

Example	`:POW:EATT 10`
	`:POW:EATT?`
	`:POW:EATT:STAT ON`
	`:POW:EATT:STAT?`

Notes	Electronic Attenuation’s specification is defined only when Mechanical Attenuation is 6 dB
Dependencies	This control only appears in Dual-Attenuator models with an Electronic Attenuator installed and licensed. It does not appear in models with the Single-Attenuator configuration, as in the Single-Attenuator configuration there is no “electronic attenuator” there is only a single integrated attenuator (which has both a mechanical and electronic stage). However, in the Single-Attenuator configuration, EATT SCPI commands are accepted for compatibility with other X-series instruments and set a “soft” attenuation as described in . The “soft” attenuation is treated as an addition to the “main” attenuation value set by the Atten control or the POW:ATT SCPI command and affects the total attenuation displayed on the Atten control and the Meas Bar The electronic attenuator (and the “soft” attenuation function provided in Single-Attenuator configurations) is unavailable above the low band (0-3.6 GHz, 0-3.4 GHz 0-3GHz, depending on the model). If the low band ranges from 0-3.6GHz, and Stop Frequency of the instrument is > 3.6 GHz, then the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed out If the Internal Preamp is on, meaning it is set to Low Band or Full, the electronic attenuator (and the “soft” attenuation function provided in Single-Attenuator configurations) is unavailable. In this case the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed out If either of the above is true, if the SCPI command is sent, an error indicating that the electronic attenuator is unavailable will be sent If both of the above are true, pressing the control will generate error message -221, in other words, the frequency range lockout takes precedence If the electronic/soft Attenuator is enabled, then the Stop Freq of the instrument is limited to 3.6 GHz and the Internal Preamp is unavailable The SCPI-only “soft” electronic attenuation for the single-attenuator configuration is not available in all measurements; in particular, it is not available in the Swept SA measurement
Couplings	Enabling and disabling the Electronic Attenuator affects the setting of the Mechanical Attenuator (in Dual-Attenuator configurations). This is described in more detail below and in the section "Attenuator Configurations and Auto/Man" on page 1752
Preset	`OFF` (Disabled) for Swept SA measurement `ON` (Enabled) for all other measurements that support the electronic attenuator
State Saved	Saved in instrument state

Min	0 dB
Max	Dual-Attenuator configuration: 24 dB Single-Attenuator configuration: the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB
Annotation	See Annotation under the **Mech Atten** control description

More Information

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear. These advantages primarily aid in remote operation and are negligible for front panel use. See "Using the Electronic Attenuator: Pros and Cons" on page 959 for a detailed discussion of the pros and cons of using the electronic attenuator.

For the Single-Attenuator configuration, for SCPI backwards compatibility, the “soft” attenuation feature replaces the Dual-Attenuator configuration’s electronic attenuator. All the same couplings and limitations apply. See "Attenuator Configurations and Auto/Man" on page 1752

Mechanical Attenuator Transition Rules

When the Electronic Attenuator is enabled, the Mechanical Attenuator transitions to a state that has no Auto function. Below are the rules for transitioning the Mechanical Attenuator. Note that the information below ONLY applies to the Dual-Attenuator configurations, and ONLY when the Electronic Attenuator is installed:

When the Electronic Attenuation is enabled from a disabled state:

The Mechanical Attenuator is initialized to 10 dB (this is its optimal performance setting). You can then set it as desired with SCPI, numeric keypad, step keys, or knob, and it behaves as it normally would in manual mode

The Auto/Man state of (Mech) Atten is saved

The Auto/Man toggle on the (Mech) Atten control disappears and the auto rules are disabled

The Electronic Attenuator is set to 10 dB less than the previous value of the Mechanical Attenuator, within the limitation that it must stay within the range of 0 to 24 dB of attenuation

Examples in the Dual-Attenuator configuration:

Mech Atten at 20 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 10 dB. New total attenuation equals the value before Elec Atten enabled

Mech Atten at 0 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 0 dB. New total attenuation does not equal the value before Elec Atten enabled

Mech Atten at 40 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 24 dB. New total attenuation does not equal the value before Elec Atten enabled

When the Electronic Attenuation is disabled from an enabled state:

The Elec Atten control is grayed out

- The Auto/Man state of (Mech) Atten is restored

If now in Auto, (Mech) Atten recouples

If now in Man, (Mech) Atten is set to the value of total attenuation that existed before the Elec Atten was disabled. The resulting value is rounded up to the smallest value possible given the (Mech) Atten Step setting - (That is, 57 dB changes to 58 dB when (Mech) Atten Step is 2 dB)

Using the Electronic Attenuator: Pros and Cons

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear.

The “finer steps” advantage of the electronic attenuator is beneficial in optimizing the alignment of the instrument dynamic range to the signal power in the front panel as well as remote use. Thus, you can achieve improved relative signal measurement accuracy. Compared to a mechanical attenuator with 2 dB steps, the 1 dB resolution of the electronic attenuator only gives better resolution when the odd-decibel steps are used. Those odd-decibel steps are less accurately calibrated than the even-decibel steps, so one tradeoff for this superior relative accuracy is reduced absolute amplitude accuracy.

Another disadvantage of the electronic attenuator is that the spectrum analyzer loses its “Auto” setting, making operation less convenient.

Also, the relationship between the dynamic range specifications (TOI, SHI, compression, and noise) and instrument performance are less well-known with the electrical attenuator. With the mechanical attenuator, TOI, SHI, and compression threshold levels increase dB-for-dB with increasing attenuation, and the noise floor does as well. With the electronic attenuator, there is an excess attenuation of about 1 to 3 dB between 0 and 3.6 GHz, making the effective TOI, SHI, and so forth, less well known. Excess attenuation is the actual attenuation relative to stated attenuation. Excess attenuation is accounted for in the instrument calibration

Adjust Atten for Min Clipping

Sets the combination of mechanical and electronic attenuation and gain based on the current measured signal level so that clipping will be at a minimum.

This is an "immediate action" function, that is, it executes once, when the control is pressed.

The algorithms that are used for the adjustment are documented under "Pre-Adjust for Min Clipping" on page 1757.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate`
Example	`:POW:RANG:OPT IMM`
Notes	Executing Adjust Atten for Min Clipping initiates the measurement.
Dependencies	Does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum measurements For the Waveform measurement, this control is available only in 5G NR Mode

Adjust Atten

Allows you to select;

- Electric attenuator only
- Combination of Electric attenuator and Mechanical attenuator

when the command `[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate` is executed.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize:TYPE EONLy | COMBined` `[:SENSe]:POWer[:RF]:RANGe:OPTimize:TYPE?`
Example	`:POW:RANG:OPT:TYPE EONL` `:POW:RANG:OPT:TYPE?`
Dependencies	Does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum measurements For the Waveform measurement, this control is available only in 5G NR Mode
Preset	`COMBined`
State Saved	Saved in instrument state

Pre-Adjust for Min Clipping

If this function is ON, it applies the adjustment described under "Adjust Atten for Min Clipping" on page 1756 each time a measurement restarts. Therefore, in Continuous measurement mode, it only executes before the first measurement.

In Dual-Attenuator models, you can set **Elec+Mech Atten**, in which case both attenuators participate in the autoranging, or **Elec Atten Only**, in which case the mechanical attenuator does not participate in the autoranging. This latter case results in less wear on the mechanical attenuator and is usually faster.

See "Adjustment Algorithm" on page 961

Selection	Example	Note
Off	`:POW:RANGe:OPT:ATT OFF`	This is the default setting
Elec Atten Only	`:POW:RANGe:OPT:ATT ELEC`	Selects only the electric attenuator to participate in auto ranging. This offers less wear on the mechanical attenuator and is usually faster

Selection	Example	Note
Mech + Elec Atten	:POW:RANGe:OPT:ATT COMB	In Dual-Attenuator models, this selects both attenuators to participate in the autoranging

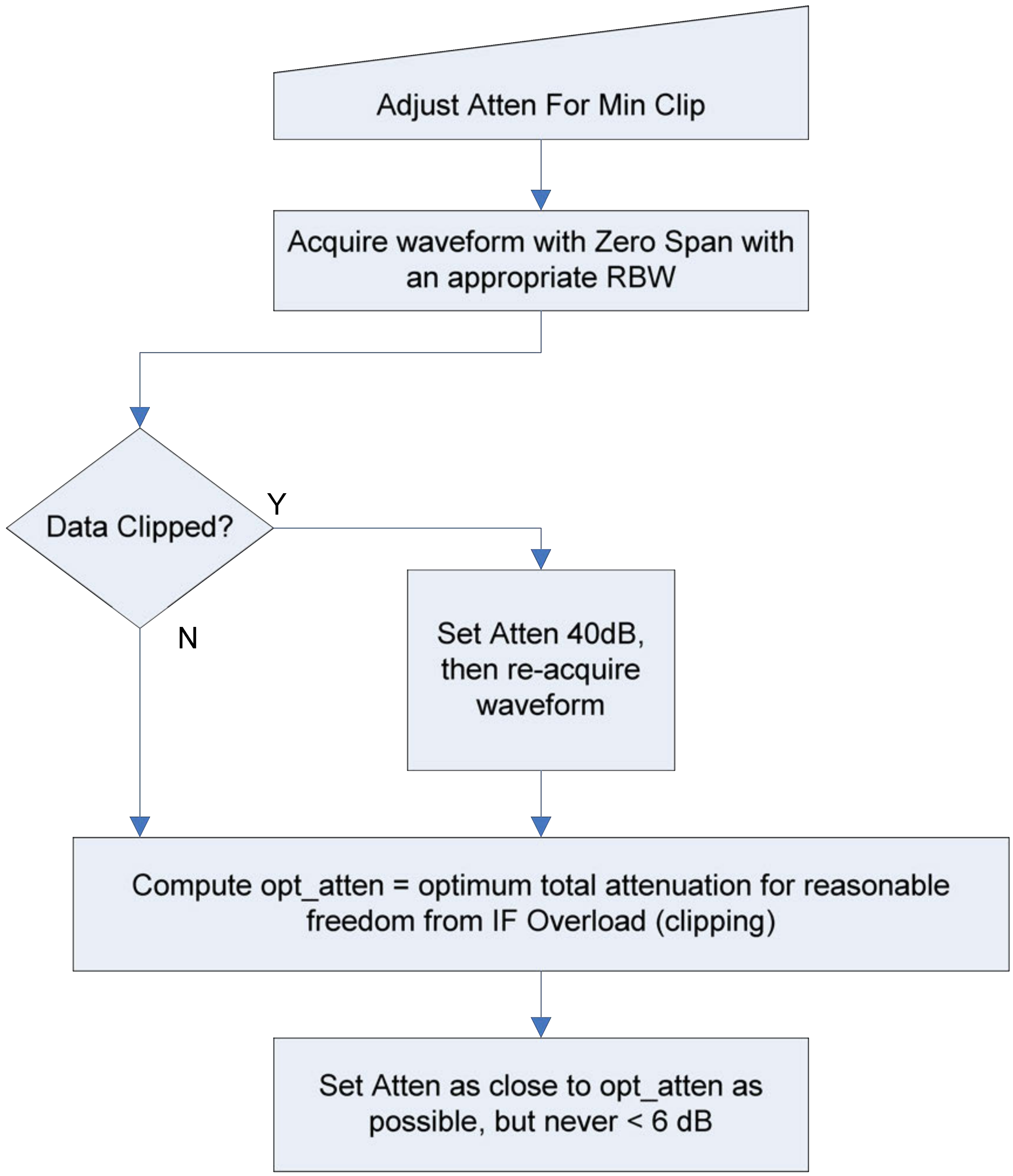
Remote Command	[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation OFF | ON | ELECtrical | COMBined [:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation?
Example	:POW:RANG:OPT:ATT OFF :POW:RANG:OPT:ATT?
Notes	The parameter option ELECtrical sets this function to ON in Single-Attenuator models The parameter option COMBined is mapped to ELECtrical in Single-Attenuator models. If you send COMBined, it sets the function to ON and returns ELEC to a query For SCPI compatibility with models that do not have an input attenuator, the ON parameter is honored and mapped to COMBined
Dependencies	This control only appears in Dual-Attenuator models with an Electronic Attenuator installed In instruments with Dual-Attenuator model, when **Enable** "Elec Atten" on page 1753 is OFF or grayed-out, "Pre-Adjust for Min Clipping" on page 960 is grayed-out This control does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum measurements For the Waveform measurement, this control is available only in 5G NR Mode
Preset	OFF when Elec Atten is Disabled at preset, otherwise ELEC
State Saved	Saved in instrument state
Range	Dual-Attenuator models: Off | Elec Atten Only | Mech + Elec Atten Single-Attenuator models: Off | On

Notes	ON aliases to "Elec Atten Only" (:POW:RANG:OPT:ATT ELEC) OFF aliases to "Off" (:POW:RANG:OPT:ATT OFF) :POW:RANG:AUTO? returns true if :POW:RANG:OPT:ATT is not OFF
Backwards Compatibility SCPI	[:SENSe]:POWer[:RF]:RANGe:AUTO ON | OFF | 1 | 0 [:SENSe]:POWer[:RF]:RANGe:AUTO?

Adjustment Algorithm

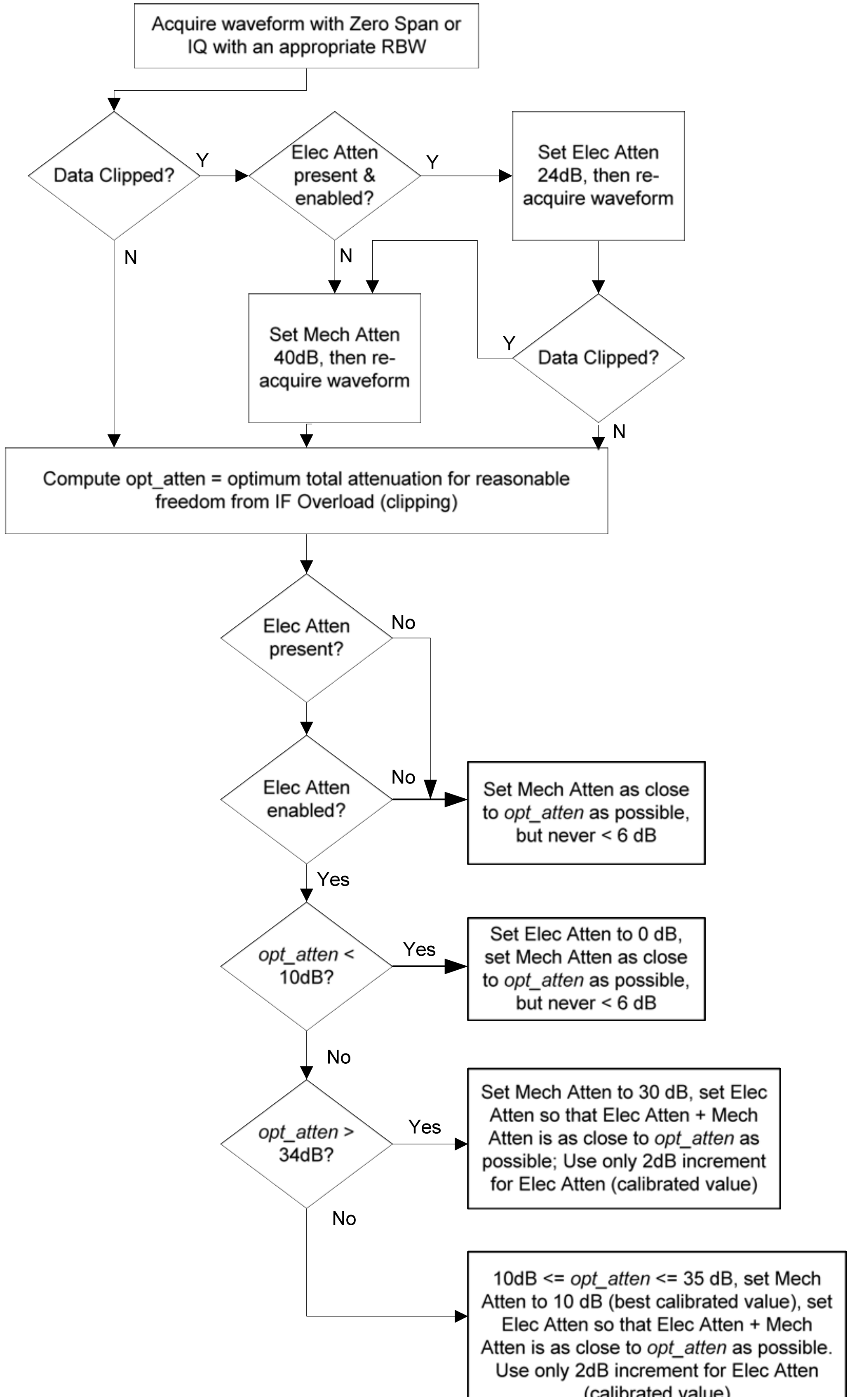
The algorithms for the adjustment are documented below:

Single-Attenuator Models

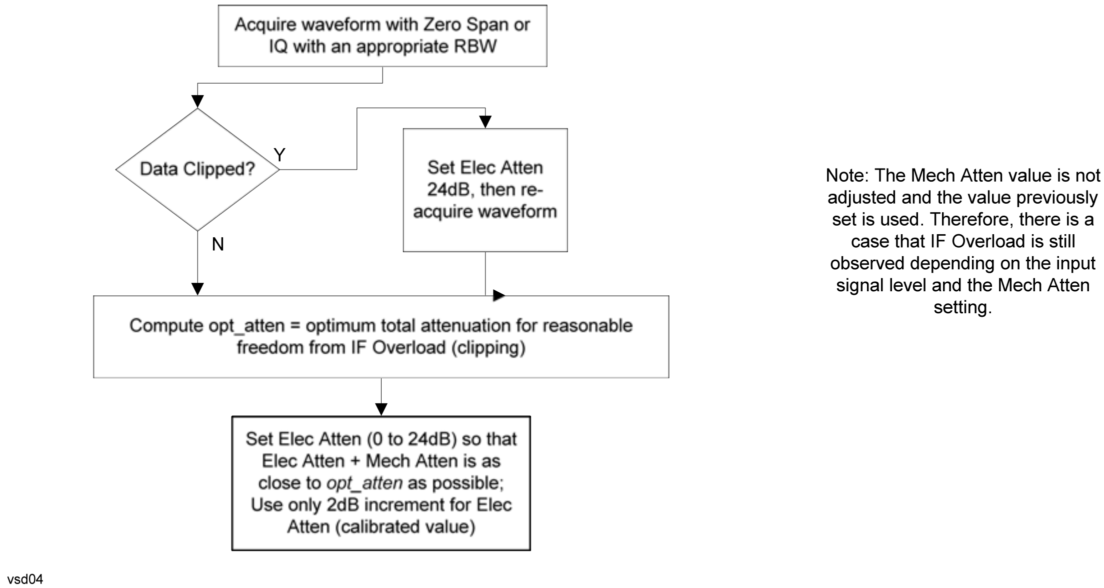


Dual-Attenuator models

"Adjust Atten for Min Clipping" on page 1756 or "Pre-Adjust for Min Clipping" on page 960 selection is Mech + Elec Atten:


Acquire waveform with Zero Span or IQ with an appropriate RBW
Data Clipped?
Y
N
Elec Atten present & enabled?
Y
N
Set Elec Atten 24dB, then re-acquire waveform
Set Mech Atten 40dB, then re-acquire waveform
Y
Data Clipped?
N
Compute opt_atten = optimum total attenuation for reasonable freedom from IF Overload (clipping)
Elec Atten present?
No
Elec Atten enabled?
No
Set Mech Atten as close to opt_atten as possible, but never < 6 dB
Yes
opt_atten < 10dB?
Yes
Set Elec Atten to 0 dB, set Mech Atten as close to opt_atten as possible, but never < 6 dB
No
opt_atten > 34dB?
Yes
Set Mech Atten to 30 dB, set Elec Atten so that Elec Atten + Mech Atten is as close to opt_atten as possible; Use only 2dB increment for Elec Atten (calibrated value)
No
10dB <= opt_atten <= 35 dB, set Mech Atten to 10 dB (best calibrated value), set Elec Atten so that Elec Atten + Mech Atten is as close to opt_atten as possible. Use only 2dB increment for Elec Atten (calibrated value)

"Pre-Adjust for Min Clipping" on page 960 selection is Elec Only:



Mech Atten Step

Controls thestep size used when making adjustments to the input attenuation.

This control is labeled **Mech Atten Step** in Dual-Attenuator models and **Atten Step** in Single-Attenuator models. In the Dual-Attenuator configuration, this control only affects the step size of the mechanical attenuator.

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement] 10 dB | 2 dB` `[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement]?`
Example	`:POW:ATT:STEP 2` `:POW:ATT:STEP?`
Notes	This feature has a toggle choice from the front panel, but it takes a specific value (in dB) when used remotely. The only valid values are 2 and 10
Dependencies	Blanked in EXA, CXA and CXA-m if option FSA (2 dB steps) is not present. If blanked, attempts to set it via SCPI yield an error
Couplings	When the attenuation step size changes, the current mechanical attenuation value is adjusted (if necessary) to be quantized to the new step size. That is, if step is set to 10 dB, mech atten is increased if necessary so it is a multiple of 10 dB
Preset	EXA, CXA and CXA-m: 10 dB (2 dB with option FSA) All other models: 2 dB
State Saved	Saved in instrument state

3.8.3.3 Range (Non-attenuator models)

This tab is only available for Keysight's modular signal analyzers and certain other Keysight products. Examples include:

- VXT
- E7760
- M9391A
- M9393A

This tab also does not appear in UXM. In UXM, all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

State Saved	No

Range

Represents the amplitude of the largest sinusoidal signal that could be present within the IF without being clipped by the ADC. For signals with high peak-to-average ratios, the range may need to exceed the rms signal power by a significant amount to avoid clipping.

This is a measurement global setting.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe <real>` `[:SENSe]:POWer[:RF]:RANGe?`
Example	`:POW:RANG 10 dBm` `:POW:RANG?`
Notes	The MIN and MAX values are affected by the External Gain parameters, and by the **Center Frequency** The hardware compensates for frequency response and alters the Range setting
Preset	0 dBm
State Saved	Yes
Min	-100
Max	100
Annotation	Meas Bar

Adjust Range for Min Clipping

Sets the combination of attenuation and gain based on the current measured signal level so that clipping will be at a minimum.

This is an "immediate action" function, that is, it executes once, when the key is pressed.

This key does not appear in measurements that do not support this functionality.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate`
Notes	Executing Adjust Range for Min Clipping initiates the measurement
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760

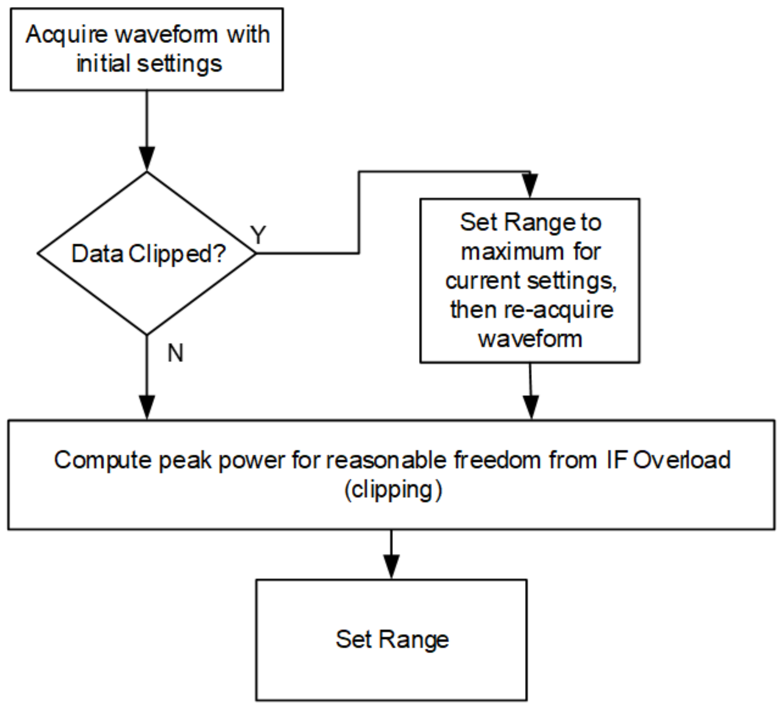
Pre-Adjust for Min Clipping

If this function is `ON`, it applies the adjustment described under Adjust Range For Min Clipping each time a measurement restarts. Therefore, in Continuous measurement mode, it only executes before the first measurement.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation OFF | ON | ELECtrical | COMBined` `[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation?`
Notes	Because there is no attenuator control available in these models, the control displays only `ON` and `OFF` choices. However, for SCPI compatibility with other platforms, all three parameters (`ELECtrical`, `COMBined`, and `ON`) are honored and all are mapped to `ELECtrical`, so if any of these three parameters is sent, a subsequent query will return `ELEC`
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760
Preset	`OFF` for Swept SA measurement; `ON` for all other measurements that support **Pre-Adjust for Min Clipping**
State Saved	Saved in instrument state

Adjustment Algorithm

The algorithm for the adjustment is documented below:



Peak-to-Average Ratio

Used with "Range (Non-attenuator models)" on page 1864 to optimize the level control in the instrument. The value is the ratio, in dB, of the peak power to the average power of the signal to be measured. A ratio of 0 should be used for sinusoidal signals; for 802.11g OFDM signals use 9 dB.

All Applications (Modes) show the current value of Peak-to-Average ratio on the control. However, some applications do not permit changing the value. In these situations, the control is grayed-out.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:PARatio <real>` `[:SENSe]:POWer[:RF]:RANGe:PARatio?`
Example	`:POW:RANG:PAR 12 dB`
Notes	In some Applications (Modes) this parameter is read-only; meaning the value will appear on the control and query via SCPI, but is not changeable. In such applications the control is grayed-out. Attempting to change the value via SCPI will be ignored but no error message will be generated
Dependencies	This control does not appear in Spectrum Analyzer Mode
Preset	10 dB VXT Models M9410A/11A: 0 dB
State Saved	Saved in instrument state
Min	0 dB
Max	20 dB VXT Models M9410A/11A: 50 dB

Mixer Lvl Offset

This is an advanced setting to adjust target Range at the input mixer, which in turn affects the signal level in the instrument's IF. This setting can be used when additional optimization is needed after setting "Peak-to-Average Ratio" on page 1866. Positive values of offset optimize noise performance over distortion, negative values optimize distortion performance over noise.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet <real>` `[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet?`
Example	`:POW:RANG:MIX:OFFS -5 dB`
Preset	0 dB
State Saved	Saved in instrument state
Min	-35 dB VXT Models M9410A/11A: -34 dB
Max	30 dB

3.8.3.4 Signal Path

Contains controls that pertain to the routing of the signal through the frontend of the instrument.

In general, this tab only appears in instruments whose hardware supports this signal routing. For example, this tab does not appear in many of the modular instrument products, including VXT Models M9420/21A. It also does not appear in UXM.

This tab *does* appear in VXT Models M9410A/11A because the Software Preselection control is in this tab, and VXT Models M9410A/11A implement a version of Software Preselection.

Presel Center

Pressing this control adjusts the centering of the preselector filter to optimize the amplitude accuracy at the frequency of the selected marker. If the selected marker is not on when **Presel Center** is pressed, the instrument turns on the selected marker, performs a peak search, and then performs centering on the marker's center frequency. If the selected marker is already on and between the start and stop frequencies of the instrument, the instrument performs the preselector calibration on that marker's frequency. If the selected marker is already on, but outside the frequency range between Start Freq and Stop Freq, the instrument first performs a peak search, and then performs centering on the marker's center frequency.

The value displayed on "Preselector Adjust" on page 1869 will change to reflect the new preselector tuning.

A number of considerations should be observed to ensure proper operation. See "Proper Preselector Operation" on page 969.

Remote Command	`[:SENSe]:POWer[:RF]:PCENter`
Example	`:POW:PCEN`
Notes	Note that the rules outlined above under the control description apply for the remote command as well as the key. The result of the command is dependent on marker position, etc. Any message shown by the control press is also shown in response to the remote command
Dependencies	Does not appear in CXA-m Does not appear in VXT Models M9410A/11A Grayed-out if the microwave preselector is off – If the selected marker's frequency is below Band 1, an advisory message is generated "Preselector not used in this frequency range" and no action is taken – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz – Blank in models that do not include a preselector, such as option 503. If the remote command is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View
Couplings	The active marker position determines where the centering will be attempted If the instrument is in a measurement such as averaging when centering is initiated, the act of centering the preselector restarts averaging, but the first average trace will not be taken until the centering is completed The offset applied to do the centering reads out on the "Preselector Adjust" on page 1869 control
Status Bits/OPC dependencies	When centering the preselector, `*OPC` will not return true until the process is complete and a subsequent measurement has completed, nor will results be returned to `:READ` or `:MEASure` queries The Measuring bit should remain set while this command is operating and should not go false until the subsequent sweep/measurement has completed

Proper Preselector Operation

A number of considerations should be observed to ensure proper operation:

1 If the selected marker is off, the instrument turns on a marker, performs a peak search, and adjusts the preselector using the selected marker's frequency. It uses the "highest peak" peak search method unqualified by threshold or excursion, so that there is no chance of a 'no peak found' error. It continues with that peak, even if it is the peak of just noise. Therefore, for this operation to work properly, there should be a signal on screen in a preselected range for the peak search to find

2 If the selected marker is already on, the instrument attempts the centering at that marker's frequency. There is no preselector for signals below about 3.6 GHz, so if the marker is on a signal below 3.6 GHz, no centering will be attempted and an advisory message generated

3 In some models, the preselector can be bypassed. If it is bypassed, no centering will be attempted in that range and a message will be generated

Preselector Adjust

Allows you to manually adjust the preselector filter frequency to optimize its response to the signal of interest. This function is only available when "Presel Center" on page 1868is available.

For general purpose signal analysis, using **Presel Center** is recommended. Centering the filter minimizes the impact of long-term preselector drift. **Preselector Adjust** can be used instead to manually optimize the preselector. One application of manual optimization would be to peak the preselector response, which both optimizes the signal-to-noise ratio and minimizes amplitude variations due to small (short-term) preselector drifting.

When **Presel Center** is performed, the offset applied to do the centering becomes the new value of **Preselector Adjust**.

Remote Command	`[:SENSe]:POWer[:RF]:PADJust <freq>` `[:SENSe]:POWer[:RF]:PADJust?`
Example	`:POW:PADJ 100KHz` `:POW:PADJ?`
Notes	The value on the control reads out to 0.1 MHz resolution
Dependencies	– Does not appear in CXA-m – Does not appear in VXT Models M9410A/11A – Grayed-out if microwave preselector is off – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz – Blank in models that do not include a preselector, such as option 503. If the SCPI is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View
Preset	0 MHz
State Saved	The **Preselector Adjust** value set by "Presel Center" on page 1868, or by manually adjusting **Preselector Adjust** It is not saved in instrument state, and does not survive a Preset or power cycle
Min	-500 MHz
Max	500 MHz
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PADJust` `[:SENSe]:POWer[:RF]:MMW:PADJust`

Notes	PSA had multiple preselectors, and you could select which preselector to adjust. Since the X-Series has only one mm/uW preselector, the preselector selection control is no longer available. However, to provide backward compatibility, we accept the legacy remote commands The command form has no effect, the query always returns `MWAVe`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:PADJust:PRESelector MWAVe | MMWave | EXTernal` `[:SENSe]:POWer[:RF]:PADJust:PRESelector?`

Internal Preamp

Accesses a menu of controls for the internal preamps. Turning on the preamp gives a better noise figure, but a poorer inter-modulation distortion (TOI) to noise floor dynamic range. You can optimize this setting for your particular measurement.

The instrument takes the preamp gain into account as it sweeps. If you sweep outside of the range of the preamp, the instrument will also account for that. The displayed result always reflects the correct gain.

For some measurements, when the preamp is on and any part of the displayed frequency range is below the lowest frequency for which the preamp has specifications, a warning condition message appears in the status line. For example, for a preamp with a 9 kHz lowest specified frequency: "Preamp: Accy unspec'd below 9 kHz".

Selection	Example	Note
Off	`:POW:GAIN OFF`	
Low Band	`:POW:GAIN ON` `:POW:GAIN:BAND LOW`	Sets the internal preamp to use only the low band. The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Low Band selection in the dropdown
Full Range	`:POW:GAIN ON` `:POW:GAIN:BAND FULL`	Sets the internal preamp to use its full range. The low band (0-3.6 GHz, 0-3.4 GHz, 0-3GHz, depending on the model) is supplied by the low band preamp and the frequencies above low band are supplied by the high band preamp The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Full Range selection in the dropdown. If the high band option is not installed the Full Range selection does not appear

Remote Command	`[:SENSe]:POWer[:RF]:GAIN:BAND LOW | FULL` `[:SENSe]:POWer[:RF]:GAIN:BAND?`

	`[:SENSe]:POWer[:RF]:GAIN[:STATe] OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:GAIN[:STATe]?`

Example	`:POW:GAIN:BAND LOW`
	`:POW:GAIN:BAND?`
	`:POW:GAIN OFF`
	`:POW:GAIN?`

Dependencies	Preamp is not available on all hardware platforms. If the preamp is not present or is unlicensed, the control is not shown Does not appear in VXT Models M9410A/11A/15A If `:POW:GAIN:BAND FULL` is sent when a low band preamp is available, the preamp band parameter is set to `LOW` instead of `FULL`, and an "Option not installed" message is generated The preamp is not available when the electronic/soft attenuator is enabled
Preset	`LOW` `OFF`
State Saved	Saved in instrument state
Annotation	When the USB Preamp is not connected to USB, the Preamp annotation in the Meas Bar says "Off" if the preamp is off and displays the frequency range of the low band or full range preamp depending on the setting. For example, if the Preamp is set to Low Band and the Low Band is 3.6 GHz the annotation says "3.6 GHz". If it is a 13.6 GHz preamp and it is set to Full Range the annotation says "13.6 GHz" When the USB Preamp is connected to USB, the Preamp annotation says "Preamp: USB" if the internal preamp is off or "Preamp: USB, Int" if the internal preamp is on (only for measurements that support the USB preamp)

LNA

Lets you turn the Low Noise Amplifier (**LNA**) on or off.

The LNA is an additional preamplifier that provides superior DANL and frequency range compared to the Internal Preamp. The LNA provides lower system noise figure, especially at frequencies above 100 MHz, and can be operated up to the full range of 50 GHz instruments.

For best possible sensitivity, the LNA can be turned on together with the "Internal Preamp" on page 1870, although if you operate both preamps together, note that the TOI (distortion) specifications are impacted. The sensitivity improvement of this combination is substantial when operating in high band (frequencies above 3.6 GHz).

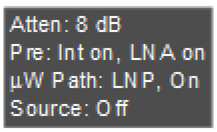
See "More Information" on page 973

Remote Command	`[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe] OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe]?`
Example	`:POW:GAIN:LNA ON`

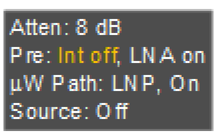
Dependencies	Requires option LNA Option LNA is not required by VXT model M9415A Does not appear in VXT models M9420A/21A/10A/11A May not appear in some measurements
Preset	OFF
State Saved	Saved in State

More Information

When the LNA is installed, the preamp annotation changes to show the state of both the LNA and the Internal Preamp. Below is an example:



Note that when operating entirely in the low band (below about 3.6 GHz), if the LNA is on, the Internal Preamp is switched off (even if you have its switch set to ON). This is because the noise performance is actually degraded in low band if both preamps are on. In this case, the annotation reflects the actual state of the two preamps, but the Internal Preamp annotation displays in amber, to warn you that the actual state of the Internal Preamp does not match the **Internal Preamp** switch control display:



µW Path Control

Options for this control include **µW Preselector Bypass** (Option MPB), **Low Noise Path** (Option LNP) and **Full Bypass Enable** in the High Band path circuits.

When the µW Preselector is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. When **Low Noise Path Enable** is selected, the instrument automatically bypasses certain circuitry in the high frequency bands that can contribute to noise, when it is appropriate based on other instrument settings.

For most applications, the preset state is **Standard Path**, which provides the best remote-control throughput, minimizes acoustic noise from switching and minimizes the risk of wear in the hardware switches, particularly in remote test scenarios where both low band and high band setups will follow in rapid succession. In this path, the bypass of the low band/high band switch and microwave preamp is never activated, which can cause some noise degradation but preserves the life of the bypass switch.

For applications that utilize the wideband IF paths, the preset state is **µW Preselector Bypass**, if option MPB is present. This is because, when using a wideband IF such as the 140 MHz IF, the µW Preselector's bandwidth can be narrower than the available IF bandwidth, causing degraded amplitude flatness and phase linearity, so it is desirable to bypass the preselector in the default case.

You may choose **Low Noise Path Enable** for a lower noise floor, especially in the 21-26.5 GHz region, though without improving many measures of dynamic range, and without giving the best possible noise floor. The preamp, if purchased and used, gives better noise floor than does **Low Noise Path Enable**, but the preamp's compression threshold and third-order intercept are much poorer than that of **Low Noise Path Enable**.

A fourth choice is **Full Bypass Enable**, which combines **µW Preselector Bypass** and **Low Noise Path Enable**. Because this can bypass most of the circuitry between the input and the first mixer, care should be taken when using this setting to avoid damaging the mixer. **Full Bypass Enable** is only available if both options LNP and MPB are present, as well as option FBP.

Path	Example	Note
Standard Path	`:POW:MW:PATH STD`	Normal setting for most measurements. µW Preselector in circuit, Low Noise Path disabled
Low Noise Path Enable	`:POW:MW:PATH LNP`	See "Low Noise Path Enable" on page 978
µW Preselector Bypass	`:POW:MW:PATH MPB`	See "µW Preselector Bypass" on page 980
Full Bypass Enable	`:POW:MW:PATH FULL`	See "Full Bypass Enable" on page 980

Remote Command	`[:SENSe]:POWer[:RF]:MW:PATH STD | LNPath | MPBypass | FULL` `[:SENSe]:POWer[:RF]:MW:PATH?`

Example	`:POW:MW:PATH LNP`
	Enables the Low Noise path
	`:POW:MW:PATH?`

Notes	If "Presel Center" on page 1868 is performed, the instrument will momentarily switch to the Standard Path, regardless of the setting of **µW Path Control** The DC Block will always be switched in when the low noise path is switched in, to protect succeeding circuitry from DC. Note that this does not mean "when the low noise path is enabled" but when, based on the Low Noise Path rules, the path is actually switched in. This can happen when the selection is **Low Noise Path Enable** or **Full Bypass Enable**. In the case where the DC Block is switched in the instrument is now AC coupled. However, if you selected DC coupling, the UI would still behave as though it were DC coupled, including all annunciation, warnings, status bits, and responses to SCPI queries. This is because, based on other settings, the instrument could switch out the low noise path at any time and hence go back to being DC coupled Alignment switching ignores the settings in this menu, and restores them when finished
Dependencies	Does not appear in CXA-m

	Does not appear in VXT Models M9410A/11A Does not appear in BBIQ and External Mixing The **Low Noise Path Enable** selection does not appear unless Option LNP is present and licensed The **µW Preselector Bypass** selection does not appear unless Option MPB is present and licensed The **Full Bypass Enable** selection does not appear unless options LNP and MPB are both present as well as option FBP In any of these cases, if the required options are not present and the SCPI command is sent, error -241, "Hardware missing; Option not installed" is generated **Low Noise Path Enable** and **Full Bypass Enable** are grayed-out if the current measurement does not support them **Low Noise Path Enable** and **Full Bypass Enable** are not supported in Avionics and MMR Modes. In any of these cases (that is, the feature is not supported in either measurement or mode), if the SCPI command is sent, the following error is generated: -221, “Setting Conflict; Feature not supported for this measurement”
Preset	All except modes specified below: `STD` IQ Analyzer, VXA, Pulse and Avionics mode: – MPB option present and licensed: `MPB` – MPB option not present and licensed: `STD`
State Saved	Save in instrument state
Range	Standard Path|Low Noise Path Enable|µW Presel Bypass|Full Bypass Enable
Annotation	In the Meas Bar, if the Standard path is chosen, it says: µW Path: Standard If Low Noise Path is enabled but the LNP switch is not thrown, it shows: µW Path: LNP,Off If the Low Noise Path is enabled and the LNP switch IS thrown, it shows: µW Path: LNP,On If the preselctor is bypassed, it says: µW Path: Bypass If Full Bypass Enable is selected but the LNP switch is not thrown, it shows: µW Path: FByp,Off If Full Bypass Enable is selected and the LNP switch IS thrown, it shows: µW Path: FByp,On

µW Path Control Auto [Mode: VMA, WLAN, NR5G, CQM]

In VMA, WLAN, 5G NR, CQM modes, an Auto/Man switch is added to **µW Path Control**:

This allows the function to automatically switch based on certain Auto Rules as shown below:

VMA Mode

Measurement	When µW Path Control is in Auto:
Digital Demod	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Custom OFDM	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Presel Bypass
SEM	Always Presel Bypass
Spurious Emissions	Always Standard Path

WLAN Mode

Measurement	When µW Path Control is in Auto:
Modulation Analysis	Always Presel Bypass
Spectral Flatness	Always Presel Bypasss
Power vs Time	Always Presel Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Always Presel Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Always Presel Bypass
SEM	1. For 11be 320M, when 'Enabled Wideband IF for FFT' is OFF or 'Sweep Type Rule' is Best Dynamic Range, auto µW path is standard. 2. For other cases, auto µW path is presel bypass if presel bypass is enabled,

Measurement	When µW Path Control is in Auto:
	auto µW path is standard if presel bypass is not enabled.
Spurious Emissions	Always Standard Path

5G NR Mode

Measurement	When µW Path Control is in Auto:
Modulation Analysis	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and “Allow Full Bypass in Auto” is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and “Allow Full Bypass in Auto” is On), otherwise choose Preselector Bypass
Channel Power	Always Standard Path
Occupied BW	Always Standard Path
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Standard Path
SEM	Always Standard Path
Spurious Emissions	Always Standard Path
Transmit On|Off Power	Use Standard Path unless tuned frequency > 3.6 GHz and Info BW > 15 MHz, in which case choose Preselector Bypass

Channel Quality Mode

Measurement	When µW Path Control is in Auto:
Group Delay	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and “Allow Full Bypass in Auto” is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass

Remote Command	`[:SENSe]:POWer[:RF]:MW:PATH:AUTO ON | OFF | 1 | 0` `[:SENSe]:POWer[:RF]:MW:PATH:AUTO?`
Example	`:POW:MW:PATH:AUTO ON` `:POW:MW:PATH:AUTO?`

Dependencies	Only appears in VMA, WLAN, 5G NR and CQM modes
Couplings	See the tables above
Preset	ON
Range	ON|OFF

Low Noise Path Enable

You may select **Low Noise Path Enable**, which gives a lower noise floor under some circumstances, particularly when operating in the 21-26.5 GHz region. With the Low Noise Path enabled, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

– The instrument is not in the Low Band, meaning:

– the start frequency is above 3.5 GHz and

– the stop frequency is above 3.6 GHz

– the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Low Noise Path Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Low Noise Path Enable** is selected in the user interface. The only time the Low Noise Path is used is when **Low Noise Path Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

For measurements that use IQ acquisition, the low noise path is used when **Center Frequency** is in High Band (> 3.6 GHz) and no preamp is in use. In other words, the rules above are modified to use only the center frequency to qualify which path to switch in. This is not the case for FFTs in the Swept SA measurement; they use the same rules as swept measurements.

Note that the Low Noise Path, while giving improved DANL, has the disadvantage of decreased TOI performance and decreased gain compression performance relative to the standard path.

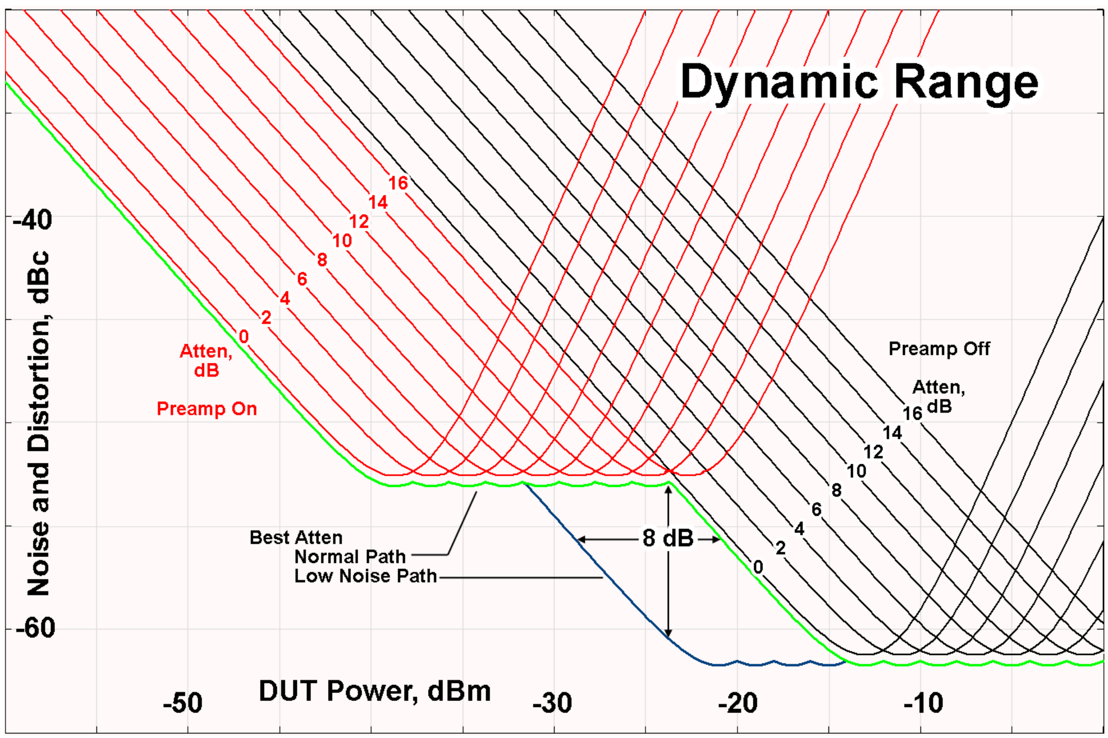
Note also that the bypass switch is a mechanical switch and has finite life, so if the **Low Noise Path Enable** is selected, it is possible to cause frequent cycling of this switch by frequently changing instrument settings such that the above conditions hold true only some of the time. A user making tests of this nature should consider opting for the **Standard Path**, which will never throw the bypass switch, at the expense of some degraded noise performance.

The low noise path is useful for situations where the signal level is so low that the instrument performance is dominated by noise even with 0 dB attenuation, but still high enough that the preamp option would have excessive third-order intermodulation or compression. The preamp, if purchased and used, gives better

noise floor than does the “Low Noise Path.” However, its compression threshold and third-order intercept are much poorer than that of the non-preamp path.

There are some applications, typically for signals around –30 dBm, for which the third-order dynamic range of the standard path is good enough, but the noise floor is not low enough even with 0 dB input attenuation. When the third-order dynamic range of the preamp path is too little and the noise floor of the standard path is too high, the Low Noise Path can provide the best dynamic range

The graph below illustrates the concept. It shows, in red, the performance of an instrument at different attenuation settings, both with the preamp on and off, in a measurement that is affected by both instrument noise and instrument TOI. The green shows the best available dynamic range, offset by 0.5 dB for clarity. The blue shows how the best available dynamic range improves for moderate signal levels with the low noise path switched in. In this illustration, the preamp improves the noise floor by 15 dB while degrading the third-order intercept by 30 dB, and the low noise path reduces loss by 8 dB. The attenuator step size is 2 dB.



There are other times where selecting the low noise path improves performance, too. Compression-limited measurements such as finding the nulls in a pulsed-RF spectrum can profit from the low noise path in a way similar to the TOI-limited measurement illustrated. Accuracy can be improved when the low noise path allows the optimum attenuation to increase from a small amount like 0, 2 or 4 dB to a larger amount, giving better return loss at the instrument input. Harmonic measurements, such as second and third harmonic levels, are much improved using the low noise path because of the superiority of that path for harmonic (though not intermodulation) distortion performance.

µW Preselector Bypass

Toggles the preselector bypass switch for band 1 and higher. When the microwave presel is on, the signal path is preselected. When the microwave preselector is off, the signal path is not preselected. The preselected path is the normal path for the instrument.

The preselector is a tunable bandpass filter which prevents signals away from the frequency of interest from combining in the mixer to generate in-band spurious signals (images). The consequences of using a preselector filter are its limited bandwidth, the amplitude and phase ripple in its passband, and any amplitude and phase instability due to center frequency drift.

Option MPB or pre-selector bypass provides an unpreselected input mixer path for certain X-Series signal analyzers with frequency ranges above 3.6 GHz. This signal path allows a wider bandwidth and less amplitude variability, which is an advantage when doing modulation analysis and broadband signal analysis. The disadvantage is that, without the preselector, image signals will be displayed. Another disadvantage of bypassing the preselector is increased LO emission levels at the front panel input port.

Image responses are separated from the real signal by twice the 1st IF. For IF Paths of 10 MHz and 25 MHz, the 1st IF is 322.5 MHz, so the image response and the real signal will be separated by 645 MHz. The 1st IF will be different for other IF Path settings. When viewing a real signal and its corresponding image response in internal mixing, the image response will be to the left of the real signal.

Also, the image response and the real signal typically have the same amplitude and exhibit the same shape factor.

However, if Option FS1, Fast Sweep Capability, is enabled, the image response in the Swept SA measurement appears lower in amplitude and has a much wider shape factor compared to the real signal.

Full Bypass Enable

With **Full Bypass Enable** selected, the microwave preselector is bypassed. In addition, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

- The instrument is not in the Low Band, meaning:
- the start frequency is above 3.5 GHz and
- the stop frequency is above 3.6 GHz.
- the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. The only time the Low

Noise Path is used is when **Full Bypass Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

CAUTION: When **Full Bypass Enable** is selected, and "Attenuation" on page 1747 is set to 0 dB, there will be a direct AC connection between the input and the first converter when the Low Noise Path switches in (when Start Freq >3.6 GHz and the Preamp is either not licensed, set to Low Band, or Off). This puts the first converter at high risk to be damaged by high AC power. Consequently, whenever **Full Bypass Enable** is selected, a warning message appears in the status bar:

Full Bypass Enabled, maximum safe input power reduced

Microwave Preselector Bypass Backwards Compatibility

Example	`:POW:MW:PRES OFF` Bypasses the microwave preselector
Notes	Included for Microwave Preselector Bypass backwards compatibility The `ON` parameter sets the `STD` path (`:POW:MW:PATH STD`) The `OFF` parameter sets path `MPB` (`:POW:MW:PATH MPB`)
Preset	`ON`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe] ON | OFF | 0 | 1` `[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe]?`

Frequency Extender Preselection Bypass

Frequency Extender Preselection Bypass only applies to the high frequency path of the Frequency Extender and only if the Frequency Extender allows it. For example, the V3050A high frequency path is 50 – 110 GHz and does allow control of the preselector bypass.

When the Frequency Extender's preselection is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. For bandwidths greater than 2.5 [GHz], it is recommended that the signal bypass the Frequency Extender Preselector since the max bandwidth of the Preselector can be as narrow as 2.5 [GHz].

For most applications, the preset state is `OFF`, which gives the best remote-control throughput, minimizes acoustic noise from switching, minimizes out of band spurs, and minimizes the risk of wear in the hardware switches.

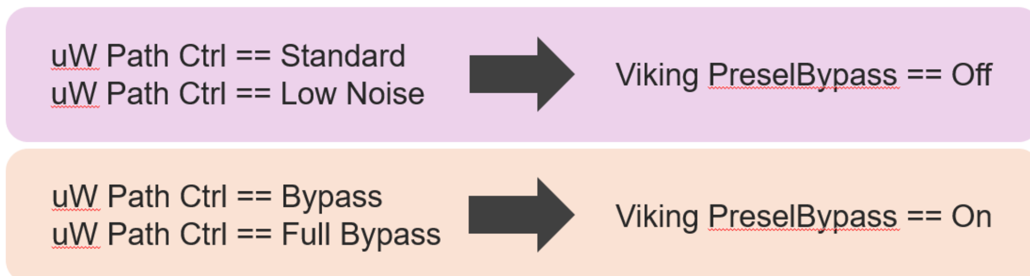
Coupling with Microwave Preselector Control

The control of whether to apply or bypass the Frequency Extender's preselection is dependent on the Microwave Path Control setting.

The coupling between the Microwave Path Control and Frequency Extender Preselector Bypass is described below.

UW PATH CTRL	UW PRESELECTOR	VIKING PRESELECTOR
Standard Path	On	**On**
Low Noise Path Enable	On	**On**
uW Presel Bypass	Off	**Off**
Full Bypass Enable	Off	**Off**

In other words…



For the Frequency Extender Preselector Bypass to take effect, it requires a Frequency Extender device (such as V3050A) be connected and External RF (ERFIN) selected as the input.

The Frequency Extender Preselector is applied or bypassed depending on the Microwave Path Control setting only when the acquisition is above 50 [GHz]. Hence, it will be bypassed only when the acquisition is above 50 [GHz].

Preselector and Bandwidth Conflict

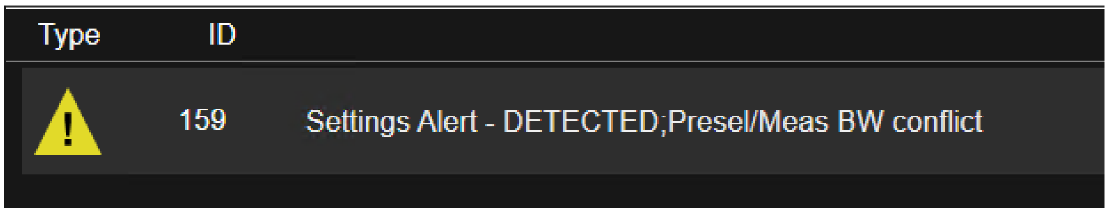
When the Frequency Extender Preselector is applied and the signal bandwidth is greater than 2.5 [GHz], then a settings alert message will show to warn the user that the signal may be distorted due to the limitation of the Frequency Extender Preselector bandwidth.

An example of the settings alert message is shown below.

Settings Alert message in the Status Bar at the bottom of the display.

Settings Alert message in the error queue

.



Software Preselection

Software Preselection is provided in some instruments, either to compensate for issues with provided hardware preselection or to provide the preselection function when there is no hardware preselector.

N9041B

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 50 GHz, software preselection must be used to suppress and separate images above 50 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

In the N9041B, Software Preselection only applies for frequencies above 50 GHz, therefore it is only used for RF Input 2. Even if it is turned on, it will not be used for other inputs and never for frequencies below 50 GHz. This is why the label of this control contains the parenthetical note “(>~50 GHz)”.

Note that in the N9041B, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

N9042B+V3050A

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 88 GHz, software preselection must be used to suppress and separate images above 88 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

For N9042B+V3050A, Software Preselection only applies for frequencies above 88 GHz, therefore it is only used for External RF. Even if it is turned on, it will not be used for other inputs and never for frequencies below 88 GHz. This is why the label of this control contains the parenthetical note “(>~88 GHz)”.

Note that for N9042B+V3050A, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

VXT models M9410A/11A

Software Preselection is used to provide the preselection function, as there is no hardware preselector in these models. Two background traces are taken and compared point by point, and the point with the lowest amplitude from the two traces is used. This provides a method to reduce spurs that are internally generated within the VXT, but the user should note the following when using Software Preselection:

- There is some speed cost due to the need to take multiple captures
- Taking the point with the lowest amplitude in each trace will make the average noise level lower at all points that do not have a spur. This can reduce the accuracy of the measurement of noise and noise-like signals.

Because of the difficulty in identifying spurs manually, you are encouraged to leave Software Preselection ON at all times in VXT models M9410A/11A. If you turn it off in order to speed up your measurement or improve noise accuracy, be aware of unwanted onscreen spurs.

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel:STATe 0 | 1 | ON | OFF` `[:SENSe]:POWer[:RF]:SWPresel:STAT?`
Example	`:POW:SWPR:STAT 1` `:POW:SWPR:STAT?`
Dependencies	Only appears in N9041B, N9042B+V2050A, and VXT models M9410A/11A. Does not appear in all measurements
Couplings	Sweep Time is affected by SW Preselection. Also Auto Tune supports SW Preselection, so set SW Preselection state and then do Auto Tune
Preset	N9041B: OFF N9042B+V3050A: ON M9410A/11A: ON
State Saved	Saved in instrument state

SW Preselection Type

Specifies the algorithm used for software preselection.

Two hidden sweeps are taken in succession. The second sweep is offset in LO frequency by 2*IF/N. For each point in each trace, the smaller amplitude from the two traces is taken and placed in that point in the selected trace. The Peak detector is auto-selected to improve the image suppression effectiveness. Responses of each trace that lie on top of one another will remain and are valid signals. Other signals are images and are suppressed. The action of taking the smaller of the two traces will make the average noise level lower in all points that do not have an image, thus reducing the accuracy of the measurement of noise and noise-like signals.

- NORMal - mathematically removes all image and multiple responses of signals present at the input
- ADVanced - any trace processing (such as "max hold" or trace averaging) is performed on the points of both candidate traces before the "select minimum" operation occurs. This form of processing works better for non-stationary signals, such as pulsed-RF signals

Remote Command	[:SENSe]:POWer[:RF]:SWPResel NORMal | ADVanced [:SENSe]:POWer[:RF]:SWPResel?
Example	:POW:SWPR NORM :POW:SWPR?
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed-out. Its grayout message is "Unavailable unless SW Presel enabled"
Preset	N9041B: ADVanced N9042B+V3050A: NORMal
State Saved	Saved in instrument state

SW Preselection BW

Specifies the effective bandwidth to be used for Software Preselection.

The choices are:

- NORMal – when making Swept measurements, a software preselection algorithm is used which takes up to 4 background acquisitions, then post-processes the result. This algorithm can remove images from signals with an occupied bandwidth up to around 3 GHz. (Default/Preset setting). When making FFT measurements, this algorithm is not used, instead the same algorithm is used as for NARRow (below)
- NARRow– a software preselection algorithm is used which takes two background acquisitions, then post-processes the result to detect and remove images from wideband signals with occupied bandwidths up to 2 GHz. This increases the risk of images failing to be rejected, but improves the measurement speed

Remote Command	[:SENSe]:POWer[:RF]:SWPResel:BW NORMal | NARRow [:SENSe]:POWer[:RF]:SWPResel:BW?
Example	:POW:SWPR:BW NARR
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed out. Its grayout message is "Unavailable unless SW Presel enabled" For N9042B+V3050A the parameter is SCPI only and always set to NARRow when Software

	Preselection is enabled
Preset	N9041B: NORMal N9042B+V3050A: NARRow
State Saved	Saved in instrument state

High Freq Prefilter

Lets you set the state of Prefilter for Center Frequencies above 1310 MHz.

In VXT Models M9410A/11A, the Receiver RF path has a bank of filters that come after the RF Attenuator in the signal path. Since this bank of filters precedes the mixer they are known as the "Prefilter" bank. Their purpose is to eliminate unwanted in-band mixing products by filtering out all but the desired frequencies before the signals get to the mixer. There are 13 prefilter bands to cover the frequencies between 9 kHz and 6000 MHz. The Prefilter provides the necessary rejection of the unwanted signal.

Remote Command	`[:SENSe]:<measurement>:PFILter[:STATe] ON | OFF | 1 | 0` `[:SENSe]:<measurement>:PFILter[:STATe]?`

Example	For example, to enable High Freq Prefilter in IQ Analyzer Mode:
	For the Complex Spectrum Measurement:
	`:SPEC:PFIL ON`
	For the IQ Waveform Measurement:
	`:WAV:PFIL ON`
	`:`

Dependencies	This control only appears in VXT models M9410A/11A with center frequency above 1310 MHz
Preset	See "Prefilter Presets" below
State Saved	Saved in instrument state

Prefilter Presets

Meas	Mode	Preset
SPEC	BASIC	OFF
WAV	BASIC, WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
MON	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
RHO	WCDMA	OFF
CDP	WCDMA	OFF
PCON	WCDMA	OFF
EVMQ	WCDMA	OFF
CHP	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF

Meas	Mode	Preset
OBW	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
ACP	WCDMA, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
SEM	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PST	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PVT	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF
EVM	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF
FLAT	WLAN	OFF
EVMM	WLAN	OFF
CEVM	LTEAFDD, LTEATDD	OFF
PAVT	5GNR, VMA	OFF
DDEM	VMA	OFF
OFDM	VMA	OFF
SAN	SA	ON
HARM	SA	ON

3.8.4 BW

The BW key opens the bandwidth menu, which contains controls for the Resolution Bandwidth and Video Bandwidth functions of the instrument.

The Resolution BW functions control filter bandwidth and filter type. There are two filter types, Gaussian and Flattop. The Gaussian filters have a response curve that is parabolic on a log scale. The Flattop filter shape is a close approximation of a rectangular filter.

3.8.4.1 Settings

The Settings tab contains the basic Bandwidth functions. In most measurements it is the only tab under Bandwidth.

Res BW

Activates the resolution bandwidth active function, which allows you to manually set the resolution bandwidth (RBW) of the instrument.

Normally, Res BW (Auto) selects automatic coupling of the Res BW to Span using the ratio set by the Span:3 dB RBW control (some measurements do not have a Span:3 dB RBW control, in which case the measurement chooses the optimal ratio). To decouple the resolution bandwidth, press the Auto/Man toggle on the Res BW control, or simply enter a different value for Res BW.

When the Res BW is manually selected, it may be returned to the coupled state by pressing the Auto/Man toggle on the Res BW control. This may also be done by pressing Auto Couple or by performing a Preset.

See:

"RBW Presets" on page 989

"More Information" on page 989

Remote Command	`[:SENSe]:OBWidth:BANDwidth[:RESolution] <bandwidth>`
	`[:SENSe]:OBWidth:BANDwidth[:RESolution]?`
	`[:SENSe]:OBWidth:BANDwidth[:RESolution]:AUTO ON | OFF | 1 | 0`
	`[:SENSe]:OBWidth:BANDwidth[:RESolution]:AUTO?`

Example	`:OBW:BAND 5 MHz`
	`:OBW:BAND?`
	`:OBW:BAND:AUTO ON`
	`:OBW:BAND:AUTO?`

Notes	For numeric entries, all RBW Types choose the nearest (arithmetically, on a linear scale, rounding up) available RBW to the value entered The setting and querying of values depend on the current bandwidth type This parameter is preset by the Meas Method selection. Preset values are as follows: – IBW: 100 kHz – IBWR: 27 kHz – FAST (WCDMA): 390 kHz When Meas Method is "Fast Power" and Fast Power RBW mode is "Speed," RBW is calculated as follows: – RBW = Span × 2.442 × 10^{-3}
Couplings	Sweep time is coupled to the RBW. As the RBW changes, the sweep time (if set to Auto) is changed to maintain amplitude calibration Video bandwidth (VBW) is coupled to the RBW. As the resolution bandwidth changes, the video bandwidth (if set to Auto) changes to maintain the ratio of VBW/RBW (10:1) When the Res BW is set to Auto, the resolution bandwidth is auto-coupled to the span. The ratio of Span/RBW is approximately 106:1 when auto coupled. When Res BW is set to Man, and the bandwidths are entered manually, these bandwidths are used regardless of other instrument settings
Preset	Auto (unless noted in the table below) See table below
State Saved	Saved in instrument state
Min	1 Hz
Max	8 MHz is the max equivalent –3 dB RBW, which means that the named RBW (the one shown on the control etc.) can actually exceed 8 MHz if using a filter other than –3 dB Gaussian
Annotation	A "#" mark appears before "RBW" in the annotation when it is switched from Auto to Manual coupling
Backwards Compatibility Notes	For backwards compatibility this command obeys both the `BANDwidth` and `BWIDth` forms For ESA, the maximum Res BW was 5 MHz; on X-Series it is 8 MHz

RBW Presets

Unless noted in the table below, the Preset value of RBW is **Auto**.

Mode	Preset Value
WCDMA	30 kHz
BT	10 kHz
WLAN	100 kHz
MSR	30 kHz
LTE, LTETDD, LTEAFDD, LTEATDD, 5G NR	30 kHz

More Information

When **Res BW** is set to **Auto**, the bandwidth selected depends on the Filter Type (see "Filter Type" below).

Only certain discrete resolution bandwidths are available. The available bandwidths are dependent on the **Filter Type** or the **EMC Standard**. If an unavailable bandwidth is entered with the numeric keypad, the closest available bandwidth is selected.

Video BW

Lets you change the instrument post-detection filter (VBW or "video bandwidth") from 1 Hz to 8 MHz in approximately 10% steps. In addition, a wide-open video filter bandwidth may be chosen by selecting 50 MHz. The VBW is annotated at the bottom of the display, in the center.

Normally, **Video BW (Auto)** selects automatic coupling of the Video BW to RBW using the ratio set by the VBW:3 dB RBW control. To decouple the resolution bandwidth, press the **Auto/Man** toggle on the **Video BW** control, or simply enter a different value for **Video BW**.

When the **Video BW** is manually selected, it may be returned to the coupled state by pressing the **Auto/Man** toggle on the **Video BW** control. This may also be done by pressing Auto Couple or by performing a **Preset**.

Remote Command	`[:SENSe]:OBWidth:BANDwidth:VIDeo <bandwidth>`
	`[:SENSe]:OBWidth:BANDwidth:VIDeo?`
	`[:SENSe]:OBWidth:BANDwidth:VIDeo:AUTO ON | OFF | 1 | 0`
	`[:SENSe]:OBWidth:BANDwidth:VIDeo:AUTO?`

Example	`:OBW:BAND:VID 2.4 MHz`
	`:OBW:BAND:VID?`
	`:OBW:BAND:VID:AUTO ON`
	`:OBW:BAND:VID:AUTO?`

Notes	For numeric entries, the instrument chooses the nearest (arithmetically, on a linear scale, rounding up)

	available VBW to the value entered. The 50 MHz VBW is defined to mean "wide open" The values shown in this table reflect the conditions after a Mode Preset
Dependencies	Sometimes the displayed Video BW is not actually used to process the trace data: When the Average Detector is selected and Sweep Type is set to **Swept**, the video bandwidth filter cannot be used, because it uses the same hardware as the Average Detector When the Quasi-Peak, EMI Average or RMS Average detector is selected the VBW is implemented by the digital IF as part of the detector When this is the case, the VBW still acts to change the Sweep Time, if Sweep Time is in Auto, and still affects the data on other traces for which this is not the case
Couplings	Video bandwidth (VBW) is normally coupled to RBW. If **VBW** is set to Auto, then the VBW is changed as the RBW changes, to maintain the ratio set by the VBW:3 dB RBW control (usually 10:1 for measurements that do not have a VBW:3 dB RBW control)
Preset	Auto (unless noted in table below) ON
State Saved	Saved in instrument state
Min	1 Hz
Max	50 MHz
Annunciation	A "#" mark appears before "VBW" in the annotation when it is not coupled
Annotation	In the bottom center of the screen, "VBW <value> <units>" indicates the current video bandwidth value. Note that for some detectors this is not the value actually used for VBW (see above)
Backwards Compatibility Notes	For backwards compatibility this command obeys both the `BANDwidth` and `BWIDth` forms

VBW Presets

Unless noted in the table below, the Preset value of VBW is **Auto**.

Mode ID	Preset Value
WCDMA	300 kHz
BT	30 kHz

RBW Filter Type

Selects the type for the resolution bandwidth filters. Historically, the Res BW filters in HP/Agilent/Keysight spectrum analyzers were Gaussian filters, specified using the –3 dB bandwidth of the filter. That is, a 10 MHz Res BW filter was a Gaussian shape with its –3 dB points 10 MHz apart. In the X-Series, the **RBW Filter BW** menu lets you choose between a Gaussian and Flat Top filter shape, for varying measurement conditions.

Filter Type	SCPI Example
Gaussian	`:BAND:SHAP GAUS`
Flattop	`:BAND:SHAP FLAT`

For more information see the RBW Filter Type control description for the Swept SA measurement.

Remote Command	`[:SENSe]:OBWidth:BANDwidth:SHAPe GAUSsian | FLATtop` `[:SENSe]:OBWidth:BANDwidth:SHAPe?`
Example	`:OBW:BAND:SHAP GAUS` `:OBW:BAND:SHAP?`
Notes	`GAUSsian` = Gaussian `FLATtop` = Flattop
Dependencies	In the Swept SA measurement, the **RBW Filter Type** control is grayed out if the **EMC Standard** is set to **CISPR** or **MIL**. In this case the **Filter Type** is always Gaussian; the **Filter BW** is chosen as appropriate for the filter and the standard. Any attempt to set it to Flattop will give an error
Preset	Auto Couple chooses the preset value
State Saved	Saved in instrument state
Annotation	The annotation under RBW in the bottom left of the screen shows the type of filter or bandwidth that is being used. The following examples illustrate this:

–3 dB (Normal) filter BW:	Res BW 300 Hz
–6 dB filter BW:	Res BW (–6 dB) 422 Hz
Noise filter BW:	Res BW (Noise) 317 Hz
Impulse filter BW:	Res BW (Impulse) 444 Hz
CISPR filter BW :	Res BW (CISPR) 200 Hz
MIL filter BW:	Res BW (MIL) 1 kHz
Flattop filter type:	Res BW (Flattop) 300 Hz

Backwards Compatibility SCPI	`[:SENSe]:OBWidth:BWIDth:SHAPe`

3.8.5 Display

The Display key opens the Display Menu, which lets you configure display items for the current Mode, Measurement View or Window.

3.8.5.1 Meas Display

The Meas Display tab contains controls for setting the display for the current Measurement, View or Window.

x dB BW Boundaries On/Off

Turns the x dB BW Boundaries On and Off.

Remote Command	:DISPlay:OBWidth:WINDow[1]:XDB 0 | 1 | OFF | ON :DISPlay:OBWidth:WINDow[1]:XDB?
Example	:DISP:OBW:WIND:XDB 1 :DISP:OBW:WIND:XDB?
Preset	0
State Saved	Saved in instrument state
Range	OFF|ON
Backwards Compatibility SCPI	:DISPlay:OBWidth:VIEW:WINDow[1]:XDB

Boundary Frequency

Selects frequency display type from either Offset or Absolute:

– OFFSet: offsets from Center Freq to OBW boundary frequency are displayed

– ABSolute: absolute frequencies are displayed

Remote Command	:DISPlay:OBWidth:WINDow2:BOUNdaries:FREQuency OFFSet | ABSolute :DISPlay:OBWidth:WINDow2:BOUNdaries:FREQuency?
Example	:DISP:OBW:WIND2:BOUN:FREQ ABS :DISP:OBW:WIND2:BOUN:FREQ?
Preset	OFFSet
State Saved	Saved in instrument state
Range	OFFSet|ABSolute
Backwards Compatibility SCPI	:DISPlay:OBWidth:VIEW2:WINDow2:BOUNdaries:FREQuency

3.8.5.2 View

Contains controls for selecting the current **View**, and for editing User Views.

Views

The Occupied BW measurement has two Predefined views: the OBW Result View and the OBW Boundaries View.

These Views are multiple-window Views. When in a multiple window View, you select a window by touching it. The menu controls may sometimes change depending on which window is selected.

Whenever the View changes, the default menu is **Frequency**, unless otherwise specified in the View description.

If you have modified the current View, using the "View Editor" on page 128, an asterisk appears next to that View in the radio button panel. You can save the modified View as a User View (see "Save Layout as New View" on page 1890).

View Selection by Name

Remote Command	`:DISPlay:OBWidth:VIEW[:SELect] OBWResults | BOUNdaries` `:DISPlay:OBWidth:VIEW[:SELect]?`
Example	`:DISP:OBW:VIEW OBWR` `:DISP:OBW:VIEW?`
Preset	`OBWResults`
State Saved	Saved in instrument state
Range	`OBWResults|BOUNdaries`

View Selection by Number

Remote Command	`:DISPlay:OBWidth:VIEW:NSELect <integer>` `:DISPlay:OBWidth:VIEW:NSELect?`
Example	`:DISP:OBW:VIEW:NSEL 2` `:DISP:OBW:VIEW:NSEL?`
Preset	1
State Saved	Saved in instrument state
Min/Max	1/2

OBW Results

Windows: "Graph" on page 944, "Metrics - OBW Results" on page 945

The spectrum trace is displayed in the upper window. Measurement results such as Occupied Bandwidth or Power are displayed in the lower window.

Example	`:DISP:OBW:VIEW OBWR`

OBW Boundaries

Windows: "Graph" on page 944, "Metrics - OBW Boundaries" on page 947

The spectrum trace is displayed in the upper window. The lower window of OBW Results view is replaced by the OBW boundaries table in this view. Occupied bandwidth and X dB bandwidth for both lower and upper boundaries are displayed.

Example	`:DISP:OBW:VIEW BOUN`

User View

Lets you choose a View from the saved User Views for the current measurement. This panel only appears if a User View exists for the current measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:SELect <alphanumeric>` `:DISPlay:VIEW:ADVanced:SELect?`
Example	Select Baseband as the current View `:DISP:VIEW:ADV:SEL “Baseband”`

Notes	You must be in the measurement whose View you are trying to set to send the command. You can only set Views for the current measurement using this command
	For predefined views, the parameter is derived from the view name that is shown in the View list in the user interface. For example, if you are trying to select the Trace Zoom view in the Swept SA measurement, you send:
	`:DISP:VIEW:ADV:SEL "Trace Zoom"`
	because “Trace Zoom” is the name of the View as seen in the Mode/Meas dialog or in the Display, View menu
	You *cannot* use the legacy View parameter (which in this case would be `TZOom`) with `:DISP:VIEW:ADV:SEL`
	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case. Thus, both of the following forms work:
	`:DISP:VIEW:ADV:SEL "Trace Zoom"`
	`:DISP:VIEW:ADV:SEL "TRACE ZOOM"`
	If the specified view is not a valid View, the query returns the error message “-224, Illegal parameter value; View with the name <alphanumeric> does not exist”
	If the display is disabled (via `:DISP:ENAB OFF`) then the error message “-221, Settings conflict; View SCPI cannot be used while Display is disabled” is generated

Backwards Compatibility SCPI	The legacy node `:DISPlay:VIEW[:SELect]` is retained for backwards compatibility, but it only supports predefined views

Restore Layout to Default

Restores the Layout to the default for Basic.

Modified Views are very temporary; if you exit the current measurement they are discarded, and they are not saved in State. To retain this View for later use, and to be able to return easily to your original Basic View, you can save your edited View as a "User View".

Save Layout as New View

Saves your new View as a User View. An alpha keyboard appears, which lets you name your new View; the default is the old View name plus a number.

Remote Command	`:DISPlay:VIEW:ADVanced:NAME <alphanumeric>`
Example	`:DISP:VIEW:ADV:NAME "Baseband"` Creates a new View named `Baseband` from the current View, and selects it as the current View
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If `<alphanumeric>` name already exists as a View, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; User View SCPI cannot be used while Display is disabled" is generated

Re-Save User View

You can re-edit a User View; if you make changes, then an asterisk will appear next to the User View's name. You can then tap **Re-Save User View** to save it back to its existing name, or **Save Layout as New View** to add another, new User View.

This is a front panel function only, there is no remote command available to perform this function. To do this remotely, you must first perform **Save Layout as New View**, then delete the old User View and rename the new one with the name of the View you just deleted.

Rename User View

You can rename the current View by giving it a new unique name. Only User Views can be renamed, if the current View is a Predefined View, an error occurs.

Remote Command	`:DISPlay:VIEW:ADVanced:REName <alphanumeric>`
Example	`:DISP:VIEW:ADV:REN "Baseband"`
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated

	on a single case If the <alphanumeric> specifying the new name is already present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot rename a Predefined View" is generated If the display is disabled (via :DISP:ENAB OFF) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete User View

You can delete the current View if it is a User View. The default view becomes the current view for the Measurement.

Remote Command	:DISPlay:VIEW:ADVanced:DELete
Example	:DISP:VIEW:ADV:DEL
Notes	<alphanumeric> is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the <alphanumeric> is not present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> does not exist" is generated If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot delete a Predefined View" is generated If the display is disabled (via :DISP:ENAB OFF) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete All User Views

Deletes all previously saved User Views. The default view becomes the current view for the Measurement if a User View was the current view when this command was executed.

Remote Command	:DISPlay:VIEW:ADVanced:DELete:ALL
Example	:DISP:VIEW:ADV:DEL:ALL
Notes	Disabled if there are no User Views

View Editor Remote Commands

The following remote commands help you manage Views and User Views. Note that the SCPI node for User Views handles both Predefined and User Views. The legacy nodes, :DISPlay:VIEW[:SELect] and :DISPlay:VIEW:NSEL, are retained for backwards compatibility, but they only support predefined views.

View Listing Query

Returns a string containing a comma-separated list of names for *all* the Views, including User Views, available for the current Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:CATalog?`
Example	`:DISP:VIEW:ADV:CAT?`
Notes	Returns a quoted string of the available Views for the current measurement, separated by commas. The list includes names for *all* the Views, including User Views, available for the current Measurement Example: `"Normal,Trace Zoom,Spectrogram,Baseband,myView1,yourView1"` No distinction is made between Predefined and User Views If you switch measurements with the display disabled (via `:DISP:ENAB OFF`), then query the list of available Views, the result is undefined

User View Listing Query

Returns a string containing a comma-separated list of names for *only* the User Views available for the current Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:USER:CATalog?`
Example	`:DISP:VIEW:ADV:USER:CAT?`
Notes	Returns a quoted string of the available User Views for the current measurement, separated by commas. Example: `"Baseband,myView1,yourView1"` If you switch measurements with the display disabled (see "Display Enable (Remote Command Only)" on page 1894), then query the list of available Views, the result is undefined

3.8.5.3 Annotation

Contains controls for setting up the annotation for the current Mode or Measurement.

Graticule

Turns the display graticule On or Off for all windows with graticules in all measurements in the current Mode. Also turns the graticule Y-Axis annotation on and off.

Remote Command	`:DISPlay:GRATicule[:STATe] OFF | ON | 0 | 1`

	:DISPlay:GRATicule[:STATe]?
Example	:DISP:GRAT OFF
Notes	The graticule is the set of horizontal and vertical lines that make up the grid/divisions for the X-Axis and Y-Axis
Preset	ON
State Saved	Saved in instrument state
Backwards Compatibility SCPI	:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe] OFF | ON | 0 | 1 :DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe]? This command is accepted for backwards compatibility with older instruments, but the WINDow, TRACe and GRID parameters are ignored

Screen Annotation

Controls the display of the annunciation and annotation around the graticule, including any annotation on lines (such as the display line, the threshold line, etc.) and the Y-Axis annotation, for all windows with screen annotation in all measurements in the current Mode.

This does *not* include marker annotation (or the N dB result). When OFF, the graticule expands to fill the entire graticule area, leaving only the 1.5% gap above the graticule, as described in the **Trace** section.

Remote Command	:DISPlay:ANNotation:SCReen[:STATe] OFF | ON | 0 | 1 :DISPlay:ANNotation:SCReen[:STATe]?
Example	:DISP:ANN:SCR OFF
Dependencies	Grayed-out and forced to OFF when **System Display Settings**, **Annotation** is OFF
Preset	ON This remains OFF through a Preset when **System Display Settings**, **Annotation** is set to OFF
State Saved	Saved in instrument state

Trace Annotation

Turns on and off the labels on the traces, showing their detector (or their Math Mode) as described in the **Trace** section, for all windows in all measurements in the current Mode for which Trace Annotation on/off is supported.

If Trace Math is being performed on a trace, then the Trace Math annotation replaces the detector annotation.

For measurements that support limit lines, this key also turns on and off the labels on the Limit Lines. The label is the Limit number annotation and Limit Comment displayed on the graph. If the length of the comment is greater than 20 characters, the first 8 characters and the last 8 characters are displayed, joined with ....

Remote Command	`:DISPlay:ANNotation:TRACe[:STATe] ON | OFF | 1 | 0` `:DISPlay:ANNotation:TRACe[:STATe]?`
Example	`:DISP:ANN:TRAC OFF`
Preset	`OFF`
State Saved	Saved in instrument state

Control Annotation

Turns on and off the display of values on the Active Function controls for all measurements in the current Mode. This is a security feature.

Remote Command	`:DISPlay:ACTivefunc[:STATe] ON | OFF | 1 | 0` `:DISPlay:ACTivefunc[:STATe]?`
Example	`:DISP:ACT OFF`
Dependencies	Grayed out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Meas Bar

Turns the Measurement Bar at the top of the screen on and off for all measurements in the current Mode. When `OFF`, the graticule area expands to fill the area formerly occupied by the Measurement Bar.

Remote Command	`:DISPlay:ANNotation:MBAR[:STATe] OFF | ON | 0 | 1` `:DISPlay:ANNotation:MBAR[:STATe]?`
Example	`:DISP:ANN:MBAR OFF`
Dependencies	Grayed out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Display Enable (Remote Command Only)

Turns the display on/off, including the display drive circuitry. The backlight stays lit to confirm that the instrument is on. The display enable setting is mode global. Theare three reasons for turning the display off:

1. To increase speed as much as possible by freeing the instrument from having to update the display

2. To reduce emissions from the display, drive circuitry

3. For security purposes

If you have turned off the display:

– and you are in local operation, the display can be turned back on by pressing any key or by sending `:SYSTem:DEFaults MISC` or `:DISPlay:ENABle ON` (neither `*RST` nor :SYSTem:PRESet enable the display)

– and you are in remote operation, the display can be turned back on by pressing the **Local** or **Esc** keys, or by sending `:SYSTem:DEFaults MISC` or `:DISPlay:ENABle ON` (neither `*RST` nor `:SYSTem:PRESet` enable the display)

– and you are using either the `:SYSTem:KLOCk` command or GPIB local lockout, then *no* front-panel key press will turn the display back on. You must turn it back on remotely.

If the display is `OFF`, many SCPI commands related to User Views and Multiscreen functionality do not work, and return the error messages "-221, Settings conflict; Screen SCPI cannot be used when Display is disabled" or "221, Settings conflict; View SCPI cannot be used while Display is disabled". These commands include:

Name	Command
Select User View	`:DISPlay:VIEW:ADVanced:SELect`
Rename User View	`:DISPlay:VIEW:ADVanced:REName`
Delete User View	`:DISPlay:VIEW:ADVanced:DELete`
Create User View	`:DISPlay:VIEW:ADVanced:NAME`
Select Screen	`:INSTrument:SCReen:SELect`
Delete Screen	`:INSTrument:SCReen:DELete`
Delete All But This Screen	`:INSTrument:SCReen:DELete:ALL`
Add Screen	`:INSTrument:SCReen:CREate`
Rename Screen	`:INSTrument:SCReen:REName`
Sequencer On/Off	`:SYSTem:SEQuencer`

Remote Command	`:DISPlay:ENABle OFF | ON | 0 | 1` `:DISPlay:ENABle?`
Example	`:DISP:ENAB OFF`
Couplings	`:DISP:ENAB OFF` turns Backlight `OFF` and `:DISP:ENAB ON` turns Backlight `ON`, but changing Backlight settings does *not* change the state of `:DISP:ENAB`
Preset	`ON` Set by `:SYST:DEF MISC`, but not affected by `*RST` or `:SYSTem:PRESet`

State Saved	Not saved in instrument state
Backwards Compatibility Notes	`:SYST:PRES` no longer turns on `:DISPlay:ENABle` as it did in legacy analyzers

3.8.6 Freq

The Freq key opens the Frequency menu, which contains controls that allow you to control the Frequency and Channel parameters of the instrument.

Some features in the Frequency menu are the same for all measurements in the current Mode – they do not change as you change measurements. Settings like these are called "Meas Global" and are unaffected by Meas Preset. For example, the Center Freq setting is the same for all measurements - it does not change as you change measurements.

3.8.6.1 Settings

The Settings Tab contains controls that pertain to the X axis parameters of the measurement. These parameters control how data on the vertical (X) axis is displayed and control instrument settings that affect the horizontal axis.

Span

Set the frequency of the occupied bandwidth span for the current measurement.

Remote Command	`[:SENSe]:OBWidth:FREQuency:SPAN <freq>`
	`[:SENSe]:OBWidth:FREQuency:SPAN?`
	`[:SENSe]:OBWidth:FREQuency:SPAN:AUTO ON | OFF | 0 | 1`
	`[:SENSe]:OBWidth:FREQuency:SPAN:AUTO?`

Example	`:OBW:FREQ:SPAN 2.4 MHz`
	`:OBW:FREQ:SPAN?`
	`:OBW:FREQ:SPAN:AUTO 0`
	`:OBW:FREQ:SPAN:AUTO?`

Notes	Span Auto Detector (`[:SENSe]:OBWidth:FREQuency:SPAN:AUTO`) is only available in the MSR, LTEAFDD/LTEATDD and 5GNR modes
Dependencies	The Auto Detect functionality is only available in the MSR, LTEAFDD/LTEATDD and 5GNR modes
Preset	SA: 3 MHz WCDMA: 10 MHz LTE, LTETDD, LTEAFDD, LTEATDD: 10 MHz BT: 2 MHz 5GNR: 200 MHz

	RTS: 27 kHz MSR: 10 MHz WLAN: – If Radio Std is 802.11b: 30MHz – If Radio Std is 802.11a/g/n/ac/ax/be (20MHz): 25 MHz – If Radio Std is 802.11n/ac/ax/be (40MHz): 50 MHz – If Radio Std is 802.11n/ac/ax/be (80MHz): 100 MHz – If Radio Std is 802.11ac/ax/be (160MHz): 200 MHz – If Radio Std is 802.11be (320MHz): 400 MHz
State Saved	Yes
Min	100 Hz
Max	Hardware Maximum Span For the max value of each hardware, see Center Frequency Presets table in 6.2.1.1 Center Frequency
Backwards Compatibility SCPI	`[:SENSe]:EBWidth:FREQuency:SPAN`

Center Frequency

Sets the frequency that corresponds to the horizontal center of the graticule. While adjusting the Center Frequency the Span is held constant.

The center frequency setting is the same for all measurements within a mode, that is, it is Meas Global. Some modes are also able to share a Mode Global center frequency value. If this is the case, the Mode will have a **Global** tab in its **Meas Setup** menu.

The **Center Freq** function sets (and queries) the Center Frequency for the currently selected input. If your instrument has multiple inputs, and you select another input, the Center Freq changes to the value for that input. SCPI commands are available to directly set the Center Freq for a specific input.

Center Freq is remembered as you go from input to input. Thus you can set a Center Freq of 10 GHz with the RF Input selected, change to BBIQ and set a Center Freq of 20 MHz, then switch to External Mixing and set a Center Freq of 60 GHz, and when you go back to the RF Input the Center Freq will go back to 10 GHz; back to BBIQ and it is 20 MHz; back to External Mixing and it is 60 GHz.

See:

"RF Center Freq" on page 1005

"Ext Mix Center Freq" on page 1006

"I/Q Center Freq" on page 1007

"Center Frequency Presets" on page 1003

"VXT Models with Radio Heads/CIU Frequency Range" on page 1005

Remote Command	`[:SENSe]:FREQuency:CENTer <freq>` `[:SENSe]:FREQuency:CENTer?`

Example	`:FREQ:CENT 50 MHz`
	sets Center Frequency to 50 MHz
	`:FREQ:CENT UP`
	increments the Center Frequency by the value of CF Step
	`:FREQ:CENT?`
	returns the current value of Center Frequency

Notes	This command sets the RF, External Mixing or I/Q Center Frequency depending on the selected input For RF input it is equivalent to `:FREQ:RF:CENT` For I/Q input it is equivalent to `:FREQ:IQ:CENT` For External Mixer it is equivalent to `:FREQ:EMIX:CENT` Preset and Max values are dependent on Hardware Options If no terminator (e.g.., MHz) is sent the terminator Hz is used. If a terminator with unit other than Frequency is used, an invalid suffix error message is generated
Dependencies	Not available in the MSR, LTEAFDD/LTEATDD and 5GNR modes.
Preset	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 1003, "RF Center Freq" on page 1005, "Ext Mix Center Freq" on page 1006, "I/Q Center Freq" on page 1007 and "VXT Models with Radio Heads/CIU Frequency Range" on page 1005
State Saved	Saved in instrument state
Min/Max	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 1003, "RF Center Freq" on page 1005, "I/Q Center Freq" on page 1007 and "VXT Models with Radio Heads/CIU Frequency Range" on page 1005
Annotation	Center <value> appears in the lower left corner of the display
Status Bits/OPC dependencies	Non-overlapped

Center Frequency Presets

The following table provides the Center Frequency Presets for the Spectrum Analyzer mode, and the Max Freq, for the various frequency options:

Freq Option	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
503 (all but CXA)	1.805 GHz	3.6 GHz	3.7 GHz
503 (CXA)	1.505 GHz	3.0 GHz	3.08 GHz
507 (all but CXA)	3.505 GHz	7.0 GHz	7.1 GHz
507 (CXA)	3.755 GHz	7.5 GHz	7.58 GHz

Freq Option	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
508 (all but MXE)	1.805 GHz	3.6 GHz	8.5 GHz
508 (MXE)	4.205 GHz	8.4 GHz	8.5 GHz
513	6.805 GHz	13.6 GHz	13.8 GHz
526 (except CXA and MXE)	13.255 GHz	26.5 GHz	27.0 GHz*
526 (CXA)	13.255 GHz	26.5 GHz	26.55 GHz
526 (MXE)	1.805 GHz	3.6 GHz	27.0 GHz
532	16.005 GHz	32.0 GHz	32.5 GHz
540	20.005 GHz	40.0 GHz	40.5 GHz
543	21.505 GHz	43.0 GHz	43.0 GHz
544	22.005 GHz	44.0 GHz	45.0 GHz
550	25.005 GHz	50.0 GHz	52 GHz
F03 (CXA-m)	1.505 GHz	3.0 GHz	3.08 GHz
F07 (CXA-m)	3.755 GHz	7.5 GHz	7.575 GHz
F13 (CXA-m)	6.805 GHz	13.6 GHz	13.8 GHz
F26 (CXA-m)	13.255 GHz	26.5 GHz	26.55 GHz
504 (M9420A/21A, M8920A)	2.145 GHz	3.88GHz	3.88 GHz
506 (M9420A/21A, M8920A)	3.245 GHz	6.08GHz	6.08 GHz
F06 (M9410A/11A)	1.0 GHz	6.08 GHz	6.08 GHz
F06 (M9415A)	1 GHz	1.08 GHz	6.6 GHz
F08 (M9415A)	1 GHz	1.08 GHz	8.6 GHz
F12 (M9415A)	1 GHz	1.08 GHz	12.9 GHz

*For option 526, the Max CF in RTSA is 26.999999995 GHz.

N9041B Center Freq Presets

Input	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
Input 1, all models	25.005 GHz	50.0 GHz	52 GHz
Input 2, opt 585	42.505 GHz	85.0 GHz	86 GHz
Input 2, opt 590	45.005 GHz	90.0 GHz	92 GHz
Input 2, opt 5CX	55.005 GHz	110.0 GHz	110 GHz

Input 2, CXA and MXE

Model	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
CXA opt C75	0.7505 GHz	1.5 GHz	1.58 GHz
MXE	505 MHz	1 GHz	1.000025 GHz

Tracking Generator Frequency Limits (CXA only)

Tracking Generator Option	Min Freq (clips to this freq when turn TG on and can't tune below while TG on)	If above this Freq, Stop Freq clipped to this Freq when TG turned on	Max Freq (can't tune above) while TG on
T03	9 kHz	3.0 GHz	3.08 GHz
T06	9 kHz	6.0 GHz	6.05 GHz

Tracking Generator Frequency Limits(CXA-m only)

Tracking Generator Option	Min Freq (clips to this freq when turn TG on and can't tune below while TG on)	If above this Freq, Stop Freq clipped to this Freq when TG turned on	Max Freq (can't tune above) while TG on
T03	2 MHz	3.08 GHz	3.08 GHz
T07	2 MHz	7.575 GHz	7.575 GHz
T13	2 MHz	13.8 GHz	13.8 GHz
T26	2 MHz	26.55 GHz	26.55 GHz

VXT Models with Radio Heads/CIU Frequency Range

The following table shows the Center Frequency Presets and Range for VXT modes with Radio Heads/CIU.

Products with Radio Heads/CIU	Preset	Start frequency	Stop frequency
M9421A + CIU	6 GHz	5.9 GHz	12 GHz
M9410A + CIU	6 GHz	5.9 GHz	12 GHz
M9410A + CIU + RRH	25 GHz	24.25 GHz	43.5 GHz

RF Center Freq

SCPI command for specifying the RF Center Frequency. This command will set the Center Frequency to be used when the RF input is selected, even if the RF input is not the input that is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:RF:CENTer <freq>` `[:SENSe]:FREQuency:RF:CENTer?`
Example	`:FREQ:RF:CENT 30 MHz`

	`:FREQ:RF:CENT?`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode
Dependencies	If the electronic/soft attenuator is enabled, any attempt to set Center Frequency such that the Stop Frequency would be >3.6 GHz fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning
Preset	See table above
State Saved	Saved in instrument state
Min	-79.999995 MHz
Max	See table above. Basically instrument maximum frequency - 5 Hz If the knob or step keys are being used, also depends on the value of Span

Ext Mix Center Freq

SCPI command for specifying the External Mixer Center Frequency. This command will set the Center Frequency to be used when the External Mixer is selected, even if the External Mixer input is not the input which is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:EMIXer:CENTer <freq>` `[:SENSe]:FREQuency:EMIXer:CENTer?`
Example	`:FREQ:EMIX:CENT 60 GHz` `:FREQ:EMIX:CENT?`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode
Couplings	When returning to External Mixing after having been switched to one of the other inputs (e.g., RF), you will come back into the settings that you had when you left External Mixing. So you will come back to the band you were in with the Center Frequency that you had. However, Span is not an input-dependent parameter, therefore you will bring the span over from the other input. Therefore, the instrument comes back with the span from the previous input, limited as necessary by the current mixer setup
Preset	When a Mode Preset is performed while in External Mixing, the Start frequency of the current Mode is set to the nominal Min Freq of the lowest harmonic range in the Harmonic Table for the current mixer setup. Similarly, the Stop frequency of the current Mode is set to the nominal Max Freq of the highest harmonic range in the Harmonic Table. The Center Freq thus presets to the point arithmetically equidistant from these two frequencies Note that, if the current measurement has a limited Span available to it, and cannot achieve the Span shown in the table (Span=Stop Freq – Start Freq), the instrument uses the maximum Span the measurement allows, and still sets the Center Freq to the midpoint of the Start and Stop Freq values in the Harmonic Table When Restore Input/Output Defaults is performed, the mixer presets to the 11970A, whose Start and Stop frequencies are 26.5 and 40 GHz respectively. The center of these two frequencies is 33.25 GHz Therefore, after a Restore Input/Output Defaults, if you go into External Mixing and do a Mode Preset while in the Spectrum Analyzer Mode, the resulting Center Freq is 33.25 GHz

State Saved	Yes
Min	The minimum frequency in the currently selected mixer band + 5 Hz If the knob or step keys are being used, also depends on Span
Max	The maximum frequency in the currently selected mixer band - 5 Hz If the knob or step keys are being used, also depends on Span

I/Q Center Freq

SCPI command for specifying the I/Q Center Frequency. This command will set the Center Frequency to be used when the I/Q input is selected, even if the I/Q input is not the input which is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:IQ:CENTer <freq>` `[:SENSe]:FREQuency:IQ:CENTer?`
Example	`:FREQ:IQ:CENT 30 MHz`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode
Preset	0 Hz
State Saved	Saved in instrument state
Min	-40.049995 MHz
Max	40.049995 MHz

Full Span (Remote Command Only)

Changes the Occupied Bandwidth Span to show the full frequency range of the instrument. It maximizes the span within a range not changing the center frequency. When using external mixing, it changes the displayed frequency span to the frequency range specified for the selected external mixing band.

Remote Command	`[:SENSe]:OBWidth:FREQuency:SPAN:FULL`
Example	`:OBW:FREQ:SPAN:FULL`
Couplings	Selecting full span changes the measurement span value

3.8.7 Marker

Accesses a menu that enables you to select, set up and control the markers for the current measurement. If there are no active markers, **Marker** selects marker 1, sets it to Normal and places it at the center of the display. If the selected marker is Off, it is set to Normal and placed it at the center of the screen on the trace determined by the Marker Trace rules.

For more detailed information on the types of Markers and the interaction between Markers, see the Marker section of the Swept SA measurement.

3.8.7.1 Select Marker

Specifies the selected marker. The term “selected marker” is used throughout this document to specify which marker will be affected when you change marker settings, perform a Peak Search, etc.

The Select Marker control appears above the menu panel, indicating that it applies to all controls in the Marker menu panels. Select Marker is blanked if you select a tab whose controls do NOT depend on the selected marker (e.g., Counter).

On any menu tab for which Select Marker displays, the first control is always **Marker Frequency|Time**.

Notes	The selected marker is remembered even when not in the Marker menu and is used if a Search is done or a Band Function is turned on or for Signal Track or Continuous Peak
Preset	Marker 1
State Saved	The number of the selected marker is saved in instrument state
Annunciation	Appears in the marker results block label for **Normal** and **Delta** markers

3.8.7.2 Settings

The controls on the Settings tab include the Marker active function and a radio button selection of the marker control mode (Normal, Delta or Off) for the selected marker, as well as additional functions that help you use markers.

Marker Frequency

Sets the marker X Axis value in the current marker X Axis Scale unit. It has no effect if the control mode is **Off,** but is the SCPI equivalent of entering an X value if the control mode is **Normal** or **Delta**.

Remote Command	`:CALCulate:OBWidth:MARKer[1]|2|...|12:X <freq>` `:CALCulate:OBWidth:MARKer[1]|2|...|12:X?`
Example	`:CALC:OBW:MARK3:X 0` `:CALC:OBW:MARK3:X?`
Notes	If no suffix is sent, uses the fundamental units for the current marker X Axis Scale. If a suffix is sent that does not match the current marker X Axis Scale unit, an error “Invalid suffix” is generated The query returns the marker’s absolute X Axis value if the control mode is **Normal**, or the offset from the marker’s reference marker if the control mode is **Delta.** The query is returned in the fundamental units for the current marker X Axis scale: Hz for **Frequency** and **Inverse Time**, seconds for **Period** and **Time**
Preset	After a preset, all markers are turned OFF, so Marker X Axis Value query returns a not a number (NAN)

State Saved	Saved in instrument state
Min	-9.9E+37
Max	9.9E+37
Annotation	Mkr # <X value> and <Marker value> upper right on graph

Marker X Axis Position (Remote Command Only)

Sets the marker X Axis Scale position in trace points. This setting has no effect if the control mode is **Off,** but is the SCPI equivalent of entering a value if the control mode is **Normal** or **Delta** - except in trace points rather than X Axis Scale units. The entered value is immediately translated into the current X Axis Scale units for setting the value of the marker.

Remote Command	:CALCulate:OBWidth:MARKer[1]|2|...|12:X:POSition <real> :CALCulate:OBWidth:MARKer[1]|2|...|12:X:POSition?
Example	:CALC:OBW:MARK10:X:POS 0 :CALC:OBW:MARK10:X:POS?
Notes	The query returns the marker's absolute X Axis value in trace points if the control mode is **Normal**, or the offset from the marker's reference marker in trace points if the control mode is **Delta**. The value is returned as a real number, not an integer, corresponding to the translation from X Axis Scale units to trace points . When a Marker is turned on, it is placed center of the screen on the trace. Therefore the default value depends on instrument condition. If the marker is Off the response is Not A Number
Preset	After a preset, all markers are turned OFF, so Marker X Axis Value query returns a Not A Number (NAN)
State Saved	Saved in instrument state
Min	-9.9E+37
Max	9.9E+37

Marker Y Axis Value (Remote Command only)

Returns the marker Y Axis value in the current marker Y Axis unit.

Remote Command	:CALCulate:OBWidth:MARKer[1]|2|...|12:Y?
Example	:CALC:OBW:MARK11:Y?
Notes	The query returns the marker Y-axis result, if the control mode is **Normal** or **Delta.** If the marker is **Off** the response is Not A Number
Preset	Result dependent on Markers setup and signal source
State Saved	No
Backwards Compatibility SCPI	:CALCulate:OBWidth:MARKer[1]|2|...|12:FUNCtion:RESult?

Marker Mode

Sets the marker control mode to **Normal**, **Delta**, or **Off**. All interactions and dependencies detailed under the control description are enforced when the remote command is sent. If the selected marker is Off, pressing Marker sets it to Normal and places it at the center of the screen on the trace determined by the **Marker Trace** rules. At the same time, **Marker X Axis Value** appears on the Active Function area.

The default active function is the active function for the currently selected marker control mode. If the current control mode is Off, there is no active function and the active function is turned off.

Remote Command	`:CALCulate:OBWidth:MARKer[1]|2|...|12:MODE POSition | DELTa | OFF` `:CALCulate:OBWidth:MARKer[1]|2|...|12:MODE?`
Example	`:CALC:OBW:MARK:MODE POS` `:CALC:OBW:MARK:MODE?`
Preset	`OFF`
State Saved	Saved in instrument state
Range	`POSition|DELTa|OFF`
Annotation	Mkr # <X value> and <Marker value> upper right on graph When Marker Trace is Polar in WCDMA mode: Mkr # <Chip Value (RHO & QPSKEVM)/Symbol Value (CDP)>, <X value> and <Y value> upper right on graph

Backward Compatibility SCPI Command

Sets or queries the state of a marker. Setting a marker which is OFF to state ON or 1 puts it in **Normal** mode and places it at the center of the screen.

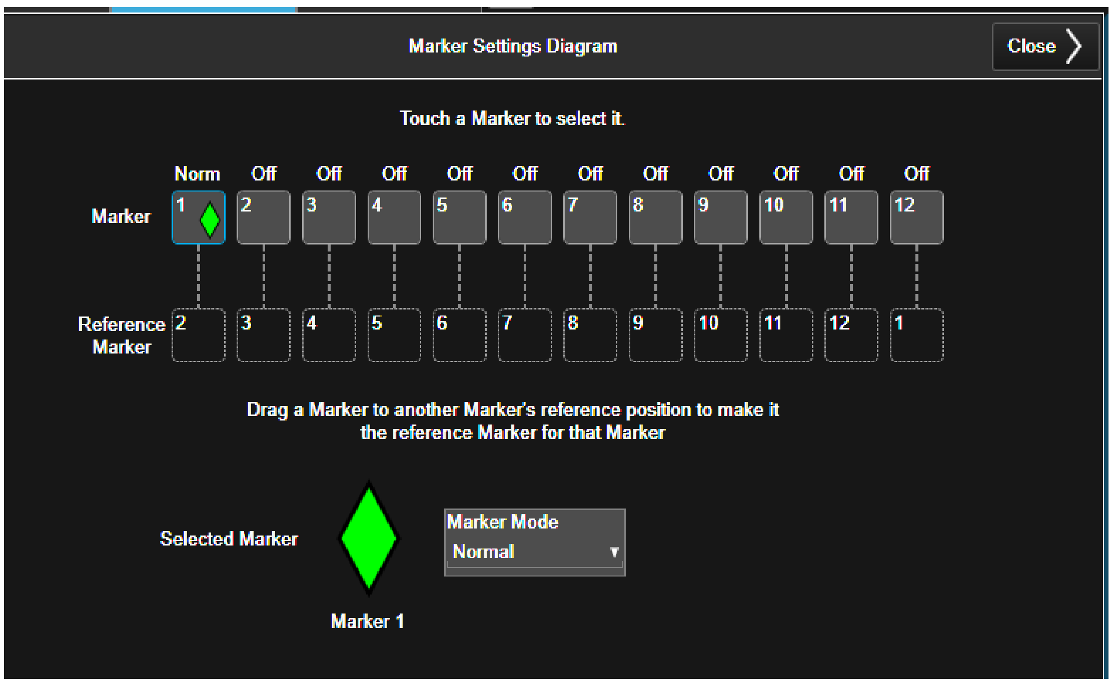
Remote Command	`:CALCulate:OBWidth:MARKer[1]|2|...|12:STATe OFF | ON | 0 | 1` `:CALCulate:OBWidth:MARKer[1]|2|...|12:STATe?`
Example	`:CALC:OBW:MARK3:STAT ON` `:CALC:OBW:MARK3:STAT?`
Preset	`OFF`
State Saved	Saved in instrument state
Range	`OFF|ON`

Delta Marker (Reset Delta)

Pressing this button is exactly the same as pressing the “Delta” selection on the Marker Mode radio button. The selected marker becomes a Delta Marker. If the selected marker is already a Delta marker, the reference marker is moved to the current position of the selected marker, thus resetting the Delta to zero.

Marker Settings Diagram

The Marker Settings Diagram lets you configure the Marker system using a visual utility.



All Markers Off

Turns off all markers.

Remote Command	`:CALCulate:OBWidth:MARKer:AOFF`
Example	`:CALC:OBW:MARK:AOFF`

3.8.7.3 Peak Search

The controls on the Peak Search tab allow you to move the marker to selected peaks of the signal, giving you enormous analysis capabilities, particularly when combined with the Delta Marker function.

NOTE

Pressing the **Peak Search** hardkey automatically moves you to the **Peak Search** page of the **Marker** menu *and* performs a Peak Search.

Pressing the **Peak Search** tab once you are already *in* the **Marker** menu does *not* perform a Peak Search.

Marker Frequency

The Marker Frequency control is the fundamental control that you use to move a marker around on the trace. This is the same as the Marker Frequency control on the Settings tab.

Peak Search

Pressing the **Peak Search** control moves the selected marker to the trace point which has the maximum y-axis value for that marker's trace.

NOTE	Pressing the **Peak Search** hardkey automatically moves you to the **Peak Search** page of the **Marker** menu *and* performs a Peak Search.

Remote Command	`:CALCulate:OBWidth:MARKer[1]|2|...|12:MAXimum`

Example	`:CALC:OBW:MARK2:MAX`
	`:SYST:ERR?`
	can be used to query the errors to determine if a peak is found. The message "No peak found" (-200) will be returned after an unsuccessful search

Notes	Sending this command selects the subopcoded marker In the WCDMA mode, this command does not work when the selected marker is located on the polar trace. In this case, the command is ignored

Marker Delta

Pressing this button is exactly the same as pressing the "Delta" selection on the Marker Mode radio button on the Settings tab. The selected marker becomes a Delta Marker. If the selected marker is already a Delta marker, the reference marker is moved to the current position of the selected marker, thus resetting the Delta to zero.

The control is duplicated here in the Peak Search Menu to allow you to conveniently perform a peak search and change the marker's control mode to Delta without having to access two separate menus.

3.8.7.4 Properties

The controls on the Properties tab are used to set certain properties of the selected marker.

Marker Frequency

The Marker Frequency control is the fundamental control that you use to move a marker around on the trace. This is the same as the Marker Frequency control on the Settings tab.

Relative To

Selects the marker to which the selected marker is relative (its reference marker).

Every marker has another marker to which it is relative. This marker is referred to as the “reference marker” for that marker. This attribute is set by the **Marker, Properties, Relative To** key. The marker must be a **Delta** marker to make this attribute relevant. If it is a **Delta** marker, the reference marker determines how the marker is controlled and how its value is displayed. A marker cannot be relative to itself.

Remote Command	`:CALCulate:OBWidth:MARKer[1]|2|...|12:REFerence <integer>` `:CALCulate:OBWidth:MARKer[1]|2|...|12:REFerence?`
Example	`:CALC:OBW:MARK:REF 2` `:CALC:OBW:MARK:REF?`
Notes	This command causes the marker specified with the subopcode to become selected Range (for SCPI command): 1 to 12. If the range is exceeded the value is clipped A marker cannot be relative to itself so that choice is not available, and if sent from SCPI generates error -221: “Settings conflict; marker cannot be relative to itself” When queried a single value is returned (the specified marker numbers relative marker)
Couplings	The act of specifying the selected marker’s reference marker makes the selected marker a Delta marker If the reference marker is off it is turned on in **Normal** mode at the delta marker location
Preset	The preset default “Relative To” marker (reference marker) is the next higher numbered marker (current marker +1). For example, if marker 2 is selected, then it’s default reference marker is marker 3. The exception is marker 12, which has a default reference of marker 1 Set to the defaults by using **Restore Mode Defaults.** This is not reset by **Marker Off**, **All Markers Off**, or **Preset**
State Saved	Saved in instrument state. Not affected by Marker Off and hence not affected by Preset or power cycle
Min	1
Max	12
Annunciation	Appears in the marker label of a **Delta** marker

Marker Trace

Selects the trace on which you want your marker placed. A marker is associated with one and only one trace. This trace is used to determine the placement, result, and X-Axis Scale of the marker. All markers have an associated trace; it is from that trace that they determine their attributes and behaviors, and it is to that trace that they go when they become Normal or Delta markers.

Specifying a Marker Trace manually or with this command associates the marker with the specified trace. If the marker is not OFF, it moves the marker from the trace it was on to the new trace. If the marker is OFF it stays off but is now associated with the specified trace.

The query returns the number of the trace on which the marker is currently placed.

Remote Command	`:CALCulate:OBWidth:MARKer[1]|2|...|12:TRACe 1 | 2 | 3` `:CALCulate:OBWidth:MARKer[1]|2|...|12:TRACe?`
Example	`:CALC:OBW:MARK2:TRAC 2` `:CALC:OBW:MARK2:TRAC?`
Notes	A marker may be placed on a blanked and/or inactive trace, even though the trace is not visible and/or updating An application may register a trace name to be displayed on the control instead of a trace number
Couplings	The state of **Marker Trace** is not affected by the "Auto Couple" on page 1718 key Sending the remote command causes the addressed marker to become selected.
Preset	1
State Saved	Saved in instrument state
Min	1
Max	3

Marker Settings Diagram

The **Marker Settings Diagram** lets you configure the Marker system using a visual utility. This is the same as the"Marker Settings Diagram" on page 1011 control on the **Settings** tab.

3.8.8 Meas Setup

The Meas Setup menu panel contains functions for setting up the measurement parameters and also contains functions for setting up parameters global to all measurements in the mode.

3.8.8.1 Settings

The Settings tab contains frequently used Meas Setup functions to which you will want the fastest access.

Avg/Hold Num

Specifies the number of measurement averages used when calculating the measurement result. The average is displayed at the end of each sweep.

Initiates an averaging routine that averages the sweep points in a number of successive sweeps, resulting in trace smoothing.

After the specified number of average counts, the average mode (termination control) setting determines the average action.

Remote Command	`[:SENSe]:OBWidth:AVERage:COUNt <integer>` `[:SENSe]:OBWidth:AVERage:COUNt?`
Example	`:OBW:AVER:COUN 1500` `:OBW:AVER:COUN?`
Preset	10
State Saved	Yes
Min/Max	1/10000
Annotation	The average count is displayed in the measurement bar on the front panel display. The annotation appears in the format n/N where n is the current average and N is the average count
Backwards Compatibility SCPI	`[:SENSe]:EBWidth:AVERage:COUNt`

Averaging On/Off

Turns averaging on or off.

NOTE In this measurement, the **Average Type** is preset to the `Log-Pwr Avg (Video)` method. Other averaging methods are not available.

Remote Command	`[:SENSe]:OBWidth:AVERage[:STATe] ON | OFF | 1 | 0` `[:SENSe]:OBWidth:AVERage[:STATe]?`
Example	`:OBW:AVER ON` `:OBW:AVER?`
Couplings	Averaging state is coupled to "Max Hold (Remote Command Only)" on page 1021. If **Max Hold** is changed from `OFF` to `ON`, Averaging state is automatically set to `ON`
Preset	`ON`
State Saved	Yes
Range	`ON|OFF`
Backwards Compatibility SCPI	`[:SENSe]:EBWidth:AVERage[:STATe]`

Average Mode

Enables you to set the averaging mode.

- When set to EXPonential the measurement averaging continues using the specified number of averages to compute each averaged value. The average is displayed at the end of each sweep
- When set to REPeat, the measurement resets the average counter each time the specified number of averages is reached

Remote Command	[:SENSe]:OBWidth:AVERage:TCONtrol EXPonential | REPeat [:SENSe]:OBWidth:AVERage:TCONtrol?
Example	:OBW:AVER:TCON REP :OBW:AVER:TCON?
Preset	EXP
State Saved	Yes
Range	EXPonential|REPeat

% of OBW Power

Assigns the percentage of the total power that is measured within the Occupied Bandwidth for the current measurement. The resulting Occupied Bandwidth limits are displayed by markers placed on the frequencies of the specified percentage.

Remote Command	[:SENSe]:OBWidth:PERCent <real> [:SENSe]:OBWidth:PERCent?
Example	:OBW:PERC 75 :OBW:PERC?
Preset	99.00
State Saved	Yes
Min/Max	10/99.99

Power Ref

This control enables you to select Power Ref Type:

- Total Power – Total power in the current span is displayed
- OBW Power – With the OBW percent power, occupied power is displayed

When Power Ref type is changed, the annotation in the lower window and Remote Command SCPI Results also change.

Remote Command	`[:SENSe]:OBWidth:PREFerence TPOWer | OBWPower` `[:SENSe]:OBWidth:PREFerence?`
Example	`:OBW:PREF TPOW` `:OBW:PREF?`
Preset	`TPOWer`
State Saved	Saved in instrument state
Range	`TPOWer|OBWPower`

x dB

Sets the x dB value used for the "x dB bandwidth" result that measures the bandwidth between two points on the signal which is x dB down from the highest signal point within the OBW Span.

Remote Command	`[:SENSe]:OBWidth:XDB <rel_ampl>` `[:SENSe]:OBWidth:XDB?`
Example	`:OBW:XDB -20` `:OBW:XDB?`
Preset	-26.0 dB Unless noted below BT: -20.0 dB
State Saved	Yes
Min/Max	-100.0 dB/-0.1 dB
Backwards Compatibility SCPI	`[:SENSe]:EBWidth:XDB`

Power Integration Method

Selects the power integration method:

– Normal - By integrating the linear power bucket values from the lower edge of the trace, and interpolating to find the point where the integrated power equals (1 – [Occ BW % Pwr]) / 2 (0.5% if, for example, the 99% occupied bandwidth is to be found) of the total power, frequency f1 is obtained. This procedure is repeated from the upper trace edge to find frequency f2. This calculation uses linear interpolation to find the lower and upper carrier boundary point within the width of a sweep point (the span divided by the number of sweep points), f1 and f2

– From Center - Measures the power spectrum distribution within two times or more frequency range over the requirement for Occupied Bandwidth specification centering on the current carrier frequency

Remote Command	`[:SENSe]:OBWidth:INTegration[:METHod] NORMal | ICENter` `[:SENSe]:OBWidth:INTegration[:METHod]?`

Example	:OBW:INT NORM :OBW:INT?
Preset	NORMal unless noted below For 5GNR, Uplink: ICENter
State Saved	Yes
Range	NORMal|ICENter

Spur Avoidance

Because the VXT models M9410A/11A/15A are direct-conversion (zero-IF) receivers, feedthrough leakage from the local oscillator appears as a spurious signal (spur) at the center frequency. The **Spur Avoidance** function is provided to eliminate this spur, at the expense of some measurement speed.

When **Spur Avoidance** is enabled (the default), the instrument uses a software algorithm to remove this spur from the displayed measurement data, but the algorithm only operates under certain conditions. Specifically, it only operates in the multiple capture case.

You can disable this function to speed up your measurement by setting Spur Avoidance to “Disabled.”

Note that when Spur Avoidance is not in effect, either because you have disabled it or because you are not in multiple capture, the following warning message will appear in the status bar:

`Settings Alert;Spur Avoidance Off`

This is to alert you that measurement accuracy might be impacted by the fact that Spur Avoidance is not in effect.

Remote Command	[:SENSe]:OBWidth:SAVoid[:STATe] OFF | ON | 0 | 1 [:SENSe]:OBWidth:SAVoid[:STATe]?
Example	:OBW:SAV ON :OBW:SAV?
Dependencies	This control only appears in VXT models M9410A/11A/15A
Preset	OFF
State Saved	Saved in instrument state
Range	OFF|ON

Meas Setup Summary Table

The Meas Setup Summary Table lets you view and access many of the parameters in the Meas Setup menus on one screen.

Auto Couple

Immediately puts all Auto/Man functions into Auto. The **Auto Couple** action is confined to the current measurement only. It does not affect other measurements in the mode.

In the Auto state, Auto/Man functions are said to be “coupled”, meaning their values change as you make changes to other values in the measurement. This helps ensure accurate measurements and optimum dynamic range. Auto Couple is an immediate action function, and when it is executed, all the Auto/Man controls for the current measurement are set to Auto, and all measurement settings coupled to the Auto/Man parameters are automatically set to their optimal value.

For further details of measurement-specific settings (if any), see "Measurement-Specific Details" on page 1020 below.

Remote Command	`:COUPle ALL`
Example	`:COUP ALL`
Backwards Compatibility SCPI	`:COUPLE ALL | NONE`
Backwards Compatibility Notes	`:COUP:NONE` puts all Auto/Man parameters in manual mode, decoupling all the coupled instrument parameters. It is retained for backwards compatibility and is *not* recommended for making measurements or new designs

All Auto/Man parameter couplings in the measurement are set to Auto. This includes couplings that may be unavailable or grayed-out due to the current state. For example, in the Swept SA measurement, there is no Auto/Man coupling for RBW while in Zero Span. Nonetheless, if **Auto Couple** were executed while in Zero Span it would set RBW to Auto "behind the scenes" so that, on exit from Zero Span, it would be in Auto.

Any Auto/Man selection specific (local) to the other measurements in the current Mode will not be affected by **Auto Couple**. Any functions that are *not* coupled with other instrument parameters, such as ranging or leveling variables, such as "AutoRange" or "AutoScale", will not be affected.

Executing the **Auto Couple** command generates the informational message, "All Auto/Man functions have been set to Auto".

Each parameter, upon being set to Auto, selects and sets the appropriate auto-coupled value based on that parameter’s coupling rules. The Dependency Resolver orchestrates the couplings for parameters that are dependent on one or more other parameters. The coupling and dependency rules for each parameter are defined in the chapter describing that parameter.

Executing the **Auto Couple** command *does not* affect markers, marker functions, trace or display attributes, or any other instrument setting other than those specifically mentioned above.

Measurement-Specific Details

TOI

Parameters affected by Auto Couple are:

- Center Frequency Step
- Resolution Bandwidth
- Span/RBW Ratio
- Sweep Time
- Video BandwidthVBW/RBW ratio
- Upper and Lower Tone (set to Sense
-)Zero span measurement Resolution Bandwidth
- Zero span measurement Dwell Time

Harmonics

For Harmonics, these parameters are:

- Resolution Bandwidth
- Fundamental Frequency
- Dwell Time
- Range Table Resolution Bandwidths
- Range Table Dwell Times

Meas Preset

Restores all measurement parameters to their default values.

Remote Command	`:CONFigure:OBWidth`
Example	`:CONF:OBW`

Max Hold (Remote Command Only)

When ON, Max Hold displays and holds the maximum responses of the current measurement. Turn Max Hold OFF to disable the maximum hold feature.

Remote Command	[:SENSe]:OBWidth:MAXHold ON | OFF | 1 | 0 [:SENSe]:OBWidth:MAXHold?
Example	:OBW:MAXH ON :OBW:MAXH?
Couplings	Max Hold is coupled to Average/Hold state. The Max Hold function is activated only if Average state is On. If Max Hold is changed to On when Average state is Off, Average state is automatically set to On
Preset	OFF
State Saved	Yes
Range	OFF|ON
Backwards Compatibility SCPI	[:SENSe]:EBWidth:MAXHold

3.8.8.2 Radio

The Radio tab contains controls to select the Radio Device, and enable or disable HSPA/HSPA+ options.

Radio Device

Allows you to specify the device to be used.

Remote Command	[:SENSe]:RADio:STANdard:DEVice BTS | MS [:SENSe]:RADio:STANdard:DEVice?
Example	:RAD:STAN:DEV MS :RAD:STAN:DEV?
Preset	BTS
State Saved	Saved in instrument state.
Range	BTS | MS
Backwards Compatibility SCPI	[:SENSe]:RADio:DEVice

HSPA Enable

Allows you to turn on or off the HSDPA/HSUPA option enable. This selection is necessary because some of the auto detection functions that expect an HSPA signal are less tolerant when the signal is noisy or distorted. When the HSPA signal is not expected, turn HSPA Enable off.

Remote Command	`[:SENSe]:RADio:CONFigure:HSDPa[:STATe] 0 | 1 | OFF | ON` `[:SENSe]:RADio:CONFigure:HSDPa[:STATe]?`
Example	`:RAD:CONF:HSDP 0` `:RAD:CONF:HSDP?`
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

HSPA+ Enable

Allows you to turn on or off the HSPA+ option enable. This selection is necessary because some of the auto detection functions that expect an HSPA+ signal are less tolerant when the signal is noisy or distorted. When the HSPA+ signal is not expected, turn HSPA+ Enable off.

Remote Command	`[:SENSe]:RADio:CONFigure:EHSPa[:STATe] OFF | ON | 0 | 1` `[:SENSe]:RADio:CONFigure:EHSPa[:STATe]?`
Example	`:RAD:CONF:EHSP 0` `:RAD:CONF:EHSP?`
Notes	When HSPA enable is OFF, HSPA+ function is disabled too.
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

3.8.8.3 Limits

The Limits tab lets you set measurement Limits and be alerted when they have been exceeded.

3.8.8.4 Advanced

The Advanced tab contains controls for setting advanced functions of the instrument.

– This tab does not appear in EXM or VXT

– This tab does not appear in the M9393A or M9391A

Noise Floor Extension

Allows you to turn on/configure the Noise Floor Extension (NFE) function. Some Modes (such as Spectrum Analyzer Mode), support two states of NFE, Full and Adaptive. The ON state (in Modes which do not support Adaptive NFE) matches the FULL state (in Modes which DO support Adaptive NFE).

In ON or FULL NFE, the expected noise power of the instrument (derived from a factory calibration) is subtracted from the trace data. This will usually reduce the apparent noise level by about 10 dB in low band, and 8 dB in high band (>~3.6 GHz).

In Adaptive NFE, there is not the same dramatic visual impact on the noise floor as there is in Full NFE. Adaptive NFE controls the amount of correction that is applied based on other instrument settings like RBW, averaging and sweep time. Adaptive NFE controls the degree of potential improvement in the noise floor to give more improvement for those instrument settings that can make good use of the potential improvement, such as settings that provide more averaging. The result is that when not much averaging is being performed, the signal displays more like the NFE-off case; and when lots of averaging is being performed, the signal displays more like the full-NFE case.

Adaptive NFE (in Modes which support it) is recommended for general-purpose use. For fully ATE (automatic test equipment) applications, where the distraction of a person using the instrument is not a risk, Full NFE is recommended.

NFE works with any RBW, VBW, detector, any setting of Average Type, any amount of trace averaging, and any signal type. It is ineffective when the trace is not smoothed (smoothing processes include narrow VBWs, trace averaging, and long sweep times with the detector set to Average or Peak). It works best with extreme amounts of smoothing, and with the average detector, with the Average Type set to Power.

In those cases where the cancellation is ineffective, it nonetheless has no undesirable side-effects. There is no significant speed impact to having Noise Floor Extension on.

The best accuracy is achieved when substantial smoothing occurs in each point before trace averaging. Thus, when using the average detector, results are better with long sweep times and fewer trace averages. When using the sample detector, the VBW filter should be set narrow with less trace averaging, instead of a wide VBW filter with more trace averaging.

NOTE	Noise Floor Extensions has no effect unless the RF Input is selected, therefore it does nothing when External Mixing is selected. In Modes that support Adaptive NFE, the default state of NFE is Adaptive. In Modes that do not support Adaptive NFE, the default state of NFE is OFF. Prior to the introduction of Adaptive NFE (firmware version A.18.00), the default state of NFE was OFF for all Modes.

With the introduction of Adaptive NFE, the menu control is changed from On|Off to Full|Adaptive|Off. For SCPI Backwards Compatibility, the existing SCPI command to turn NFE on and off was retained, and a new command was added to set the state to turn Adaptive On and Off

`[:SENSe]:CORRection:NOISe:FLOor ON|OFF|1|0` is retained, default changed to On for modes which support Adaptive NFE

`[:SENSe]:CORRection:NOISe:FLOor:ADAPtive ON|OFF|1|0` is added (for certain Modes), default=On

FULL = `:CORRection:NOISe:FLOor ON` plus `:CORRection:NOISe:FLOor:ADAPtive ON`

Remote Command	`[:SENSe]:CORRection:NOISe:FLOor ON | OFF | 1 | 0` `[:SENSe]:CORRection:NOISe:FLOor?`
Example	`:CORR:NOIS:FLO ON`
Dependencies	This control only appears in instruments with the NFE or NF2 license installed. In all others, the control does not appear, however the SCPI command will be accepted without error (but will have no effect)
Couplings	When NFE is enabled in any mode manually, a prompt will be displayed reminding you to perform the Characterize Noise Floor operation if it is needed. If NFE is enabled through SCPI and a Characterize Noise Floor operation is needed, an error will be entered in the system error queue
Preset	Unaffected by Mode Preset. Turned ON at startup and by Restore Mode Defaults in Modes which support Adaptive. Turned OFF at startup and by Restore Mode Defaults in Modes which do not support Adaptive
State Saved	No

Remote Command	`[:SENSe]:CORRection:NOISe:FLOor:ADAptive ON | OFF | 1 | 0` `[:SENSe]:CORRection:NOISe:FLOor:ADAptive?`

Example	First turn NFE on, this is Full mode
	`:CORR:NOIS:FLO ON`
	Then set it to Adaptive
	`:CORR:NOIS:FLO:ADAP ON`

Dependencies	Only available in Modes that support Adaptive NFE Only appears in instruments with the NFE or NF2 license installed. In all others, the control does not appear, however the SCPI command will be accepted without error (but will have no effect)

Couplings	Sending :CORR:NOIS:FLO ON turns NFE Adaptive OFF for backwards compatibility. So to turn Adaptive on, you must issue the commands in the proper order, as shown in the example above
Preset	Not affected by Mode Preset, but set to ON at startup and by Restore Mode Defaults
State Saved	No

More Information

The instrument is characterized in the factory (or during a field calibration) with a model of the noise, referred to the input mixer, versus frequency in each band and path combination. Bands are 0 (low band) and 1 through 4 (high band) in a 26.5 GHz instrument, for example. Paths include normal paths, preamp paths, the electronic attenuator, etc.

In most band/path combinations, the noise can be well characterized based on just two parameters and the instrument frequency response before compensation for frequency-dependent losses.

After the noise density at the input mixer is estimated, the effects of the input attenuator, RBW, detector, etc. are computed to get the estimated input-port-referred noise level.

In the simplest case, the measured power (signal plus analyzer noise) in each display point (bucket) is compensated by subtracting the estimated noise power, leaving just the signal power. This is the operation when the detector is Average and the Average Type is set to Power.

In other cases, operation is often not quite as good but still highly effective. With peak detection, the noise floor is estimated based on the RBW and the duration of the bucket using the same equations used in the noise marker function. The voltage of the noise is subtracted from the voltage of the observed signal-plus-noise measurement to compute the estimated signal voltage. The peak detector is one example of processing that varies with detector to give good estimates of the signal level without the analyzer noise.

For best operation, the average detector and the power scale are recommended, as already stated. Peak detection for pulsed-RF can still give excellent effectiveness. FFT analysis does not work well, and does not do NFE well, with pulsed-RF signals, so this combination is not recommended. Negative peak detection is not very useful, either. Sample detection works well, but is never better than the average detector because it doesn’t smooth as well. The Normal detector is a combination of peak and negative peak behaviors, and works about as well as these.

For best operation, extreme smoothing is desirable, as already stated. Using narrow VBWs works well, but using very long bucket durations and the average detector works best. Reducing the number of trace points will make the buckets longer.

For best operation, the power scale (Average Type = Power) is optimum. When making CW measurements in the presence of noise without NFE, averaging on the decibel scale has the advantage of reducing the effect of noise. When using NFE, the NFE does an even better job than using the log scale ever could. Using NFE with the log scale is not synergistic, though; NFE with the power scale works a little better than NFE with log averaging type.

The results from NFE with internal preamp can often be lower than the theoretical noise in a signal source at room temperature, a noise density of -174 dBm/Hz. This is expected and useful behavior, because NFE is designed to report the amount of input signal that is in excess of the thermal noise, not the amount that includes the thermal noise. This can be a useful behavior because thermal noise often interferes with what you want to measure, instead of being part of what you want to measure. Note that NFE is not adequately accurate to always be able to read below kTB.

Adaptive NFE provides an alternative to fully-on and -off NFE. Fully-on NFE can, notably in cases with little or no averaging of the spectrum, result in a display that is distractingly unfamiliar in the variability in response to low level signals. Fully-off NFE fails to achieve the potential improvement in dynamic range and associated accuracy of measurement of low level signals. Adaptive NFE controls the degree of potential improvement in the noise floor to give more improvement for those instrument settings that can make good use of the potential improvement—those settings with high degrees of variance reduction through some variant of averaging. When the potential improvement is small, the display acts like the NFE-off case, and when it is high, it acts like the fully-on case, and in-between, application is a compromise between attractiveness and effectiveness.

On instruments with the NF2 license installed, the calibrated Noise Floor used by Noise Floor Extensions should be refreshed periodically. Keysight recommends that the **Characterize Noise Floor** operation be performed after the first 500 hours of operation, and once every calendar year. The control to perform this is located in the **System, Alignments, Advanced** menu. If you have not done this yourself at the recommended interval, then when you turn on Noise Floor Extensions, the instrument will prompt you to do so with a dialog that says:

“This action will take several minutes to perform. Please disconnect all cables from the RF input and press Enter to proceed. Press ESC to cancel, or Postpone to postpone for a week”

If you Cancel, you will be prompted again the next time you turn NFE on. If you postpone, you will be prompted again after a week passes and you then turn NFE on.

IF Gain

The IF Gain control can be used to set the IF Gain function to Auto, Low Gain or High Gain. These settings affect sensitivity and IF overloads.

This only applies to the RF input. It does not apply to baseband I/Q input.

Remote Command	`[:SENSe]:OBWidth:IF:GAIN[:STATe] ON | OFF | 1 | 0`
	`[:SENSe]:OBWidth:IF:GAIN[:STATe]?`
	`[:SENSe]:OBWidth:IF:GAIN:AUTO[:STATe] ON | OFF | 1 | 0`

	[:SENSe]:OBWidth:IF:GAIN:AUTO[:STATe]?
Example	:OBW:IF:GAIN ON :OBW:IF:GAIN? :OBW:IF:GAIN:AUTO OFF :OBW:IF:GAIN:AUTO?
Notes	ON = high gain OFF = low gain
Dependencies	The IF Gain control has no effect when the U7227A USB Preamplifier is connected. This is not annotated or reflected on any control; there are no controls grayed out nor any SCPI locked out. The instrument simply behaves as though both IF Gain is set to Low regardless of the setting on the control This control is not available in VXT, EXM, or UXM This control is not available in the E7760, M9393A or M9391A
Couplings	Auto sets IF Gain to High Gain under any of the following conditions: – the input attenuator is set to 0 dB – or the preamp is turned on and the frequency range is under 3.6 GHz For other conditions, Auto sets IF Gain to Low Gain
Preset	OFF OFF
State Saved	Saved in instrument state
Range	Low Gain|High Gain

3.8.8.5 Global

The controls in this menu apply to all Modes in the instrument.

Some controls (for example, **Global Center Freq**) allow you to switch certain Meas Global parameters to a Mode Global state. These switches apply to all Modes that support global settings. For example, no matter what Mode you are in when you set **Global Center Freq** to ON, it applies to all Modes that support Global Settings.

Other controls (for example, **Extend Low Band**) are actually set in this menu, but apply to all Modes.

Global Center Freq

The software maintains a Mode Global value called **Global Center Freq**.

When **Global Center Freq** is switched ON, the current Mode's center frequency is copied into the **Global Center Frequency**, and from then on all Modes that support global settings use the **Global Center Frequency**, so you can switch between any of these Modes and the Center Freq will remain unchanged.

Adjusting the Center Freq of any Mode that supports Global Settings, while **Global Center Freq** is ON, modifies the Global Center Frequency.

When **Global Center Freq** is switched OFF, the Center Freq of the current Mode is unchanged, but now the Center Freq of each Mode is once again independent.

When **Mode Preset** is pressed while **Global Center Freq** is ON, the Global Center Freq is preset to the preset Center Freq of the current Mode.

This function is reset to OFF when "Restore Defaults" on page 1737 (in this tab) is pressed, or when **System**, **Restore Defaults**, **All Modes** is pressed.

Remote Command	:INSTrument:COUPle:FREQuency:CENTer ALL | NONE :INSTrument:COUPle:FREQuency:CENTer?
Example	:INST:COUP:FREQ:CENT ALL :INST:COUP:FREQ:CENT?
Preset	Set to OFF on **Global** Settings, **Restore Defaults** and **System, Restore Defaults, All Modes**
Range	ALL|NONE

Preset	OFF
Backwards Compatibility SCPI	:GLOBal:FREQuency:CENTer[:STATe] 1 | 0 | ON | OFF :GLOBal:FREQuency:CENTer[:STATe]?

Global EMC Std

When this control is switched ON, the current Mode's EMC Std is copied into the **Global EMC Std**, and from then on all Modes that support global settings use the Global EMC Std, so you can switch between any of these Modes and the EMC Std will remain unchanged.

Adjusting the EMC Std of any Mode that supports Global Settings, while Global EMC Std is ON, will modify the **Global EMC Std**.

When **Global EMC Std** is switched OFF, the EMC Std of the current Mode is unchanged, but now the EMC Std of each Mode is once again independent. When **Mode Preset** is pressed while **Global EMC Std** is ON, the Global EMC Std is preset to the preset EMC Std of the current Mode.

This function is reset to OFF when "Restore Defaults" on page 1737 (in this tab) is pressed, or when **System, Restore Defaults, All Modes** is pressed.

Remote Command	:INSTrument:COUPle:EMC:STANdard ALL | NONE :INSTrument:COUPle:EMC:STANdard?
Example	:INST:COUP:EMC:STAN ALL :INST:COUP:EMC:STAN?

Dependencies	Only available if option EMC is installed
Preset	Set to OFF on **Global** Settings, **Restore Defaults** and **System, Restore Defaults, All Modes**
Range	ALL|NONE

Extend Low Band

The software maintains a Mode Global value called **Extend Low Band**.

Under the current sweep configuration crossing over two bands, when **Extend Low Band** is turned ON, the instrument checks whether one band can cover the whole sweep frequency range or not. If it can, then the instrument locks the band; otherwise, it does nothing (the band crossover occurs).

This function does *not* work when **Band Lock** under **System** > **Service** > **Lock Functions** is not -1 (no Band Lock). In that case, **Band Lock** takes priority over **Extend Low Band**.

This function is reset to OFF when "Restore Defaults" on page 1737 (in this tab) is pressed, or when **System**, **Restore Defaults**, **All Modes** is pressed.

This parameter is available for SA, RTSA, WCDMA, WIMAX OFDMA, LTEAFDD, LTEATDD Modes.

Remote Command	:INSTrument:COUPle:FREQuency:BAND:EXTend 0 | 1 | ON | OFF :INSTrument:COUPle:FREQuency:BAND:EXTend?
Example	:INST:COUP:FREQ:BAND:EXT 1 :INST:COUP:FREQ:BAND:EXT?
Dependencies	Only applies to UXA, PXA, MXA and EXA
Preset	Set to OFF by **Global** Settings > **Restore Defaults** and **System** > **Restore Defaults** > **All Modes**
Range	ON|OFF

Restore Defaults

Resets all of the functions in the **Global** Settings menu to OFF. This also occurs when **System**, **Restore Defaults**, **All Modes** is pressed.

Remote Command	:INSTrument:COUPle:DEFault
Example	:INST:COUP:DEF
Backwards Compatibility SCPI	:GLOBal:DEFault

3.8.9 Sweep

The Sweep key accesses controls that enable you configure and control the acquisition of data and the X-axis parameters of the instrument. These controls might include Sweep Time, Continuous/Single, Pause/Resume, X Scale and number of Points.

3.8.9.1 Sweep/Control

Contains controls for the Sweep and Control functions of the instrument, such as Sweep Time and Continuous/Single.

Sweep Time

Controls the time the instrument takes to sweep the current frequency span in swept measurements, displays the sweep time in swept measurements, and displays the equivalent Sweep Time in FFT measurements.

NOTE **In instruments without sweeping hardware this control may be labelled "Acquisition Time"**

When **Sweep Time** is in Auto, the instrument computes a time that will give accurate measurements based on other settings of the instrument, such as RBW and VBW.

You can choose a shorter sweep time to improve the measurement throughput (with some potential unspecified accuracy reduction), but the Meas Uncal indicator will come on if the sweep time you set is less than the calculated Auto Sweep time.

You can also select a longer sweep time, which can be useful (for example) for obtaining accurate insertion loss measurements on very narrowband filters.

NOTE **Significantly faster sweep times are available with Option FS1.**

NOTE **The Meas Uncal (measurement uncalibrated) warning is given in the Status Bar at the bottom of the screen when the manual Sweep time entered is faster than the time computed by the instrument's Sweep time equations, that is, the Auto Sweep Time. The instrument's computed Sweep time will give accurate measurements; if you sweep faster than this your measurements may be inaccurate. A Meas Uncal condition may be corrected by returning the Sweep Time to Auto; by entering a longer Sweep Time; or by choosing a wider RBW and/or VBW.**

Remote Command	`[:SENSe]:OBWidth:SWEep:TIME <time>`
	`[:SENSe]:OBWidth:SWEep:TIME?`
	`[:SENSe]:OBWidth:SWEep:TIME:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:OBWidth:SWEep:TIME:AUTO?`

Example	`:OBW:SWE:TIME 50 ms` `:OBW:SWE:TIME?`

	`:OBW:SWE:TIME:AUTO OFF` `:OBW:SWE:TIME:AUTO?`
Dependencies	In certain instruments without sweeping hardware, such as VXT models M9420A/21A, the Sweep Time control is grayed out, and the Auto/Man toggle disappears
Couplings	Sweep time is coupled to RBW when **Sweep Time** is set to Auto; in this case the sweep time is changed as the RBW changes, to maintain amplitude calibration Sweep Time is also coupled to the Video Bandwidth (VBW). As the VBW is changed, the sweep time (when set to Auto) is changed to maintain amplitude calibration. This occurs because of common hardware between the two circuits
Preset	Automatically Calculated unless noted below WCDMA: 32.6 ms `ON` unless noted below WCDMA Mode: `OFF`
State Saved	Saved in instrument state
Min	Typically: 1 ms
Max	In swept spans: 4000 s
Annotation	The sweep time is displayed in the lower-right corner of the screen. The number of points is displayed parenthetically, as Sweep 13.3 ms (1001 points) A "#" mark appears before "Sweep" in the annotation when it is switched from Auto to Manual coupling
Status Bits/OPC dependencies	Meas Uncal is Bit 0 in the STATus:QUEStionable:INTegrity:UNCalibrated register

Sweep/Measure

Allows you to toggle between Continuous and Single sweep or measurement operation. The Single/Continuous state is Meas Global, so the setting affects *all* measurements.

The front-panel key **Single/Cont** performs exactly the same function

NOTE	In the `WAVeform` measurement, this control only appears in the Meas Bar, and not in the **Sweep/Control** tab.

See "More Information" on page 1032

Remote Command	`:INITiate:CONTinuous OFF | ON | 0 | 1` `:INITiate:CONTinuous?`

Example	`:INIT:CONT 0`
	`:INIT:CONT OFF`
	puts instrument into Single measurement operation

	`:INIT:CONT 1`
	`:INIT:CONT ON`
	puts instrument into Continuous measurement operation

Preset	ON Note that `:SYST:PRES` sets `:INIT:CONT` to `ON` but `*RST` sets `:INIT:CONT` to `OFF`
State Saved	Saved in instrument state
Annunciation	The **Single/Continuous** icon in the Meas Bar changes depending on the setting: – A line with an arrow is Single – A loop with an arrow is Continuous

More Information

With **Avg/Hold Num** (in the **Meas Setup** menu) set to **Off** or set to **On** with a value of 1, a sweep is taken after the trigger condition is met; and the instrument continues to take new sweeps after the current sweep has completed and the trigger condition is again met. However, with **Avg/Hold Num** set to On with a value >1, multiple sweeps (data acquisitions) are taken for the measurement. The trigger condition must be met prior to each sweep. The sweep is not stopped when the average count k equals the number N set for Avg/Hold Num is reached, but the number k stops incrementing. A measurement average usually applies to all traces, marker results, and numeric results, but sometimes only applies to the numeric results.

If the instrument is in Single measurement, pressing the **Cont/Single** toggle control does not change k and does not cause the sweep to be reset; the only action is to put the instrument into Continuous measurement operation.

If it is already in Continuous sweep:

- the `:INIT:CONT 1` command has no effect
- the `:INIT:CONT 0` command will place the instrument in Single Sweep but will have no effect on the current sequence until k = N, at which point the current sequence will stop and the instrument will go to the idle state.

See "Restart" on page 1738 control description for details on the `:INIT:IMM` (Restart) function.

If you are already in Single sweep, the `:INIT:CONT OFF` command has no effect.

If you are already in Single Sweep, then pressing the **Cont/Single** toggle control in the middle of a sweep does not restart the sweep or sequence. Similarly, pressing the **Cont/Single** toggle control does not restart the sweep or sequence if the sweep is not in the idle state (for example, if you are taking a very slow sweep, or the instrument is waiting for a trigger). Even though pressing the **Cont/Single** toggle control in the middle of a sweep does *not* restart the sweep, sending `:INIT:IMM` *does* reset it.

Restart

The **Restart** function restarts the current sweep, or measurement, or set of averaged/held sweeps or measurements. In measurements that support pausing, if you are Paused, pressing **Restart** performs a **Resume**.

The Restart function is accessed in several ways:

- Pressing the **Restart** key
- Sending the remote command `:INIT:IMM`
- Sending the remote command `:INIT:REST`

See "More Information" on page 1033

Remote Command	`:INITiate[:IMMediate]` `:INITiate:RESTart`
Example	`:INIT:IMM` `:INIT:REST`
Notes	`:INIT:REST` and `:INIT:IMM` and the front-panel **Restart** key perform exactly the same function
Couplings	Resets average/hold count k For the first sweep, overwrites all active (update=on) traces with new current data For application modes, resets other parameters as required by the measurement
Status Bits/OPC dependencies	This is an Overlapped command The `:STATus:OPERation` register bits 0 through 8 are cleared The `:STATus:QUEStionable` register bit 9 (INTegrity sum) is cleared The `SWEEPING` bit is set The `MEASURING` bit is set
Backwards Compatibility Notes	For Spectrum Analysis mode in ESA and PSA, the **Restart** hardkey and the `:INIT:REST` command restart trace averages (displayed average count reset to 1) for a trace in **Clear Write**, but did not restart **Max Hold** and **Min Hold** In the X-Series, the **Restart** hardkey and the `:INIT:REST` command restart not only **Trace Average**, but **Max Hold** and **Min Hold** traces as well For wireless comms modes in ESA and PSA, the **Restart** hardkey and the `:INIT:REST` command restarted every measurement, including all traces and numeric results. There is no change to this operation

More Information

The **Restart** function first aborts the current sweep or measurement as quickly as possible. It then resets the sweep and trigger systems, sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is in the process of aligning when a Restart is executed, the alignment finishes before the restart function is performed.

Even when set for Single operation, multiple sweeps may be taken when **Restart** is pressed (for example, when averaging/holding is on). Thus when we say that Restart "restarts a measurement," depending on the current settings, we may mean:

- It restarts the current sweep
- It restarts the current measurement
- It restarts the current set of sweeps if any trace is in Trace Average, Max Hold or Min Hold
- It restarts the current set of measurements if Averaging, or Max Hold, or Min Hold is on for the measurement

With Average/Hold Number (in Meas Setup menu) set to 1, or Averaging off, or no trace in Trace Average or Hold, a single sweep is equivalent to a single measurement. A single sweep is taken after the trigger condition is met; and the instrument stops sweeping once that sweep has completed. However, with Average/Hold Number >1 and at least one trace set to Trace Average, Max Hold, or Min Hold (SA Measurement) or Averaging on (most other measurements), multiple sweeps/data acquisitions are taken for a single measurement. The trigger condition must be met prior to each sweep. The sweep is stopped when the average count k equals the number N set for Average/Hold Number. A measurement average usually applies to all traces, marker results, and numeric results, but sometimes only applies to the numeric results.

Once the full set of sweeps has been taken, the instrument will go to the idle state. To take one more sweep without resetting the average count, increment the average count by 1, by pressing the step up key while Average/Hold Number is the active function, or by sending the remote command `:CALC:AVER:TCON UP`.

Pause/Resume

Pauses a measurement after the current data acquisition is complete.

When a measurement is paused:

- The label on this control changes to **Resume**. Pressing **Resume** un-pauses the measurement.
- Pressing **Restart** also performs a **Resume**.

Remote Command	`:INITiate:PAUSe` `:INITiate:RESume`
Example	`:INIT:PAUS` `:INIT:RES`

Dependencies	Not displayed in Modes that do not support pausing
Couplings	When Averaging is On, if the measurement is paused no more updates will occur until either a Resume or Restart occurs If the measurement is resumed, the averaging continues to use the traces from before the Pause occurred and continues to use the traces from the point where the Resume occurred. This still provides real-time traces, but they will no longer be gap free In a view with a Waterfall window, when the measurement is paused, the Waterfall stops updating. When Resume is selected, the Waterfall will retain the existing traces and continue updating using traces from the point at which Resume was selected. The time stamp of the individual Waterfall traces will show the time from the beginning of the measurement the trace relates to, showing there was a gap in the Waterfall capture In Density view, when the measurement is paused, the Density Display stops updating. When the measurement is resumed, if Persistence is `ON`, the persistence fading will continue from the point when the measurement was paused If a Restart occurs, the average counter is reset and all results are discarded. The measurement begins again, using traces after the Restart occurred

Abort (Remote Command Only)

This command stops the current measurement. It aborts the current measurement as quickly as possible, resets the sweep and trigger systems, and puts the measurement into an "idle" state. If the instrument is in the process of aligning when `:ABORt` is sent, the alignment finishes before the abort function is performed, so `:ABORt` does *not* abort an alignment.

If the instrument is set for Continuous measurement, it sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is set for Single measurement, it remains in the "idle" state until an `:INIT:IMM` command is received.

Remote Command	`:ABORt`
Example	`:ABOR`
Notes	If `:INIT:CONT` is `ON`, then a new continuous measurement will start immediately, with sweep (data acquisition) occurring once the trigger condition has been met If `:INIT:CONT` is `OFF`, then `:INIT:IMM` is used to start a single measurement, with sweep (data acquisition) occurring once the trigger condition has been met
Dependencies	For continuous measurement, `:ABORt` is equivalent to the **Restart** key Not all measurements support the abort command
Status Bits/OPC dependencies	The `:STATus:OPERation` register bits 0 through 8 are cleared The `:STATus:QUEStionable` register bit 9 (INTegrity sum) is cleared Since all the bits that feed into OPC are cleared by `:ABORt`, the `:ABORt` will cause the *OPC query to return true

3.8.9.2 Sweep Config

This tab accesses controls that enable you to configure the Sweep and Control functions of the instrument, such as Sweep Rules.

Sweep Time Rules

Switches the instrument between normal and accuracy sweep states.

Setting **Auto Sweep Time** to **Accy** results in slower sweep times, usually about three times as long, but yields better amplitude accuracy for CW signals. The instrument amplitude accuracy specifications only apply when **Auto Sweep Time** is set to **Accy**.

Additional amplitude errors which occur when **Auto Sweep Time** is set to **Norm** are usually well under 0.1 dB, though this is not guaranteed. Because of the faster sweep times and still low errors, **Norm** is the preferred setting of **Auto Sweep Time**. **Auto Sweep Time** is set to **Norm** on a **Preset** or **Auto Couple**. This means that in the Preset or Auto Coupled state, instrument amplitude accuracy specifications do not apply.

Remote Command	`[:SENSe]:OBWidth:SWEep:TIME:AUTO:RULes NORMal | ACCuracy` `[:SENSe]:OBWidth:SWEep:TIME:AUTO:RULes?`
Example	`:OBW:SWE:TIME:AUTO:RUL NORM` `:OBW:SWE:TIME:AUTO:RUL?`
Dependencies	This control does not appear in Spectrum Analyzer Mode in VXT models M9420A/21A This control is not available in E7760
Couplings	Set to `NORMal` when **Auto Couple** is pressed or sent remotely
Preset	`NORMal`
State Saved	Saved in instrument state
Range	`NORMal|ACCuracy`

Points

Sets the number of points taken per sweep, and displayed in the traces. The current value of points is displayed parenthetically, next to the sweep time in the lower-right corner of the display. Using more points provides greater resolution. Using fewer points compacts the data and decreases the time required to access a trace over the remote interface.

Increasing the number of points does not increase the sweep time. However, it can slightly impact the trace processing time and therefore the overall measurement speed. Decreasing the number of points does not decrease the sweep time, but it may speed up the measurement, depending on the other sweep settings (for example, in FFT sweeps). Fewer points will always speed up the I/O.

Due to minimum sweep rate limitations of the hardware, the minimum sweep time available to the user will increase above its normal value of 1 ms as the number of sweep points increases above 15001.

Changing the number of sweep points has several effects on the instrument.Since markers are read at the point location, the marker reading may change.The sweep time resolution will change. Trace data for all the traces will be cleared and, if **Sweep** is in **Cont**, a new trace taken. If any trace is in average or hold, the averaging starts over.

Because of sweep time quantization issues, the knob and up/down keys cannot be used to adjust the number of points.

When in a split screen display each window may have its own value for points.

When sweep points is changed, an informational message "Sweep points changed, all traces cleared" is displayed and in the 5G NR mode, Auto Sweep Points is set to `OFF`(0).

Remote Command	`[:SENSe]:OBWidth:SWEep:POINts <integer>` `[:SENSe]:OBWidth:SWEep:POINts?`
Example	`:OBW:SWE:POIN 501` `:OBW:SWE:POIN?`
Dependencies	This function is not available when Signal ID is set to On in External Mixing Neither the knob nor the step keys can be used to change this value. If it is tried, a warning is given Not displayed in modes that do not support Swept
Couplings	Whenever the number of sweep points change: – All trace data is erased – Any traces with Update Off will also go to Display Off (like going from View to Blank in the older instruments) – Sweep time is re-quantized – Any limit lines that are on will be updated – If averaging/hold is on, averaging/hold starts over – Auto Sweep Points is set to OFF (5G NR only) The resolution of setting the sweep time depends on the number of points selected
Preset	1001 unless noted below LTE, LTETDD, MSR, LTEAFDD, LTEATDD: 2001 5GNR: 7001
State Saved	Saved in instrument state
Min	101
Max	100,001
Annotation	On second line of annotations, in lower right corner in parenthesis behind the sweep annotation

3.8.10 Trace

The **Trace** menu lets you control the acquisition, display, storage, detection and manipulation of trace data for the available traces. The Trace Control tab of this menu contains radio-button selections for the trace type (**Clear/Write, Trace Average, Max Hold, Min Hold**) and **View/Blank** setting for the selected trace.

3.8.10.1 Select Trace

Specifies the *selected trace*, which is the trace that will be affected when you change trace settings.

The **Select Trace** control appears above the menu panel, indicating that it applies to *all* controls in the menu panel. **Select Trace** is blanked if you select a tab whose controls do *not* depend on the selected trace (for example, **Trace Function**).

Notes	The selected trace is remembered even when not in the **Trace** menu
Preset	Trace 1
State Saved	Yes

3.8.10.2 Trace Control

The controls on the Trace Control tab allow you to set the type of the Trace and its update mode.

There are four Trace Types: **Clear/Write, Trace Average, Max Hold** and **Min Hold.** Each type handles data in a different way.

Each trace also has two values that determine whether it is being written or not and whether it is being displayed or not. These values, **Update** and **Display,** are described more fully in the "View/Blank" on page 1420 control description; when **Update** is `ON` a trace is updating and when **Update** is `OFF` it is not; and when **Display** is `ON` it is visible and when **Display** is `OFF` it is not. These terms are used throughout the descriptions below.

When Trace Annotation (see **Display** menu) is `ON`, each non-blanked trace is labeled on the trace with the detector used to take it.

For slower sweeps a visual indicator exists on the trace where the new data is being written, a green “caret” or ^ symbol, which moves across the bottom of the graticule showing the current trace point.

Trace Type

Allows you to select the type of trace you want to you use for the current measurement. There are four Trace Types:

Type	Option	Description
Clear Write	`WRITe`	Each trace update replaces the old data in the trace with new data
Trace Average	`AVERage`	The instrument maintains and displays an average trace, which represents the cumulative average on a point-by-point basis of the new trace data and previous averaged trace data
Max Hold	`MAXHold`	The instrument maintains and displays a max hold trace, which represents the maximum data value on a point-by-point basis of the new trace data and previous trace data
Min Hold	`MINHold`	The instrument maintains and displays a min hold trace, which represents the minimum data value on a point-point basis of the new trace data and previous trace data

Besides the **Trace Type**, the state of "View/Blank" on page 1420 must be set to **Active** (**Update**ON, **Display**ON) for a trace to be updating and visible. Selecting any **Trace Type** automatically makes the trace **Active**.

Remote Command	`:TRACe[1]|2|3:OBWidth:TYPE WRITe | AVERage | MAXHold | MINHold` `:TRACe:OBWidth:TYPE?`
Example	`:TRAC:OBW:TYPE MINH` `:TRAC:OBW:TYPE?`
Couplings	When Detector setting is `AUTO` (`[:SENSe]:OBWidth:DETector:AUTO?`), Detector (`[:SENSe]:OBWidth:DETector[:FUNCtion]?`) switches aligning with the switch of this parameter: – `NORMal` with WRITe (Clear Write) – `AVERage` with AVERage – "`POSitive` (peak)" with MAXHold – "`NEGative` (peak)" with MINHold
Preset	`AVERage`
State Saved	Saved in instrument state
Range	ClearWrite|Average|MaxHold|MinHold

Clear and Write | Restart Averaging | Restart Max/Min Hold

This control starts the trace writing as though the trace type had just been selected. Pressing this control has exactly the same effect as selecting the current trace type again – the control is provided because it may not be obvious that re-selecting the *same* selection from a radio button menu will take an action.

This button displays different labels depending on the "Trace Type" on page 1038:

– Clear/Write: Clear and Write

– Trace Average: Restart Averaging

– Max Hold: Restart Max Hold

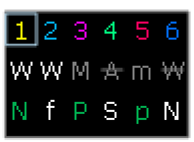
– Min Hold: Restart Min Hold

View/Blank

This control lets you set the state of the two trace variables: Update and Display. The four choices available in this dropdown menu are:

Active	Update and Display both ON
View	Update Off and Display ON
Blank	Update Off and Display OFF
Background	Update ON, Display OFF Allows a trace to be blanked *and* continue to update "in the background", which was not possible in the past

A trace with Display `OFF` is indicated by a strikethrough thru the type letter in the trace annotation panel in the Measurement Bar. A trace with Update `OFF` is indicated by dimming the type letter in the trace annotation panel in the Measurement Bar. In the example below, Traces 3, 4, 5 and 6 have Update `OFF`, and Traces 4 and 6 have Display `OFF`.



See:

– "Trace Update State On/Off" on page 1041

– "Trace Display State On/Off" on page 1041

– "More Information" on page 1041

Notes	See tables below for detail on the SCPI to control the two variables: Update and Display
Dependencies	When Signal ID is on, this key is grayed out
Couplings	Selecting a trace type (Clear/Write, Trace Average, Max Hold, Min Hold) for a trace (pressing the key or sending the equivalent SCPI command) puts the trace in **Active** (Update ON and Display ON), even if that trace type was already selected Selecting a detector for a trace (pressing the key or sending a `[:SENS]:DET:TRAC` command) puts the trace in **Active** (Update ON and Display ON), even if that detector was already selected Selecting a "Math Function" on page 1422 other than `OFF` for a trace (pressing the key or sending the equivalent SCPI command) puts the trace in **Active** (Update ON and Display ON), even if that math mode was already selected Loading a trace from a file puts that trace in View regardless of the state it was in when it was saved; as does being the target of a **Copy** or a participant in an **Exchange**

Trace Update State On/Off

Remote Command	`:TRACe[1]|2|...|6[:<meas>]:UPDate[:STATe] ON | OFF | 0 | 1` `:TRACe[1]|2|...|6[:<meas>]:UPDate[:STATe]?`
Example	`:TRAC2:UPD 0` Makes trace 2 inactive (stops updating)
Couplings	Whenever you set **Update** to ON for any trace, the **Display** is set to ON for that trace
Preset	ON for Trace 1; OFF for 2–6
State Saved	Saved in instrument state
Backwards Compatibility Notes	`:TRACe:MODE VIEW` sets `:TRACe:UPDate OFF`, `:TRACe:DISPlay ON`, for the selected trace. In earlier instruments, View and Blank were trace modes, set by `:TRACe:MODE` command. In the X-Series, View and Blank are two of the states set by the `:TRACe:UPDate` and `:TRACe:DISPlay` commands. The `:TRACe:MODE VIEW` command yields the new equivalent, which is Update=OFF, Display=ON

Trace Display State On/Off

Remote Command	`:TRACe[1]|2|...|6[:<meas>]:DISPlay[:STATe] ON | OFF | 0 | 1` `:TRACe[1]|2|...|6[:<meas>]:DISPlay[:STATe]?`

Example	`:TRAC2:DISP 1`
	Makes trace 1 visible
	`:TRAC3:DISP 3`
	Blanks trace 3

Couplings	Whenever you set Update to On for any trace, the Display is set to On for that trace
Preset	ON for Trace 1; OFF for 2–6
State Saved	Saved in instrument state
Backwards Compatibility Notes	`:TRACe:MODE BLANk` sets `:TRACe:UPDate OFF`, `:TRACe:DISPlay OFF`, for the selected trace. In earlier instruments, View and Blank were trace modes, set by `:TRACe:MODE` command. In the X-Series, View and Blank are two of the states set by the `:TRACe:UPDate` and `:TRACe:DISPlay` commands. The `:TRACe:MODE BLANk` command yields the new equivalent, which is Update=OFF, Display=OFF

More Information

When a trace becomes inactive, any update from the `:SENSe` system (detectors) immediately stops – this does not wait for the end of the sweep. The trace data remains unchanged, but stops updating. If the trace is blanked, this still does not affect the data in the trace. Traces that are blanked (Display=OFF) do not display nor appear on printouts, but their data stays intact, they may be queried, and markers may be placed on them.

In most cases, inactive traces are static and unchanging; however, there are cases when an inactive trace will update, specifically:

- if data is written to that trace from remote
- if trace data is loaded from mass storage
- if the trace is the target of a **Copy** or participant in an **Exchange**
- if the trace is cleared using the Clear Trace function (below)

Inactive traces that are also being displayed (traces in **View**) are displayed at half intensity. Traces in **View** display across the entire X-Axis of the instrument. Their horizontal placement does not change, even if X-Axis settings subsequently are changed, although Y-Axis settings do affect the vertical placement of data.

When a trace becomes active (Update=`ON`), the trace is cleared, the average count is reset, and a new sweep is initiated.

Note that putting a trace into Display=`OFF` and/or Update=`OFF` does *not* restart the sweep and does *not* restart Averaging or Hold functions for any traces.

3.8.10.3 Detector

The Detector tab lets you choose and configure detectors for the selected trace.

Detector

Selects a detector to be used by the instrument for the current measurement. The following choices are available:

Option	Behavior
`AUTO`	The detector selected depends on marker functions, trace functions, average type, and the trace averaging function For details, see "Detector Select Auto/Man" on page 1043
`NORMal`	The detector determines the peak of the CW-like signals, and it yields alternating maximums and minimums of noise-like signals. This is also referred to as Rosenfell detection
`AVERage`	The detector determines the average of the signal within the sweep points, using RMS averaging
`POSitive` Peak	The detector determines the maximum of the signal within the sweep points
`SAMPle`	The detector indicates the instantaneous level of the signal at the center of the sweep points represented by each display point
`NEGative` Peak	The detector determines the minimum of the signal within the sweep points
`RMS`	Equivalent to AVERage

Because they may not find a spectral component's true peak, neither AVERage nor SAMPle detectors measure amplitudes of CW signals as accurately as Peak (POSitive) or NORMal, but they do measure noise without the biases of peak detection.

Remote Command	[:SENSe]:OBWidth:DETector[:FUNCtion] NORMal | AVERage | POSitive | SAMPle | NEGative | RMS [:SENSe]:OBWidth:DETector[:FUNCtion]?
Example	:OBW:DET NORM :OBW:DET? :OBW:DET RMS Sets the detector to Average. Average uses RMS averaging, so this is equivalent to selecting an RMS detector
Notes	The query returns a name that corresponds to the detector type, as shown below The RMS selection sets the detector type to AVERage with RMS averaging. Therefore if RMS has been selected, the query returns AVER

String Returned	Definition
NORM	Normal
AVER	Average (RMS)
POS	Peak
SAMP	Sample
NEG	Negative Peak

Couplings	When Detector setting is AUTO, ([:SENSe]:OBWidth:DETector:AUTO?), Detector ([:SENSe]:OBWidth:DETector[:FUNCtion]?) switches aligning with the switch of this parameter: "NORMal" with Clear Write, "AVERage" with AVERage, "POSitive (peak)" with MAXHold, and "NEGative (peak)" with MINHold
Preset	AVERage
State Saved	Saved in instrument state
Range	NORMal|AVERage|POSitive|SAMPle|NEGative|RMS

Detector Select Auto/Man

This toggle sets the Detector mode to Auto or Manual. In Auto, the proper detector is chosen based on rules that take into account the measurement settings and other instrument settings.

When any detector is selected by the user, this toggles automatically set to Man (manual).

Remote Command	[:SENSe]:OBWidth:DETector:AUTO ON | OFF | 1 | 0 [:SENSe]:OBWidth:DETector:AUTO?

Example	:OBW:DET:AUTO ON :OBW:DET:AUTO?
Couplings	When Detector setting is "Auto" ([:SENSe]:OBWidth:DETector:AUTO?), Detector ([:SENSe]:OBWidth:DETector[:FUNCtion]?) switches aligning with the switch of this parameter: "NORMal" with Clear Write, "AVERage" with AVERage, "POSitive (peak)" with MAXHold, and "NEGative (peak)" with MINHold
Preset	ON
State Saved	Yes

3.8.10.4 Math

The Math tab lets you turn on and configure trace math functions.

Math Function

Trace math functions perform mathematical operations between traces and, in some cases, user-specified offsets. When in a trace math function, the indicated function is performed during the sweep with the math function used in place of a detector.

The trace operands for the math function are set using the **Trace Operands** control.

See also "More Information" on page 1045 and "How trace math is processed" on page 1048.

Remote Command	:CALCulate:OBWidth:MATH TRACe1 | TRACe2 | TRACe3, PDIFference | PSUM | LOFFset | LDIFference | OFF, TRACe1 | TRACe2 | TRACe3,TRACe1 | TRACe2 | TRACe3, <real>,<real> :CALCulate:OBWidth:MATH? TRACe1 | TRACe2 | TRACe3
Example	:CALC:OBW:MATH TRAC1,PDIF,TRAC2,TRAC3,0,0 Sets Trace 1 to Power Diff trace math function, and sets the First Trace operand (for Trace 1) to Trace 2 and the Second Trace operand (for Trace 1) to Trace 3 :CALC:OBW:MATH TRAC1,PSUM,TRAC2,TRAC3,0,0 Sets Trace 1 to Power Sum trace math function and sets the First Trace operand (for Trace 1) to Trace 2 and the Second Trace operand (for Trace 1) to Trace 3 :CALC:OBW:MATH TRAC1,LOFF,TRAC3,TRAC2,-6.00,0 Sets Trace 1 to Log Offset trace math function, sets the First Trace operand (for Trace 1) to Trace 3, leaves the Second Trace operand (for Trace 1) unchanged (it is irrelevant for this function) and sets the Log Offset (for Trace 1) to -6 dB :CALC:OBW:MATH TRAC1,LDIF,TRAC2,TRAC3,0,-6.00 Sets Trace 1 to Log Diff trace math function, sets the First Trace operand (for Trace 1) to Trace 2, sets the Second Trace operand (for Trace 1) to Trace 3, and sets the Log Difference reference for Trace 1 to -6 dBm

	`:CALC:OBW:MATH TRAC1,OFF,TRAC2,TRAC3,0,0` Turns off trace math for trace 1
Notes	**Math Function** has 6 main sets of parameters:

Set 1	Defines the "result trace"	`TRACe1|TRACe2|TRACe3`
Set 2	Defines the "function"	`PDIFference|PSUM|LOFFset|LDIFference|OFF`
Set 3	A "trace operand" (1)	`TRACe1|TRACe2|TRACe3`
Set 4	A "trace operand" (2)	`TRACe1|TRACe2|TRACe3`
Set 5	Defines the "Log Offset" (in dB)	
Set 6	Defines the "Log Difference Reference" (in dBm)	

	Note that the Trace Math mode is an enumeration; that is, when a math function is set for a trace, it turns off any math function that is on for that trace and sets the new math function. The parameters sent in the command are reflected in the values in the control menu. There is no default for any parameter; all 6 parameters must be sent to satisfy the parser. Failure to specify a parameter results in a missing parameter message Remote command examples are included in each section below
Dependencies	None of the trace operands can be the destination trace. If any of the three trace math commands is sent with a destination trace number matching one of the operands, a warning is generated and the function does not turn on
Couplings	Whenever a math function other than `OFF` is selected for a trace, that trace is set to Display=`ON` and Update=`ON`
Preset	`OFF,TRACe2,TRACe3,0,0 | OFF,TRACe3,TRACe1,0,0 | OFF,TRACe1,TRACe2,0,0`
State Saved	The trace math function for each trace is saved in instrument state
Range	Power Difference|Power Sum|Log Offset|Log Difference|Off
Annunciation	The function is annotated on the trace if Trace Annotation is `ON`
Status Bits/OPC dependencies	`*OPC` can be used to detect the completion of a sweep, which will also correspond to the completion of the math operation, since all math takes place during the sweep

More Information

IMPORTANT To generate a trace math result, *you must take a sweep*. The trace math engine, described below, operates in concert with the sweep engine in the instrument.

Until a sweep has been taken, even if the constituent traces are not in Update mode, no result is generated.

Note that certain events can affect the trace in ways that affects all points at once. This can happen in any number of ways, including:

- A trace clear taking place
- A trace being loaded from the file system
- Trace data being sent in from the remote interface
- A copy or exchange of trace data

You should try to avoid these occurrences during a sweep, as they will tend to invalidate the math result being accumulated.

The Trace Math functions are:

Power Diff (Op1 - Op2)

Calculates a power difference between the `First Trace` operand and the `Second Trace` operand and puts the result in the destination trace.

During the sweep, the following formula is executed for each point in the trace operands, and the corresponding point is generated for the destination trace:

```
DestinationTrace = 10 log(10(1/10)(FirstTrace) – 10(1/10)(SecondTrace))
```

The values of the trace points are assumed to be in a decibel scale, as they are internally stored.

If a point in `FirstTrace` is equal to `maxtracevalue`, the resultant point is also `maxtracevalue`.

Otherwise, if the result of the subtraction is less than or equal to 0, the resultant point is `mintracevalue`.

Power Sum (Op1 + Op2)

Calculates a power sum between the `First Trace` operand and the `Second Trace` operand and puts the result in the destination trace.

During the sweep, the following formula is executed for each point in the trace operands, and the corresponding point is generated for the destination trace.

```
DestinationTrace = 10 log(10(1/10)(FirstTrace) + 10(1/10)(SecondTrace))
```

The values of the trace points are assumed to be in a decibel scale, as they are internally stored.

If a point in either trace operand is equal to `maxtracevalue`, the resultant point is also `maxtracevalue`.

Log Offset (Op1 + Offset)

Calculates a log offset from the `First Trace` operand and puts the result in the destination trace. This is like the B-DL function in some older instruments. The offset is entered on the `Offset` control, which only appears when this math function is in force for the selected trace. Each destination trace has its own offset.

During the sweep, the following formula is executed for each point in the trace operand, and the corresponding point is generated for the destination trace.

```
DestinationTrace = FirstTrace + Offset
```

The values of the trace points are assumed to be in dBm (as they are internally stored) and the offset is in dB.

If a point in the trace operand is equal to `maxtracevalue`, the resultant point is also `maxtracevalue`.

If a point in the trace operand is equal to `mintracevalue`, the resultant point is also `mintracevalue`.

Example: If offset is 25 dB, then our destination trace will be higher than the operand trace by 25 dB.

Note that the `Second Trace` operand is not used for this function.

Log Diff (Op1 - Op2 + Ref)

Offsets the difference between the `First Trace` operand and the `Second Trace` operand by a reference and puts the result in the destination trace. This is like the A-B+DL function in some older instruments. The Reference is entered on the **Reference** control, which only appears when this math function is in force for the selected trace. Each destination trace has its own reference.

Offsets the difference between the `First Trace` operand and the `Second Trace` operand by a reference and puts the result in the destination trace. This is like the A-B+DL function in some older instruments. The Reference is entered on the **Reference** control, which only appears when this math function is in force for the selected trace. Each destination trace has its own reference.

During the sweep, the following formula is executed for each point in the trace operands, and the corresponding point is generated for the destination trace.

```
DestinationTrace = (FirstTrace - SecondTrace) + Reference
```

The values of the operand trace points are assumed to be in decibel units (as they are internally stored) and the reference is in dBm so the result is in dBm.

Example: If the first operand trace 1 is at 5 dBm, the second operand trace 2 is at –5 dBm, and the reference is –25 dBm, then the destination trace will be –15 dBm.

Example: If the first operand trace1 is at 60 dBuV, the second operand trace 2 is at 50 dBuV, and the reference is 35 dBuV, then the destination trace will be 45 dBuV.

If a point in `FirstTrace` is equal to `maxtracevalue`, the resultant point is also `maxtracevalue`.

If a point in `FirstTrace` is equal to `mintracevalue`, the resultant point is also `mintracevalue`.

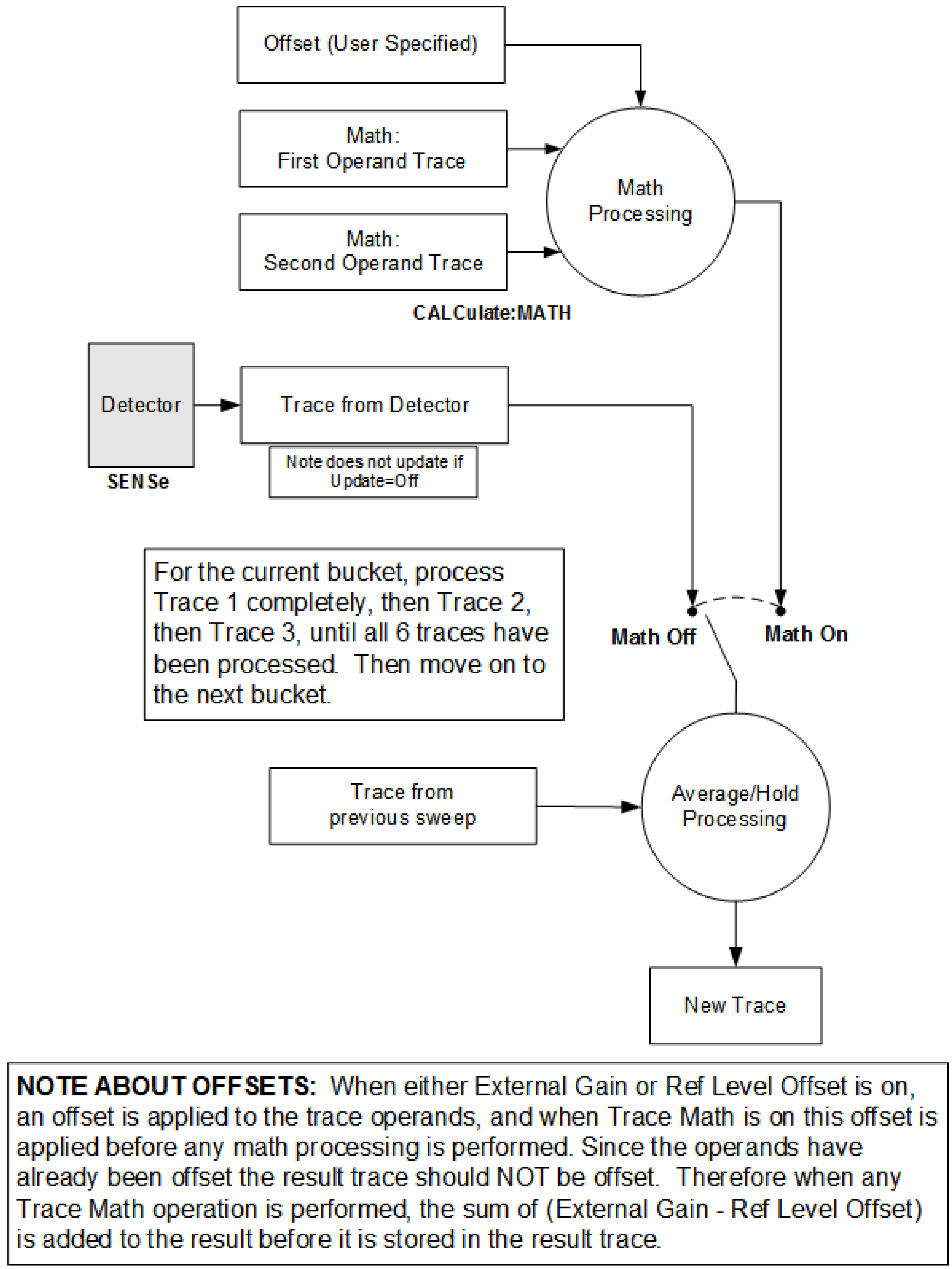
If neither of the above is true for a given point, then:

- If that point in `SecondTrace` is equal to `maxtracevalue`, the resultant point is `mintracevalue`.
- If that point in `SecondTrace` is equal to `mintracevalue`, the resultant point is `maxtracevalue`.

How trace math is processed

Whenever a trace math function is turned on, or the parameters and/or operands of an existing trace math function are changed, the destination trace is cleared. After the trace is cleared, all x-axis values in the trace, and the domain of the trace, are set to match the X-Axis settings of the first trace operand. When this is complete, a new sweep is initiated.

The process of acquiring data, processing it using the math and Average/Hold functions, and presenting it as trace data, consists of several functional blocks, as shown below:



For each active trace, the current trace point is processed for `Trace 1`, then `Trace 2`, then `Trace 3`, etc. Trace data is taken from either the detector for that trace, or from the mathematical result of up to two other traces and an offset, depending on whether trace math is on or not. The resultant data is then fed to the Average/Hold processing block, where (if the trace type is Average, Max Hold, or Min Hold) it is processed with previous trace data. The new trace data resulting from this process is then available for display, storage or remote output.

When the processing is complete for `Trace 1`, `Trace 2` is processed, and so on until all six traces have been processed. This allows a downstream trace to use as one of its math components a fully processed upstream trace. In other words, if math is `ON` for `Trace 4`, and its operand traces are `Trace 2` and `Trace 3`, then all detector, math, average and hold processing for Traces 2 and 3 is completed before the math is performed for `Trace 4`. When the current trace point is completed for all traces, the instrument moves on to the next trace point.

This allows very flexible and powerful math functions to be configured. For example, `Trace 1` can be an average trace, which can be fed with an offset to `Trace 2`, which can also be in **Max Hold**, allowing you to obtain the **Max Hold** of an Average trace.

Note that none of this processing is performed on inactive traces.

Note also that for any active trace with math `ON`, the Operand traces should have *lower* numbers than the trace (for example, using `Trace 4` as an operand for `Trace 1` will cause the data coming from `Trace 4` to be delayed by one sweep).

Operand 1/2

Selects the first and second trace operands, respectively, to be used for the trace math functions for the destination trace.

The operands are common to all math functions for a given trace. The most recently sent `:CALCulate:MATH` command for a given trace sets the operands for that trace, and will be reflected on the trace operand controls for that trace.

Example	The following examples are for the Swept SA measurement.
	1) Set Trace 3 to Power Diff trace math function. Set the First Trace operand (for Trace 3) to Trace 1 and the Second Trace operand (for Trace 3) to Trace 2
	`:CALC:MATH TRACE3,PDIF,TRACE1,TRACE2,0,0`
	
	2) Set Trace 3 to Log Offset trace math function. Set the First Trace operand (for Trace 3) to Trace 1, leave the Second Trace operand (for Trace 3) unchanged (it is irrelevant for this function) and set the Log Offset (for Trace 3) to -6 dB
	`:CALC:MATH TRACE3,LOFF,TRACE1,TRACE2,-6.00,0`

Notes	See the Math Function section for how to specify Operand 1 and Operand 2 using the `:CALCulate:MATH` SCPI command
Dependencies	The destination trace cannot be an operand. The destination trace number is gray on the dropdown
Preset	**Operand 1**: Trace number minus 2 (wraps at 1) For example, for Trace 1, Operand 1 presets to Trace 5; for Trace 6, it presets to Trace 4 **Operand 2**: Trace number minus 1 (wraps at 1) For example, for Trace 1, Operand 2 presets to Trace 6; for Trace 6, it presets to Trace 5
State Saved	Operand 1 and Operand 2 for each trace are stored in instrument state

Offset

The Offset value is used by the Log Offset math function.

Example	The following example is for the Swept SA measurement. `:CALC:MATH TRACE3,LOFF,TRACE1,TRACE2,-6.00,0` Sets Trace 3 to Log Offset trace math function, sets the First Trace operand (for Trace 3) to Trace 1, leaves the Second Trace operand (for Trace 3) unchanged (it is irrelevant for this function) and sets the Log Offset (for Trace 3) to -6 dB
State Saved	The Log Offset value for each trace is saved in Instrument State
Min	–100 dB
Max	100 dB

Reference

The Reference value is used by the Log Diff math function.

Example	The following example is for the Swept SA measurement. `:CALC:MATH TRACE3,LDIF,TRACE1,TRACE2,0,-6.00` Sets Trace 3 to Log Diff trace math function, sets the First Trace operand (for Trace 3) to Trace 1, sets the Second Trace operand (for Trace 3) to Trace 2, and sets the Log Difference reference (for Trace 3) to -6 dBm
State Saved	The Log Difference reference value for each trace is saved in instrument state
Min/Max	Same as reference level

3.8.10.5 Trace Function

The Trace Function includes controls to:

- Copy and Exchange traces
- Preset or Clear all traces

From Trace

Selects the trace to be copied to or exchanged with the **To Trace** when a "Copy" on page 1553 or "Exchange" on page 1553 is performed

Preset	1

To Trace

Selects the trace to be copied from or exchanged with the **From Trace** when a "Copy" on page 1553 or "Exchange" on page 1553 is performed

Preset	2

Copy

This button executes a Trace Copy based on the From Trace and To Trace parameters. The Copy is done from the From Trace to the To Trace. The action is performed once.

The X-Axis settings and domain of a trace go with it when it is copied.

Remote Command	For Swept SA Measurement (in SA Mode):
	`:TRACe:COPY TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6, TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6`
	
	For all other measurements:
	`:TRACe:<meas>:COPY TRACe1 | TRACe2 | TRACe3, TRACe1 | TRACe2 | TRACe3`
	where:
	<meas> is the identifier for the current measurement.
	Note that the format of the TRACe<n> parameter differs from that for the Swept SA Measurement.

Example	`:TRAC:COPY TRACE1,TRACE3` Copies Trace 1 to Trace 3 and puts Trace 3 in Update=Off, Display=On
Notes	The `:TRACe:COPY` command is of the form: `:TRACe:COPY <source_trace>,<dest_trace>`
Dependencies	When Signal ID is on, this key is grayed out
Couplings	The destination trace is put in View (Update=Off, Display=On) after the copy

Preset	For Swept SA Measurement (in SA Mode):
	`TRACE1, TRACE2`
	For all other measurements:
	`TRACe1, TRACe2`

Exchange

This button executes a Trace Exchange based on the From Trace and To Trace parameters. The From Trace and To Trace are exchanged with each other. The action is performed once.

The X-Axis settings and domain of a trace go with it when it is exchanged with another trace.

Remote Command	For Swept SA Measurement (in SA Mode):
	`:TRACe:EXCHange TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6, TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6`
	
	For all other measurements:
	`:TRACe:<meas>:EXCHange TRACe1 | TRACe2 | TRACe3, TRACe1 | TRACe2 | TRACe3`
	where:
	<meas> is the identifier for the current measurement.
	Note that the format of the TRACe<n> parameter differs from that for the Swept SA Measurement.

Example	`:TRAC:EXCH TRACE1,TRACE2` Exchanges Trace 1 and Trace 2 and puts both traces in Update=Off, Display=On
Notes	The `TRACe[:<meas>]:EXCHange` command is of the form: `:TRACe[:<meas>]:EXCHange <trace_1>,<trace_2>`
Couplings	Both traces are put in View (Update=Off, Display=On) after the exchange
Backwards Compatibility Notes	The copy and exchange operations menu in ESA and PSA is replaced with the more general purpose Trace Function menu. The remote commands are unaffected, as they were already general

Preset All Traces

Turns on Trace 1 and blanks all other traces. Useful when you have many traces on and you want to go back to having only Trace 1 on the display. Does not affect the trace type, detector or any other aspect of the trace system.

Remote Command	`:TRACe[:<meas>]:PRESet:ALL`
Example	`:TRAC:PRES:ALL`
Dependencies	When Signal ID is on, this key is grayed out

Clear All Traces

Clears all traces. Does not affect the state of any function or variable in the instrument. Loads `mintracevalue` into all of the points all traces, except traces in **Min Hold** in which case it loads `maxtracevalue`. Does so even if Update=Off.

Remote Command	`:TRACe[:<meas>]:CLEar:ALL`
Example	`:TRAC:CLE:ALL` Clears all traces
Dependencies	When Signal ID is on, this key is grayed out

3.8.10.6 Advanced

The **Advanced** tab contains controls for setting advanced functions of the instrument.

Measure Trace

Specifies which trace's scalar results are displayed in the Metrics window and retrieved by sending a Read/Fetch command.

- Trace 1
- Trace 2
- Trace 3

Remote Command	`:CALCulate:OBWidth:MTRace TRACe1 | TRACe2 | TRACe3` `:CALCulate:OBWidth:MTRace?`
Example	`:CALC:OBW:MTR TRACe1` `:CALC:OBW:MTR?`
Dependencies	Trace 2 and Trace 3 are grayed out when no trace data is available
Preset	`TRACe1`
State Saved	No
Range	`TRACe1|TRACe2|TRACe3`

3.9 ACP Measurement

ACP is a measurement of the amount of interference, or power, in an adjacent frequency channel. The results are displayed as a bar graph or as spectrum data, with measurement data at specified offsets.

ACP Measurement Commands

The following commands are used to retrieve the measurement results:

`:CONFigure:ACPower`

`:CONFigure:ACPower:NDEFault`

`:INITiate:ACPower`

`:FETCh:ACPower[n]?`

`:READ:ACPower[n]?`

`:MEASure:ACPower[n]?`

Remote Command Results for ACP Measurement

n	Condition	Results Returned
1, or not specified	Mode = SA mode, Radio Std = None, Number of carriers = 1 and only offset A is on	Returns 3 comma-separated values that correspond to: 1. Reference carrier power, 2. lower-adjacent channel power (dBc), and 3. upper-adjacent channel power (dBc) of a trace specified by Measure Trace When in the Spectrum Analyzer (SA) Mode, the values are in the current Y Axis Unit of the instrument
1, or not specified	Meas Type = Total power reference	Returns 28 comma-separated scalar results of a trace specified by Measure Trace in the following order 1. 0.0 2. Total carrier power (dBm) 3. 0.0 4. Reference power (dBm) 5. Lower offset A - relative power (dB) 6. Lower offset A - absolute power (dBm) 7. Upper offset A - relative power (dB) 8. Upper offset A - absolute power (dBm) 9. Lower offset B - relative power (dB) 10. Lower offset B - absolute power (dBm)

n	Condition	Results Returned
		11. Upper offset B - relative power (dB) 12. Upper offset B - absolute power (dBm) ... 25. Lower offset F - relative power (dB) 26. Lower offset F - absolute power (dBm) 27. Upper offset F - relative power (dB) 28. Upper offset F - absolute power (dBm) If the results are not available, -999.0 is returned When in the Spectrum Analyzer (SA) Mode, the values are in the current Y Axis Unit of the instrument When in MSR, LTE Advanced FDD/TDD, and 5G NR, this trace includes only outer offset results and their reference value(s)
	Meas Type = Power spectral density reference	Returns 28 comma-separated scalar results of a trace specified by Measure Trace in the following order: 1. 0.0 2. Total carrier power (dBm/Hz or dBm/MHz) 3. 0.0 4. Reference power (dBm/Hz or dBm/MHz) 5. Lower offset A - relative power (dB) 6. Lower offset A - absolute power (dBm/Hz or dBm/MHz) 7. Upper offset A - relative power (dB) 8. Upper offset A - absolute power (dBm/Hz or dBm/MHz) 9. Lower offset B - relative power (dB) 10. Lower offset B - absolute power (dBm/Hz or dBm/MHz) 11. Upper offset B - relative power (dB) 12. Upper offset B - absolute power (dBm/Hz or dBm/MHz) ... 25. Lower offset F - relative power (dB) 26. Lower offset F - absolute power (dBm/Hz or dBm/MHz) 27. Upper offset F - relative power (dB) 28. Upper offset F - absolute power (dBm/Hz or dBm/MHz) If the results are not available, -999.0 is returned When in the Spectrum Analyzer (SA) Mode, the values are in the current Y Axis Unit of the instrument When in MSR, LTE Advanced FDD/TDD, and 5G NR, this trace includes only outer offset results and their reference value(s)
	Meas Method = FAST	Returns 5 comma-separated results of a trace specified by Measure Trace in the following order: 1. Reference carrier - absolute power (dBm) 2. Lower offset A - absolute power (dBm)

n	Condition	Results Returned
		3. Upper offset A - absolute power (dBm) 4. Lower offset B - absolute power (dBm) 5. 5. Upper offset B - absolute power (dBm)
	Mode = LTEAFDD, LTEATDD, 5G NR, MSR Meas Type = Total power reference and Power Ref = Left & Right Carriers or Left & Right Sub-blocks	Returns 28 comma-separated scalar results of a trace specified by Measure Trace in the following order: 1. 0.0 2. Total carrier power (dBm) 3. Left Reference power (dBm) 4. Right Reference power (dBm) 5. Lower offset A - relative power (dB) 6. Lower offset A - absolute power (dBm) 7. Upper offset A - relative power (dB) 8. Upper offset A - absolute power (dBm) 9. Lower offset B - relative power (dB) 10. Lower offset B - absolute power (dBm) 11. Upper offset B - relative power (dB) 12. Upper offset B - absolute power (dBm) ... 25. Lower offset F - relative power (dB) 26. Lower offset F - absolute power (dBm) 27. Upper offset F - relative power (dB) 28. Upper offset F - absolute power (dBm) If the results are not available, -999.0 is returned When in MSR, LTE Advanced FDD/TDD, and 5G NR, this trace includes only outer offset results and their reference value(s)
	Mode = LTEAFDD, LTEATDD, 5G NR, MSR Meas Type = Power spectral density reference and Power Ref = Left & Right Carriers or Left & Right Sub-blocks	Returns 28 comma-separated scalar results of a trace specified by Measure Trace in the following order: 1. 0.0 2. Total carrier power (dBm/Hz or dBm/MHz) 3. Left reference power (dBm/Hz or dBm/MHz) 4. Right reference power (dBm/Hz or dBm/MHz) 5. Lower offset A - relative power (dB) 6. Lower offset A - absolute power (dBm/Hz or dBm/MHz) 7. Upper offset A - relative power (dB) 8. Upper offset A - absolute power (dBm/Hz or dBm/MHz) 9. Lower offset B - relative power (dB) 10. Lower offset B - absolute power (dBm/Hz or dBm/MHz) 11. Upper offset B - relative power (dB) 12. Upper offset B - absolute power (dBm/Hz or dBm/MHz)

n	Condition	Results Returned
		… 25. Lower offset F - relative power (dB) 26. Lower offset F - absolute power (dBm/Hz or dBm/MHz) 27. Upper offset F - relative power (dB) 28. Upper offset F - absolute power (dBm/Hz or dBm/MHz) If the results are not available, -999.0 is returned When in MSR, LTE Advanced FDD/TDD, and 5G NR, this trace includes only outer offset results and their reference value(s)
2	Meas Type = Total power reference	Returns 48 scalar results of a trace specified by Measure Trace in the following order: 1. Channel (1) - relative power (dB) 2. Channel (1) - absolute power (dBm) 3. Channel (2) - relative power (dB) 4. Channel (2) - absolute power (dBm) … 23. Channel (12) - relative power (dB) 24. Channel (12) - absolute power (dBm) 25. Lower offset A - relative power (dB) 26. Lower offset A - absolute power (dBm) 27. Upper offset A - relative power (dB) 28. Upper offset A - absolute power (dBm) 29. Lower offset B - relative power (dB) 30. Lower offset B - absolute power (dBm) 31. Upper offset B - relative power (dB) 32. Upper offset B - absolute power (dBm) … 45. Lower offset F - relative power (dB) 46. Lower offset F - absolute power (dBm) 47. Upper offset F - relative power (dB) 48. Upper offset F - absolute power (dBm) If the results are not available, -999.0 is returned When in the Spectrum Analyzer (SA) Mode, the values are in the current Y Axis Unit of the instrument When in MSR, LTE Advanced FDD/TDD, and 5G NR, this trace includes only outer offset results and their reference value(s)
	Meas Type = Power spectral density reference	Returns 48 scalar results of a trace specified by Measure Trace in the following order: 1. Channel (1) - relative power (dB) 2. Channel (1) - absolute power (dBm/Hz or dBm/MHz)

n	Condition	Results Returned
		3. Channel (2) - relative power (dB) 4. Channel (2) - absolute power (dBm/Hz or dBm/MHz) ... 23. Channel (12) - relative power (dB) 24. Channel (12) - absolute power (dBm/Hz or dBm/MHz) 25. Lower offset A - relative power (dB) 26. Lower offset A - absolute power (dBm/Hz or dBm/MHz) 27. Upper offset A - relative power (dB) 28. Upper offset A - absolute power (dBm/Hz or dBm/MHz) 29. Lower offset B - relative power (dB) 30. Lower offset B - absolute power (dBm/Hz or dBm/MHz) 31. Upper offset B - relative power (dB) 32. Upper offset B - absolute power (dBm/Hz or dBm/MHz) ... 45. Lower offset F - relative power (dB) 46. Lower offset F - absolute power (dBm/Hz or dBm/MHz) 47. Upper offset F - relative power (dB) 48. Upper offset F - absolute power (dBm/Hz or dBm/MHz) If the results are not available, -999.0 is returned When in the Spectrum Analyzer (SA) Mode, the values are in the current Y Axis Unit of the instrument When in MSR, LTE Advanced FDD/TDD, and 5G NR, this trace includes only outer offset results and their reference value(s)
3	Mode = DTMB (CTTB) or CMMB, Radio BW = 8 MHz and Meas Type = Total power reference	Returns 28 scalar values of the pass/fail (0 = passed, or 1 = failed) determined by testing the relative to the reference carrier and by testing the absolute power limit of the offset frequencies (measured as total power in dB) for a trace specified by Measure Trace 1. Lower offset A - relative limit result 2. Lower offset A - absolute limit result 3. Upper offset A - relative limit result 4. Upper offset A - absolute limit result 5. Lower offset B - relative limit result 6. Lower offset B - absolute limit result 7. Upper offset B - relative limit result 8. Upper offset B - absolute limit result ... 21. Lower offset F - relative limit result 22. Lower offset F - absolute limit result 23. Upper offset F - relative limit result

n	Condition	Results Returned
		24. Upper offset F - absolute limit result 25. Inside Adjacent Channel - relative limit result 26. Inside Adjacent Channel - absolute limit result 27. Outside Adjacent Channel - relative limit result 28. Outside Adjacent Channel - absolute limit result If Radio Device = Exciter, the last four (25, 26, 27 and 28) results returned -999.0
	Mode = DTMB (CTTB) or CMMB, Radio BW = 8 MHz and Meas Type = Power spectral density reference	Returns 28 scalar values of the pass/fail (0 = passed, or 1 = failed) determined by testing the relative to the reference carrier and by testing the absolute power limit of the offset frequencies (measured as power spectral density in dB) for a trace specified by Measure Trace 1. Lower offset A - relative limit result 2. Lower offset A - absolute limit result 3. Upper offset A - relative limit result 4. Upper offset A - absolute limit result 5. Lower offset B - relative limit result 6. Lower offset B - absolute limit result 7. Upper offset B - relative limit result 8. Upper offset B - absolute limit result ... 21. Lower offset F - relative limit result 22. Lower offset F - absolute limit result 23. Upper offset F - relative limit result 24. Upper offset F - absolute limit result 25. -999.0 26. -999.0 27. -999.0 28. -999.0 The last four results always returned -999.0
	Meas Type = Total power reference	Returns 24 scalar values of the pass/fail (0 = passed, or 1 = failed) determined by testing the relative to the reference carrier and by testing the absolute power limit of the offset frequencies (measured as total power in dB) for a trace specified by Measure Trace 1. Lower offset A - relative limit result 2. Lower offset A - absolute limit result 3. Upper offset A - relative limit result 4. Upper offset A - absolute limit result 5. Lower offset B - relative limit result 6. Lower offset B - absolute limit result

n	Condition	Results Returned
		7. Upper offset B - relative limit result 8. Upper offset B - absolute limit result ... 21 Lower offset F - relative limit result 22 Lower offset F - absolute limit result 23 Upper offset F - relative limit result 24 Upper offset F - absolute limit result If the results are not available, 1 is returned. When in MSR, LTE-Advanced FDD/TDD, and 5G NR, this trace includes only outer offset results
	Meas Type = Power spectral density reference	Returns 24 scalar values of the pass/fail (0 = passed, or 1 = failed) determined by testing the relative to the reference carrier and by testing the absolute power limit of the offset frequencies (measured as power spectral density in dB) for a trace specified by Measure Trace 1. Lower offset A - relative limit result 2. Lower offset A - absolute limit result 3. Upper offset A - relative limit result 4. Upper offset A - absolute limit result 5. Lower offset B - relative limit result 6. Lower offset B - absolute limit result 7. Upper offset B - relative limit result 8. Upper offset B - absolute limit result ... 21 Lower offset F - relative limit result 22 Lower offset F - absolute limit result 23 Upper offset F - relative limit result 24 Upper offset F - absolute limit result If the results are not available, 1 is returned. When in MSR, LTE-Advanced FDD/TDD, and 5G NR, this trace includes only outer offset results
4		Returns <Num Pts> comma-separated scalar values representing the Y values in Trace 1
5		Returns <Num Pts> comma-separated scalar values representing the Y values in Trace 2
6		Returns <Num Pts> comma-separated scalar values representing the Y values in Trace 3
7	Meas Type = Total power reference	Returns (2 * Number of Carriers) scalar results of a trace specified by Measure Trace in the following order: The Number of Carriers is the value filled in Carriers under Carrier Setup menu. If license N9060A-5FP is enabled, max value of Number of Carriers is 18, otherwise, max value of Number of

n	Condition	Results Returned
		Carriers is 12. In MSR, max value of Number of Carriers is 100. In the LTE-Advanced FDD/TDD mode, max value of number of carriers is 5 and in the 5G NR mode, 16 1. Channel (1) - relative power (dB) 2. Channel (1) - absolute power (dBm) 3. Channel (2) - relative power (dB) 4. Channel (2) - absolute power (dBm) ... 2 * Number of Carriers -1. Channel (Number of Carriers) - relative power (dB) 2 * Number of Carriers. Channel (Number of Carriers) - absolute power (dBm) If the results are not available, 9.91E+37 is returned When in the Spectrum Analyzer (SA) Mode, the values are in the current Y Axis Unit of the instrument
	Meas Type = Power spectral density reference	Returns (2 * Number of Carriers) scalar results of a trace specified by Measure Trace in the following order: The Number of Carriers is the value filled in Carriers under Carrier Setup menu If license N9060A-5FP is enabled, max value of Number of Carriers is 18, otherwise, max value of Number of Carriers is 12. In MSR, max value of Number of Carriers is 100. In the LTE-Advanced FDD/TDD mode, max value of number of carriers is 5 and in the 5G NR mode, 16 1. Channel (1) - relative power (dB) 2. Channel (1) - absolute power (dBm/Hz or dBm/MHz) 3. Channel (2) - relative power (dB) 4. Channel (2) - absolute power (dBm/Hz or dBm/MHz) ... 2 * Number of Carriers -1. Channel (Number of Carriers) - relative power (dB) 2 * Number of Carriers. Channel (Number of Carriers) - absolute power (dBm/Hz or dBm/MHz) If the results are not available, 9.91E+37 is returned When in the Spectrum Analyzer (SA) Mode, the values are in the current Y Axis Unit of the instrument
8	Mode = LTEAFDD, LTEATDD, 5G NR, MSR	Returns scalar results of a trace specified by Measure Trace in the following order: 1. 0.0 2. Total carrier power (dBm) 3. Reference Power *1 (See "Reference Power Result Details" on

n	Condition	Results Returned
		page 1065) 4. Reference Power *2 (See "Reference Power Result Details" on page 1065) 5. Inner Lower offset A - relative power (dB) 6. Inner Lower offset A - absolute power (dBm, dBm/Hz or dBm/MHz) 7. Inner Upper offset A - relative power (dB) 8. Inner Upper offset A - absolute power (dBm, dBm/Hz or dBm/MHz) 9. Inner Lower offset B - relative power (dB) 10. Inner Lower offset B - absolute power (dBm, dBm/Hz or dBm/MHz) 11. Inner Upper offset B - relative power (dB) 12. Inner Upper offset B - absolute power (dBm, dBm/Hz or dBm/MHz) ... 25. Inner Lower offset F - relative power (dB) 26. Inner Lower offset F - absolute power (dBm, dBm/Hz or dBm/MHz) 27. Inner Upper offset F - relative power (dB) 28. Inner Upper offset F - absolute power (dBm, dBm/Hz or dBm/MHz) This trace includes only inner offset results Unit of absolute power results – dBm: Meas Type = Total Pwr Ref – dBm/Hz: Meas Type = PSD Ref, PSD Unit = dBm/Hz – dBm/MHz: Meas Type = PSD Ref, PSD Unit = dBm/MHz If the results are not available, 9.91E+37 is returned
9	Mode = LTEAFDD, LTEATDD, 5G NR, MSR	Returns scalar values of the pass/fail (0 = passed, or 1 = failed) determined by testing the relative to the reference carrier and by testing the absolute power limit of the offset frequencies for a trace specified by Measure Trace 1. Inner Lower offset A - relative limit result 2. Inner Lower offset A - absolute limit result 3. Inner Upper offset A - relative limit result 4. Inner Upper offset A - absolute limit result 5. Inner Lower offset B - relative limit result 6. Inner Lower offset B - absolute limit result 7. Inner Upper offset B - relative limit result 8. Inner Upper offset B - absolute limit result

n	Condition	Results Returned
		... 21. Inner Lower offset F - relative limit result 22. Inner Lower offset F - absolute limit result 23. Inner Upper offset F - relative limit result 24. Inner Upper offset F - absolute limit result
10	Mode = LTEAFDD, LTEATDD, 5G NR, MSR	Returns scalar values of offset results of a trace specified by Measure Trace. Numbers returned in this trace is 10 x actually measured offsets. Note that upper and lower sides of an offset are returned separately. For example, when only outer offset A is measured with offset side both, 10 x 2 = 20 values are returned 1. Inner = 1 or Outer = 2 2. Offset A~F. (A=1, B=2, ... F=6) 3. Offset Side. Lower=1 or Upper=2 4. Relative power or relative PSD (dBc or dB) 5. Absolute power (dBm) or absolute PSD (dBm/Hz or dBm/MHz) 6. Reference power (dBm) or reference PSD (dBm/Hz or dBm/MHz) 7. Reference Index 1 8. Reference Index 2 9. 0 (Reserved) 10. 0 (Reserved) ... 10(n-1)+1. Inner = 1 or Outer = 2 10(n-1)+2. Offset A~F. (A=1, B=2, ... F=6) 10(n-1)+3. Offset Side. Lower=1 or Upper=2 10(n-1)+4. Relative power or relative PSD (dBc or dB) 10(n-1)+5. Absolute power (dBm) or absolute PSD (dBm/Hz or dBm/MHz) 10(n-1)+6. Reference power (dBm) or reference PSD (dBm/Hz or dBm/MHz) 10(n-1)+7. Reference Index 1 10(n-1)+8. Reference Index 2 10(n-1)+9. 0 (Reserved) 10(n-1)+10. 0 (Reserved) Where n is number of offsets Meas Type determines which type of power result is returned, i.e., power or PSD. Unit for PSD results is determined by PSD Unit

n	Condition	Results Returned
		If result is not available, 9.91E+37 is returned

Reference Power Result Details

Power Ref	Reference Power *1	Reference Power *2
Left & Right Carriers Max Power Carriers in Sub-block	Left or Max Power Carrier in the lower sub-block (dBm, dBm/Hz or dBm/MHz)	Right or Max Power Carrier in the upper sub-block (dBm, dBm/Hz or dBm/MHz)
Left & Right Sub-blocks	Integrated Power of the lower sub-block (dBm, dBm/Hz or dBm/MHz)	Integrated Power of the upper sub-block (dBm, dBm/Hz or dBm/MHz)
Others	0.0	Reference carrier power (dBm, dBm/Hz or dBm/MHz)

3.9.1 Views

The ACP measurement has two views: "Normal" on page 1115 and "Carrier Info" on page 1115.

These Views are multiple-window Views. When in a multiple window View, you select a window by touching it. The menu controls may sometimes change depending on which window is selected.

Whenever the View changes, the default menu is Frequency, unless otherwise specified in the View description.

NOTE **Y Scale/Div, Y Ref Position, Y Auto Scale, Y Ref Value and Bar Graph affect both views. For example, power bars on the traces in both views appear or disappear when Bar Graph is toggled.**

View Selection by Name

Selects the results view. The following command allows you to select the desired measurement view by enumeration.

Remote Command	`:DISPlay:ACPower:VIEW[:SELect] PRESult | CINFormation` `:DISPlay:ACPower:VIEW[:SELect]?`
Example	`:DISP:ACP:VIEW PRES` `:DISP:ACP:VIEW?`

Preset	PRESult
State Saved	Saved in instrument state
Range	PRESult|CINFormation

View Selection by Number (Remote Command Only)

Selects the results view. The following command allows you to select the desired measurement view by enumeration.

Remote Command	:DISPlay:ACPower:VIEW:NSELect <integer> :DISPlay:ACPower:VIEW:NSELect?
Example	:DISP:ACP:VIEW:NSEL 1 :DISP:ACP:VIEW:NSEL?
Dependencies	This command is available only for LTE-Advanced FDD/TDD and 5G NR
Preset	1
State Saved	Saved in instrument state
Min/Max	1/2

3.9.1.1 Normal

Windows: "Graph" on page 1066, "Metrics" on page 1067,

Dual window view of the graph and the metrics.

Example	:DISP:ACP:VIEW PRES

3.9.1.2 Carrier Info

Windows: "Graph" on page 1066, "Metrics" on page 1067,

Dual window view of the graph and the metrics.

Example	:DISP:ACP:VIEW CINF

3.9.2 Windows

This section describes the Windows that are available in the ACP measurement.

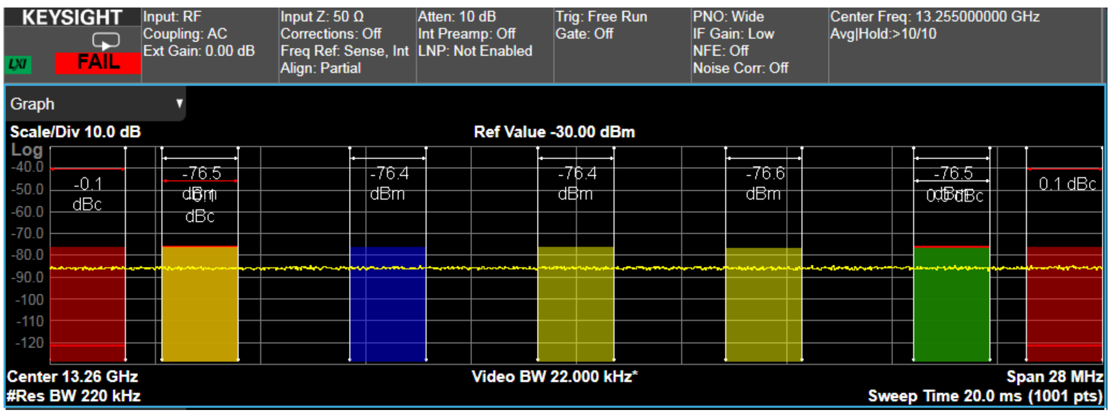
3.9.2.1 Graph

The Graph window is used to display the spectrum being measured by the ACP measurement.

The results of the measurement can be displayed as a single spectrum trace view or displayed with a Bar Graph trace on the spectrum trace.

The Graph window appears in several Views, as follows:

View	Size	Position
Normal	Half, full width	Top
Carrier Info	Half, full width	Top
Gate View	One third, full width	Middle



When the Bar Graph is On and Limit Test is On, the color of each bar graph reflects the limit test result. When the limit test fails, the bar color is red, and when limit test passes, the bar color is blue.

When RBW is selected as the measurement method, the spectrum trace is not displayed, only the bar graph is displayed. In addition, the Bar Graph control (under the Display front-panel key) is set to ON and is grayed out.

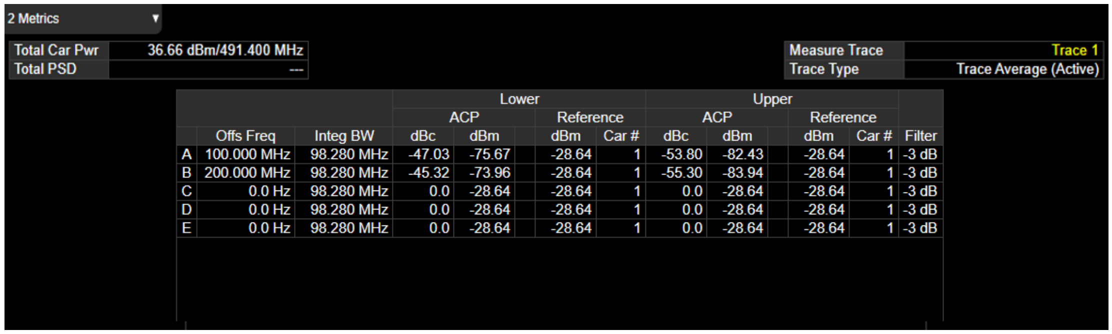
3.9.2.2 Metrics

The Metrics window displays the textual results of the ACP measurement.

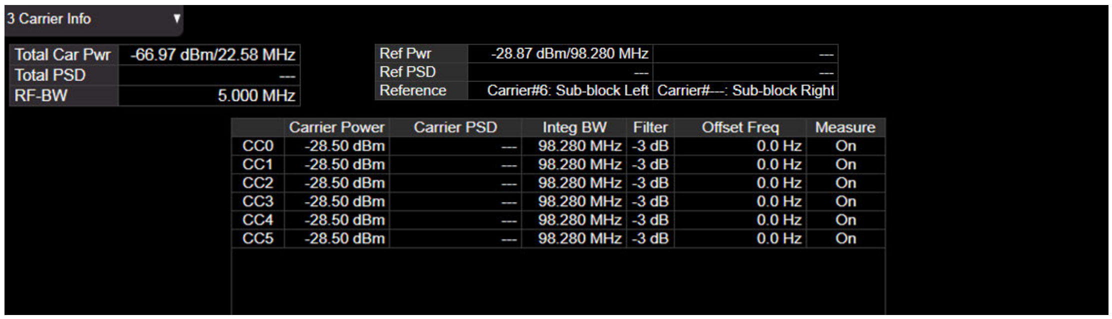
Views in which the Metrics window appears:

View	Size	Position
Normal	Half, full width	Bottom
Carrier Info	Half, full width	Bottom
Gate View	One Third, full width	Bottom

Metrics Window in Normal view



Metrics Window in Carrier Info view



The text window displays the following results:

Total Carrier Power

This is the total power of all the carriers with carrier power present set to yes. The power is calculated by integrating across the bandwidth declared by the Carrier Integ BW parameter for each carrier and then totaling the sums. The total integration bandwidth is shown as part of the result. This will be the total of the Carrier Integ Bw of the carriers used in calculating the total carrier power. If the RRC Filter is on, then the integration bandwidth used is (1 + alpha)/T where T = 1/(Carrier Integ BW) multiplied by the number of carriers with carrier power present set to yes.

Ref Power

This is the power of the reference. The power is calculated by integrating across the bandwidth defined by the Reference Type. The integration bandwidth is shown as a part of the result. For some Power Reference Type, this is the value of the Carrier Integ BW for that carrier unless the RRC Filter is on, then the integration bandwidth used is the displayed value, which is (1 + alpha)/T where T = 1/(Carrier Integ BW).

Reference

In multi-carrier applications, this row displays what is used as a reference power.

Carrier Power

This is the power in all the currently defined carriers. If the carrier has carrier power present, the power will be absolute. If the carrier is defined as not having power present, the power will be relative to the reference carrier. The power is calculated by integrating across the bandwidth declared by the Carrier Integ BW parameter. The integration bandwidth is shown as part of the result. This is the value of the Carrier Integ BW for the carrier unless the RRC Filter is on, then the integration bandwidth used is the displayed value, which is (1 + alpha)/T where T = 1/(Carrier Integ BW).

Offset Relative Power

This is the power in the offsets relative to the reference carrier. The power is calculated by integrating across the bandwidth declared by the Offset Integ BW parameter. The offset integration bandwidth is shown as part of the result. This is the value on the Offset Integ BW menu unless the RRC Filter is on, then the integration bandwidth used is the displayed value, which is (1 + alpha)/T where T = 1/(Offset Integ BW).

Offset Absolute Power

This is the absolute power in the offsets. The power is calculated by integrating across the bandwidth declared by the Offset Integ BW parameter. The offset integration bandwidth is shown as part of the result. This is the value on the Offset Integ BW menu unless the RRC Filter is on, then the integration bandwidth used is the displayed value, which is (1 + alpha)/T where T = 1/(Offset Integ BW).

RF-BW

It displays the total bandwidth from the lowest carrier to the highest carrier whatever their measurement states are on or off.

Integration Bandwidth

It displays the noise bandwidth of each carrier to be measured in the ACP measurement

Measure Trace

See "Measure Trace" on page 1259

Trace Type

This is the trace type (and view/blank parameter) of a trace specified by Measure Trace.

Measure Trace and Trace Type are displayed only when Meas Method is set to “Integration BW”, “Filtered IBW”, or “Fast Power”

Filter

It displays whether RRC filter is used for ACP measurement or not.

Offset Frequency

It shows the offset frequency from the carrier reference frequency in multi-carrier measurements. The carrier frequency display type determines whether the relative frequency or absolute frequency will be displayed.

Sub-block

As for intra-band non-contiguous spectrum operation, the sub-block concept is introduced, which refers to one contiguous allocated block of spectrum for transmission and reception in the intra-band non-contiguous aggregation mode. So far we support the two sub-blocks. It displays which sub-block the carrier belongs to in the intra-band non-contiguous aggregation mode. The column will be displayed when the carrier allocation mode is non-contiguous.

Measure

It shows whether the carrier power presents or not.

3.9.2.3 Gate

Turning on Gate View shows the Gate Window, which allows you to see your Gating signal at the same time as the measured data. See the description under Gate View in the Trigger, Gate Settings section.

View	Size	Position
Gate View	One third, full width	Top

3.9.3 Amplitude

Activates the **Amplitude** menu and selects **Reference Level** or **Reference Value** as the active function, depending on the measurement.

Some features in this menu apply to multiple measurements. Some other features apply only to specific measurements and their controls are blanked or grayed-out in measurements that do not support the feature.

3.9.3.1 Y Scale

Contains controls that pertain to the Y-Axis parameters of the measurement. These parameters control how data on the vertical (Y) axis is displayed and control instrument settings that affect the vertical axis.

Ref Value

Sets the value for the absolute power reference. The reference line is at the top, center, or bottom of the graticule, depending on the value of the **Ref Position** function.

Remote Command	`:DISPlay:ACPower:WINDow[1]:TRACe:Y[:SCALe]:RLEVel <real>` `:DISPlay:ACPower:WINDow[1]:TRACe:Y[:SCALe]:RLEVel?`
Example	`:DISP:ACP:WIND:TRAC:Y:RLEV 100` `:DISP:ACP:WIND:TRAC:Y:RLEV?`
Couplings	When **Auto Scaling** is `ON` (default), this value is automatically determined by the measurement result. When you set a value manually, **Auto Scaling** changes to `OFF`

	Attenuation is not coupled to Ref Value
Preset	10.00 dBm
State Saved	Saved in instrument state
Min/Max	-250.00 dBm / 250.00 dBm
Annotation	Ref <value> top left of graph
Backwards Compatibility SCPI	`:DISPlay:ACPower:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:RLEVel`

Scale/Div

For measurements that support a logarithmic Y-Axis, **Scale/Div** sets the height of one division of the graticule in the current Y-Axis unit.

Scale/Div also determines the displayed amplitude range in the log plot graph. Since there are usually 10 vertical graticule division on the display, the total amplitude range of the graph is typically 10x this amount. For example, if Scale/Div is 10 dB, then the total range of the graph is 100 dB.

Remote Command	`:DISPlay:ACPower:WINDow[1]:TRACe:Y[:SCALe]:PDIVision <rel_ampl>` `:DISPlay:ACPower:WINDow[1]:TRACe:Y[:SCALe]:PDIVision?`
Example	`:DISP:ACP:WIND:TRAC:Y:PDIV 5` `:DISP:ACP:WIND:TRAC:Y:PDIV?`
Couplings	When **Auto Scaling** is `ON` (default), this value is automatically determined by the measurement result. When you set a value manually, **Auto Scaling** changes to `OFF`
Preset	10.00 dB / Div
State Saved	Saved in instrument state
Min	0.10 dB
Max	20 dB
Annotation	<value> dB/ left upper of graph
Backwards Compatibility SCPI	`:DISPlay:ACPower:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:PDIVision`

Ref Position

Positions the reference level at the top, center, or bottom of the Y Scale display. Changing the reference position does not change the reference level value.

Remote Command	`:DISPlay:ACPower:WINDow[1]:TRACe:Y[:SCALe]:RPOSition TOP | CENTer | BOTTom` `:DISPlay:ACPower:WINDow[1]:TRACe:Y[:SCALe]:RPOSition?`

Example	:DISP:ACP:WIND:TRAC:Y:RPOS CENT :DISP:ACP:WIND:TRAC:Y:RPOS?
Preset	TOP
State Saved	Saved in instrument state
Range	TOP|CENTer|BOTTom
Annotation	The greater than (>) and less than (<) symbols are displayed on both sides of the graph to indicate the Reference Position
Backwards Compatibility SCPI	:DISPlay:ACPower:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:RPOSition

Auto Scaling

Toggles the **Auto Scaling** function between On and Off.

Remote Command	:DISPlay:ACPower:WINDow[1]:TRACe:Y[:SCALe]:COUPle 0 | 1 | OFF | ON :DISPlay:ACPower:WINDow[1]:TRACe:Y[:SCALe]:COUPle?
Example	:DISP:ACP:WIND:TRAC:Y:COUP OFF :DISP:ACP:WIND:TRAC:Y:COUP?
Couplings	When **Auto Scaling** is ON, and the **Restart** front-panel key is pressed, this function automatically sets the scale per division to 10 dB and determines the reference values based on the measurement results When you set a value to either **Scale/Div** or **Ref Value** manually, **Auto Scaling** automatically changes to OFF
Preset	1
State Saved	Saved in instrument state
Range	OFF|ON
Backwards Compatibility SCPI	:DISPlay:ACPower:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:COUPle

3.9.3.2 Attenuation

Controls the attenuator functions and interactions between the attenuation system components.

There are two attenuator configurations in the X-Series. One is a Dual-Attenuator configuration consisting of a mechanical attenuator and an optional electronic attenuator. The other configuration uses a single attenuator with combined mechanical and electronic sections thatcontrols all the attenuation functions. Different models in the X-Series come with different configurations.

– See "Dual-Attenuator Configurations" on page 1073

– See "Single-Attenuator Configuration" on page 1074

Most attenuation settings are the same for all measurements – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset.

This tab is only available when the hardware set includes an input attenuator, which is typically only the case when using Keysight’s box instruments. For example, this tab does not appear in:

– VXT models M9420A/21A/10A/11A

– E7760

– M9391A

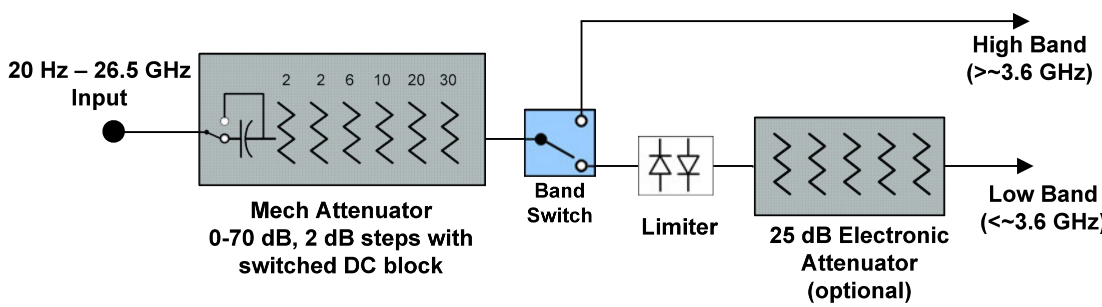
– M9393A

This tab also does not appear in UXM. In UXM all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

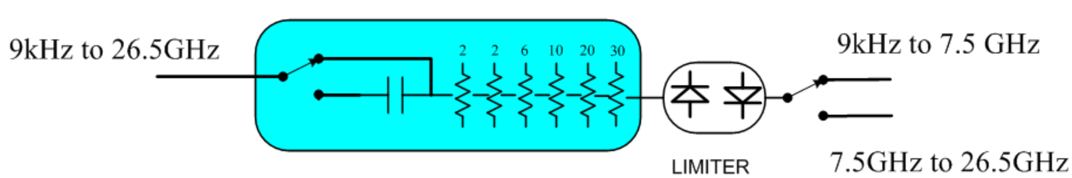
Dependencies	In measurements that support the I/Q inputs, this tab is unavailable when I/Q is the selected input, and is replaced by the Range tab in that case

Dual-Attenuator Configurations

Configuration 1: Mechanical attenuator + optional electronic attenuator

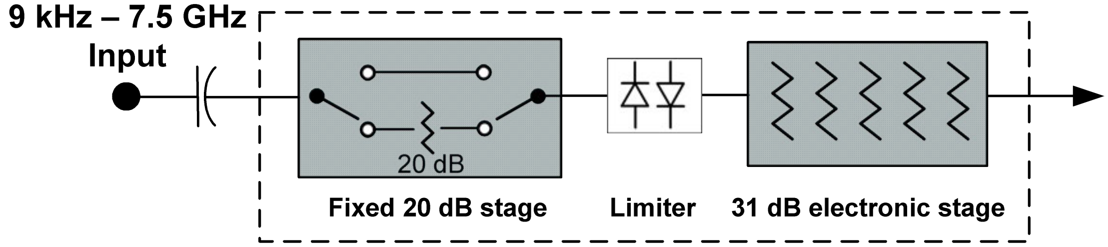


Configuration 2: Mechanical attenuator, no optional electronic attenuator



(note that Configuration 2 is not strictly speaking a dual-section attenuator, since there is no electronic section available. However, it behaves exactly like Configuration 1 without the Electronic Attenuator option EA3, therefore for the sake of this document it is grouped into the “Dual-Attenuator” configuration)

Single-Attenuator Configuration



You can tell which attenuator configuration you have by pressing the Attenuation tab, which (in most Modes) opensthe Attenuation menu. If the first control in the Attenuation menu says **Mech Atten** you have the Dual-Attenuator configuration. If the first control says **Atten** you have the Single-Attenuator configuration.

(Note that depending on the measurement, there may be no Auto/Man functionality on the Mech Atten control).

In the Single-Attenuator configuration, youcontrol the attenuation with a single control, as the fixed stage has only two states. In the Dual-Attenuator configuration, both stages have significant range so you are given separate control of the mechanical and electronic attenuator stages.

When you have the Dual-Attenuator configuration, you may still have only a Single-Attenuator, because unless option EA3 (the Electronic Attenuator option) is available, and you purchase it, you will have only the mechanical attenuator.

Mech Atten

This control is labeled **Mech Atten** in Dual-Attenuator models and **Atten** in Single-Attenuator models. In the Dual-Attenuator configuration, this control only affects the mechanical attenuator.

This control lets you modify the attenuation applied to the RF input signal path. This value is normally auto coupled to the Ref Level, the Internal Preamp Gain, any

External Gain that is entered, and the Max Mixer Level, as described in the table below.

See "Attenuator Configurations and Auto/Man" on page 1076

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation <rel_ampl>`
	`[:SENSe]:POWer[:RF]:ATTenuation?`
	`[:SENSe]:POWer[:RF]:ATTenuation:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:POWer[:RF]:ATTenuation:AUTO?`

Example	`:POW:ATT 20`
	Dual-Attenuator configuration: sets the mechanical attenuator to 20 dB
	Single-Attenuator mode: sets the main attenuation to 20 dB (see below for definition of "main" attenuation)
	In either case, if the attenuator was in Auto, it is set to Manual
	`:POW:ATT:AUTO ON`
	Turn Auto Mech Atten ON

Dependencies	Some measurements do not support the Auto setting of "Mech Atten" on page 1074. In these measurements, the Auto/Man selection is not available, and the Auto/Man toggle function is not available In Dual-Attenuator configurations, when the electronic attenuator is enabled, the mechanical attenuator has no auto setting and the Auto/Man toggle function is not available. The state of Auto/Man is remembered and restored when the electronic attenuator is once again disabled. This is described in more detail in "Elec Atten" on page 1753 See "Attenuator Configurations and Auto/Man" on page 1076 for more information on the Auto/Man functionality `:POW:ATT:AUTO` is only available in measurements that support Mech Atten Auto, such as Swept SA
Couplings	If the RF Input Port is the RF Input: – If the USB Preamp is connected to USB, use 0 dB for Mech Atten – Otherwise compute the auto-selected value of Mech Atten based on **Reference Level**, Int Preamp, External Gain, Ref Level Offset, Max Mixer Level, µW Path Control and IF Gain settings. Limit this value to be no less than 6 dB (total attenuation below 6 dB can never be chosen by Auto) – In the N9041B, if the RF Input Port is RF Input 2, use the formula above and subtract the Full Range Atten value from the result to determine the Mech Atten. Limit the value so that it is never lower than 0 dB and so that total attenuation, including Full Range Atten, is never less than 6 dB (total attenuation, including Full Range Atten below 6 dB, can never be chosen by Auto) In External Mixingand BBIQ, where the Attenuator is not in the signal path, the Attenuator setting changes as described above when "Mech Atten" on page 1074 is in Auto, but no changes are made to the actual attenuator hardware setting until the input is changed back to the RF Input For CXA-m with option FSA (Fine-Step Attenuator or 2 dB steps), the FSA-like behavior is only available when the frequency setting is <= 7.5GHz. So, when the frequency is changed from below 7.5GHz to above 7.5GHz, the attenuation setting will be changed to a multiple of 10dB which will be no smaller than the previous setting. For example, 4dB attenuation will be changed to 10dB
Preset	The preset for Mech Attenuation is "Auto" The Auto value of attenuation is 10 dB

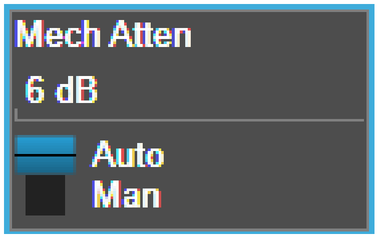
	ON
State Saved	Saved in instrument state
Min	0 dB The attenuation set by this control cannot be decreased below 6 dB with the knob or step keys. Values below 6 dB must be directly entered from the keypad or via SCPI. This protects against setting a dangerously small attenuation value, which can put the instrument at risk of damage to input circuitry. If the current mechanical attenuation is below 6 dB, it can be increased with the knob and step keys, but not decreased
Max	CXA Option 503 or 507: 50 dB EXA: 60 dB All other models: 70 dB Note that in the Single-Attenuator configuration, the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB.
Annotation	The current value for Total Atten is displayed in the Measurement Bar at the top of the display. A value appears for Electronic Attenuation only if the Electronic Attenuator is enabled. The annotation appears as Atten: <total> dB (e<elec>) The e letter is in amber in Single-Attenuator configurations For example: Dual-Attenuator configuration: Atten: 24 dB (e14) Indicating the total attenuation is at 24 dB and the electronic attenuation is at 14 dB Single-Attenuator configuration: A: 24 dB (e14) Indicating the total attenuation is at 24 dB and the “soft” attenuation is at 14 dB (see below for definition of “soft” attenuation) When in Manual, a # sign appears in front of Atten in the annotation

Attenuator Configurations and Auto/Man

As described in "Attenuation" on page 1747 , there are two distinct attenuator configurations available in the X-Series, the single attenuator and Dual-Attenuator configurations. In Dual-Attenuator configurations, we have the mechanical attenuation and the electronic attenuation, and the current total attenuation is the sum of the electronic + mechanical attenuation. In Single-Attenuator configurations, we refer to the attenuation set using "Mech Atten" on page 1074 (or `:POW:ATT`) as the “main” attenuation; and the attenuation that is set by `:POW:EATT` as the “soft” attenuation (`:POW:EATT` is honored even in the Single-Attenuator configuration, for compatibility purposes). Then the current total attenuation is the sum of the main + soft attenuation. See "Elec Atten" on page 1753 for more on “soft” attenuation.

NOTE

In some measurements, the **Mech Atten** control has an Auto/Man function. In these measurements, an Auto/Man switch is shown on the **Mech Atten** control:



Note that in configurations that include an Electronic Attenuator, this switch is only shown when the Electronic Attenuator is disabled.

In other measurements, **Mech Atten** has no Auto/Man function. In these measurements, no switch is shown on the **Mech Atten** control:

Mech Atten also appears with no switch, as above, in configurations that include an Electronic Attenuator but when the Electronic Attenuator is enabled.

Elec Atten

Controls the Electronic Attenuator in Dual-Attenuator configurations. This control does not appear in Single-Attenuator configurations, as the control of both the mechanical and electronic stages of the Single-Attenuator is integrated into the single **Atten** control.

This control includes an Enable/Disable toggle switch; it is only possible to enter a value for the Electronic Attenuator when this switch is in the “Enable” position.

See "More Information" on page 1078

<table>
<tr><td>Remote Command</td><td>[:SENSe]:POWer[:RF]:EATTenuation <rel_ampl>
[:SENSe]:POWer[:RF]:EATTenuation?
[:SENSe]:POWer[:RF]:EATTenuation:STATe OFF | ON | 0 | 1
[:SENSe]:POWer[:RF]:EATTenuation:STATe?</td></tr>
<tr><td>Example</td><td>:POW:EATT 10
:POW:EATT?
:POW:EATT:STAT ON
:POW:EATT:STAT?</td></tr>
<tr><td>Notes</td><td>Electronic Attenuation’s specification is defined only when Mechanical Attenuation is 6 dB</td></tr>
<tr><td>Dependencies</td><td>This control only appears in Dual-Attenuator models with an Electronic Attenuator installed and licensed. It does not appear in models with the Single-Attenuator configuration, as in the Single-Attenuator configuration there is no “electronic attenuator” there is only a single integrated attenuator</td></tr>
</table>

	(which has both a mechanical and electronic stage). However, in the Single-Attenuator configuration, EATT SCPI commands are accepted for compatibility with other X-series instruments and set a “soft” attenuation as described in . The “soft” attenuation is treated as an addition to the “main” attenuation value set by the Atten control or the POW:ATT SCPI command and affects the total attenuation displayed on the Atten control and the Meas Bar The electronic attenuator (and the “soft” attenuation function provided in Single-Attenuator configurations) is unavailable above the low band (0-3.6 GHz, 0-3.4 GHz 0-3GHz, depending on the model). If the low band ranges from 0-3.6GHz, and Stop Frequency of the instrument is > 3.6 GHz, then the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed out If the Internal Preamp is on, meaning it is set to Low Band or Full, the electronic attenuator (and the “soft” attenuation function provided in Single-Attenuator configurations) is unavailable. In this case the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed out If either of the above is true, if the SCPI command is sent, an error indicating that the electronic attenuator is unavailable will be sent If both of the above are true, pressing the control will generate error message -221, in other words, the frequency range lockout takes precedence If the electronic/soft Attenuator is enabled, then the Stop Freq of the instrument is limited to 3.6 GHz and the Internal Preamp is unavailable The SCPI-only “soft” electronic attenuation for the single-attenuator configuration is not available in all measurements; in particular, it is not available in the Swept SA measurement
Couplings	Enabling and disabling the Electronic Attenuator affects the setting of the Mechanical Attenuator (in Dual-Attenuator configurations). This is described in more detail below and in the section "Attenuator Configurations and Auto/Man" on page 1752
Preset	`OFF` (Disabled) for Swept SA measurement `ON` (Enabled) for all other measurements that support the electronic attenuator
State Saved	Saved in instrument state
Min	0 dB
Max	Dual-Attenuator configuration: 24 dB Single-Attenuator configuration: the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB
Annotation	See Annotation under the **Mech Atten** control description

More Information

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear. These advantages primarily aid in remote operation and are negligible for front panel use. See "Using the Electronic Attenuator: Pros and Cons" on page 1079 for a detailed discussion of the pros and cons of using the electronic attenuator.

For the Single-Attenuator configuration, for SCPI backwards compatibility, the “soft” attenuation feature replaces the Dual-Attenuator configuration’s electronic attenuator. All the same couplings and limitations apply. See "Attenuator Configurations and Auto/Man" on page 1752

Mechanical Attenuator Transition Rules

When the Electronic Attenuator is enabled, the Mechanical Attenuator transitions to a state that has no Auto function. Below are the rules for transitioning the Mechanical Attenuator. Note that the information below ONLY applies to the Dual-Attenuator configurations, and ONLY when the Electronic Attenuator is installed:

When the Electronic Attenuation is enabled from a disabled state:

The Mechanical Attenuator is initialized to 10 dB (this is its optimal performance setting). You can then set it as desired with SCPI, numeric keypad, step keys, or knob, and it behaves as it normally would in manual mode

The Auto/Man state of (Mech) Atten is saved

The Auto/Man toggle on the (Mech) Atten control disappears and the auto rules are disabled

The Electronic Attenuator is set to 10 dB less than the previous value of the Mechanical Attenuator, within the limitation that it must stay within the range of 0 to 24 dB of attenuation

Examples in the Dual-Attenuator configuration:

Mech Atten at 20 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 10 dB. New total attenuation equals the value before Elec Atten enabled

Mech Atten at 0 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 0 dB. New total attenuation does not equal the value before Elec Atten enabled

Mech Atten at 40 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 24 dB. New total attenuation does not equal the value before Elec Atten enabled

When the Electronic Attenuation is disabled from an enabled state:

The Elec Atten control is grayed out

- The Auto/Man state of (Mech) Atten is restored

If now in Auto, (Mech) Atten recouples

If now in Man, (Mech) Atten is set to the value of total attenuation that existed before the Elec Atten was disabled. The resulting value is rounded up to the smallest value possible given the (Mech) Atten Step setting - (That is, 57 dB changes to 58 dB when (Mech) Atten Step is 2 dB)

Using the Electronic Attenuator: Pros and Cons

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear.

The “finer steps” advantage of the electronic attenuator is beneficial in optimizing the alignment of the instrument dynamic range to the signal power in the front panel as well as remote use. Thus, you can achieve improved relative signal measurement accuracy. Compared to a mechanical attenuator with 2 dB steps, the 1 dB resolution

of the electronic attenuator only gives better resolution when the odd-decibel steps are used. Those odd-decibel steps are less accurately calibrated than the even-decibel steps, so one tradeoff for this superior relative accuracy is reduced absolute amplitude accuracy.

Another disadvantage of the electronic attenuator is that the spectrum analyzer loses its “Auto” setting, making operation less convenient.

Also, the relationship between the dynamic range specifications (TOI, SHI, compression, and noise) and instrument performance are less well-known with the electrical attenuator. With the mechanical attenuator, TOI, SHI, and compression threshold levels increase dB-for-dB with increasing attenuation, and the noise floor does as well. With the electronic attenuator, there is an excess attenuation of about 1 to 3 dB between 0 and 3.6 GHz, making the effective TOI, SHI, and so forth, less well known. Excess attenuation is the actual attenuation relative to stated attenuation. Excess attenuation is accounted for in the instrument calibration

Adjust Atten for Min Clipping

Sets the combination of mechanical and electronic attenuation and gain based on the current measured signal level so that clipping will be at a minimum.

This is an "immediate action" function, that is, it executes once, when the control is pressed.

The algorithms that are used for the adjustment are documented under "Pre-Adjust for Min Clipping" on page 1757.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate`
Example	`:POW:RANG:OPT IMM`
Notes	Executing Adjust Atten for Min Clipping initiates the measurement.
Dependencies	Does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum measurements For the Waveform measurement, this control is available only in 5G NR Mode

Adjust Atten

Allows you to select;

- Electric attenuator only
- Combination of Electric attenuator and Mechanical attenuator

when the command `[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate` is executed.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize:TYPE EONLy | COMBined` `[:SENSe]:POWer[:RF]:RANGe:OPTimize:TYPE?`

Example	`:POW:RANG:OPT:TYPE EONL` `:POW:RANG:OPT:TYPE?`
Dependencies	Does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum measurements For the Waveform measurement, this control is available only in 5G NR Mode
Preset	`COMBined`
State Saved	Saved in instrument state

Pre-Adjust for Min Clipping

If this function is ON, it applies the adjustment described under "Adjust Atten for Min Clipping" on page 1756 each time a measurement restarts. Therefore, in Continuous measurement mode, it only executes before the first measurement.

In Dual-Attenuator models, you can set **Elec+Mech Atten**, in which case both attenuators participate in the autoranging, or **Elec Atten Only**, in which case the mechanical attenuator does not participate in the autoranging. This latter case results in less wear on the mechanical attenuator and is usually faster.

See "Adjustment Algorithm" on page 1082

Selection	Example	Note
Off	`:POW:RANGe:OPT:ATT OFF`	This is the default setting
Elec Atten Only	`:POW:RANGe:OPT:ATT ELEC`	Selects only the electric attenuator to participate in auto ranging. This offers less wear on the mechanical attenuator and is usually faster
Mech + Elec Atten	`:POW:RANGe:OPT:ATT COMB`	In Dual-Attenuator models, this selects both attenuators to participate in the autoranging

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation OFF | ON | ELECtrical | COMBined` `[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation?`
Example	`:POW:RANG:OPT:ATT OFF` `:POW:RANG:OPT:ATT?`
Notes	The parameter option `ELECtrical` sets this function to `ON` in Single-Attenuator models The parameter option `COMBined` is mapped to `ELECtrical` in Single-Attenuator models. If you send `COMBined`, it sets the function to `ON` and returns `ELEC` to a query For SCPI compatibility with models that do not have an input attenuator, the `ON` parameter is honored and mapped to `COMBined`
Dependencies	This control only appears in Dual-Attenuator models with an Electronic Attenuator installed In instruments with Dual-Attenuator model, when **Enable** "Elec Atten" on page 1753 is `OFF` or grayed-out, "Pre-Adjust for Min Clipping" on page 1081 is grayed-out This control does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum

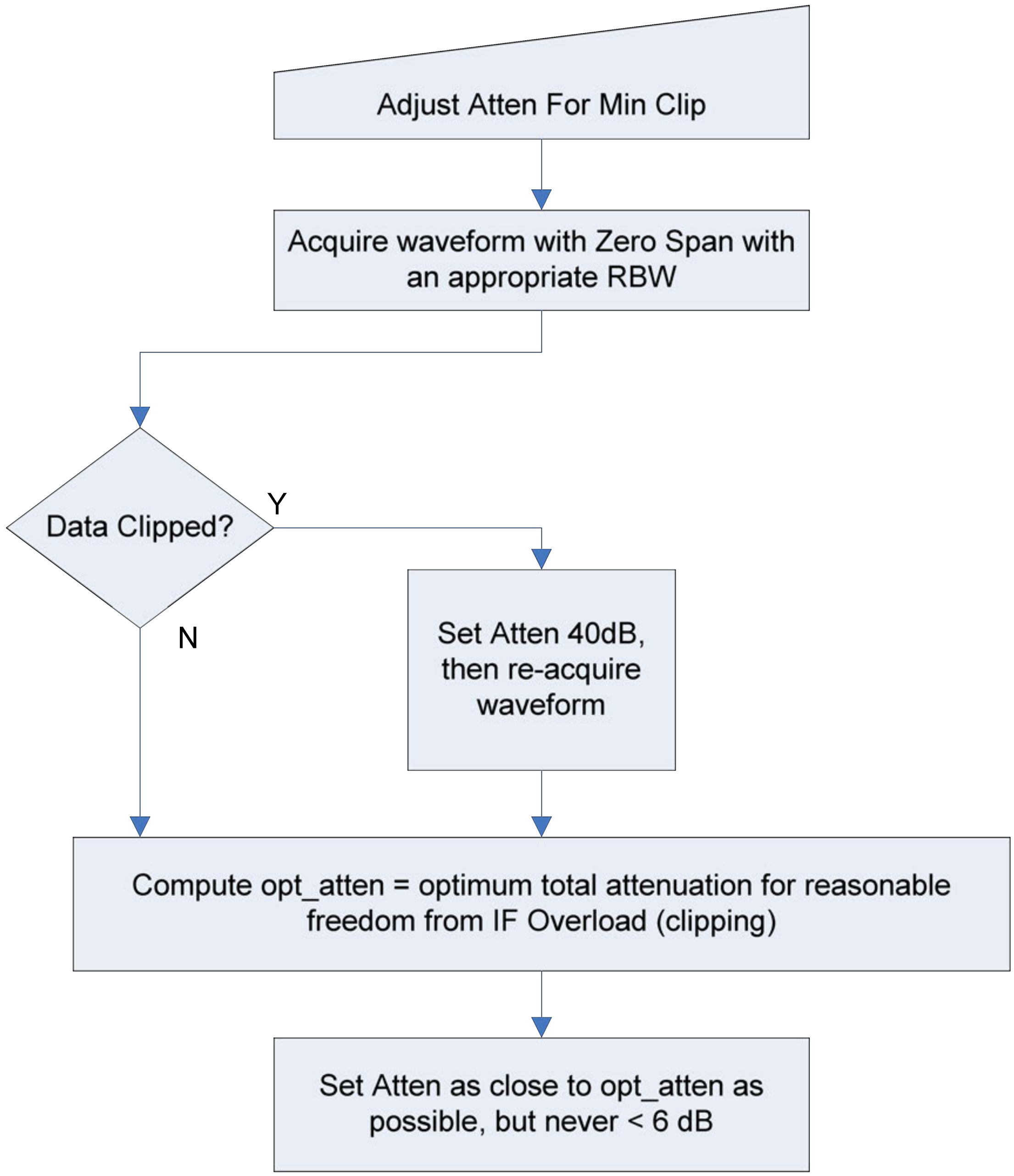
	measurements For the Waveform measurement, this control is available only in 5G NR Mode
Preset	`OFF` when Elec Atten is Disabled at preset, otherwise `ELEC`
State Saved	Saved in instrument state
Range	Dual-Attenuator models: Off | Elec Atten Only | Mech + Elec Atten Single-Attenuator models: Off | On

Notes	`ON` aliases to "Elec Atten Only" (`:POW:RANG:OPT:ATT ELEC`) `OFF` aliases to "Off" (`:POW:RANG:OPT:ATT OFF`) `:POW:RANG:AUTO?` returns true if `:POW:RANG:OPT:ATT` is not `OFF`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:RANGe:AUTO ON | OFF | 1 | 0` `[:SENSe]:POWer[:RF]:RANGe:AUTO?`

Adjustment Algorithm

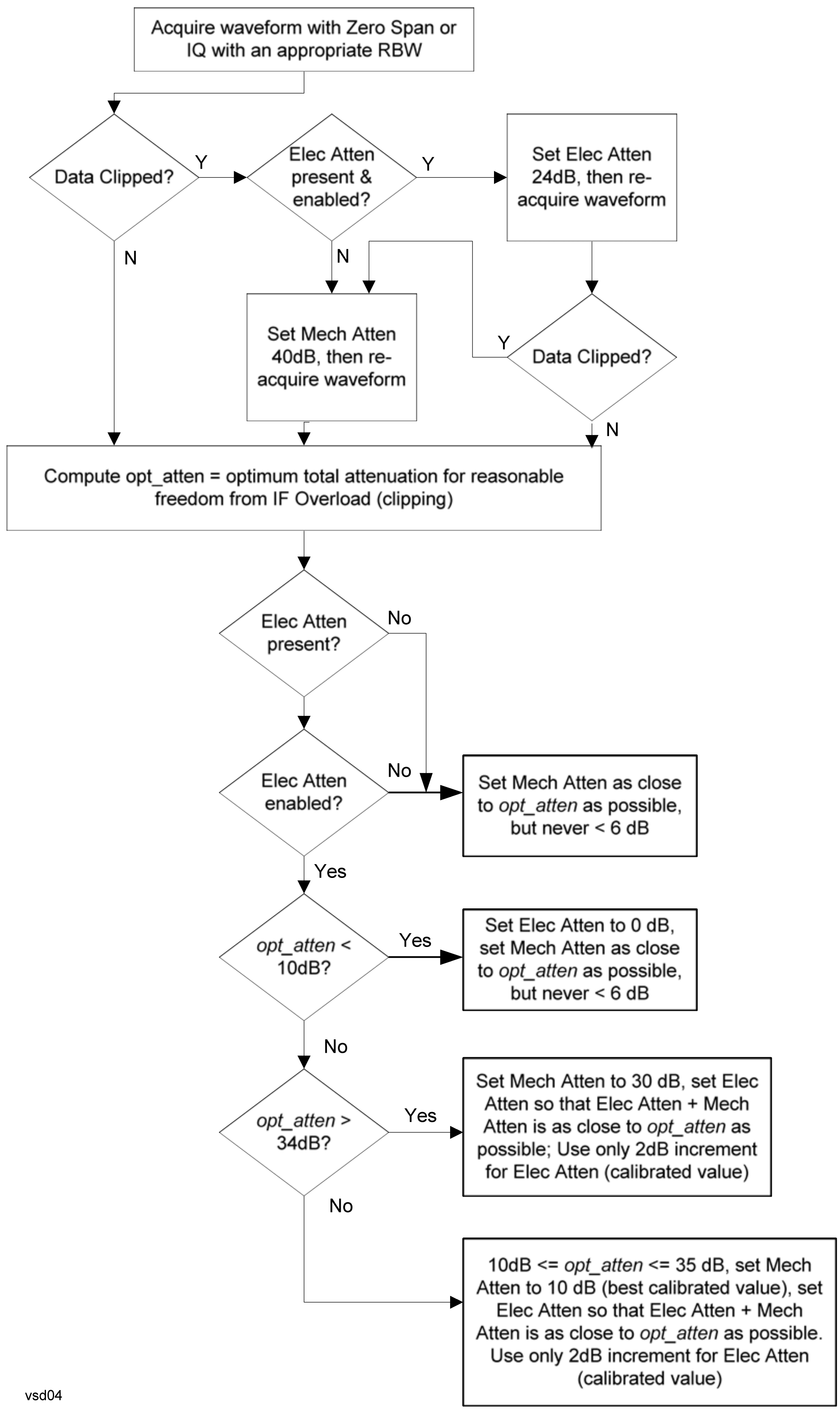
The algorithms for the adjustment are documented below:

Single-Attenuator Models

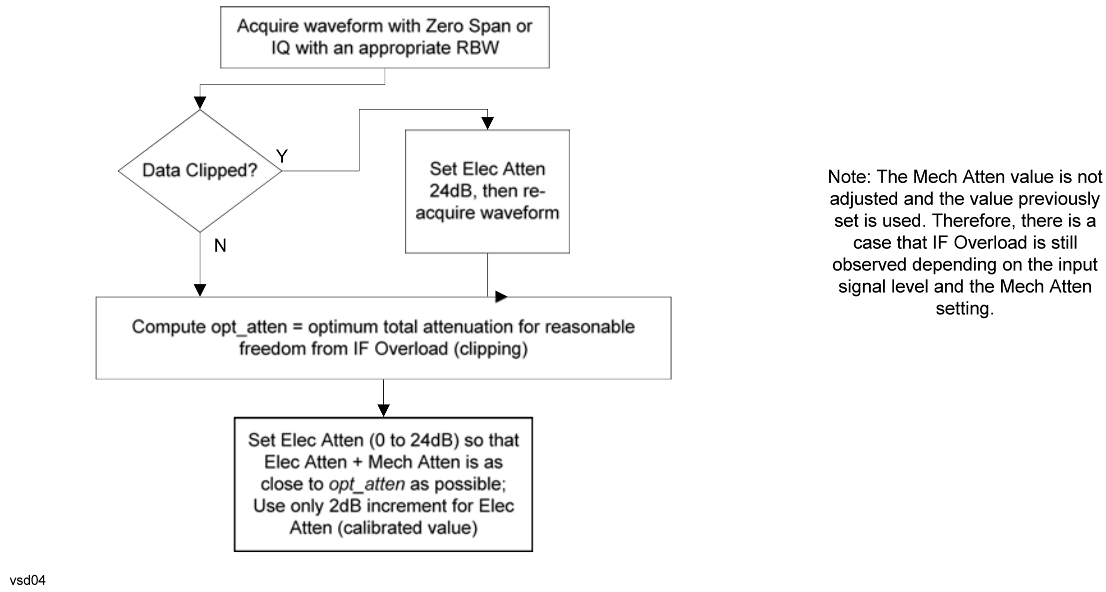


Dual-Attenuator models

"Adjust Atten for Min Clipping" on page 1756 or "Pre-Adjust for Min Clipping" on page 1081 selection is Mech + Elec Atten:


Acquire waveform with Zero Span or IQ with an appropriate RBW
Data Clipped?
Y
N
Elec Atten present & enabled?
Y
N
Set Elec Atten 24dB, then re-acquire waveform
Set Mech Atten 40dB, then re-acquire waveform
Y
Data Clipped?
N
Compute opt_atten = optimum total attenuation for reasonable freedom from IF Overload (clipping)
Elec Atten present?
No
Elec Atten enabled?
No
Set Mech Atten as close to *opt_atten* as possible, but never < 6 dB
Yes
opt_atten < 10dB?
Yes
Set Elec Atten to 0 dB, set Mech Atten as close to *opt_atten* as possible, but never < 6 dB
No
opt_atten > 34dB?
Yes
Set Mech Atten to 30 dB, set Elec Atten so that Elec Atten + Mech Atten is as close to *opt_atten* as possible; Use only 2dB increment for Elec Atten (calibrated value)
No
10dB <= *opt_atten* <= 35 dB, set Mech Atten to 10 dB (best calibrated value), set Elec Atten so that Elec Atten + Mech Atten is as close to *opt_atten* as possible. Use only 2dB increment for Elec Atten (calibrated value)
vsd04

"Pre-Adjust for Min Clipping" on page 1081 selection is Elec Only:



Mech Atten Step

Controls thestep size used when making adjustments to the input attenuation.

This control is labeled **Mech Atten Step** in Dual-Attenuator models and **Atten Step** in Single-Attenuator models. In the Dual-Attenuator configuration, this control only affects the step size of the mechanical attenuator.

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement] 10 dB | 2 dB` `[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement]?`
Example	`:POW:ATT:STEP 2` `:POW:ATT:STEP?`
Notes	This feature has a toggle choice from the front panel, but it takes a specific value (in dB) when used remotely. The only valid values are 2 and 10
Dependencies	Blanked in EXA, CXA and CXA-m if option FSA (2 dB steps) is not present. If blanked, attempts to set it via SCPI yield an error
Couplings	When the attenuation step size changes, the current mechanical attenuation value is adjusted (if necessary) to be quantized to the new step size. That is, if step is set to 10 dB, mech atten is increased if necessary so it is a multiple of 10 dB
Preset	EXA, CXA and CXA-m: 10 dB (2 dB with option FSA) All other models: 2 dB
State Saved	Saved in instrument state

3.9.3.3 Range (Non-attenuator models)

This tab is only available for Keysight's modular signal analyzers and certain other Keysight products. Examples include:

- VXT
- E7760
- M9391A
- M9393A

This tab also does not appear in UXM. In UXM, all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

State Saved	No

Range

Represents the amplitude of the largest sinusoidal signal that could be present within the IF without being clipped by the ADC. For signals with high peak-to-average ratios, the range may need to exceed the rms signal power by a significant amount to avoid clipping.

This is a measurement global setting.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe <real>` `[:SENSe]:POWer[:RF]:RANGe?`
Example	`:POW:RANG 10 dBm` `:POW:RANG?`
Notes	The MIN and MAX values are affected by the External Gain parameters, and by the **Center Frequency** The hardware compensates for frequency response and alters the Range setting
Preset	0 dBm
State Saved	Yes
Min	-100
Max	100
Annotation	Meas Bar

Adjust Range for Min Clipping

Sets the combination of attenuation and gain based on the current measured signal level so that clipping will be at a minimum.

This is an "immediate action" function, that is, it executes once, when the key is pressed.

This key does not appear in measurements that do not support this functionality.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate`
Notes	Executing Adjust Range for Min Clipping initiates the measurement
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760

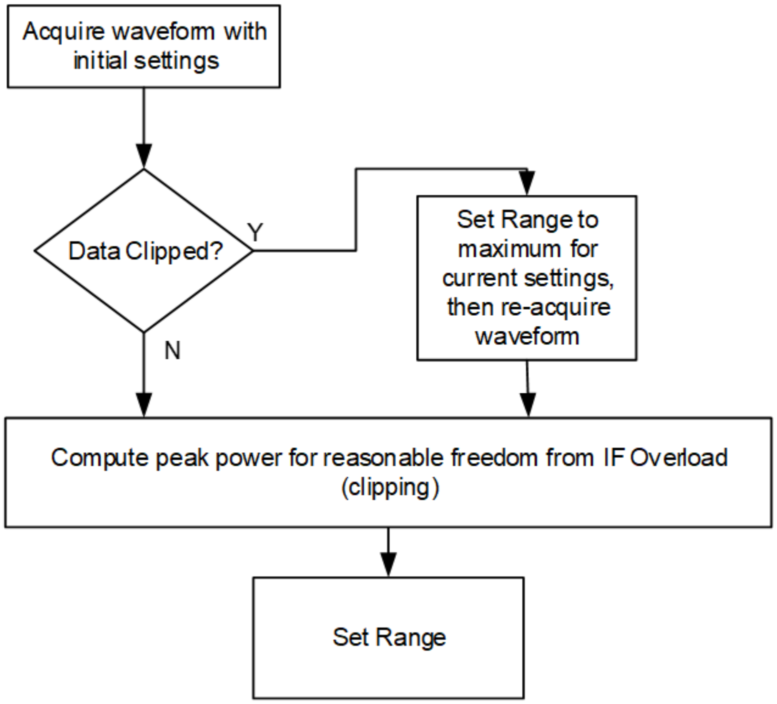
Pre-Adjust for Min Clipping

If this function is `ON`, it applies the adjustment described under Adjust Range For Min Clipping each time a measurement restarts. Therefore, in Continuous measurement mode, it only executes before the first measurement.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation OFF | ON | ELECtrical | COMBined` `[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation?`
Notes	Because there is no attenuator control available in these models, the control displays only `ON` and `OFF` choices. However, for SCPI compatibility with other platforms, all three parameters (`ELECtrical`, `COMBined`, and `ON`) are honored and all are mapped to `ELECtrical`, so if any of these three parameters is sent, a subsequent query will return `ELEC`
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760
Preset	`OFF` for Swept SA measurement; `ON` for all other measurements that support **Pre-Adjust for Min Clipping**
State Saved	Saved in instrument state

Adjustment Algorithm

The algorithm for the adjustment is documented below:



Peak-to-Average Ratio

Used with "Range (Non-attenuator models)" on page 1864 to optimize the level control in the instrument. The value is the ratio, in dB, of the peak power to the average power of the signal to be measured. A ratio of 0 should be used for sinusoidal signals; for 802.11g OFDM signals use 9 dB.

All Applications (Modes) show the current value of Peak-to-Average ratio on the control. However, some applications do not permit changing the value. In these situations, the control is grayed-out.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:PARatio <real>` `[:SENSe]:POWer[:RF]:RANGe:PARatio?`
Example	`:POW:RANG:PAR 12 dB`
Notes	In some Applications (Modes) this parameter is read-only; meaning the value will appear on the control and query via SCPI, but is not changeable. In such applications the control is grayed-out. Attempting to change the value via SCPI will be ignored but no error message will be generated
Dependencies	This control does not appear in Spectrum Analyzer Mode
Preset	10 dB VXT Models M9410A/11A: 0 dB
State Saved	Saved in instrument state
Min	0 dB
Max	20 dB

	VXT Models M9410A/11A: 50 dB

Mixer Lvl Offset

This is an advanced setting to adjust target Range at the input mixer, which in turn affects the signal level in the instrument's IF. This setting can be used when additional optimization is needed after setting "Peak-to-Average Ratio" on page 1866. Positive values of offset optimize noise performance over distortion, negative values optimize distortion performance over noise.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet <real>` `[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet?`
Example	`:POW:RANG:MIX:OFFS -5 dB`
Preset	0 dB
State Saved	Saved in instrument state
Min	-35 dB VXT Models M9410A/11A: -34 dB
Max	30 dB

3.9.3.4 Signal Path

Contains controls that pertain to the routing of the signal through the frontend of the instrument.

In general, this tab only appears in instruments whose hardware supports this signal routing. For example, this tab does not appear in many of the modular instrument products, including VXT Models M9420/21A. It also does not appear in UXM.

This tab *does* appear in VXT Models M9410A/11A because the Software Preselection control is in this tab, and VXT Models M9410A/11A implement a version of Software Preselection.

Presel Center

Pressing this control adjusts the centering of the preselector filter to optimize the amplitude accuracy at the frequency of the selected marker. If the selected marker is not on when **Presel Center** is pressed, the instrument turns on the selected marker, performs a peak search, and then performs centering on the marker's center frequency. If the selected marker is already on and between the start and stop frequencies of the instrument, the instrument performs the preselector calibration on that marker's frequency. If the selected marker is already on, but outside the frequency range between Start Freq and Stop Freq, the instrument first performs a peak search, and then performs centering on the marker's center frequency.

The value displayed on "Preselector Adjust" on page 1869 will change to reflect the new preselector tuning.

A number of considerations should be observed to ensure proper operation. See "Proper Preselector Operation" on page 1090.

Remote Command	`[:SENSe]:POWer[:RF]:PCENter`
Example	`:POW:PCEN`
Notes	Note that the rules outlined above under the control description apply for the remote command as well as the key. The result of the command is dependent on marker position, etc. Any message shown by the control press is also shown in response to the remote command
Dependencies	Does not appear in CXA-m Does not appear in VXT Models M9410A/11A Grayed-out if the microwave preselector is off – If the selected marker's frequency is below Band 1, an advisory message is generated "Preselector not used in this frequency range" and no action is taken – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz – Blank in models that do not include a preselector, such as option 503. If the remote command is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View
Couplings	The active marker position determines where the centering will be attempted If the instrument is in a measurement such as averaging when centering is initiated, the act of centering the preselector restarts averaging, but the first average trace will not be taken until the centering is completed The offset applied to do the centering reads out on the "Preselector Adjust" on page 1869 control
Status Bits/OPC dependencies	When centering the preselector, `*OPC` will not return true until the process is complete and a subsequent measurement has completed, nor will results be returned to `:READ` or `:MEASure` queries The Measuring bit should remain set while this command is operating and should not go false until the subsequent sweep/measurement has completed

Proper Preselector Operation

A number of considerations should be observed to ensure proper operation:

1 If the selected marker is off, the instrument turns on a marker, performs a peak search, and adjusts the preselector using the selected marker's frequency. It uses the "highest peak" peak search method unqualified by threshold or excursion, so that there is no chance of a 'no peak found' error. It continues with that peak, even if it is the peak of just noise. Therefore, for this operation to work properly, there should be a signal on screen in a preselected range for the peak search to find

2 If the selected marker is already on, the instrument attempts the centering at that marker's frequency. There is no preselector for signals below about 3.6 GHz, so if the marker is on a signal below 3.6 GHz, no centering will be attempted and an advisory message generated

3 In some models, the preselector can be bypassed. If it is bypassed, no centering will be attempted in that range and a message will be generated

Preselector Adjust

Allows you to manually adjust the preselector filter frequency to optimize its response to the signal of interest. This function is only available when "Presel Center" on page 1868is available.

For general purpose signal analysis, using **Presel Center** is recommended. Centering the filter minimizes the impact of long-term preselector drift. **Preselector Adjust** can be used instead to manually optimize the preselector. One application of manual optimization would be to peak the preselector response, which both optimizes the signal-to-noise ratio and minimizes amplitude variations due to small (short-term) preselector drifting.

When **Presel Center** is performed, the offset applied to do the centering becomes the new value of **Preselector Adjust**.

Remote Command	`[:SENSe]:POWer[:RF]:PADJust <freq>` `[:SENSe]:POWer[:RF]:PADJust?`
Example	`:POW:PADJ 100KHz` `:POW:PADJ?`
Notes	The value on the control reads out to 0.1 MHz resolution
Dependencies	– Does not appear in CXA-m – Does not appear in VXT Models M9410A/11A – Grayed-out if microwave preselector is off – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz – Blank in models that do not include a preselector, such as option 503. If the SCPI is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View
Preset	0 MHz
State Saved	The **Preselector Adjust** value set by "Presel Center" on page 1868, or by manually adjusting **Preselector Adjust** It is not saved in instrument state, and does not survive a Preset or power cycle
Min	-500 MHz
Max	500 MHz
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PADJust` `[:SENSe]:POWer[:RF]:MMW:PADJust`

Notes	PSA had multiple preselectors, and you could select which preselector to adjust. Since the X-Series has only one mm/uW preselector, the preselector selection control is no longer available. However, to provide backward compatibility, we accept the legacy remote commands The command form has no effect, the query always returns `MWAVe`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:PADJust:PRESelector MWAVe | MMWave | EXTernal` `[:SENSe]:POWer[:RF]:PADJust:PRESelector?`

Internal Preamp

Accesses a menu of controls for the internal preamps. Turning on the preamp gives a better noise figure, but a poorer inter-modulation distortion (TOI) to noise floor dynamic range. You can optimize this setting for your particular measurement.

The instrument takes the preamp gain into account as it sweeps. If you sweep outside of the range of the preamp, the instrument will also account for that. The displayed result always reflects the correct gain.

For some measurements, when the preamp is on and any part of the displayed frequency range is below the lowest frequency for which the preamp has specifications, a warning condition message appears in the status line. For example, for a preamp with a 9 kHz lowest specified frequency: "Preamp: Accy unspec'd below 9 kHz".

Selection	Example	Note
Off	`:POW:GAIN OFF`	
Low Band	`:POW:GAIN ON` `:POW:GAIN:BAND LOW`	Sets the internal preamp to use only the low band. The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Low Band selection in the dropdown
Full Range	`:POW:GAIN ON` `:POW:GAIN:BAND FULL`	Sets the internal preamp to use its full range. The low band (0-3.6 GHz, 0-3.4 GHz, 0-3GHz, depending on the model) is supplied by the low band preamp and the frequencies above low band are supplied by the high band preamp The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Full Range selection in the dropdown. If the high band option is not installed the Full Range selection does not appear

Remote Command	`[:SENSe]:POWer[:RF]:GAIN:BAND LOW | FULL` `[:SENSe]:POWer[:RF]:GAIN:BAND?`

	`[:SENSe]:POWer[:RF]:GAIN[:STATe] OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:GAIN[:STATe]?`

Example	`:POW:GAIN:BAND LOW`
	`:POW:GAIN:BAND?`
	`:POW:GAIN OFF`
	`:POW:GAIN?`

Dependencies	Preamp is not available on all hardware platforms. If the preamp is not present or is unlicensed, the control is not shown Does not appear in VXT Models M9410A/11A/15A If `:POW:GAIN:BAND FULL` is sent when a low band preamp is available, the preamp band parameter is set to `LOW` instead of `FULL`, and an "Option not installed" message is generated The preamp is not available when the electronic/soft attenuator is enabled
Preset	`LOW` `OFF`
State Saved	Saved in instrument state
Annotation	When the USB Preamp is not connected to USB, the Preamp annotation in the Meas Bar says “Off” if the preamp is off and displays the frequency range of the low band or full range preamp depending on the setting. For example, if the Preamp is set to Low Band and the Low Band is 3.6 GHz the annotation says “3.6 GHz”. If it is a 13.6 GHz preamp and it is set to Full Range the annotation says “13.6 GHz” When the USB Preamp is connected to USB, the Preamp annotation says “Preamp: USB” if the internal preamp is off or “Preamp: USB, Int” if the internal preamp is on (only for measurements that support the USB preamp)

LNA

Lets you turn the Low Noise Amplifier (**LNA**) on or off.

The LNA is an additional preamplifier that provides superior DANL and frequency range compared to the Internal Preamp. The LNA provides lower system noise figure, especially at frequencies above 100 MHz, and can be operated up to the full range of 50 GHz instruments.

For best possible sensitivity, the LNA can be turned on together with the "Internal Preamp" on page 1870, although if you operate both preamps together, note that the TOI (distortion) specifications are impacted. The sensitivity improvement of this combination is substantial when operating in high band (frequencies above 3.6 GHz).

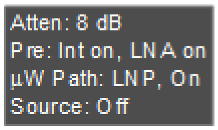
See "More Information" on page 1094

Remote Command	`[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe] OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe]?`
Example	`:POW:GAIN:LNA ON`
Dependencies	Requires option LNA

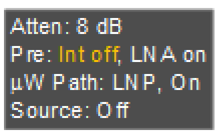
	Option LNA is not required by VXT model M9415A Does not appear in VXT models M9420A/21A/10A/11A May not appear in some measurements
Preset	OFF
State Saved	Saved in State

More Information

When the LNA is installed, the preamp annotation changes to show the state of both the LNA and the Internal Preamp. Below is an example:



Note that when operating entirely in the low band (below about 3.6 GHz), if the LNA is on, the Internal Preamp is switched off (even if you have its switch set to ON). This is because the noise performance is actually degraded in low band if both preamps are on. In this case, the annotation reflects the actual state of the two preamps, but the Internal Preamp annotation displays in amber, to warn you that the actual state of the Internal Preamp does not match the **Internal Preamp** switch control display:



µW Path Control

Options for this control include **µW Preselector Bypass** (Option MPB), **Low Noise Path** (Option LNP) and **Full Bypass Enable** in the High Band path circuits.

When the µW Preselector is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. When **Low Noise Path Enable** is selected, the instrument automatically bypasses certain circuitry in the high frequency bands that can contribute to noise, when it is appropriate based on other instrument settings.

For most applications, the preset state is **Standard Path**, which provides the best remote-control throughput, minimizes acoustic noise from switching and minimizes the risk of wear in the hardware switches, particularly in remote test scenarios where both low band and high band setups will follow in rapid succession. In this path, the bypass of the low band/high band switch and microwave preamp is never activated, which can cause some noise degradation but preserves the life of the bypass switch.

For applications that utilize the wideband IF paths, the preset state is **µW Preselector Bypass**, if option MPB is present. This is because, when using a wideband IF such as

the 140 MHz IF, the µW Preselector's bandwidth can be narrower than the available IF bandwidth, causing degraded amplitude flatness and phase linearity, so it is desirable to bypass the preselector in the default case.

You may choose **Low Noise Path Enable** for a lower noise floor, especially in the 21-26.5 GHz region, though without improving many measures of dynamic range, and without giving the best possible noise floor. The preamp, if purchased and used, gives better noise floor than does **Low Noise Path Enable**, but the preamp's compression threshold and third-order intercept are much poorer than that of **Low Noise Path Enable**.

A fourth choice is **Full Bypass Enable**, which combines **µW Preselector Bypass** and **Low Noise Path Enable**. Because this can bypass most of the circuitry between the input and the first mixer, care should be taken when using this setting to avoid damaging the mixer. **Full Bypass Enable** is only available if both options LNP and MPB are present, as well as option FBP.

Path	Example	Note
Standard Path	`:POW:MW:PATH STD`	Normal setting for most measurements. µW Preselector in circuit, Low Noise Path disabled
Low Noise Path Enable	`:POW:MW:PATH LNP`	See "Low Noise Path Enable" on page 1099
µW Preselector Bypass	`:POW:MW:PATH MPB`	See "µW Preselector Bypass" on page 1100
Full Bypass Enable	`:POW:MW:PATH FULL`	See "Full Bypass Enable" on page 1101

Remote Command	`[:SENSe]:POWer[:RF]:MW:PATH STD | LNPath | MPBypass | FULL` `[:SENSe]:POWer[:RF]:MW:PATH?`

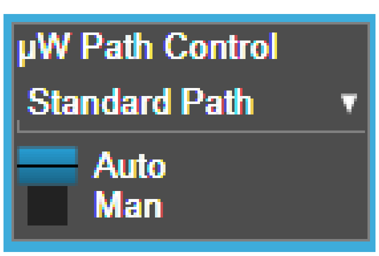
Example	`:POW:MW:PATH LNP`
	Enables the Low Noise path
	`:POW:MW:PATH?`

Notes	If "Presel Center" on page 1868 is performed, the instrument will momentarily switch to the Standard Path, regardless of the setting of **µW Path Control** The DC Block will always be switched in when the low noise path is switched in, to protect succeeding circuitry from DC. Note that this does not mean "when the low noise path is enabled" but when, based on the Low Noise Path rules, the path is actually switched in. This can happen when the selection is **Low Noise Path Enable** or **Full Bypass Enable.** In the case where the DC Block is switched in the instrument is now AC coupled. However, if you selected DC coupling, the UI would still behave as though it were DC coupled, including all annunciation, warnings, status bits, and responses to SCPI queries. This is because, based on other settings, the instrument could switch out the low noise path at any time and hence go back to being DC coupled Alignment switching ignores the settings in this menu, and restores them when finished
Dependencies	Does not appear in CXA-m Does not appear in VXT Models M9410A/11A Does not appear in BBIQ and External Mixing

	The **Low Noise Path Enable** selection does not appear unless Option LNP is present and licensed The **µW Preselector Bypass** selection does not appear unless Option MPB is present and licensed The **Full Bypass Enable** selection does not appear unless options LNP and MPB are both present as well as option FBP In any of these cases, if the required options are not present and the SCPI command is sent, error -241, "Hardware missing; Option not installed" is generated **Low Noise Path Enable** and **Full Bypass Enable** are grayed-out if the current measurement does not support them **Low Noise Path Enable** and **Full Bypass Enable** are not supported in Avionics and MMR Modes. In any of these cases (that is, the feature is not supported in either measurement or mode), if the SCPI command is sent, the following error is generated: -221, “Setting Conflict; Feature not supported for this measurement”
Preset	All except modes specified below: `STD` IQ Analyzer, VXA, Pulse and Avionics mode: – MPB option present and licensed: `MPB` – MPB option not present and licensed: `STD`
State Saved	Save in instrument state
Range	Standard Path|Low Noise Path Enable|µW Presel Bypass|Full Bypass Enable
Annotation	In the Meas Bar, if the Standard path is chosen, it says: µW Path: Standard If Low Noise Path is enabled but the LNP switch is not thrown, it shows: µW Path: LNP,Off If the Low Noise Path is enabled and the LNP switch IS thrown, it shows: µW Path: LNP,On If the preselctor is bypassed, it says: µW Path: Bypass If Full Bypass Enable is selected but the LNP switch is not thrown, it shows: µW Path: FByp,Off If Full Bypass Enable is selected and the LNP switch IS thrown, it shows: µW Path: FByp,On

µW Path Control Auto [Mode: VMA, WLAN, NR5G, CQM]

In VMA, WLAN, 5G NR, CQM modes, an Auto/Man switch is added to **µW Path Control**:



This allows the function to automatically switch based on certain Auto Rules as shown below:

VMA Mode

Measurement	When µW Path Control is in Auto:
Digital Demod	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Custom OFDM	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Presel Bypass
SEM	Always Presel Bypass
Spurious Emissions	Always Standard Path

WLAN Mode

Measurement	When µW Path Control is in Auto:
Modulation Analysis	Always Presel Bypass
Spectral Flatness	Always Presel Bypasss
Power vs Time	Always Presel Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Always Presel Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Always Presel Bypass
SEM	1. For 11be 320M, when 'Enabled Wideband IF for FFT' is OFF or 'Sweep Type Rule' is Best Dynamic Range, auto µW path is standard. 2. For other cases, auto µW path is presel bypass if presel bypass is enabled, auto µW path is standard if presel bypass is not enabled.
Spurious Emissions	Always Standard Path

5G NR Mode

Measurement	When µW Path Control is in Auto:
Modulation	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in

Measurement	When µW Path Control is in Auto:
Analysis	which case choose Full Bypass if conditions warrant(FBP Option is available and “Allow Full Bypass in Auto” is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and “Allow Full Bypass in Auto” is On), otherwise choose Preselector Bypass
Channel Power	Always Standard Path
Occupied BW	Always Standard Path
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Standard Path
SEM	Always Standard Path
Spurious Emissions	Always Standard Path
Transmit On|Off Power	Use Standard Path unless tuned frequency > 3.6 GHz and Info BW > 15 MHz, in which case choose Preselector Bypass

Channel Quality Mode

Measurement	When µW Path Control is in Auto:
Group Delay	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and “Allow Full Bypass in Auto” is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass

Remote Command	`[:SENSe]:POWer[:RF]:MW:PATH:AUTO ON | OFF | 1 | 0` `[:SENSe]:POWer[:RF]:MW:PATH:AUTO?`
Example	`:POW:MW:PATH:AUTO ON` `:POW:MW:PATH:AUTO?`
Dependencies	Only appears in VMA, WLAN, 5G NR and CQM modes
Couplings	See the tables above
Preset	ON
Range	ON|OFF

Low Noise Path Enable

You may select Low Noise Path Enable, which gives a lower noise floor under some circumstances, particularly when operating in the 21-26.5 GHz region. With the Low Noise Path enabled, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

- The instrument is not in the Low Band, meaning:
- the start frequency is above 3.5 GHz and
- the stop frequency is above 3.6 GHz
- the internal preamp is not installed or (if installed) is set to Off or Low Band

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the Low Noise Path Enable is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the Low Noise Path Enable is selected in the user interface. The only time the Low Noise Path is used is when Low Noise Path Enable is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

For measurements that use IQ acquisition, the low noise path is used when Center Frequency is in High Band (> 3.6 GHz) and no preamp is in use. In other words, the rules above are modified to use only the center frequency to qualify which path to switch in. This is not the case for FFTs in the Swept SA measurement; they use the same rules as swept measurements.

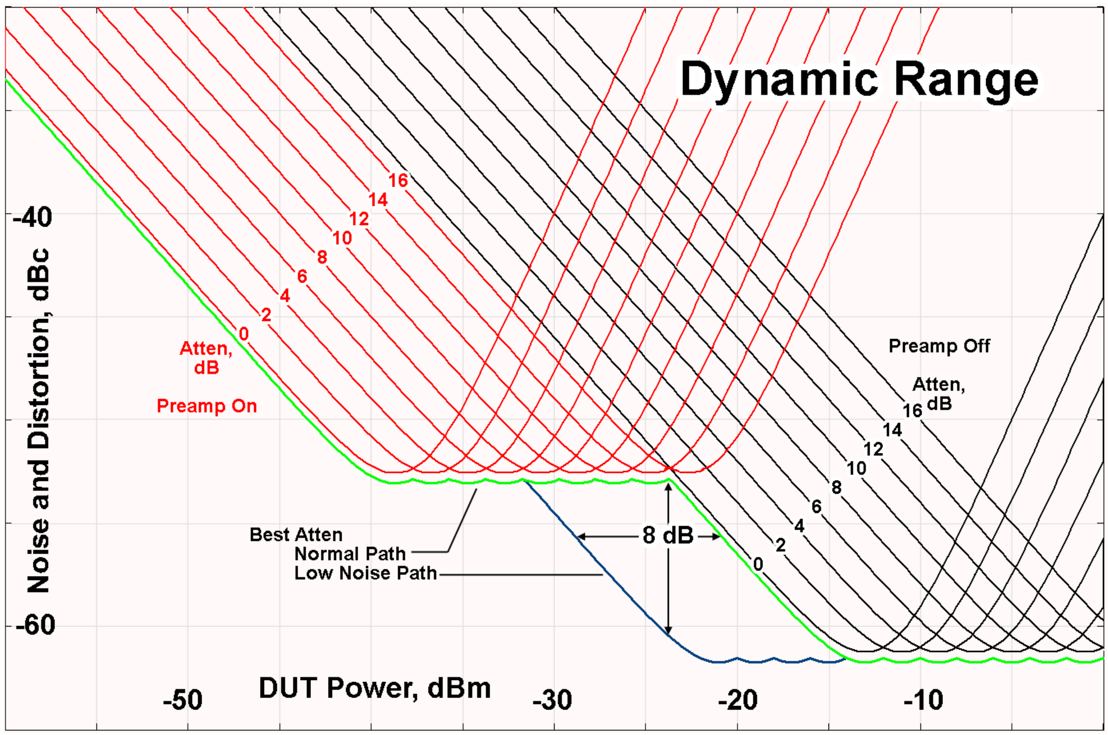
Note that the Low Noise Path, while giving improved DANL, has the disadvantage of decreased TOI performance and decreased gain compression performance relative to the standard path.

Note also that the bypass switch is a mechanical switch and has finite life, so if the Low Noise Path Enable is selected, it is possible to cause frequent cycling of this switch by frequently changing instrument settings such that the above conditions hold true only some of the time. A user making tests of this nature should consider opting for the Standard Path, which will never throw the bypass switch, at the expense of some degraded noise performance.

The low noise path is useful for situations where the signal level is so low that the instrument performance is dominated by noise even with 0 dB attenuation, but still high enough that the preamp option would have excessive third-order intermodulation or compression. The preamp, if purchased and used, gives better noise floor than does the “Low Noise Path.” However, its compression threshold and third-order intercept are much poorer than that of the non-preamp path.

There are some applications, typically for signals around –30 dBm, for which the third-order dynamic range of the standard path is good enough, but the noise floor is not low enough even with 0 dB input attenuation. When the third-order dynamic range of the preamp path is too little and the noise floor of the standard path is too high, the Low Noise Path can provide the best dynamic range

The graph below illustrates the concept. It shows, in red, the performance of an instrument at different attenuation settings, both with the preamp on and off, in a measurement that is affected by both instrument noise and instrument TOI. The green shows the best available dynamic range, offset by 0.5 dB for clarity. The blue shows how the best available dynamic range improves for moderate signal levels with the low noise path switched in. In this illustration, the preamp improves the noise floor by 15 dB while degrading the third-order intercept by 30 dB, and the low noise path reduces loss by 8 dB. The attenuator step size is 2 dB.



There are other times where selecting the low noise path improves performance, too. Compression-limited measurements such as finding the nulls in a pulsed-RF spectrum can profit from the low noise path in a way similar to the TOI-limited measurement illustrated. Accuracy can be improved when the low noise path allows the optimum attenuation to increase from a small amount like 0, 2 or 4 dB to a larger amount, giving better return loss at the instrument input. Harmonic measurements, such as second and third harmonic levels, are much improved using the low noise path because of the superiority of that path for harmonic (though not intermodulation) distortion performance.

µW Preselector Bypass

Toggles the preselector bypass switch for band 1 and higher. When the microwave presel is on, the signal path is preselected. When the microwave preselector is off, the signal path is not preselected. The preselected path is the normal path for the instrument.

The preselector is a tunable bandpass filter which prevents signals away from the frequency of interest from combining in the mixer to generate in-band spurious signals (images). The consequences of using a preselector filter are its limited bandwidth, the amplitude and phase ripple in its passband, and any amplitude and phase instability due to center frequency drift.

Option MPB or pre-selector bypass provides an unpreselected input mixer path for certain X-Series signal analyzers with frequency ranges above 3.6 GHz. This signal path allows a wider bandwidth and less amplitude variability, which is an advantage when doing modulation analysis and broadband signal analysis. The disadvantage is that, without the preselector, image signals will be displayed. Another disadvantage of bypassing the preselector is increased LO emission levels at the front panel input port.

Image responses are separated from the real signal by twice the 1st IF. For IF Paths of 10 MHz and 25 MHz, the 1st IF is 322.5 MHz, so the image response and the real signal will be separated by 645 MHz. The 1st IF will be different for other IF Path settings. When viewing a real signal and its corresponding image response in internal mixing, the image response will be to the left of the real signal.

Also, the image response and the real signal typically have the same amplitude and exhibit the same shape factor.

However, if Option FS1, Fast Sweep Capability, is enabled, the image response in the Swept SA measurement appears lower in amplitude and has a much wider shape factor compared to the real signal.

Full Bypass Enable

With **Full Bypass Enable** selected, the microwave preselector is bypassed. In addition, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

- The instrument is not in the Low Band, meaning:
- the start frequency is above 3.5 GHz and
- the stop frequency is above 3.6 GHz.
- the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. The only time the Low Noise Path is used is when **Full Bypass Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

CAUTION	When **Full Bypass Enable** is selected, and "Attenuation" on page 1747 is set to 0 dB, there will be a direct AC connection between the input and the first converter

when the Low Noise Path switches in (when Start Freq >3.6 GHz and the Preamp is either not licensed, set to Low Band, or Off). This puts the first converter at high risk to be damaged by high AC power. Consequently, whenever **Full Bypass Enable** is selected, a warning message appears in the status bar:

Full Bypass Enabled, maximum safe input power reduced

Microwave Preselector Bypass Backwards Compatibility

Example	`:POW:MW:PRES OFF` Bypasses the microwave preselector
Notes	Included for Microwave Preselector Bypass backwards compatibility The `ON` parameter sets the `STD` path (`:POW:MW:PATH STD`) The `OFF` parameter sets path `MPB` (`:POW:MW:PATH MPB`)
Preset	`ON`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe] ON | OFF | 0 | 1` `[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe]?`

Frequency Extender Preselection Bypass

Frequency Extender Preselection Bypass only applies to the high frequency path of the Frequency Extender and only if the Frequency Extender allows it. For example, the V3050A high frequency path is 50 – 110 GHz and does allow control of the preselector bypass.

When the Frequency Extender's preselection is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. For bandwidths greater than 2.5 [GHz], it is recommended that the signal bypass the Frequency Extender Preselector since the max bandwidth of the Preselector can be as narrow as 2.5 [GHz].

For most applications, the preset state is `OFF`, which gives the best remote-control throughput, minimizes acoustic noise from switching, minimizes out of band spurs, and minimizes the risk of wear in the hardware switches.

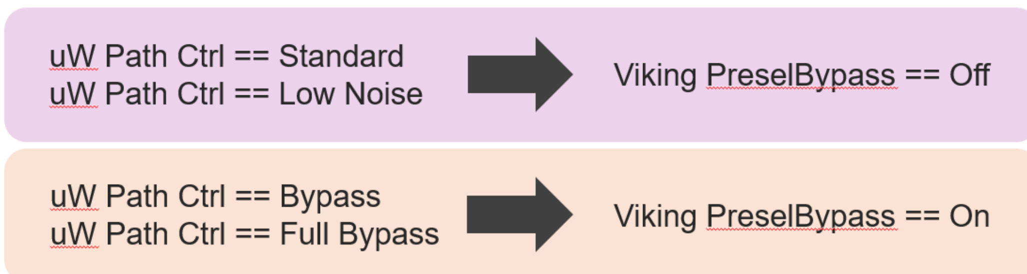
Coupling with Microwave Preselector Control

The control of whether to apply or bypass the Frequency Extender's preselection is dependent on the Microwave Path Control setting.

The coupling between the Microwave Path Control and Frequency Extender Preselector Bypass is described below.

UW PATH CTRL	UW PRESELECTOR	VIKING PRESELECTOR
Standard Path	On	**On**
Low Noise Path Enable	On	**On**
uW Presel Bypass	Off	**Off**
Full Bypass Enable	Off	**Off**

In other words…



For the Frequency Extender Preselector Bypass to take effect, it requires a Frequency Extender device (such as V3050A) be connected and External RF (ERFIN) selected as the input.

The Frequency Extender Preselector is applied or bypassed depending on the Microwave Path Control setting only when the acquisition is above 50 [GHz]. Hence, it will be bypassed only when the acquisition is above 50 [GHz].

Preselector and Bandwidth Conflict

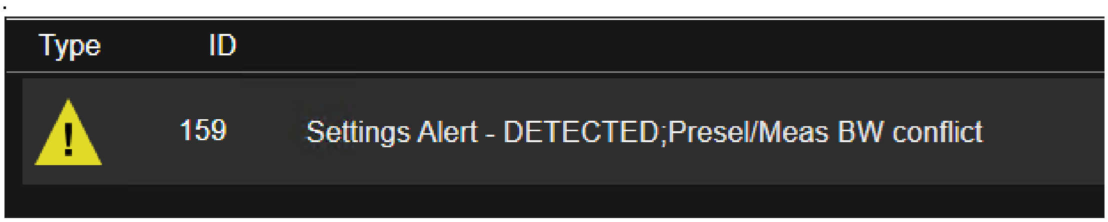
When the Frequency Extender Preselector is applied and the signal bandwidth is greater than 2.5 [GHz], then a settings alert message will show to warn the user that the signal may be distorted due to the limitation of the Frequency Extender Preselector bandwidth.

An example of the settings alert message is shown below.

Settings Alert message in the Status Bar at the bottom of the display.

Settings Alert message in the error queue

.



Software Preselection

Software Preselection is provided in some instruments, either to compensate for issues with provided hardware preselection or to provide the preselection function when there is no hardware preselector.

N9041B

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 50 GHz, software preselection must be used to suppress and separate images above 50 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

In the N9041B, Software Preselection only applies for frequencies above 50 GHz, therefore it is only used for RF Input 2. Even if it is turned on, it will not be used for other inputs and never for frequencies below 50 GHz. This is why the label of this control contains the parenthetical note “(>~50 GHz)”.

Note that in the N9041B, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

N9042B+V3050A

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 88 GHz, software preselection must be used to suppress and separate images above 88 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

For N9042B+V3050A, Software Preselection only applies for frequencies above 88 GHz, therefore it is only used for External RF. Even if it is turned on, it will not be used for other inputs and never for frequencies below 88 GHz. This is why the label of this control contains the parenthetical note “(>~88 GHz)”.

Note that for N9042B+V3050A, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

VXT models M9410A/11A

Software Preselection is used to provide the preselection function, as there is no hardware preselector in these models. Two background traces are taken and compared point by point, and the point with the lowest amplitude from the two traces is used. This provides a method to reduce spurs that are internally generated within the VXT, but the user should note the following when using Software

Preselection:

- There is some speed cost due to the need to take multiple captures
- Taking the point with the lowest amplitude in each trace will make the average noise level lower at all points that do not have a spur. This can reduce the accuracy of the measurement of noise and noise-like signals.

Because of the difficulty in identifying spurs manually, you are encouraged to leave Software Preselection ON at all times in VXT models M9410A/11A. If you turn it off in order to speed up your measurement or improve noise accuracy, be aware of unwanted onscreen spurs.

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel:STATe 0 | 1 | ON | OFF` `[:SENSe]:POWer[:RF]:SWPresel:STAT?`
Example	`:POW:SWPR:STAT 1` `:POW:SWPR:STAT?`
Dependencies	Only appears in N9041B, N9042B+V2050A, and VXT models M9410A/11A. Does not appear in all measurements
Couplings	Sweep Time is affected by SW Preselection. Also Auto Tune supports SW Preselection, so set SW Preselection state and then do Auto Tune
Preset	N9041B: OFF N9042B+V3050A: ON M9410A/11A: ON
State Saved	Saved in instrument state

SW Preselection Type

Specifies the algorithm used for software preselection.

Two hidden sweeps are taken in succession. The second sweep is offset in LO frequency by 2*IF/N. For each point in each trace, the smaller amplitude from the two traces is taken and placed in that point in the selected trace. The Peak detector is auto-selected to improve the image suppression effectiveness. Responses of each trace that lie on top of one another will remain and are valid signals. Other signals are images and are suppressed. The action of taking the smaller of the two traces will make the average noise level lower in all points that do not have an image, thus reducing the accuracy of the measurement of noise and noise-like signals.

- `NORMal` - mathematically removes all image and multiple responses of signals present at the input
- `ADVanced` - any trace processing (such as “max hold” or trace averaging) is performed on the points of both candidate traces before the “select minimum” operation occurs. This form of processing works better for non-stationary signals, such as pulsed-RF signals

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel NORMal | ADVanced` `[:SENSe]:POWer[:RF]:SWPResel?`
Example	`:POW:SWPR NORM` `:POW:SWPR?`
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed-out. Its grayout message is "Unavailable unless SW Presel enabled"
Preset	N9041B: `ADVanced` N9042B+V3050A: `NORMal`
State Saved	Saved in instrument state

SW Preselection BW

Specifies the effective bandwidth to be used for Software Preselection.

The choices are:

– `NORMal` – when making Swept measurements, a software preselection algorithm is used which takes up to 4 background acquisitions, then post-processes the result. This algorithm can remove images from signals with an occupied bandwidth up to around 3 GHz. (Default/Preset setting). When making FFT measurements, this algorithm is not used, instead the same algorithm is used as for `NARRow` (below)

– `NARRow`– a software preselection algorithm is used which takes two background acquisitions, then post-processes the result to detect and remove images from wideband signals with occupied bandwidths up to 2 GHz. This increases the risk of images failing to be rejected, but improves the measurement speed

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel:BW NORMal | NARRow` `[:SENSe]:POWer[:RF]:SWPResel:BW?`
Example	`:POW:SWPR:BW NARR`
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed out. Its grayout message is "Unavailable unless SW Presel enabled" For N9042B+V3050A the parameter is SCPI only and always set to `NARRow` when Software Preselection is enabled
Preset	N9041B: `NORMal` N9042B+V3050A: `NARRow`
State Saved	Saved in instrument state

High Freq Prefilter

Lets you set the state of Prefilter for Center Frequencies above 1310 MHz.

In VXT Models M9410A/11A, the Receiver RF path has a bank of filters that come after the RF Attenuator in the signal path. Since this bank of filters precedes the mixer they are known as the “Prefilter” bank. Their purpose is to eliminate unwanted in-band mixing products by filtering out all but the desired frequencies before the signals get to the mixer. There are 13 prefilter bands to cover the frequencies between 9 kHz and 6000 MHz. The Prefilter provides the necessary rejection of the unwanted signal.

Remote Command	`[:SENSe]:<measurement>:PFILter[:STATe] ON | OFF | 1 | 0` `[:SENSe]:<measurement>:PFILter[:STATe]?`

Example	For example, to enable High Freq Prefilter in IQ Analyzer Mode:
	For the Complex Spectrum Measurement:
	`:SPEC:PFIL ON`
	For the IQ Waveform Measurement:
	`:WAV:PFIL ON`
	`:`

Dependencies	This control only appears in VXT models M9410A/11A with center frequency above 1310 MHz
Preset	See “Prefilter Presets” below
State Saved	Saved in instrument state

Prefilter Presets

Meas	Mode	Preset
SPEC	BASIC	OFF
WAV	BASIC, WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
MON	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
RHO	WCDMA	OFF
CDP	WCDMA	OFF
PCON	WCDMA	OFF
EVMQ	WCDMA	OFF
CHP	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
OBW	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
ACP	WCDMA, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
SEM	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PST	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PVT	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF
EVM	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF

Meas	Mode	Preset
FLAT	WLAN	OFF
EVMM	WLAN	OFF
CEVM	LTEAFDD, LTEATDD	OFF
PAVT	5GNR, VMA	OFF
DDEM	VMA	OFF
OFDM	VMA	OFF
SAN	SA	ON
HARM	SA	ON

3.9.4 BW

Opens the **BW** menu, which contains controls for the Resolution Bandwidth and Video Bandwidth functions of the instrument.

The Resolution BW functions control filter bandwidth and filter type. There are two filter types, Gaussian and Flattop. The Gaussian filters have a response curve that is parabolic on a log scale. The Flattop filter shape is a close approximation of a rectangular filter.

3.9.4.1 Settings

Contains the basic Bandwidth functions. In most measurements it is the only tab under Bandwidth.

Res BW

Activates the resolution bandwidth active function, which allows you to manually set the resolution bandwidth (RBW) of the instrument.

Normally, **Res BW** (Auto) selects automatic coupling of the Res BW to Span using the ratio set by the Span:3 dB RBW control (some measurements do not have a Span:3 dB RBW control, in which case the measurement chooses the optimal ratio). To decouple the resolution bandwidth, press the **Auto/Man** toggle on the **Res BW** control, or simply enter a different value for **Res BW**.

When the **Res BW** is manually selected, it may be returned to the coupled state by pressing the **Auto/Man** toggle on the **Res BW** control. This may also be done by pressing **Auto Couple** or by performing a **Preset**.

See:

– "RBW Presets" on page 1110

– "More Information" on page 1110

Remote Command	`[:SENSe]:ACPower:BANDwidth[:RESolution] <bandwidth>`
	`[:SENSe]:ACPower:BANDwidth[:RESolution]?`
	`[:SENSe]:ACPower:BANDwidth[:RESolution]:AUTO ON | OFF | 1 | 0`
	`[:SENSe]:ACPower:BANDwidth[:RESolution]:AUTO?`

Example	`:ACP:BAND 5 MHz`
	`:ACP:BAND?`
	`:ACP:BAND:AUTO ON`
	`:ACP:BAND:AUTO?`

Notes	For numeric entries, all RBW Types choose the nearest (arithmetically, on a linear scale, rounding up) available RBW to the value entered The setting and querying of values depend on the current bandwidth type This control is available only in the IBW mode This parameter is preset by the Meas Method selection. Preset values are as follows: IBW: 100 kHz IBWR: 27 kHz FAST (WCDMA): 390 kHz When Meas Method is “Fast Power” and Fast Power RBW mode is “Speed,” RBW is calculated as follows: RBW = Span × 2.442 × 10^{-3}
Dependencies	When Meas Method is RBW, FAST, or Fast Power and Fast Power RBW mode is Speed, this control is disabled. If pressed, an advisory message is generated. If the equivalent SCPI command is sent, a "Setting conflict" warning is generated
Couplings	Sweep time is coupled to the RBW. As the RBW changes, the sweep time (if set to Auto) is changed to maintain amplitude calibration Video bandwidth (VBW) is coupled to the RBW. As the resolution bandwidth changes, the video bandwidth (if set to Auto) changes to maintain the ratio of VBW/RBW (10:1) When the Res BW is set to Auto, the resolution bandwidth is auto-coupled to the span. The ratio of Span/RBW is approximately 106:1 when auto coupled. When Res BW is set to Man, and the bandwidths are entered manually, these bandwidths are used regardless of other instrument settings
Preset	Auto (unless noted in the table below) See table below
State Saved	Saved in instrument state
Min	1 Hz
Max	8 MHz is the max equivalent –3 dB RBW, which means that the named RBW (the one shown on the control etc.) can actually exceed 8 MHz if using a filter other than –3 dB Gaussian
Annotation	A “#” mark appears before “RBW” in the annotation when it is switched from Auto to Manual coupling
Backwards Compatibility Notes	For backwards compatibility this command obeys both the `BANDwidth` and `BWIDth` forms For ESA, the maximum Res BW was 5 MHz; on X-Series it is 8 MHz The following command is supported `[:SENSe]:ACP:SWEep:BANDwidth|BWIDth[:RESolution]`

RBW Presets

Unless noted in the table below, the Preset value of RBW is **Auto**.

Mode	Preset Value
WCDMA	100 kHz
MSR	100 kHz

More Information

When **Res BW** is set to **Auto**, the bandwidth selected depends on the Filter Type (see "Filter Type" below).

Only certain discrete resolution bandwidths are available. The available bandwidths are dependent on the **Filter Type** or the **EMC Standard**. If an unavailable bandwidth is entered with the numeric keypad, the closest available bandwidth is selected.

In some Power Suite measurements, in the LTE-Advanced applications (both FDD and TDD), when Res BW is in Auto, the resolution bandwidth is predefined based on the corresponding bandwidth of the single LTE carrier, as shown in the table below. In the Multi-carrier case, the narrowest RBW among the active carriers is used.

LTE-A FDD/TDD

	Auto RBW, kHz	
Carrier BW	CHP	ACP
1.4 MHz	20	51
3 MHz	43	51
5 MHz	68	100
10 MHz	150	100
15 MHz	220	100
20 MHz	270	100
200 kHz (NB-IoT in FDD)	10	10

5G NR

100 kHz for all carrier BW

Video BW

Lets you change the instrument post-detection filter (VBW or "video bandwidth") from 1 Hz to 8 MHz in approximately 10% steps. In addition, a wide-open video filter bandwidth may be chosen by selecting 50 MHz. The VBW is annotated at the bottom of the display, in the center.

Normally, **Video BW (Auto)** selects automatic coupling of the Video BW to RBW using the ratio set by the VBW:3 dB RBW control. To decouple the resolution bandwidth, press the **Auto/Man** toggle on the **Video BW** control, or simply enter a different value for **Video BW**.

When the **Video BW** is manually selected, it may be returned to the coupled state by pressing the **Auto/Man** toggle on the **Video BW** control. This may also be done by pressing **Auto Couple** or by performing a **Preset**.

For more information, see "VBW Presets" on page 1112

Remote Command	`[:SENSe]:ACPower:BANDwidth:VIDeo <bandwidth>`
	`[:SENSe]:ACPower:BANDwidth:VIDeo?`
	`[:SENSe]:ACPower:BANDwidth:VIDeo:AUTO ON | OFF | 1 | 0`
	`[:SENSe]:ACPower:BANDwidth:VIDeo:AUTO?`

Example	`:ACP:BAND:VID 2.4 MHz`
	`:ACP:BAND:VID?`
	`:ACP:BAND:VID:AUTO ON`
	`:ACP:BAND:VID:AUTO?`

Notes	For numeric entries, the instrument chooses the nearest (arithmetically, on a linear scale, rounding up) available VBW to the value entered. The 50 MHz VBW is defined to mean “wide open” The values shown in this table reflect the conditions after a Mode Preset
Dependencies	Sometimes the displayed Video BW is not actually used to process the trace data: – When the Average Detector is selected and **Sweep Type** is set to **Swept, t**he video bandwidth filter cannot be used, because it uses the same hardware as the Average Detector – When the Quasi-Peak, EMI Average or RMS Average detector is selected the VBW is implemented by the digital IF as part of the detector When this is the case, the VBW still acts to change the Sweep Time, if **Sweep Time** is in Auto, and still affects the data on other traces for which this is not the case When **Meas Method** is RBW, FAST, or Fast Power, this control is disabled. If pressed, an advisory message is generated. If the equivalent command is sent, a "Setting conflict" warning is generated
Couplings	Video bandwidth (VBW) is normally coupled to RBW. If **VBW** is set to Auto, then the VBW is changed as the RBW changes, to maintain the ratio set by the VBW:3 dB RBW control (usually 10:1 for measurements that do not have a VBW:3 dB RBW control)
Preset	See "VBW Presets" on page 1112 below
State Saved	Saved in instrument state
Min	1 Hz
Max	50 MHz
Annunciation	A “#” mark appears before “VBW” in the annotation when it is not coupled
Annotation	In the bottom center of the screen, “VBW <value> <units>” indicates the current video bandwidth value. Note that for some detectors this is not the value actually used for VBW (see above)
Backwards Compatibility Notes	For backwards compatibility this command obeys both the `BANDwidth` and `BWIDth` forms

VBW Presets

Unless noted in the table below, the Preset value of VBW is **Auto**.

Mode	Preset Value
WCDMA	1 MHz

RBW Filter Type

Selects the type for the resolution bandwidth filters. Historically, the Res BW filters in HP/Agilent/Keysight spectrum analyzers were Gaussian filters, specified using the –3 dB bandwidth of the filter. That is, a 10 MHz Res BW filter was a Gaussian shape with its –3 dB points 10 MHz apart. In the X-Series, the **RBW Filter BW** menu lets you choose between a Gaussian and Flat Top filter shape, for varying measurement conditions.

Filter Type	SCPI Example
Gaussian	`:BAND:SHAP GAUS`
Flattop	`:BAND:SHAP FLAT`

For more information, see the RBW Filter Type control description for the Swept SA measurement.

Remote Command	`[:SENSe]:ACPower:BANDwidth:SHAPe GAUSsian | FLATtop` `[:SENSe]:ACPower:BANDwidth:SHAPe?`
Example	`:ACP:BAND:SHAP GAUS` `:ACP:BAND:SHAP?`
Notes	`GAUSsian`= Gaussian `FLATtop` = Flattop
Dependencies	When **Meas Method** is FAST or Fast Power, this control is disabled. If pressed, an advisory message is generated. If the equivalent command is sent, a "Setting conflict" warning is generated
Preset	**Auto Couple** chooses the preset value
State Saved	Saved in instrument state
Annotation	The annotation under RBW in the bottom left of the screen shows the type of filter or bandwidth that is being used
Backwards Compatibility SCPI	`[:SENSe]:ACPower:BWIDth:SHAPe`

RBW Filter BW

Selects a Gaussian filter based on its –3 dB (Normal) bandwidth or its –6 dB bandwidth.

Remote Command	`[:SENSe]:ACPower:BANDwidth:TYPE DB3 | DB6` `[:SENSe]:ACPower:BANDwidth:TYPE?`
Example	`:ACP:BAND:TYPE DB3` `:ACP:BAND:TYPE?`
Dependencies	When **Filter Type** is `FLATtop` or **Meas Method** is RBW, FAST, or Fast Power, this control is disabled. If pressed, an advisory message is generated. If the equivalent command is sent, a "Setting conflict" warning is generated
Preset	`DB3`
State Saved	Saved in instrument state
Range	–3 dB (Normal)|–6 dB
Backwards Compatibility SCPI	`[:SENSe]:ACPower:BWIDth:TYPE`

3.9.5 Display

Lets you configure display items for the current Mode, Measurement View or Window.

3.9.5.1 Meas Display

Contains controls for setting up the display for the current Measurement, View or Window.

Bar Graph On/Off

Turns the Bar Graph On and Off.

Remote Command	`:DISPlay:ACPower:WINDow[1]:BGRaph OFF | ON | 0 | 1` `:DISPlay:ACPower:WINDow[1]:BGRaph?`
Example	`:DISP:ACP:WIND:BGR OFF` `:DISP:ACP:WIND:BGR?`
Dependencies	When the method is RBW, this control is always set to `ON` and grayed-out
Preset	`ON`
State Saved	Saved in instrument state
Range	`OFF|ON`
Backwards Compatibility SCPI	`:DISPlay:ACPower:VIEW[1]:WINDow[1]:BGRaph`

3.9.5.2 View

Contains controls for selecting the current **View**, and for editing User Views.

Views

The ACP measurement has two views: "Normal" on page 1115 and "Carrier Info" on page 1115.

These Views are multiple-window Views. When in a multiple window View, you select a window by touching it. The menu controls may sometimes change depending on which window is selected.

Whenever the View changes, the default menu is Frequency, unless otherwise specified in the View description.

NOTE: **Y Scale/Div, Y Ref Position, Y Auto Scale, Y Ref Value and Bar Graph affect both views. For example, power bars on the traces in both views appear or disappear when Bar Graph is toggled.**

View Selection by Name

Selects the results view. The following command allows you to select the desired measurement view by enumeration.

Remote Command	`:DISPlay:ACPower:VIEW[:SELect] PRESult | CINFormation` `:DISPlay:ACPower:VIEW[:SELect]?`
Example	`:DISP:ACP:VIEW PRES` `:DISP:ACP:VIEW?`
Preset	`PRESult`
State Saved	Saved in instrument state
Range	`PRESult|CINFormation`

View Selection by Number (Remote Command Only)

Selects the results view. The following command allows you to select the desired measurement view by enumeration.

Remote Command	`:DISPlay:ACPower:VIEW:NSELect <integer>` `:DISPlay:ACPower:VIEW:NSELect?`
Example	`:DISP:ACP:VIEW:NSEL 1` `:DISP:ACP:VIEW:NSEL?`
Dependencies	This command is available only for LTE-Advanced FDD/TDD and 5G NR
Preset	1

State Saved	Saved in instrument state
Min/Max	1/2

Normal

Windows: "Graph" on page 1066, "Metrics" on page 1067,

Dual window view of the graph and the metrics.

Example	`:DISP:ACP:VIEW PRES`

Carrier Info

Windows: "Graph" on page 1066, "Metrics" on page 1067,

Dual window view of the graph and the metrics.

Example	`:DISP:ACP:VIEW CINF`

User View

Lets you choose a View from the saved User Views for the current measurement. This panel only appears if a User View exists for the current measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:SELect <alphanumeric>` `:DISPlay:VIEW:ADVanced:SELect?`
Example	Select Baseband as the current View `:DISP:VIEW:ADV:SEL “Baseband”`

Notes	You must be in the measurement whose View you are trying to set to send the command. You can only set Views for the current measurement using this command
	For predefined views, the parameter is derived from the view name that is shown in the View list in the user interface. For example, if you are trying to select the Trace Zoom view in the Swept SA measurement, you send:
	`:DISP:VIEW:ADV:SEL "Trace Zoom"`
	because “Trace Zoom” is the name of the View as seen in the Mode/Meas dialog or in the Display, View menu
	You *cannot* use the legacy View parameter (which in this case would be `TZOom`) with `:DISP:VIEW:ADV:SEL`
	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case. Thus, both of the following forms work:
	`:DISP:VIEW:ADV:SEL "Trace Zoom"`
	`:DISP:VIEW:ADV:SEL "TRACE ZOOM"`
	If the specified view is not a valid View, the query returns the error message “-224, Illegal parameter value; View with the name <alphanumeric> does not exist”

	If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated
Backwards Compatibility SCPI	The legacy node `:DISPlay:VIEW[:SELect]` is retained for backwards compatibility, but it only supports predefined views

Restore Layout to Default

Restores the Layout to the default for Basic.

Modified Views are very temporary; if you exit the current measurement they are discarded, and they are not saved in State. To retain this View for later use, and to be able to return easily to your original Basic View, you can save your edited View as a "User View".

Save Layout as New View

Saves your new View as a User View. An alpha keyboard appears, which lets you name your new View; the default is the old View name plus a number.

Remote Command	`:DISPlay:VIEW:ADVanced:NAME <alphanumeric>`
Example	`:DISP:VIEW:ADV:NAME "Baseband"` Creates a new View named `Baseband` from the current View, and selects it as the current View
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If `<alphanumeric>` name already exists as a View, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; User View SCPI cannot be used while Display is disabled" is generated

Re-Save User View

You can re-edit a User View; if you make changes, then an asterisk will appear next to the User View's name. You can then tap **Re-Save User View** to save it back to its existing name, or **Save Layout as New View** to add another, new User View.

This is a front panel function only, there is no remote command available to perform this function. To do this remotely, you must first perform **Save Layout as New View**, then delete the old User View and rename the new one with the name of the View you just deleted.

Rename User View

You can rename the current View by giving it a new unique name. Only User Views can be renamed, if the current View is a Predefined View, an error occurs.

Remote Command	`:DISPlay:VIEW:ADVanced:REName <alphanumeric>`
Example	`:DISP:VIEW:ADV:REN "Baseband"`
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the `<alphanumeric>` specifying the new name is already present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot rename a Predefined View" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete User View

You can delete the current View if it is a User View. The default view becomes the current view for the Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:DELete`
Example	`:DISP:VIEW:ADV:DEL`
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the `<alphanumeric>` is not present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> does not exist" is generated If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot delete a Predefined View" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete All User Views

Deletes all previously saved User Views. The default view becomes the current view for the Measurement if a User View was the current view when this command was executed.

Remote Command	`:DISPlay:VIEW:ADVanced:DELete:ALL`
Example	`:DISP:VIEW:ADV:DEL:ALL`
Notes	Disabled if there are no User Views

View Editor Remote Commands

The following remote commands help you manage Views and User Views. Note that the SCPI node for User Views handles both Predefined and User Views. The legacy nodes, `:DISPlay:VIEW[:SELect]` and `:DISPlay:VIEW:NSEL`, are retained for backwards compatibility, but they only support predefined views.

View Listing Query

Returns a string containing a comma-separated list of names for *all* the Views, including User Views, available for the current Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:CATalog?`
Example	`:DISP:VIEW:ADV:CAT?`
Notes	Returns a quoted string of the available Views for the current measurement, separated by commas. The list includes names for *all* the Views, including User Views, available for the current Measurement Example: `"Normal,Trace Zoom,Spectrogram,Baseband,myView1,yourView1"` No distinction is made between Predefined and User Views If you switch measurements with the display disabled (via `:DISP:ENAB OFF`), then query the list of available Views, the result is undefined

User View Listing Query

Returns a string containing a comma-separated list of names for *only* the User Views available for the current Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:USER:CATalog?`
Example	`:DISP:VIEW:ADV:USER:CAT?`
Notes	Returns a quoted string of the available User Views for the current measurement, separated by commas. Example: `"Baseband,myView1,yourView1"` If you switch measurements with the display disabled (see "Display Enable (Remote Command Only)" on page 1894), then query the list of available Views, the result is undefined

3.9.5.3 Annotation

Contains controls for setting up the annotation for the current Mode or Measurement.

Graticule

Turns the display graticule On or Off for all windows with graticules in all measurements in the current Mode. Also turns the graticule Y-Axis annotation on and off.

Remote Command	`:DISPlay:GRATicule[:STATe] OFF | ON | 0 | 1` `:DISPlay:GRATicule[:STATe]?`
Example	`:DISP:GRAT OFF`
Notes	The graticule is the set of horizontal and vertical lines that make up the grid/divisions for the X-Axis and Y-Axis
Preset	`ON`
State Saved	Saved in instrument state

Backwards Compatibility SCPI	`:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe] OFF | ON | 0 | 1`
	`:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe]?`
	This command is accepted for backwards compatibility with older instruments, but the `WINDow`, `TRACe` and `GRID` parameters are ignored

Screen Annotation

Controls the display of the annunciation and annotation around the graticule, including any annotation on lines (such as the display line, the threshold line, etc.) and the Y-Axis annotation, for all windows with screen annotation in all measurements in the current Mode.

This does *not* include marker annotation (or the N dB result). When `OFF`, the graticule expands to fill the entire graticule area, leaving only the 1.5% gap above the graticule, as described in the **Trace** section.

Remote Command	`:DISPlay:ANNotation:SCReen[:STATe] OFF | ON | 0 | 1` `:DISPlay:ANNotation:SCReen[:STATe]?`
Example	`:DISP:ANN:SCR OFF`
Dependencies	Grayed-out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Trace Annotation

Turns on and off the labels on the traces, showing their detector (or their Math Mode) as described in the **Trace** section, for all windows in all measurements in the current Mode for which Trace Annotation on/off is supported.

If Trace Math is being performed on a trace, then the Trace Math annotation replaces the detector annotation.

For measurements that support limit lines, this key also turns on and off the labels on the Limit Lines. The label is the Limit number annotation and Limit Comment displayed on the graph. If the length of the comment is greater than 20 characters, the first 8 characters and the last 8 characters are displayed, joined with ....

Remote Command	`:DISPlay:ANNotation:TRACe[:STATe] ON | OFF | 1 | 0` `:DISPlay:ANNotation:TRACe[:STATe]?`
Example	`:DISP:ANN:TRAC OFF`
Preset	`OFF`
State Saved	Saved in instrument state

Control Annotation

Turns on and off the display of values on the Active Function controls for all measurements in the current Mode. This is a security feature.

Remote Command	`:DISPlay:ACTivefunc[:STATe] ON | OFF | 1 | 0` `:DISPlay:ACTivefunc[:STATe]?`
Example	`:DISP:ACT OFF`
Dependencies	Grayed out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Meas Bar

Turns the Measurement Bar at the top of the screen on and off for all measurements in the current Mode. When `OFF`, the graticule area expands to fill the area formerly occupied by the Measurement Bar.

Remote Command	`:DISPlay:ANNotation:MBAR[:STATe] OFF | ON | 0 | 1` `:DISPlay:ANNotation:MBAR[:STATe]?`
Example	`:DISP:ANN:MBAR OFF`
Dependencies	Grayed out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Display Enable (Remote Command Only)

Turns the display on/off, including the display drive circuitry. The backlight stays lit to confirm that the instrument is on. The display enable setting is mode global. Theare three reasons for turning the display off:

1. To increase speed as much as possible by freeing the instrument from having to update the display
2. To reduce emissions from the display, drive circuitry
3. For security purposes

If you have turned off the display:

- and you are in local operation, the display can be turned back on by pressing any key or by sending `:SYSTem:DEFaults MISC` or `:DISPlay:ENABle ON` (neither `*RST` nor :SYSTem:PRESet enable the display)
- and you are in remote operation, the display can be turned back on by pressing the **Local** or **Esc** keys, or by sending `:SYSTem:DEFaults MISC` or `:DISPlay:ENABle ON` (neither `*RST` nor `:SYSTem:PRESet` enable the display)
- and you are using either the `:SYSTem:KLOCk` command or GPIB local lockout, then *no* front-panel key press will turn the display back on. You must turn it back on remotely.

If the display is `OFF`, many SCPI commands related to User Views and Multiscreen functionality do not work, and return the error messages “-221, Settings conflict; Screen SCPI cannot be used when Display is disabled” or “221, Settings conflict; View SCPI cannot be used while Display is disabled”. These commands include:

Name	Command
Select User View	`:DISPlay:VIEW:ADVanced:SELect`
Rename User View	`:DISPlay:VIEW:ADVanced:REName`
Delete User View	`:DISPlay:VIEW:ADVanced:DELete`
Create User View	`:DISPlay:VIEW:ADVanced:NAME`
Select Screen	`:INSTrument:SCReen:SELect`
Delete Screen	`:INSTrument:SCReen:DELete`
Delete All But This Screen	`:INSTrument:SCReen:DELete:ALL`
Add Screen	`:INSTrument:SCReen:CREate`
Rename Screen	`:INSTrument:SCReen:REName`
Sequencer On/Off	`:SYSTem:SEQuencer`

Remote Command	`:DISPlay:ENABle OFF | ON | 0 | 1` `:DISPlay:ENABle?`

Example	`:DISP:ENAB OFF`
Couplings	`:DISP:ENAB OFF` turns Backlight `OFF` and `:DISP:ENAB ON` turns Backlight `ON`, but changing Backlight settings does *not* change the state of `:DISP:ENAB`
Preset	`ON` Set by `:SYST:DEF MISC`, but not affected by `*RST` or `:SYSTem:PRESet`
State Saved	Not saved in instrument state
Backwards Compatibility Notes	`:SYST:PRES` no longer turns on `:DISPlay:ENABle` as it did in legacy analyzers

3.9.6 Freq

Contains controls that allow you to control the Frequency and Channel parameters of the instrument.

Some features in the **Frequency** menu are the same for all measurements in the current Mode – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset. For example, the **Center Freq** setting is the same for all measurements - it does not change as you change measurements.

3.9.6.1 Settings

Contains controls that pertain to the X-Axis parameters of the measurement. These parameters control how data on the vertical (X) axis is displayed and control instrument settings that affect the horizontal axis.

Center Frequency

Sets the frequency that corresponds to the horizontal center of the graticule. While adjusting the Center Frequency the Span is held constant.

The **Center Frequency** setting is the same for all measurements within a mode, that is, it is Meas Global. Some modes are also able to share a Mode Global center frequency value. If this is the case, the Mode will have a **Global** tab in its **Meas Setup** menu.

The **Center Frequency** function sets (and queries) the Center Frequency for the currently selected input. If your instrument has multiple inputs, and you select another input, the Center Freq changes to the value for that input. SCPI commands are available to directly set the Center Freq for a specific input.

Center Freq is remembered as you go from input to input. Thus you can set a Center Freq of 10 GHz with the RF Input selected, change to BBIQ and set a Center Freq of 20 MHz, then switch to External Mixing and set a Center Freq of 60 GHz, and when you go back to the RF Input the Center Freq will return to 10 GHz; back to BBIQ and it is 20 MHz; back to External Mixing and it is 60 GHz.

See:

– "RF Center Freq" on page 1125
– "Ext Mix Center Freq" on page 1126
– "I/Q Center Freq" on page 1127
– "Center Frequency Presets" on page 1124
– "VXT Models with Radio Heads/CIU Frequency Range" on page 1125

Remote Command	`[:SENSe]:FREQuency:CENTer <freq>` `[:SENSe]:FREQuency:CENTer?`

Example	Set Center Frequency to 50 MHz:
	`:FREQ:CENT 50 MHz`
	Increment the Center Frequency by the value of CF Step:
	`:FREQ:CENT UP`
	Return the current value of Center Frequency:
	`:FREQ:CENT?`

Notes	Sets the RF, External Mixing or I/Q Center Frequency depending on the selected input – For RF input it is equivalent to `:FREQ:RF:CENT` – For I/Q input it is equivalent to `:FREQ:IQ:CENT` – For External Mixer it is equivalent to `:FREQ:EMIX:CENT` Preset and Max values are dependent on Hardware Options (5xx) If no terminator (e.g., MHz) is sent the terminator Hz is used. If a terminator with unit other than Frequency is used, an invalid suffix error message is generated
Dependencies	Not available in the MSR, LTE-Advanced FDD/TDD and 5G NR modes
Preset	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 1124, "RF Center Freq" on page 1125, "Ext Mix Center Freq" on page 1126, "I/Q Center Freq" on page 1127 and "VXT Models with Radio Heads/CIU Frequency Range" on page 1125
State Saved	Saved in instrument state
Min/Max	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 1124, "RF Center Freq" on page 1125, "I/Q Center Freq" on page 1127 and "VXT Models with Radio Heads/CIU Frequency Range" on page 1125
Annotation	Center <value> appears in the lower left corner of the display
Status Bits/OPC dependencies	Non-overlapped

Center Frequency Presets

The following table provides the Center Frequency Presets for the Spectrum Analyzer mode, and the Max Freq, for the various frequency options:

Freq Option	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
503 (all but CXA)	1.805 GHz	3.6 GHz	3.7 GHz
503 (CXA)	1.505 GHz	3.0 GHz	3.08 GHz
507 (all but CXA)	3.505 GHz	7.0 GHz	7.1 GHz
507 (CXA)	3.755 GHz	7.5 GHz	7.58 GHz
508 (all but MXE)	1.805 GHz	3.6 GHz	8.5 GHz
508 (MXE)	4.205 GHz	8.4 GHz	8.5 GHz
513	6.805 GHz	13.6 GHz	13.8 GHz
526 (except CXA and MXE)	13.255 GHz	26.5 GHz	27.0 GHz*
526 (CXA)	13.255 GHz	26.5 GHz	26.55 GHz
526 (MXE)	1.805 GHz	3.6 GHz	27.0 GHz
532	16.005 GHz	32.0 GHz	32.5 GHz
540	20.005 GHz	40.0 GHz	40.5 GHz
543	21.505 GHz	43.0 GHz	43.0 GHz
544	22.005 GHz	44.0 GHz	45.0 GHz
550	25.005 GHz	50.0 GHz	52 GHz
F03 (CXA-m)	1.505 GHz	3.0 GHz	3.08 GHz
F07 (CXA-m)	3.755 GHz	7.5 GHz	7.575 GHz
F13 (CXA-m)	6.805 GHz	13.6 GHz	13.8 GHz
F26 (CXA-m)	13.255 GHz	26.5 GHz	26.55 GHz
504 (M9420A/21A, M8920A)	2.145 GHz	3.88GHz	3.88 GHz
506 (M9420A/21A, M8920A)	3.245 GHz	6.08GHz	6.08 GHz
F06 (M9410A/11A)	1.0 GHz	6.08 GHz	6.08 GHz
F06 (M9415A)	1 GHz	1.08 GHz	6.6 GHz
F08 (M9415A)	1 GHz	1.08 GHz	8.6 GHz
F12 (M9415A)	1 GHz	1.08 GHz	12.9 GHz

*For option 526, the Max CF in RTSA is 26.999999995 GHz.

N9041B Center Freq Presets

Input	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
Input 1, all models	25.005 GHz	50.0 GHz	52 GHz

Input	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
Input 2, opt 585	42.505 GHz	85.0 GHz	86 GHz
Input 2, opt 590	45.005 GHz	90.0 GHz	92 GHz
Input 2, opt 5CX	55.005 GHz	110.0 GHz	110 GHz

Input 2, CXA and MXE

Model	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
CXA opt C75	0.7505 GHz	1.5 GHz	1.58 GHz
MXE	505 MHz	1 GHz	1.000025 GHz

Tracking Generator Frequency Limits (CXA only)

Tracking Generator Option	Min Freq (clips to this freq when turn TG on and can't tune below while TG on)	If above this Freq, Stop Freq clipped to this Freq when TG turned on	Max Freq (can't tune above) while TG on
T03	9 kHz	3.0 GHz	3.08 GHz
T06	9 kHz	6.0 GHz	6.05 GHz

Tracking Generator Frequency Limits(CXA-m only)

Tracking Generator Option	Min Freq (clips to this freq when turn TG on and can't tune below while TG on)	If above this Freq, Stop Freq clipped to this Freq when TG turned on	Max Freq (can't tune above) while TG on
T03	2 MHz	3.08 GHz	3.08 GHz
T07	2 MHz	7.575 GHz	7.575 GHz
T13	2 MHz	13.8 GHz	13.8 GHz
T26	2 MHz	26.55 GHz	26.55 GHz

VXT Models with Radio Heads/CIU Frequency Range

The following table shows the Center Frequency Presets and Range for VXT modes with Radio Heads/CIU.

Products with Radio Heads/CIU	Preset	Start frequency	Stop frequency
M9421A + CIU	6 GHz	5.9 GHz	12 GHz
M9410A + CIU	6 GHz	5.9 GHz	12 GHz
M9410A + CIU + RRH	25 GHz	24.25 GHz	43.5 GHz

RF Center Freq

Specifies the RF Center Frequency. This command will set the Center Frequency to be used when the RF input is selected, even if the RF input is not the input that is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:RF:CENTer <freq>` `[:SENSe]:FREQuency:RF:CENTer?`
Example	`:FREQ:RF:CENT 30 MHz` `:FREQ:RF:CENT?`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode
Dependencies	If the electronic/soft attenuator is enabled, any attempt to set Center Frequency such that the Stop Frequency would be >3.6 GHz fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning
Preset	See table above
State Saved	Saved in instrument state
Min	-79.999995 MHz
Max	See table above. Basically instrument maximum frequency - 5 Hz If the knob or step keys are being used, also depends on the value of Span

Ext Mix Center Freq

Specifies the External Mixer Center Frequency. This command will set the Center Frequency to be used when the External Mixer is selected, even if the External Mixer input is not the input which is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:EMIXer:CENTer <freq>` `[:SENSe]:FREQuency:EMIXer:CENTer?`
Example	`:FREQ:EMIX:CENT 60 GHz` `:FREQ:EMIX:CENT?`
Notes	This command is the same in all Modes, but the parameter is Measurement Global, so the value is independent in each mode and common across all the measurements in the mode
Couplings	When returning to External Mixing after having been switched to one of the other inputs (for example, RF), you will return to the settings that you had when you left External Mixing. So you will return to the band you were in with the Center Frequency that you had. However, Span is not an input-dependent parameter, therefore you will bring the span over from the other input. Therefore, the instrument retains the span from the previous input, limited as necessary by the current mixer setup
Preset	When a **Mode Preset** is performed while in External Mixing, the Start frequency of the current Mode is set to the nominal Min Freq of the lowest harmonic range in the Harmonic Table for the current mixer setup. Similarly, the Stop frequency of the current Mode is set to the nominal Max Freq of the highest harmonic range in the Harmonic Table. The Center Freq thus presets to the point arithmetically equidistant from these two frequencies Note that, if the current measurement has a limited Span available to it, and cannot achieve the Span

	shown in the table (Span=Stop Freq – Start Freq), then the instrument uses the maximum Span the measurement allows, and still sets the Center Freq to the midpoint of the Start and Stop Freq values in the Harmonic Table When **Restore Input/Output Defaults** is performed, the mixer presets to the 11970A, whose Start and Stop frequencies are 26.5 and 40 GHz respectively. The center of these two frequencies is 33.25 GHz Therefore, after **Restore Input/Output Defaults**, if you go into External Mixing and do a Mode Preset while in the Spectrum Analyzer Mode, the resulting Center Freq is 33.25 GHz
State Saved	Yes
Min	The minimum frequency in the currently selected mixer band + 5 Hz If the knob or step keys are being used, also depends on Span
Max	The maximum frequency in the currently selected mixer band - 5 Hz If the knob or step keys are being used, also depends on Span

I/Q Center Freq

Specifies the I/Q Center Frequency. This command will set the Center Frequency to be used when the I/Q input is selected, even if the I/Q input is not the input which is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:IQ:CENTer <freq>` `[:SENSe]:FREQuency:IQ:CENTer?`
Example	`:FREQ:IQ:CENT 30 MHz`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode
Preset	0 Hz
State Saved	Saved in instrument state
Min	-40.049995 MHz
Max	40.049995 MHz

Span

Changes the displayed frequency range symmetrically about the center frequency. While adjusting the **Span**, the Center Frequency is held constant, this means that both Start Frequency and Stop Frequency will change.

In measurements that also have Start Freq and Stop Freq controls, pressing **Span** sets the frequency entry mode to Center/Span. In Center/Span mode, the center frequency and span values are displayed below the graticule, and the default active function in the Frequency menu is **Center Freq**. In the Start/Stop annotation mode, Start Freq and Stop Freq are displayed below the graticule instead of Center Freq and Span.

If the Span is set to a value greater than the maximum allowable span of the instrument, an error message is generated indicating the data is out of range and was clipped to upper limit.

The default (and minimum) Span is calculated using the number of carriers and the carrier width where;

Span = (Upper Carrier Freq + (max offset IBW * (1 + alpha)) / 2) - (Lower Carrier Freq - (max offset IBW * (1 + alpha)) / 2)

The span is increased by a factor of 1 + Filter Alpha if the RRC Filter in on.

See "Span Presets" on page 1129

Remote Command	`[:SENSe]:ACPower:FREQuency:SPAN <freq>` `[:SENSe]:ACPower:FREQuency:SPAN?`
Example	`:ACP:FREQ:SPAN 10 MHz` `:ACP:FREQ:SPAN?`
Notes	In Bluetooth Mode, the value of Span has to be an odd MHz
Dependencies	If the electrical attenuator is enabled, any attempt to set **Span** such that the Stop Frequency would be >3.6 GHz results in an error In instruments with an RF Preselector, such as MXE, you cannot sweep across the band break at 3.6 GHz while the RF Preselector is on in Continuous sweep, as there is a mechanical switch which bypasses the RF Preselector above 3.6 GHz. See the Stop Frequency control description for details of this limitation
Couplings	Span affects RBW, sweeptime, FFT & Sweep choice (including FFT Width, Phase Noise Optimization and ADC Dither auto couplings) – Any value of the Center Frequency or Span that is within the frequency range of the instrument is allowed when the value is being set through the front panel numeric key pad or the SCPI command. The other parameter is forced to a different value if needed, to keep the Start and the Stop Frequencies within the instrument's frequency range – When using the knob or the step up/down keys or the UP |DOWN keywords in SCPI, the value that is being changed i.e. the Center Frequency or Span, is limited so that the other parameter is not forced to a new value – In the Bluetooth Mode, if Meas Method is FFT, the max value of Span is coupled to the MAX IFBW of the platform The span value is clipped when the carrier settings and/or the offset settings are changed. The value is changed to satisfy following formula: Span = (Upper Carrier Freq + (max offset IBW * (1 + alpha)) / 2) - (Lower Carrier Freq - (max offset IBW * (1 + alpha)) / 2) This parameter is unavailable when **Meas Method** is Fast Power. In that case, the span is fixed by the formula above
Preset	Depends on instrument maximum frequency, mode, measurement, and selected input See "Span Presets" on page 1129
State Saved	Saved in instrument state

Min/Max	Depends on instrument maximum frequency, mode, measurement, and selected input. See "Span Presets" on page 1129 If the knob or step keys are being used, depends on the value of the other three interdependent parameters Center Frequency, Start Frequency, Stop Frequency
Annotation	Span <value> appears on the first line of the annotation in the lower right corner of display

Span Presets

The following table provides the Max Span, for the various frequency options:

Freq Option	Max Span (can't set higher than this)
503 (all but CXA)	3.7 GHz
503, F03 (CXA, CXA-m)	3.08 GHz
507 (all but CXA)	7.1 GHz
507 (CXA, CXA-m)	7.575 GHz
508 (all but MXE)	8.5 GHz
508 (MXE)	8.5 GHz
513, F13	13.8 GHz
526 (all but CXA and MXE)	27.0 GHz
526 (MXE)	27.0 GHz
526, F26 (CXA, CXA-m)	26.55 GHz
544	44.5 GHz
550	52 GHz
F06 & EP6 (VXT models M9410A/11A)	6.27 GHz
F06 & LFE & EP6 (VXT models M9411A)	6.5999935 GHz
M9415A-F06	6.27 GHz
M9415A-F08	8.27 GHz
M9415A-F12	12.57 GHz

Input 2:

Model	Max Span (can't set higher than this)
CXA opt C75	1.58 GHz
MXE	1.000025 GHz

Note that if you are in External Mixing, the maximum Span will be equal to the Maximum Stop Frequency – Minimum Start Frequency for the currently selected mixer.

Span Presets by Mode

Mode	Preset Value
SA	8 MHz

Mode	Preset Value
WCDMA	24.6848 MHz
LTE, LTETDD, LTEAFDD, LTEATDD, MSR	25 MHz
5G NR	500 MHz
Radio Test	175 kHz

CF Step

Changes the step size for the center frequency and start and stop frequency functions. Once a step size has been selected and the center frequency function is active, the step keys (and the UP|DOWN parameters for Center Frequency from remote commands) change the center frequency by the step-size value. The step size function is useful for finding harmonics and sidebands beyond the current frequency span of the instrument.

Note that the start and stop frequencies also step by the CF Step value.

Remote Command	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement] <freq>`
	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement]?`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO?`

Example	`:FREQ:CENT:STEP 500 MHz`
	`:FREQ:CENT UP`
	increases the current center frequency value by 500 MHz
	`:FREQ:CENT:STEP?`
	`:FREQ:CENT:STEP:AUTO ON`
	`:FREQ:CENT:STEP:AUTO?`

Notes	Preset and Max values are depending on Hardware Options
Dependencies	If the electronic/soft attenuator is enabled, any attempt to change the value of the center frequency >3.6 GHz by pressing the Up-arrow key, fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a “-221, Settings conflict” warning Not available in the MSR, LTE-A FDD/TDD and 5G NR modes
Couplings	When auto-coupled, the center frequency step size is set to 10% of the span
Preset	Auto ON
State Saved	Saved in instrument state
Min	– (the maximum frequency of the instrument). That is, 27 GHz max freq instrument has a CF step range of +/- 27 GHz. Note that this is the maximum frequency given the current settings of the instrument, so in External Mixing, for example, it is the maximum frequency of the current mixer band
Max	The maximum frequency of the instrument. That is, 27 GHz max freq instrument has a CF step range of

	+/- 27 GHz. Note that this is the maximum frequency given the current settings of the instrument, so in External Mixing, for example, it is the maximum frequency of the current mixer band
Status Bits/OPC dependencies	non-overlapped

3.9.7 Marker

Accesses a menu that enables you to select, set up and control the markers for the current measurement. If there are no active markers, **Marker** selects marker 1, sets it to `POSition` (Normal) and places it at the center of the display. If the selected marker is `OFF`, it is set to `POSition` and placed at the center of the screen on the trace determined by the **Marker Trace** rules.

Note that this hard key and all sub keys are unavailable when "Meas Method" on page 1142 is set to RBW.

3.9.7.1 Select Marker

Specifies the selected marker. The term “selected marker” is used throughout this document to specify which marker will be affected when you change marker settings, perform a Peak Search, etc.

The **Select Marker** control appears above the menu panel, indicating that it applies to all controls in the **Marker** menu panels. **Select Marker** is blanked if you select a tab whose controls do *not* depend on the selected marker (for example, **Counter**).

On any menu tab for which **Select Marker** displays, the first control is always **Marker Frequency|Time**.

Notes	The selected marker is remembered even when not in the Marker menu and is used if a Search is done or a Band Function is turned on or for Signal Track or Continuous Peak
Preset	Marker 1
State Saved	The number of the selected marker is saved in instrument state
Annunciation	Appears in the marker results block label for **Normal, Delta** and **Fixed** markers

3.9.7.2 Settings

The controls on this tab include the Marker active function and a radio button selection of the marker control mode (`POSition`, `DELTa`, or `OFF`) for the selected marker, as well as additional functions that help you use markers.

Marker Frequency

Sets the marker X-Axis value in the current marker X-Axis Scale unit. It has no effect if the control mode is `OFF`, but is the SCPI equivalent of entering an X value if the control mode is `POSition` or `DELTa`.

Remote Command	`:CALCulate:ACPower:MARKer[1]|2|...|12:X <freq>` `:CALCulate:ACPower:MARKer[1]|2|...|12:X?`
Example	`:CALC:ACP:MARK3:X 0` `:CALC:ACP:MARK3:X?`
Notes	If no suffix is sent, uses the fundamental units for the current marker X-Axis Scale. If a suffix is sent that does not match the current marker X-Axis Scale unit, an error "Invalid suffix" is generated The query returns the marker's absolute X Axis value if the control mode is `POSition`, or the offset from the marker's reference marker if the control mode is `DELTa`. The query is returned in the fundamental units for the current marker X-Axis scale: Hz for **Frequency and Inverse Time**, seconds for **Period and Time**
Dependencies	This control is unavailable when Meas Method is set to RBW
Preset	After a preset, all markers are turned `OFF`, so Marker X-Axis Value query returns a not a number (`NAN`)
State Saved	Saved in instrument state
Min	-9.9E+37
Max	9.9E+37
Annotation	Mkr # <X value> and <Marker value> upper right on graph

Marker X Axis Position (Remote Command Only)

Sets the marker X-Axis Scale position in trace points. This setting has no effect if the control mode is `OFF`, but is the SCPI equivalent of entering a value if the control mode is `POSition` or `DELTa` - except in trace points rather than X-Axis Scale units. The entered value is immediately translated into the current X-Axis Scale units for setting the value of the marker.

Remote Command	`:CALCulate:ACPower:MARKer[1]|2|...|12:X:POSition <real>` `:CALCulate:ACPower:MARKer[1]|2|...|12:X:POSition?`
Example	`:CALC:ACP:MARK10:X:POS 0` `:CALC:ACP:MARK10:X:POS?`
Notes	The query returns the marker's absolute X-Axis value in trace points if the control mode is `POSition`, or the offset from the marker's reference marker in trace points if the control mode is `DELTa`. The value is returned as a real number, not an integer, corresponding to the translation from X-Axis Scale units to trace points . When a Marker is turned on, it is placed center of the screen on the trace. Therefore the default value depends on instrument condition. If the marker is `OFF`, the response is Not A Number
Dependencies	This command is unavailable when **Meas Method** is set to RBW
Preset	After a preset, all markers are turned `OFF`, so Marker X-Axis Value query returns a Not A Number (`NAN`)
State Saved	Saved in instrument state
Min	-9.9E+37
Max	9.9E+37

Marker Y Axis Value (Remote Command only)

Returns the marker Y-Axis value in the current marker Y-Axis unit.

Remote Command	`:CALCulate:ACPower:MARKer[1]|2|...|12:Y?`
Example	`:CALC:ACP:MARK11:Y?`
Notes	The query returns the marker Y-axis result, if the control mode is `POSition` or `DELTa`. If the marker is `OFF`, the response is Not A Number
Dependencies	This command is unavailable when Meas Method is set to RBW
Preset	Result dependent on Markers setup and signal source
State Saved	No
Backwards Compatibility SCPI	`:CALCulate:ACPower:MARKer[1]|2|...|12:FUNCtion:RESult?`

Marker Mode

Sets the marker control mode to `POSition` (Normal), `DELTa`, or `OFF`. All interactions and dependencies detailed under the control description are enforced when the remote command is sent. If the selected marker is `OFF`, pressing **Marker** sets it to `POSition`, and places it at the center of the screen on the trace determined by the **Marker Trace** rules. At the same time, **Marker X Axis Value** appears on the Active Function area.

The default active function is the active function for the currently selected marker control mode. If the current control mode is `OFF`, there is no active function and the active function is turned off.

Remote Command	`:CALCulate:ACPower:MARKer[1]|2|...|12:MODE POSition | DELTa | OFF` `:CALCulate:ACPower:MARKer[1]|2|...|12:MODE?`
Example	`:CALC:ACP:MARK3:MODE POS` `:CALC:ACP:MARK3:MODE?`
Dependencies	This control is unavailable when **Meas Method** is set to RBW
Preset	`OFF`
State Saved	Saved in instrument state
Range	`POSition|DELTa|OFF`
Annotation	Mkr # <X value> and <Marker value> upper right on graph

Backward Compatibility SCPI Commands

Sets or queries the state of a marker. Setting a marker that is `OFF` to `ON` (1) puts it in `POSition` mode and places it at the center of the screen.

Remote Command	`:CALCulate:ACPower:MARKer[1]|2|...|12:STATe OFF | ON | 0 | 1`

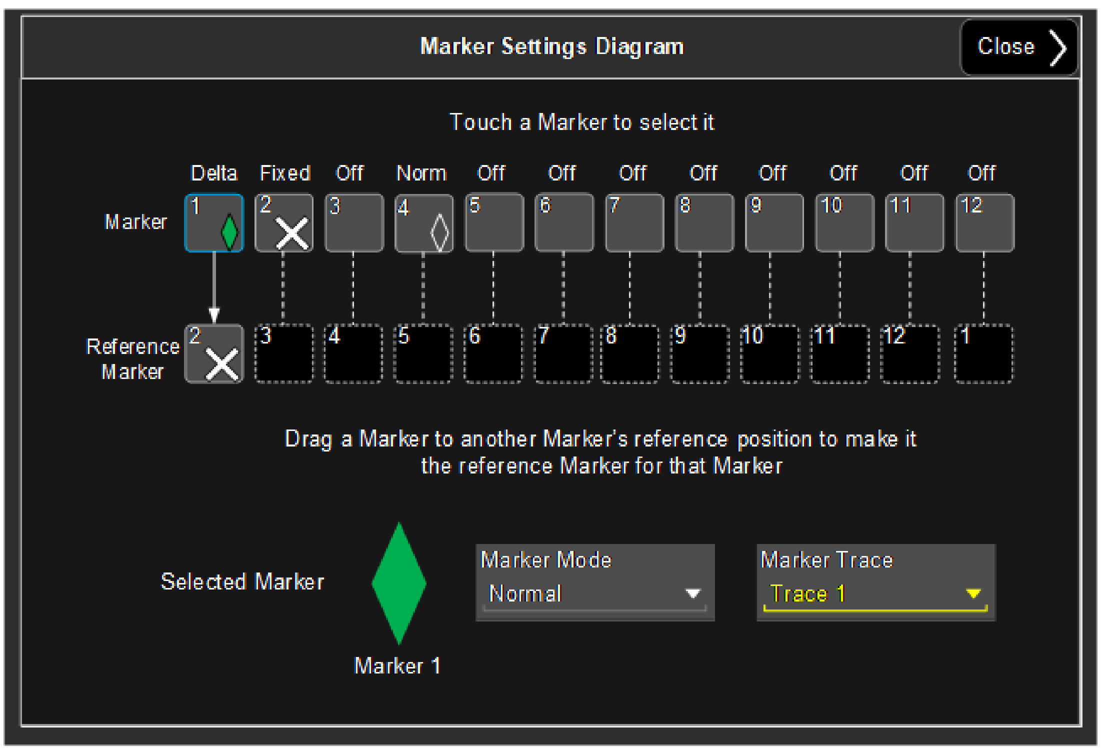
	`:CALCulate:ACPower:MARKer[1]|2|...|12:STATe?`
Example	`:CALC:ACP:MARK2:STAT ON` `:CALC:ACP:MARK2:STAT?`
Preset	`OFF`
State Saved	Saved in instrument state
Range	`OFF|ON`

Delta Marker (Reset Delta)

Pressing this button has exactly the same effect as pressing the `DELTa` selection on the **Marker Mode** radio button. The selected marker becomes a Delta Marker. If the selected marker is already a Delta marker, the reference marker is moved to the current position of the selected marker, thus resetting the Delta to zero.

Marker Settings Diagram

Lets you configure the Marker system using a visual utility.



All Markers Off

Turns off all markers.

Remote Command	`:CALCulate:ACPower:MARKer:AOFF`
Example	`:CALC:ACP:MARK:AOFF`
Dependencies	This control is unavailable when **Meas Method** is set to RBW

Couple Markers

When this function is `ON`, moving any marker causes an equal X-Axis movement of every other marker that is not `OFF`. By "equal X-Axis movement" we mean that we preserve the difference between each marker's X-Axis value (in the fundamental X-Axis units of the trace that marker is on) and the X-Axis value of the marker being moved (in the same fundamental X-Axis units).

This may result in markers going off screen.

Remote Command	`:CALCulate:ACPower:MARKer:COUPle[:STATe] ON | OFF | 1 | 0` `:CALCulate:ACPower:MARKer:COUPle[:STATe]?`
Example	`:CALC:ACP:MARK:COUP ON` `:CALC:ACP:MARK:COUP?`
Dependencies	This control is unavailable when **Meas Method** is set to RBW
Preset	`OFF` Presets on **Mode Preset** and **All Markers Off**
State Saved	Saved in instrument state

3.9.7.3 Peak Search

The controls on this tab allow you to move the marker to selected peaks of the signal, giving you enormous analysis capabilities, particularly when combined with the Delta Marker function.

NOTE

Pressing the **Peak Search** hardkey automatically moves you to the Peak Search page of the **Marker** menu *and* performs a Peak Search.

Pressing the **Peak Search** tab once you are already *in* the **Marker** menu does *not* perform a Peak Search.

Marker Frequency

This is the fundamental control that you use to move a marker around on the trace. This is the same as the **Marker Frequency** control on the **Settings** tab.

Peak Search

Pressing the **Peak Search** control moves the selected marker to the trace point which has the maximum Y-Axis value for that marker's trace.

NOTE Pressing the **Peak Search** hardkey automatically moves you to the Peak Search page of the **Marker** menu *and* performs a Peak Search.

Remote Command	`:CALCulate:ACPower:MARKer[1]|2|...|12:MAXimum`

Example	`:CALC:ACP:MARK2:MAX`
	`:SYST:ERR?`
	can be used to query the errors to determine if a peak is found. The message "No peak found" will be returned after an unsuccessful search

Notes	Sending this command selects the subopcoded marker

Next Peak

Pressing **Next Peak** moves the selected marker to the peak that is next lower in amplitude than the current marker value.

If the selected marker was `OFF`, then it is turned on as a normal marker and a peak search is performed.

Remote Command	`:CALCulate:ACPower:MARKer[1]|2|...|12:MAXimum:NEXT`
Example	`:CALC:ACP:MARK2:MAX:NEXT`
Notes	Sending this command selects the subopcoded marker
State Saved	Not part of saved state

Next Pk Right

Pressing **Next Pk Right** moves the selected marker to the nearest peak right of the current marker.

If the selected marker was `OFF`, then it is turned on as a normal marker and a peak search is performed.

Remote Command	`:CALCulate:ACPower:MARKer[1]|2|...|12:MAXimum:RIGHt`
Example	`:CALC:ACP:MARK2:MAX:RIGH`
Notes	Sending this command selects the subopcoded marker
State Saved	Not part of saved state

Next Pk Left

Pressing **Next Pk Left** moves the selected marker to the nearest peak left of the current marker.

If the selected marker was `OFF`, then it is turned on as a normal marker and a peak search is performed.

Remote Command	`:CALCulate:ACPower:MARKer[1]|2|...|12:MAXimum:LEFT`
Example	`:CALC:ACP:MARK2:MAX:LEFT`
State Saved	Not part of saved state

Minimum Peak

Moves the selected marker to the minimum Y-Axis value on the current trace.

If the selected marker is `OFF`, it is turned on before the minimum search is performed.

Remote Command	`:CALCulate:ACPower:MARKer[1]|2|...|12:MINimum`
Example	`:CALC:ACP:MARK:MIN`
Notes	Sending this command selects the subopcoded marker
State Saved	Not part of saved state

Pk-Pk Search

Finds and displays the amplitude and frequency (or time, if in zero span) differences between the highest and lowest Y-Axis value. It places the selected marker on the minimum value on its selected trace, and places that marker's reference marker on the peak of its selected trace.

This function turns on the reference marker and sets its mode to `POSition` if it is not already on. (These markers may be on two different traces.)

If the selected marker is `OFF`, a delta type marker is turned on and the peak-to-peak search is done. If the selected marker is on, but it is not a delta marker, then it is changed to delta, which turns on the reference marker if needed, and then it performs the peak-to-peak function.

Remote Command	`:CALCulate:ACPower:MARKer[1]|2|...|12:PTPeak`
Example	`:CALC:ACP:MARK:PTP`
Notes	Turns on the Marker D active function Sending this command selects the subopcoded marker
Dependencies	**Pk-Pk Search** is not available when **Coupled Markers** is on
Couplings	The selected marker becomes a delta marker if not already in delta mode
State Saved	Not part of saved state

Marker Delta

Pressing this button has exactly the same effect as pressing the DELTa selection on the **Marker Mode** radio button on the **Settings** tab. The selected marker becomes a Delta Marker. If the selected marker is already a Delta marker, the reference marker is moved to the current position of the selected marker, thus resetting the Delta to zero.

The control is duplicated here in the **Peak Search** menu to allow you to conveniently perform a peak search and change the marker's control mode to Delta without having to access two separate menus.

3.9.7.4 Properties

The controls on this tab are used to set certain properties of the selected marker.

Marker Frequency

This is the fundamental control that you use to move a marker around on the trace. This is the same as the **Marker Frequency** control on the **Settings** tab.

Relative To

Selects the marker to which the selected marker is relative (its reference marker).

Every marker has another marker to which it is relative. This marker is referred to as the "reference marker" for that marker. This attribute is set by the **Marker, Properties, Relative To** key. The marker must be a **Delta** marker to make this attribute relevant. If it is a **Delta** marker, the reference marker determines how the marker is controlled and how its value is displayed. A marker cannot be relative to itself.

Remote Command	`:CALCulate:ACPower:MARKer[1]|2|...|12:REFerence <integer>` `:CALCulate:ACPower:MARKer[1]|2|...|12:REFerence?`
Example	`:CALC:ACP:MARK2:REF 6` `:CALC:ACP:MARK2:REF?`
Notes	This command causes the marker specified with the subopcode to become selected Range (for SCPI command): 1 to 12. If the range is exceeded the value is clipped A marker cannot be relative to itself so that choice is not available, and if sent from SCPI generates error -221: "Settings conflict; marker cannot be relative to itself" When queried a single value is returned (the specified marker numbers relative marker)
Dependencies	This control is unavailable when **Meas Method** is set to RBW
Couplings	The act of specifying the selected marker's reference marker makes the selected marker a Delta marker

	If the reference marker is `OFF`, it is turned on in `POSition` mode at the delta marker location
Preset	The preset default "Relative To" marker (reference marker) is the next higher numbered marker (current marker +1). For example, if marker 2 is selected, then its default reference marker is marker 3. The exception is marker 12, which has a default reference of marker 1 Set to the defaults by using **Restore Mode Defaults.** This is not reset by **Marker Off**, **All Markers Off**, or **Preset**
State Saved	Saved in instrument state. Not affected by **Marker Off** and hence not affected by Preset or power cycle
Min	1
Max	12
Annunciation	Appears in the marker label of a **Delta** marker

Marker Trace

Selects the trace on which you want your marker placed. A marker is associated with one and only one trace. This trace is used to determine the placement, result, and X-Axis Scale of the marker. All markers have an associated trace; it is from that trace that they determine their attributes and behaviors, and it is to that trace that they go when they become Normal markers.

Specifying a Marker Trace manually or with this command associates the marker with the specified trace. If the marker is not OFF, it moves the marker from the trace it was on to the new trace. If the marker is OFF it stays off but is now associated with the specified trace.

The query returns the number of the trace on which the marker is currently placed.

Remote Command	`:CALCulate:ACPower:MARKer[1]|2|...|12:TRACe 1	2	3` `:CALCulate:ACPower:MARKer[1]|2|...|12:TRACe?`
Example	`:CALC:ACP:MARK2:TRAC 2` `:CALC:ACP:MARK2:TRAC?`
Notes	A marker may be placed on a blanked and/or inactive trace, even though the trace is not visible and/or updating An application may register a trace name to be displayed on the control instead of a trace number
Couplings	The state of **Marker Trace** is not affected by the "Auto Couple" on page 1718 key Sending the remote command causes the addressed marker to become selected.
Preset	1
State Saved	Saved in instrument state
Min	1
Max	3

Marker Settings Diagram

Lets you configure the Marker system using a visual utility. This is the same as the "Marker Settings Diagram" on page 1134 control on the **Settings** tab.

3.9.8 Meas Setup

Contains functions for setting up the measurement parameters and also contains functions for setting up parameters global to all measurements in the mode.

3.9.8.1 Settings

Contains frequently used Meas Setup functions to which you will want the fastest access.

Avg|Hold Number

Specifies the number of measurement averages used to calculate the measurement result. The average will be displayed at the end of each sweep. After the specified number of average counts, the average mode (termination control) setting determines the average action.

Remote Command	`[:SENSe]:ACPower:AVERage:COUNt <integer>` `[:SENSe]:ACPower:AVERage:COUNt?`
Example	`:ACP:AVER:COUN 250` `:ACP:AVER:COUN?`
Notes	The BAF backwards Compatibility SCPI command, `[:SENSe]:ACPR:AVERage[:STATe]`, is provided to support same functionality as `[:SENSe]:ACPr:AVERage[:STATe]` (PSA W-CDMA, PSA cdma2000 and PSA 1xEVDO) due to ACPr node conflicts with ACPower node
Preset	10
State Saved	Saved in instrument state
Min/Max	1/1000
Annotation	Avg Number is displayed in the Measurement Bar

Backwards Compatibility SCPI	`[:SENSe]:ACPR:AVERage:COUNt`
	`[:SENSe]:MCPower:AVERage:COUNt`
	Power Suite, W-CDMA

Averaging On/Off

Turns averaging on or off.

NOTE In this measurement, the **Average Type** is preset to the `Log-Pwr Avg (Video)` method. Other averaging methods are not available.

Remote Command	`[:SENSe]:ACPower:AVERage[:STATe] OFF | ON | 0 | 1` `[:SENSe]:ACPower:AVERage[:STATe]?`
Example	`:ACP:AVER OFF` `:ACP:AVER?`
Preset	`ON`
State Saved	Yes
Range	`OFF|ON`

Backwards Compatibility SCPI	`[:SENSe]:ACPR:AVERage[:STATe]`
	`[:SENSe]:MCPower:AVERage[:STATe]`
	Power Suite, W-CDMA

Avg Mode

Enables you to set the Averaging Mode. This determines the averaging action after the specified number of data acquisitions (average count) is reached.

- When set to `EXPonential`, the measurement averaging continues using the specified number of averages to compute each averaged value. The average will be displayed at the end of each sweep.
- When set to `REPeat`, the measurement resets the average counter each time the specified number of averages is reached.

Remote Command	`[:SENSe]:ACPower:AVERage:TCONtrol EXPonential | REPeat` `[:SENSe]:ACPower:AVERage:TCONtrol?`
Example	`:ACP:AVER:TCON EXP` `:ACP:AVER:TCON?`
Notes	The backwards Compatibility SCPI command, `[:SENSe]:ACPR:AVERage:TCONtrol`, is provided to support same functionality as `[:SENSe]:ACPr:AVERage:TCONtrol` (PSA W-CDMA, PSA cdma2000 and PSA 1xEVDO) due to ACPr node conflicts with ACPower node
Preset	`EXPonential`
State Saved	Saved in instrument state
Range	`EXPonential|REPeat`

Backwards Compatibility SCPI	`[:SENSe]:ACPR:AVERage:TCONtrol`
	Power Suite, W-CDMA:
	`[:SENSe]:MCPower:AVERage:TCONtrol`

Meas Method

Sets the desired method to measure ACP. The options are:

Integration BW `IBW`	One sweep of the trace is taken, and the band power for each offset is computed. Depending on the status of the Meas Type parameter (Total Power Reference or PSD Reference), results are displayed relative to the total power or the power spectral density. The display reflects either the current trace or a bar graph view
Filtered IBW `IBWRange` (max dynamic range)	The ACP Path is used to compute ACP when an ACP path is available. This method increases dynamic range, but increases measurement time as it limits the resolution bandwidth. This method is useful for improving dynamic range on a W-CDMA signal because a sharp cutoff bandpass filter is used. The accuracy of the adjacent channel power ratio is not degraded by this method, but the absolute accuracy of both adjacent channel power and carrier power are degraded by up to about 0.5 dB
RBW `RBW`	The algorithm uses zero-span and an appropriate RBW setting to capture all of the power in the carrier channel and the offsets. The zero-span algorithm (RBW method) is slower than the IBW method, but greatly improves repeatability
Fast `FAST`	WCDMA Mode or SA Mode with 3GPP WCDMA radio standard selected: Provides the same method as the Integration BW method, but is optimized for speed to measure a W-CDMA signal SA Mode with CDMA2K radio standard selected: Provides faster measurement using the FFT method with a limited parameter flexibility. When this is selected, CDMA2K preset offsets are given and control of the following are unavailable: – BW menu – Sweep/Control menu except Pause/Resume – Trace/Detector menu – Carrier Setup, Offset Limit, RRC Weighting, Filter Alpha, and Noise Correction in Meas Setup menu
Fast Power `FPOWer` (option FP2 required)	This provides faster measurement using the Hardware accelerated FFT method with a limited parameter flexibility. When this is selected, the following parameters are not available: *Points and Auto Sweep Points under Sweep When changing Meas Method to Fast Power, Auto Sweep Points is turned on and grayed out (Sweep Points will change according to the Fast Power setting). When returning Meas Method to the one other than Fast Power, Auto Sweep Points keeps on and becomes available (Sweep Points will change according to the auto sweep points calculation algorithm) *Trace Type, Restart Averaging and View/Blank under Trace when Select Trace is Trace 2 or Trace3 *Span under Frequency *Res BW, Video BW, Filter Type and Filter BW of Offset > Advanced dialog of

Carr/Offset/Limits Config control under Meas Setup

For Trigger, only Free Run, External 1 and External 2 are supported

When in microwave frequency and measurement span is > 40MHz, RF preselector must be turned off

Remote Command	`[:SENSe]:ACPower:METHod IBW | IBWRange | FAST | RBW | FPOWer` `[:SENSe]:ACPower:METHod?`
Example	`:ACP:METH IBW` `:ACP:METH?`
Notes	FAST mode is only supported for WCDMA and C2K signal. You must be in the WCDMA or SA mode with 3GPP WCDMA or CDMA2K radio standard. Otherwise a setting conflict error message will be reported MSR, LTE, LTETDD, LTE-Advanced FDD/TDD and 5G NR modes support only Integration BW, Filtered IBW and Fast Power methods
Dependencies	When `RBW`, `FAST` or `FPOWer` is selected, Gate function is not available. If you try to turn Gate `ON` while Meas Method is `RBW`, `FAST` or `FPOWer`, an error is generated When Gate function is `ON`, `RBW`, `FAST` and `FPOWer` are not available. If you try to change Meas Method to `RBW`, `FAST` or `FPOWer`, an error is generated VXT Models M9420A/21A/10A/11A support only the Integration BW method
Couplings	IBW (Range) restricts the Res BW available for making this measurement to 30 kHz. When selected, the Res BW is clipped to this value if required and an error number displayed
Preset	`IBW`
State Saved	Saved in instrument state
Range	Integration BW|Filtered IBW (max dynamic range)|RBW|Fast|Fast Power

Backwards Compatibility SCPI	`[:SENSe]:ACPR:SWEep:TYPE`
	(Power Suite, WCDMA)
	`[:SENSe]:MCPower:METHod`

Carrier/Offset/Limits Config

Opens a dialog that lets you set Carriers, Offset, and Limits parameters.

Carrier

Lets you configure your carriers, carrier spacing, noise bandwidth and measurement method.

Dependencies	This index tab appears in all Modes but the MSR, LTE-A FDD/TDD and 5G NR modes

Number of Carriers

This is the same as the **Number of Carriers** control found on the **Reference** menu panel tab under **Meas Setup**.

See "Number of Carriers" on page 1181

Couple to #1

Couples carrier settings to carrier #1. The coupled parameters are Carrier Power Present, Carrier Spacing, Measurement Noise Bandwidth, Method, and Filter Alpha.

Remote Command	`[:SENSe]:ACPower:CARRier[1]|2:LIST:COUPle OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1` `[:SENSe]:ACPower:CARRier[1]|2:LIST:COUPle?`
Example	`:ACP:CARR:LIST:COUP OFF` `:ACP:CARR:LIST:COUP?`
Notes	Carrier subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Carrier subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored For LTE-Advanced FDD/TDD mode, this control is not shown. In order to maintain backwards compatibility with the legacy LTE FDD/TDD, the SCPI command is supported in LTE & LTE-A converged application
Couplings	When set to On, the carrier settings are coupled to carrier #1. Coupled parameters are Carrier Power Present, Carrier Spacing, Measurement Noise Bandwidth, Method and Filter Alpha When a setting is changed, the couple is set to Off automatically Carrier #1 is always set to On and cannot be changed
Preset	ON
State Saved	Saved in instrument state

Carrier Pwr Present

Configures the carriers for this measurement. It allows spaces to be inserted between carriers. Carriers with the power present parameter set to YES are carriers, and those with the power present parameter set to NO are spaces. Each carrier power present is set to YES or NO. The individual carrier can be set by selecting the desired carrier.

The query for this parameter returns the current values for all of the carriers. If a carrier is defined as having no power present, the power displayed will be relative to the reference carrier, otherwise the absolute power will be displayed.

If you change the carrier power present to no and that carrier is currently configured as the reference carrier, the next carrier to the left (or the right if there are no carriers to the left) will be assigned as the reference carrier. This also applies to the scenario where there are only two carriers configured as having power present and you configure only one carrier to have no power present.

Remote Command	`[:SENSe]:ACPower:CARRier[1]|2:LIST:PPResent YES | NO, YES | NO, YES | NO, YES | NO, YES | NO, YES | NO`
	
	`[:SENSe]:ACPower:CARRier[1]|2:LIST:PPResent?`

Example	`:ACP:CARR2:LIST:PPR YES`
	
	`:ACP:CARR2:LIST:PPR?`

Notes	Carrier subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Carrier subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored When setting these values remotely, the position in the list sent corresponds to the carrier. Missing values are not permitted, therefore if you want to change values 2 and 6 you must send all values up to 6. Subsequent values will remain unchanged, unless the number of values sent is greater than the number of carriers, then subsequent values will be ignored For LTE-Advanced FDD/TDD modes, this control is not shown. In order to maintain backwards compatibility with the legacy LTE FDD/TDD modes, the SCPI command is supported in the LTE & LTE-A converged application
Couplings	Coupled to the number of carriers. When the SCPI command is sent, the number of carriers will be set to the number of entries in the parameter list
Preset	`YES`
State Saved	Saved in instrument state

Backwards Compatibility SCPI	`[:SENSe]:MCPower:CARRier[1]|2:LIST:PPResent`
	
	`:(Power Suite)`

Carrier Spacing

Sets the width of the carrier spacing. This will be the value applied to all the current slots, whether they are carriers or spaces.

Enter each carrier spacing value individually by selecting the desired carrier, and then enter the carrier width.

Remote Command	`[:SENSe]:ACPower:CARRier[1]|2:LIST:WIDTh <freq>, <freq>, <freq>, <freq>, <freq>, <freq>`
	
	`[:SENSe]:ACPower:CARRier[1]|2:LIST:WIDTh?`

Example	`:ACP:CARR2:LIST:WIDT 25kHz`
	
	`:ACP:CARR2:LIST:WIDT?`

Notes	Carrier subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Carrier subopcode 2. In those cases, commands with subopcode 2 are

	accepted without error but ignored When setting these values remotely, the position in the list sent corresponds to the carrier. Missing values are not permitted, therefore if you want to change values 2 and 6 you must send all values up to 6. Subsequent values will remain unchanged, unless the number of values sent is greater than the number of carriers, then subsequent values will be ignored For LTE-Advanced FDD/TDD modes, this control is not shown. In order to maintain backwards compatibility with the legacy LTE FDD/TDD modes, the SCPI command is supported in the LTE & LTE-A converged application
Couplings	Coupled to the number of carriers. When the SCPI command is sent, the number of carriers will be set to the number of entries in the parameter list Changing Carrier Spacing might affect the Span See the Span section for details
Preset	SA, WCDMA, LTE, LTETDD: 5 MHz Radio Test: 25 kHz
State Saved	Saved in instrument state
Min/Max	0 Hz/Depends on instrument maximum frequency. Same as the Max Span of Swept SA Measurement
Backwards Compatibility SCPI	`[:SENSe]:MCPower:CARRier[1]|2:LIST:WIDTh` (Power Suite, WCDMA)

Measurement Noise Bandwidth

Specifies the **Measurement Noise Bandwidth** used to calculate the power in the carriers.

Each Measurement Noise Bandwidth value is entered individually by selecting the desired carrier. Enter the measurement noise bandwidth on the Carrier page of the Carr/Offset/Limits Config dialog.

Remote Command	`[:SENSe]:ACPower:CARRier[1]|2:LIST:BANDwidth[:INTegration] <freq>, <freq>, <freq>, <freq>, <freq>, <freq>` `[:SENSe]:ACPower:CARRier[1]|2:LIST:BANDwidth[:INTegration]?`
Example	`:ACP:CARR2:LIST:BAND 25kHz` `:ACP:CARR2:LIST:BAND?`
Notes	In the WCDMA mode, the preset/default value is defined as 3.84 MHz. But internally, 4.6848 MHz is used as the default value Carrier subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Carrier subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored When setting these values remotely, the position in the list sent corresponds to the carrier. Missing values are not permitted, therefore if you want to change values 2 and 6 you must send all values up to 6. Subsequent values will remain unchanged, unless the number of values sent is greater than the number of carriers, then subsequent values will be ignored

	For LTE-Advanced FDD/TDD modes, this control is not shown. In order to maintain backwards compatibility with the legacy LTE FDD/TDD modes, the SCPI command is supported in the LTE & LTE-A converged application
Couplings	Coupled to the number of carriers. When the SCPI command is sent, the number of carriers is set to the number of entries in the parameter list
Preset	SA: 2 MHz WCDMA: 3.84 MHz LTE, LTETDD: 4.515 MHz|4.5 MHz Radio Test: 25 kHz
State Saved	Saved in instrument state
Min/Max	10 Hz/Depends on instrument maximum frequency. Same as the Max Span of Swept SA Measurement

Backwards Compatibility SCPI	`[:SENSe]:ACPower:BANDwidth:INTegration`
	`[:SENSe]:ACPower:BWIDth:INTegration`
	`[:SENSe]:ACPower:CARRier[1]|2:LIST:BWIDth[:INTegration]`
	Power Suite, WCDMA
	`[:SENSe]:MCPower:CARRier[1]|2:LIST:BANDwidth[:INTegration]`
	`[:SENSe]:MCPower:CARRier[1]|2:LIST:BWIDth[:INTegration]`

Method for Carrier

Accesses the carrier configuration method settings.

Remote Command	`[:SENSe]:ACPower:CARRier[1]|2:LIST:FILTer[:RRC][:STATe] ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0` `[:SENSe]:ACPower:CARRier[1]|2:LIST:FILTer[:RRC][:STATe]?`
Example	`:ACP:CARR:LIST:FILT 0,0,0,0` `:ACP:CARR:LIST:FILT?`
Notes	The binary values translate as follows: 1|ON = RRC Weighted 0|OFF = Integ BW Maximum of Array length depends on the number of carriers Some modes do not support Carrier subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored For LTE-Advanced FDD/TDD modes, this control is not shown. In order to maintain backwards compatibility with the legacy LTE FDD/TDD modes, the SCPI command is supported in the LTE & LTE-A converged application
Preset	SA, LTE, LTETDD: OFF WCDMA: ON Radio Test: OFF

State Saved	Saved in instrument state
Range	Integration BW|RRC Weighted

Filter Alpha for Carrier

Inputs the alpha value for the filter used in the current carrier configuration.

Remote Command	`[:SENSe]:ACPower:CARRier[1]|2:LIST:FILTer:ALPHa <real>, <real>, <real>, <real>, <real>, <real>` `[:SENSe]:ACPower:CARRier[1]|2:LIST:FILTer:ALPHa?`
Example	`:ACP:CARR2:LIST:FILT:ALPH 0.5` `:ACP:CARR2:LIST:FILT:ALPH?`
Notes	Some modes do not support Carrier subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored For LTE-Advanced FDD/TDD modes, this control is not shown. In order to maintain backwards compatibility with the legacy LTE FDD/TDD modes, the SCPI command is supported in the LTE & LTE-A converged application
Preset	0.22
State Saved	Saved in instrument state
Min/Max	0.01/1.0

Offset

Lets you configure the spacing of the offset regions.

Offset Frequency Define

Enables you to select offset frequency definition. Each standard defines each offset frequency from Carrier.

For example, 3GPP2 requires the “From Carrier Center to Integ BW Closer Edge” definition. LTE conformance test requires “From Carrier Edge to Integ BW Center” and/or “From Carrier Edge to Integ BW Closer Edge” definition.

`CTOCenter`	From the lowermost carrier center frequency (for lower offset), the uppermost carrier center frequency (for upper offset) to the center frequency of each Offset Integ BW
`CTOEdge`	From the lowermost carrier center frequency (for lower offset), the uppermost carrier center frequency (for upper offset) to the closest edge frequency of each Offset Integ BW
`ETOCenter`	From the lowermost carrier center frequency - spacing of this carrier /2 (for lower

	offset), the uppermost carrier center frequency + spacing of this carrier /2 (for upper offset) to the center frequency of each Offset Integ BW
ETOEdge	From the lowermost carrier center frequency - spacing of this carrier /2 (for lower offset), the uppermost carrier center frequency + spacing of this carrier /2 (for upper offset) to the closest edge of each Offset Integ BW
RTOCenter 5G NR, LTEA, MSR	From either the lower or upper RF BW** edge frequency to the center frequency of each Offset Integ BW
RTOEdge 5G NR, LTEA, MSR	From either the lower or upper RF BW** edge frequency to the closest edge frequency of each Offset Integ BW
RCTOCenter 5G NR only	From the center frequency of RF BW to the center frequency of each Offset Integ BW

** RF BW = $BW_{channel,CA}$ which is defined in each 3GPP standard, regardless of "Measure Carrier" for the uppermost and the lowermost carriers being Enabled or Disabled. When the Number of Component Carrier = 1, RF BW = $BW_{channel}$ = 2 x $F_{offset,RAT}$

See "Diagrams for Offset Freq Define" on page 1150.

Modes other than MSR, LTE-A, 5G NR

Remote Command	[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:TYPE CTOCenter | CTOEdge | ETOCenter | ETOEdge [:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:TYPE?
Example	:ACP:OFFS:TYPE ETOC :ACP:OFFS:TYPE?
Notes	Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored.
Preset	CTOCenter
State Saved	Saved in instrument state
Range	Carrier Center to Integ BW Center|Carrier Center to Integ BW Edge|Carrier Edge to Integ BW Center-|Carrier Edge to Integ BW Edge

Mode: MSR, LTEAFDD, LTEATDD

Remote Command	[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:TYPE CTOCenter | CTOEdge | ETOCenter | ETOEdge | RTOCenter | RTOEdge [:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:TYPE?
Example	:ACP:OFFS:TYPE ETOC :ACP:OFFS:TYPE?

Preset	`CTOCenter`
State Saved	Saved in instrument state
Range	Carrier Center to Integ BW Center|Carrier Center to Integ BW Edge|Carrier Edge to Integ BW Center-|Carrier Edge to Integ BW Edge|RF BW Edge to Integ BW Center|RF BW Edge to Integ BW Edge

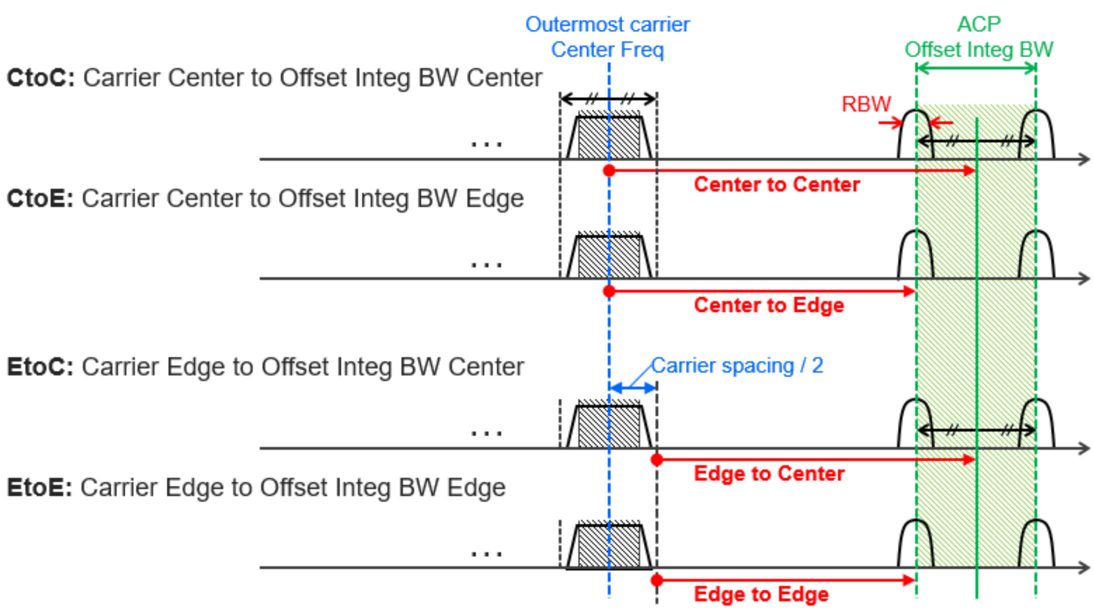
Mode: 5G NR

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:TYPE CTOCenter | CTOEdge | ETOCenter | ETOEdge | RTOCenter | RTOEdge | RCTOCenter` `[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:TYPE?`
Example	`:ACP:OFFS:TYPE ETOC` `:ACP:OFFS:TYPE?`
Preset	`CTOCenter`
State Saved	Saved in instrument state
Range	Carrier Center to Integ BW Center|Carrier Center to Integ BW Edge|Carrier Edge to Integ BW Center-|Carrier Edge to Integ BW Edge|RF BW Edge to Integ BW Center|RF BW Edge to Integ BW Edge|RF BW Center to Integ BW Center

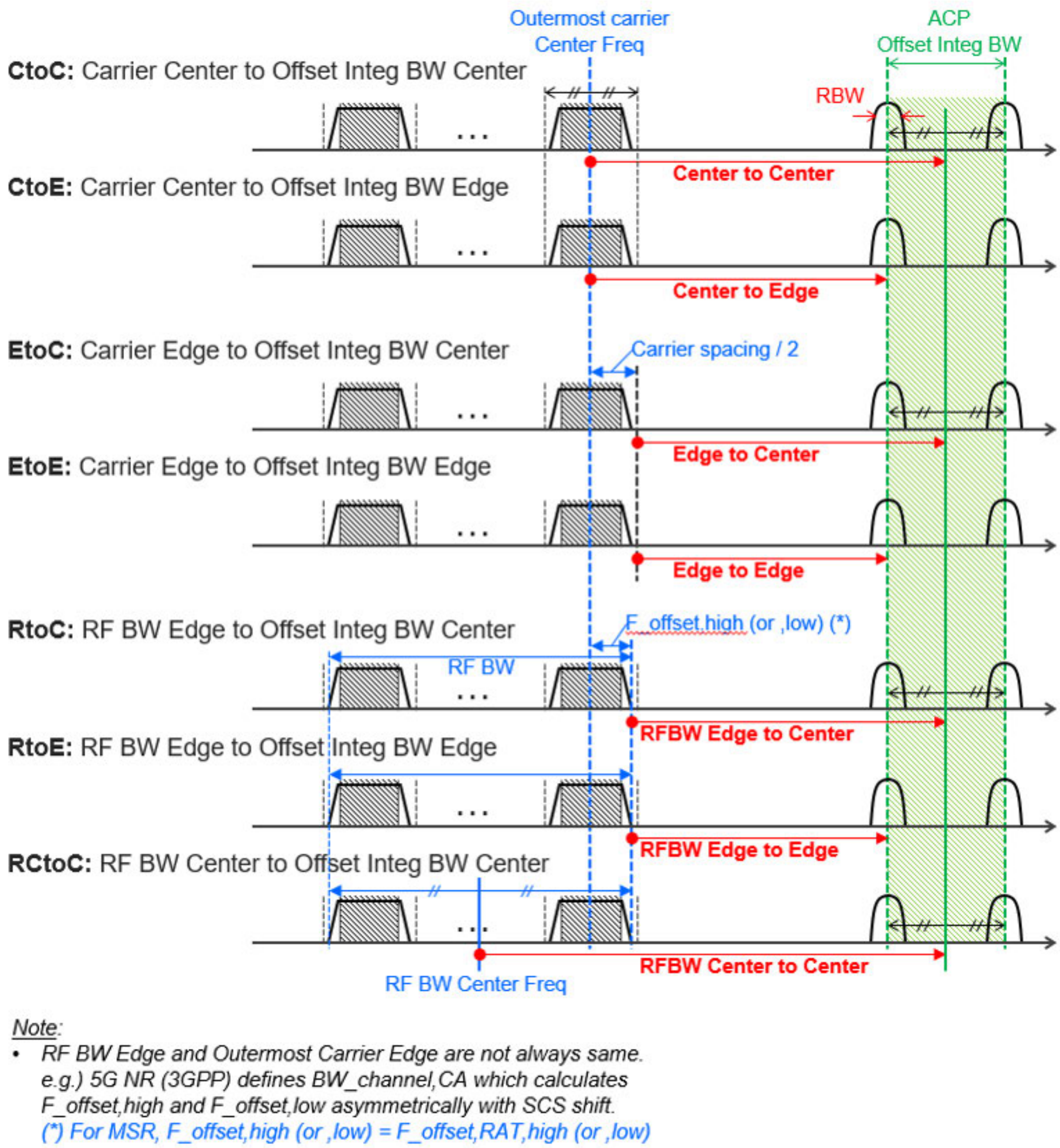
Diagrams for Offset Freq Define

Details depend on the selected mode.

Diagrams for Modes other than MSR, LTE-A, 5G NR



Diagrams for MSR, LTE-A, 5G NR



Offset Freq

This parameter determines the frequency difference between the center of the main channel and the center of the carrier.

Each **Offset Freq** state value is entered individually by selecting the desired carrier.

The list contains up to six (6) entries, depending on the mode selected, for offset frequencies. Each offset frequency in the list corresponds to a reference bandwidth in the bandwidth list.

An offset frequency of zero turns the display of the measurement for that offset off, but the measurement is still made and reported. You can turn off (not use) specific offsets with the [:SENSe]:ACP:OFFSet:LIST:STATe command.

Turning the offset off has the same effect as setting the frequency of the offset to 0 Hz and will cause it to be removed from the results screen.

Remote Command	[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:STATe OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1 [:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:STATe?
Example	:ACP:OFFS1:LIST 0,0,0,0,0,0 :ACP:OFFS1:LIST? :ACP:OFFS2:LIST:STAT 1,1,0,0,0,0 :ACP:OFFS2:LIST:STAT?
Notes	Offset subopcode. 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored When setting these values remotely, the position in the list sent corresponds to the offset. Missing values are not permitted, unless the number of values sent is greater than the number of carriers, then subsequent values will be ignored
Couplings	Changing Offset Frequency might affect the Span. See the Span control section for details
Preset	SA: 3 MHz, 0 Hz, 0 Hz, 0 Hz, 0 Hz, 0 Hz|3 MHz, 0 Hz, 0 Hz, 0 Hz, 0 Hz, 0 Hz WCDMA: 5.0 MHz, 10.0 MHz, 0 Hz, 0 Hz, 0 Hz, 0 Hz|5.0 MHz, 10.0 MHz, 0 Hz, 0 Hz, 0 Hz, 0 Hz LTE, LTETDD, LTEAFDD, LTEATDD, MSR: 5.0 MHz, 10.0 MHz, 0 Hz, 0 Hz, 0 Hz, 0 Hz|5.0 MHz, 10.0 MHz, 0 Hz, 0 Hz, 0 Hz, 0 Hz 5G NR: 100 MHz, 200 MHz, 0 Hz, 0 Hz, 0 Hz, 0 Hz|100 MHz, 200 MHz, 0 Hz, 0 Hz, 0 Hz, 0 Hz Radio Test: 25 kHz, 50 kHz, 75 kHz, 0 Hz, 0 Hz, 0 Hz SA: ON, OFF, OFF, OFF, OFF, OFF|ON, OFF, OFF, OFF, OFF, OFF WCDMA: ON, ON, OFF, OFF, OFF, OFF|ON, ON, OFF, OFF, OFF, OFF LTE, LTETDD, LTEAFDD, LTEATDD, MSR: ON, ON, OFF, OFF, OFF, OFF|ON, OFF, OFF, OFF, OFF, OFF 5G NR: ON, ON, OFF, OFF, OFF, OFF|ON, OFF, OFF, OFF, OFF, OFF Radio Test: ON, ON, ON, OFF, OFF, OFF
State Saved	Saved in instrument state Yes
Range	OFF|ON
Min/Max	0 Hz/Depends on instrument maximum frequency. Same as the Max Span of Swept SA Measurement
Backwards Compatibility SCPI	[:SENSe]:MCPower:OFFSet[1]|2:LIST[:FREQuency]

Integ BW

Sets the Integration Bandwidth for the offsets. Each resolution bandwidth in the list corresponds to an offset frequency in the list defined by [:SENSe]:ACP:OFFSet[n][:OUTer]:LIST[:FREQuency].

Enter each value individually by selecting the desired offset, then enter the Offset Integration Bandwidth.

You can turn off (not use) specific offsets with the [:SENSe]:ACP:OFFSet[n][:OUTer]:LIST:STATe command.

Remote Command	[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth[:INTegration] <freq>, <freq>, <freq>, <freq>, <freq>, <freq> [:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth[:INTegration]?
Example	:ACP:OFFS2:LIST:BAND 2MHz,2MHz,2MHz,2MHz,2MHz,2MHz :ACP:OFFS2:LIST:BAND?
Notes	Offset subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored When setting these values remotely, the position in the list sent corresponds to the offset. Missing values are not permitted i.e. if you want to change the second value, you must send all values up to it. Subsequent values will remain unchanged, unless the number of values sent is greater than the number of carriers, then subsequent values will be ignored
Couplings	Changing Integ BW might affect the Span. See Span section for details
Preset	SA: 2 MHz, 2 MHz, 2 MHz, 2 MHz, 2 MHz, 2 MHz|2 MHz, 2 MHz, 2 MHz, 2 MHz, 2 MHz, 2 MHz WCDMA: 3.84 MHz, 3.84 MHz, 3.84 MHz, 3.84 MHz, 3.84 MHz, 3.84 MHz|3.84 MHz, 3.84 MHz, 3.84 MHz, 3.84 MHz, 3.84 MHz, 3.84 MHz LTE, LTETDD, LTEAFDD,LTEATDD, MSR: 4.515 MHz, 4.515 MHz, 4.515 MHz, 4.515 MHz, 4.515 MHz, 4.515 MHz|4.5 MHz, 4.5 MHz, 4.5 MHz, 4.5 MHz, 4.5 MHz, 4.5 MHz 5G NR: 98.28 MHz, 98.28 MHz, 98.28 MHz, 98.28 MHz, 98.28 MHz, 98.28 MHz|98.31 MHz, 98.31 MHz, 98.31 MHz, 98.31 MHz, 98.31 MHz, 98.31 MHz Radio Test: 25 kHz, 25 kHz, 25 kHz, 25 kHz, 25 kHz, 25 kHz
State Saved	Saved in instrument state
Min/Max	10 Hz/Depends on instrument maximum frequency. Same as the Max Span on Swept SA Measurement
Backwards Compatibility SCPI	[:SENSe]:ACPower:OFFSet[1]|2:LIST:BWIDth[:INTegration] [:SENSe]:ACPR:OFFSet[1]|2:LIST:BANDwidth [:SENSe]:ACPR:OFFSet[1]|2:LIST:BWIDth (Power Suite, WCDMA) [:SENSe]:MCPower:OFFSet[1]|2:LIST:BANDwidth[:INTegration] [:SENSe]:MCPower:OFFSet[1]|2:LIST:BWIDth[:INTegration]

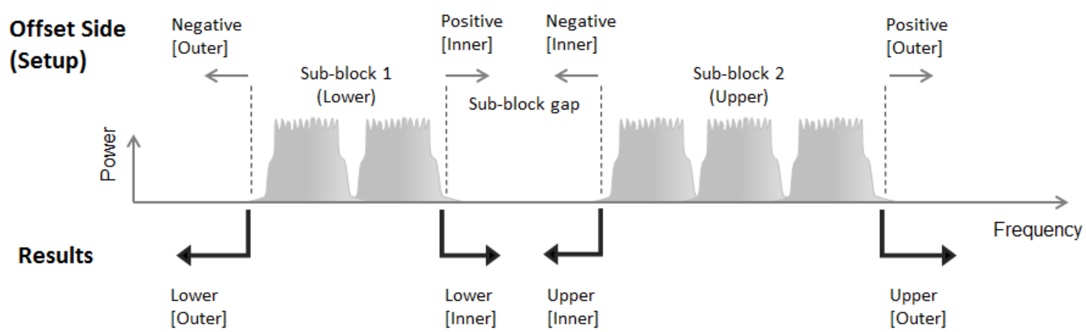
Offset Side

Specifies which offset side to measure.

Enables you to turn off (not use) specific offsetswith [:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:SIDE.

NEGative	Negative (lower) sideband only
BOTH	Both of the negative (lower) and positive (upper) sidebands
POSitive	Positive (upper) sideband only

The figure below shows the relation between the negative/positive offset side setups and the upper/lower results in the MSR and LTE-Advanced FDD/TDD Mode.



Remote Command	[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:SIDE NEGative | BOTH | POSitive,NEGative | BOTH | POSitive,NEGative | BOTH | POSitive,NEGative | BOTH | POSitive,NEGative | BOTH | POSitive,NEGative | BOTH | POSitive [:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:SIDE?
Example	:ACP:OFFS:LIST:SIDE BOTH :ACP:OFFS:LIST:SIDE?
Notes	OFFSet1 is for BTS, 2 for MS. Default is BTS Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored If you set POS or NEG in an offset, result of the inactive side returns -999
Preset	BOTH, BOTH, BOTH, BOTH, BOTH, BOTH | BOTH, BOTH, BOTH, BOTH, BOTH, BOTH
State Saved	Saved in instrument state
Range	NEGative|BOTH|POSitive

Method

Allows you to turn RRC filtering of each offset on or off. The value (roll off) for the filter will be set to the value of the **Filter Alpha** parameter.

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:FILTer[:RRC][:STATe] ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0` `[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:FILTer[:RRC][:STATe]?`
Example	`:ACP:OFFS:LIST:FILT 1,0,0` `:ACP:OFFS:LIST:FILT?`
Notes	`1|ON` = RRC Weighted, `0|OFF` = Integ BW Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored
Preset	see table below
State Saved	Saved in instrument state
Range	Integ BW|RRC Weighted

Mode	Values
SA	0, 0, 0, 0, 0, 0|0, 0, 0, 0, 0,0
WCDMA	1, 1, 1, 1, 1, 1|1, 1, 1, 1, 1, 1
LTE, LTETDD, LTEAFDD, LTEATDD, 5G NR, MSR	0, 0, 0, 0, 0, 0|0, 0, 0, 0, 0,0
Radio Test	0, 0, 0, 0, 0, 0

Filter Alpha

Sets the alpha value for the RRC Filter for each offset.

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:FILTer:ALPHa <real>, <real>, <real>, <real>, <real>, <real>` `[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:FILTer:ALPHa?`
Example	`:ACP:OFFS:LIST:FILT:ALPH 0.5,0.5,0.5,0.5,0.5,0.5` `:ACP:OFFS:LIST:FILT:ALPH?`
Notes	Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored
Preset	see table below
State Saved	Saved in instrument state
Min/Max	0.01/1.00

SA	0.22,0.22,0.22,0.22,0.22,0.22|0.22,0.22,0.22,0.22,0.22,0.22
WCDMA	0.22,0.22,0.22,0.22,0.22,0.22|0.22,0.22,0.22,0.22,0.22,0.22
LTE, LTETDD, LTEAFDD, LTEATDD, 5G NR, MSR	0.22,0.22,0.22,0.22,0.22,0.22|0.22,0.22,0.22,0.22,0.22,0.22

Advanced (Offset)

This control on the **Offset** dialog page opens up another menu page which lets you set advanced properties of the Inner Offset, such as Res BW, Video BW, and Filter parameters.

Offset Freq

This column is the same as on the main **Offset** menu page. See "Offset Freq" on page 1189

Res BW

Sets the resolution bandwidth. If an unavailable bandwidth is entered with the numeric keypad, the closest available bandwidth is selected.

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:RESolution:AUTO ON	OFF	1	0, ON	OFF	1	0, ON	OFF	1	0, ON	OFF	1	0, ON	OFF	1	0, ON	OFF	1	0` `[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:RESolution:AUTO?`

Example	`:ACP:OFFS2:LIST:BAND:RES 220kHz,220kHz,220kHz,220kHz,220kHz,220kHz`
	`:ACP:OFFS2:LIST:BAND:RES?`
	`:ACP:OFFS2:LIST:BAND:RES:AUTO 1,1,1,1,1,1`
	`:ACP:OFFS2:LIST:BAND:RES:AUTO?`

Notes	Offset subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored
Dependencies	When **Meas Method** is RBW, FAST or Fast Power, this cell is grayed out and disabled. If the cell is pressed, an advisory message is generated. If the equivalent SCPI remote command is sent, a "Setting conflict" warning is generated
Couplings	When Res BW Mode is AUTO, this value is exactly same as Res BW under BW key. When you change this value, Res BW Mode is also changed to Man
Preset	SA: 220 kHz, 220 kHz, 220 kHz, 220 kHz, 220 kHz, 220 kHz WCDMA: 100 kHz, 100 kHz, 100 kHz, 100 kHz, 100 kHz, 100 kHz LTE, LTETDD, LTEAFDD, LTEATDD, 5G NR, MSR: 100 kHz, 100 kHz, 100 kHz, 100 kHz, 100 kHz, 100 kHz|100 kHz, 100 kHz, 100 kHz, 100 kHz, 100 kHz, 100 kHz 1, 1, 1, 1, 1, 1
State Saved	Saved in instrument state

	Yes
Min/Max	1 Hz/8 MHz
Backwards Compatibility SCPI	[:SENSe]:ACPower:OFFSet[1]|2:LIST:BWIDth:RESolution [:SENSe]:ACPower:OFFSet[1]|2:LIST:BWIDth:RESolution:AUTO

Video BW

Enables you to change the instrument post-detection filter (VBW).

Remote Command	[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:VIDeo:AUTO OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1 [:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:VIDeo:AUTO?
Example	:ACP:OFFS2:LIST:BAND:VID 5MHz,5MHz,5MHz,5MHz,5MHz,5MHz :ACP:OFFS2:LIST:BAND:VID? :ACP:OFFS2:LIST:BAND:VID:AUTO 0,0,0,0,1,1 :ACP:OFFS2:LIST:BAND:VID:AUTO?
Notes	The values shown in this table reflect the conditions after a Mode Preset Offset subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored
Dependencies	When Meas Method is RBW, FAST or Fast Power, this cell is grayed out and disabled. If the cell is pressed, an advisory message is generated. If the equivalent remote command is sent, a "Setting conflict" warning is generated
Preset	SA: 22 kHz, 22 kHz, 22 kHz, 22 kHz, 22 kHz, 22 kHz WCDMA: 1 MHz, 1 MHz, 1 MHz, 1 MHz, 1 MHz, 1 MHz LTE, LTETDD, LTEAFDD, LTEATDD, 5G NR, MSR: 1 MHz, 1 MHz, 1 MHz, 1 MHz, 1 MHz, 1 MHz ON, ON, ON, ON, ON, ON
State Saved	Saved in instrument state Yes
Min/Max	1 Hz/50 MHz
Backwards Compatibility SCPI	[:SENSe]:ACPower:OFFSet[1]|2:LIST:BWIDth:VIDeo [:SENSe]:ACPower:OFFSet[1]|2:LIST:BWIDth:VIDeo:AUTO

Filter Type

Selects the type of bandwidth filter that is used.

Remote Command	[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:SHAPe GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop,

	`GAUSsian | FLATtop, GAUSsian | FLATtop` `[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:SHAPe?`
Example	`:ACP:OFFS2:LIST:BAND:SHAP FLAT,GAUS,GAUS,GAUS,GAUS,GAUS` `:ACP:OFFS2:LIST:BAND:SHAP?`
Notes	Offset subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored
Dependencies	When Res BW Mode for the offset is Auto, this cell is grayed out and disabled. Since Res BW Mode for the offset is preset to Auto on changing Meas Method to RBW, FAST or Fast Power, this cell is grayed out and disabled too. If the cell is pressed, an advisory message is generated. If the equivalent remote command is sent, a "Setting conflict" warning is generated
Preset	`GAUSsian, GAUSsian, GAUSsian, GAUSsian, GAUSsian, GAUSsian`
State Saved	Saved in instrument state
Range	`GAUSsian|FLATtop`
Backwards Compatibility SCPI	`[:SENSe]:ACPower:OFFSet[1]|2:LIST:BWIDth:SHAPe`

Filter BW

Selects a Gaussian filter based on its –3 dB (Normal) bandwidth or its –6 dB bandwidth.

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:TYPE DB3 | DB6, DB3 | DB6, DB3 | DB6, DB3 | DB6, DB3 | DB6, DB3 | DB6` `[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:TYPE?`
Example	`:ACP:OFFS2:LIST:BAND:TYPE DB3,DB3,DB3,DB3,DB3,DB3` `:ACP:OFFS2:LIST:BAND:TYPE?`
Notes	Offset subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored
Dependencies	When Filter Type if Flattop or Res BW Mode for the offset is Auto, this cell is grayed out and disabled. Since Res BW Mode for the offset is preset to Auto on changing Meas Method to RBW, FAST or Fast Power, this cell is grayed out and disabled too. If the cell is pressed, an advisory message is generated. If the equivalent remote command is sent, a "Setting conflict" warning is generated
Preset	`DB3, DB3, DB3, DB3, DB3, DB3`
State Saved	Saved in instrument state
Range	–3 dB (Normal)| –6 dB
Backwards Compatibility SCPI	`[:SENSe]:ACPower:OFFSet[1]|2:LIST:BWIDth:TYPE`

Limits

Lets you configure the limits that are used to determine whether the offset regions PASS or FAIL the limit test.

Limit Test

This checkbox is the same as the Limit test control on the **Meas Setup, Settings** tab. See "Limit Test" on page 1159.

Offset Freq

This column is the same as the **Offset Freq** column on the **Offset** index tab, see "Offset Freq" on page 1189.

Abs Limit

Enters an absolute limit value, which sets the absolute amplitude levels to test against for each of the custom offsets. The list must contain six (6) entries. If there is more than one offset, the offset closest to the carrier channel is the first one in the list. `[:SENSe]:ACP:OFFSet[n][:OUTer]:LIST:TEST` selects the type of testing to be done at each offset.

You can turn off (not use) specific offsets with the `[:SENSe]:ACP:OFFSet[n][:OUTer]:LIST:STATe` command.

The query returns the six (6) sets of real numbers that are the current absolute amplitude test limits.

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:ABSolute <real>, <real>, <real>, <real>, <real>, <real>` `[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:ABSolute?`
Example	`:ACP:OFFS2:LIST:ABS -10,-10,-10,-10,-10,-10` `:ACP:OFFS2:LIST:ABS?`
Notes	Offset subopcode. 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored
Preset	SA: 0dBm, 0 dBm, 0 dBm, 0 dBm, 0 dBm, 0 dBm|0dBm, 0 dBm, 0 dBm, 0 dBm, 0 dBm, 0 dBm WCDMA: 50 dBm, 50 dBm, 50 dBm, 50 dBm, 50 dBm, 50 dBm|50 dBm, 50 dBm, 50 dBm, 50 dBm, 50 dBm, 50 dBm LTE, LTETDD, LTEAFDD,LTEATDD, MSR: -8.45, -8.45, -8.45, -8.45, -8.45, -8.45|-50.0, -50.0, -50.0, -50.0, -50.0, -50.0 5G NR: 4.92, 4.92, 4.92, 4.92, 4.92, 4.92|-50.0, -50.0, -50.0, -50.0, -50.0, -50.0

State Saved	Saved in instrument state
Min/Max	-200.0 dBm/50.0 dBm
Backwards Compatibility SCPI	[:SENSe]:ACPR:OFFSet[1]|2:LIST:ABSolute SA, W-CDMA [:SENSe]:MCPower:OFFSet[1]|2:LIST:ABSolute SA, W-CDMA

Rel Limit (Car)

Enters a relative limit value for the carrier level. This sets the amplitude levels to test against for the specified offsets.

The amplitude level is relative to the carrier amplitude. If multiple offsets are available, the list contains six (6) entries. The offset closest to the carrier channel is the first one in the list.

[:SENSe]:ACP:OFFSet[n][:OUTer]:LIST:TEST selects the type of testing to be done at each offset.

You can turn off (not use) specific offsets with the [:SENSe]:ACP:OFFSet[n][:OUTer]:LIST:STATe command.

The query returns the six (6) sets of real numbers that are the current amplitude test limits, relative to the carrier, for each offset.

Offset[n] n = 1 is base station and n = 2 is mobiles. The default is base station (1).

Remote Command	[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:RCARrier <real>, <real>, <real>, <real>, <real>, <real> [:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:RCARrier?
Example	:ACP:OFFS2:LIST:RCAR 0,0,0,0,0,0 :ACP:OFFS2:LIST:RCAR?
Notes	Offset subopcode. 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored
Preset	SA: -45, -60, 0, 0, 0, 0|-45, -60, 0, 0, 0, 0 WCDMA: -44.2, -49.2, -49.2, -49.2, -49.2, -49.2|-32.2, -42.2, -42.2, -42.2, -42.2, -42.2 LTE, LTETDD, LTEAFDD,LTEATDD, MSR: -44.2, -44.2, -44.2, -44.2, -44.2, -44.2|-29.2, -29.2, -29.2, -29.2, -29.2, -29.2 5G NR: -43.8, -43.8, -43.8, -43.8, -43.8, -43.8|-29.2, -29.2, -29.2, -29.2, -29.2, -29.2 Radio Test: -60, -60, -60, 0, 0, 0
State Saved	Saved in instrument state

Min/Max	-150/50.0
Backwards Compatibility SCPI	[:SENSe]:MCPower:OFFSet[1]|2:LIST:RCARrier

Positive Offset Limit (SCPI only)

Enables you to set the upper limit for the upper segment of the specified offset pair.

Remote Command	:CALCulate:ACPower:OFFSet[1]|2[:OUTer]:LIST:LIMit:POSitive[:UPPer-]:DATA <real>, <real>, <real>, <real>, <real>, <real> :CALCulate:ACPower:OFFSet[1]|2[:OUTer]:LIST:LIMit:POSitive[:UPPer-]:DATA?
Example	:CALC:ACP:OFFS:LIST:LIM:POS:DATA 0,0,0,0,0,0 :CALC:ACP:OFFS:LIST:LIM:POS:DATA?
Notes	Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored
Preset	SA: -45, -60, 0, 0, 0, 0|-45, -60, 0, 0, 0, 0 WCDMA: -44.2, -49.2, -49.2, -49.2, -49.2, -49.2|-32.2, -42.2, -42.2, -42.2, -42.2, -42.2 LTE, LTETDD, LTEAFDD,LTEATDD, MSR: -44.2,-44.2,-44.2,-44.2,-44.2,-44.2|-29.2, -29.2, -29.2, -29.2, -29.2, -29.2 5G NR: -43.8, -43.8, -43.8, -43.8, -43.8, -43.8|-29.2, -29.2, -29.2, -29.2, -29.2, -29.2 Radio Test: -60, -60, -60, 0, 0, 0
State Saved	Saved in instrument state
Min/Max	-150.0/50.0
Backwards Compatibility SCPI	:CALCulate:MCPower:OFFSet:LIST:LIMit:POSitive[:UPPer]:DATA (Power Suite)

Negative Offset Limit(SCPI only)

Enables you to set the upper limit for the lower segment of the specified offset pair.

Remote Command	:CALCulate:ACPower:OFFSet[1]|2[:OUTer]:LIST:LIMit:NEGative[:UPPer-]:DATA <real>, <real>, <real>, <real>, <real>, <real> :CALCulate:ACPower:OFFSet[1]|2[:OUTer]:LIST:LIMit:NEGative[:UPPer-]:DATA?
Example	:CALC:ACP:OFFS:LIST:LIM:NEG:DATA 0,0,0,0,0,0 :CALC:ACP:OFFS:LIST:LIM:NEG:DATA?
Notes	Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored

Preset	SA: -45, -60, 0, 0, 0, 0|-45, -60, 0, 0, 0, 0 WCDMA: -44.2, -49.2, -49.2, -49.2, -49.2, -49.2|-32.2, -42.2, -42.2, -42.2, -42.2, -42.2 LTE, LTETDD, LTEAFDD,LTEATDD, MSR: -44.2, -44.2, -44.2, -44.2, -44.2, -44.2|-29.2, -29.2, -29.2, -29.2, -29.2, -29.2 5G NR: -43.8, -43.8, -43.8, -43.8, -43.8, -43.8|-29.2, -29.2, -29.2, -29.2, -29.2, -29.2 Radio Test: -60, -60, -60, 0, 0, 0
State Saved	Saved in instrument state
Min/Max	-150.0/50.0
Backwards Compatibility SCPI	`:CALCulate:MCPower:OFFSet:LIST:LIMit:NEGative[:UPPer]:DATA` (Power Suite, WCDMA)

Rel Limit (PSD)

Enters a relative limit value for the level of the power spectral density. This sets the amplitude levels to test against for any custom offsets. The amplitude level is relative to the power spectral density. If multiple offsets are available, the list contains six (6) entries. The offset closest to the carrier channel is the first one in the list.

`[:SENSe]:ACP:OFFSet[n][:OUTer]:LIST:TEST` selects the type of testing to be done at each offset.

You can turn off (not use) specific offsets with the `[:SENSe]:ACP:OFFSet[n][:OUTer]:LIST:STATe` command.

The query returns the six (6) sets of real numbers that are the current amplitude test limits, relative to the power spectral density, for each offset.

Offset[n] n = 1 is base station and n = 2 is mobiles. The default is base station (1).

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:RPSDensity <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl>` `[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:RPSDensity?`
Example	`:ACP:OFFS2:LIST:RPSD 10,10,10,10,10,10` `:ACP:OFFS2:LIST:RPSD?`
Notes	Offset subopcode. 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored
Preset	SA: -28.87 dB, -43.87 dB, 0 dB, 0 dB, 0 dB, 0 dB|-28.87 dB, -43.87 dB, 0 dB, 0 dB, 0 dB, 0 dB WCDMA: -44.2 dB, -49.2 dB, -49.2 dB, -49.2 dB, -49.2 dB, -49.2 dB|-32.2 dB, -42.2 dB, -42.2 dB, -42.2 dB, -42.2 dB, -42.2 dB LTE, LTETDD, LTEAFDD,LTEATDD, 5G NR, MSR: 0, 0, 0, 0, 0, 0|0, 0, 0, 0, 0, 0 Radio Test: -60, -60, -60, 0, 0, 0

State Saved	Saved in instrument state
Min/Max	-150.0 dB/50.0 dB

Fail Mask

Accesses a menu that enables you to select one of the logics for the fail conditions between the measurement results and the test limits. The setting defines the type of testing to be done at any custom offset frequencies. The measured powers are tested against the absolute values defined with `[:SENSe]:ACP:OFFSet[n][:OUTer]:LIST:ABSolute`, or the relative values defined with [:SENSe]:ACP:OFFSet[n][:OUTer]:LIST:RPSDensity and `[:SENSe]:ACP:OFFSet[n][:OUTer]:LIST:RCARrier`.

You can turn off (not use) specific offsets with the `[:SENSe]:ACP:OFFSet[n][:OUTer]:LIST:STATe` command.

Absolute	`ABSolute`	Fail is shown if one of the absolute ACP measurement results is larger than the limit for **Abs Limit**
Relative	`RELative`	Fail is shown if one of the relative ACP measurement results is larger than the limit for **Rel Lim (Car)** or **Rel Lim (PSD)**
Abs AND Rel	`AND`	Fail is shown if one of the absolute ACP measurement results is larger than the limit for **Abs Limit***and* one of the relative ACP measurement results is larger than the limit for **Rel Lim (Car)** or **Rel Lim (PSD)**
Abs OR Rel	`OR`	Fail is shown if one of the absolute ACP measurement results is larger than the limit for **Abs Limit***or* one of the relative ACP measurement results is larger than the limit for **Rel Lim (Car)** or **Rel Lim (PSD)**

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:TEST ABSolute | AND | OR | RELative, ABSolute | AND | OR | RELative, ABSolute | AND | OR | RELative, ABSolute | AND | OR | RELative, ABSolute | AND | OR | RELative, ABSolute | AND | OR | RELative` `[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:TEST?`
Example	`:ACP:OFFS2:LIST:TEST ABS,ABS,ABS,ABS,ABS,ABS` `:ACP:OFFS2:LIST:TEST?`
Notes	Offset subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored
Preset	SA, WCDMA: REL, REL, REL, REL, REL, REL|REL, REL, REL, REL, REL, REL LTE, LTETDD, LTEAFDD,LTEATDD, 5G NR, MSR: AND, AND, AND, AND, AND, AND|AND, AND, AND, AND, AND, AND Radio Test: REL, REL, REL, REL, REL, REL

State Saved	Saved in instrument state
Range	Absolute|Relative|Abs AND Rel (fail if both fail)|Abs OR Rel (fail if either fails)
Backwards Compatibility SCPI	`[:SENSe]:MCPower:OFFSet[1]|2:LIST:TEST`

Offset Frequency Define

This control allows you to select “Offset” definition:

`CTOCenter`	From the lowermost carrier center frequency (for lower offset), the uppermost carrier center frequency (for upper offset) to the center frequency of each Offset Integ BW
`CTOEdge`	From the lowermost carrier center frequency (for lower offset), the uppermost carrier center frequency (for upper offset) to the closest edge frequency of each Offset Integ BW
`ETOCenter`	From the lowermost carrier center frequency - spacing of this carrier /2 (for lower offset), the uppermost carrier center frequency + spacing of this carrier /2 (for upper offset) to the center frequency of each Offset Integ BW
`ETOEdge`	From the lowermost carrier center frequency - spacing of this carrier /2 (for lower offset), the uppermost carrier center frequency + spacing of this carrier /2 (for upper offset) to the closest edge frequency of each Offset Integ BW
`STOCenter`	From either the lower or upper sub-block edge frequency to the center frequency of each Offset Integ BW
`STOEdge`	From either the lower or upper sub-block edge frequency to the closest edge frequency of each Offset Integ BW
`SCTOCenter` 5G NR only	From the center frequency of sub-block** to the center frequency of each Offset Integ BW

** sub-block (bandwidth) = $BW_{channel,block}$ which is defined in each 3GPP standard, regardless of “Measure Carrier” for the uppermost and the lowermost carriers being Enabled or Disabled. When the Number of Component Carrier within each sub-block = 1, sub-block (bandwidth) = $BW_{channel}$ = 2 x $F_{offset,RAT}$.

See "Diagrams for Offset Freq Define" on page 1166"Diagrams for Offset Freq Define" on page 1188

Mode: MSR, LTEAFDD, LTEATDD

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:TYPE CTOCenter | CTOEdge | ETOCenter | ETOEdge | STOCenter | STOEdge` `[:SENSe]:ACPower:OFFSet[1]|2:INNer:TYPE?`
Example	`:ACP:OFFS:INN:TYPE ETOC` `:ACP:OFFS:INN:TYPE?`

Preset	`STOCenter`
State Saved	Saved in instrument state
Range	Carrier Center to Integ BW Center|Carrier Center to Integ BW Edge|Carrier Edge to Integ BW Center-|Carrier Edge to Integ BW Edge|Sub-block Edge to Integ BW Center|Sub-block Edge to Integ BW Edge

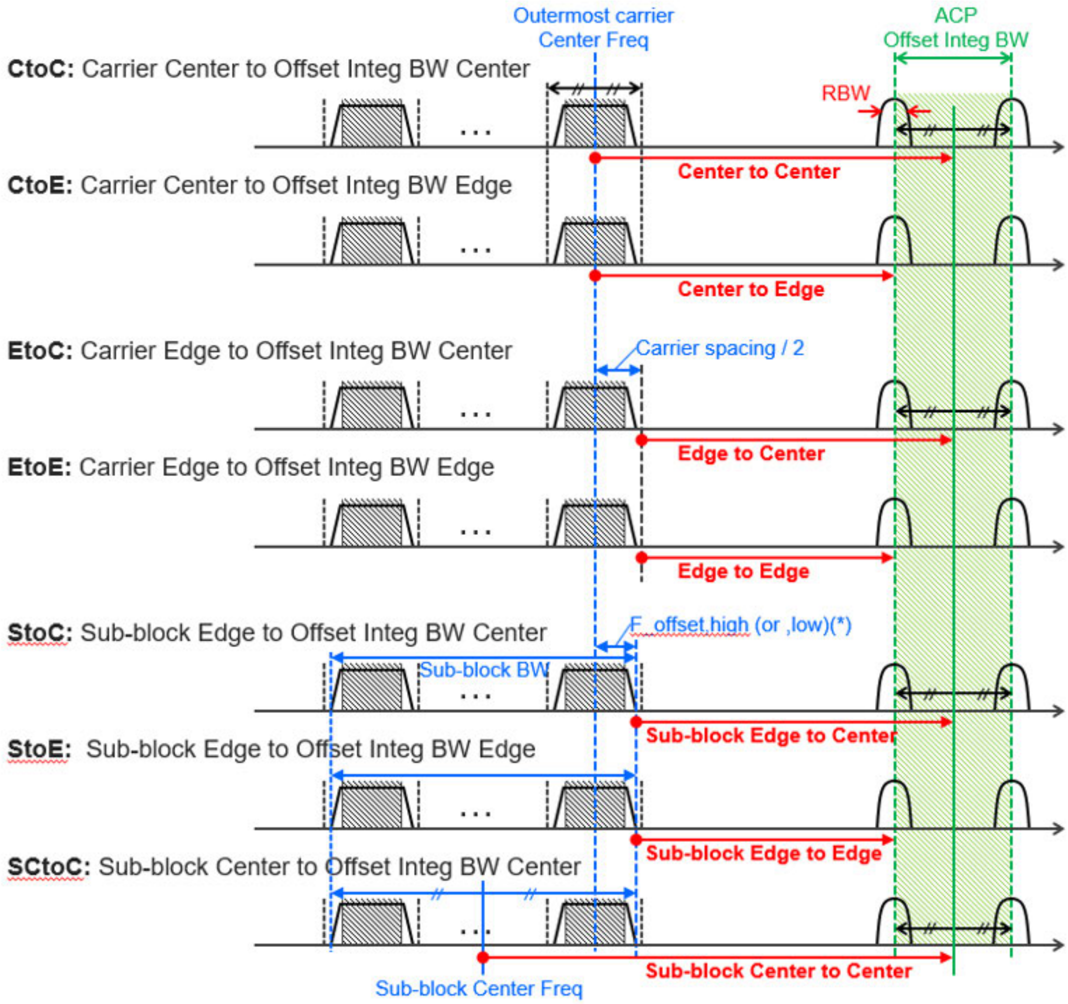
Mode: 5G NR

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:TYPE CTOCenter | CTOEdge | ETOCenter | ETOEdge | STOCenter | STOEdge | SCTOCenter`
	
	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:TYPE?`

Example	`:ACP:OFFS:INN:TYPE ETOC`
	
	`:ACP:OFFS:INN:TYPE?`

Preset	`STOCenter|CTOCenter`
State Saved	Saved in instrument state
Range	Carrier Center to Integ BW Center|Carrier Center to Integ BW Edge|Carrier Edge to Integ BW Center-|Carrier Edge to Integ BW Edge|Sub-block Edge to Integ BW Center|Sub-block Edge to Integ BW Edge|Sub-block Center to Integ BW Center

Diagrams for Offset Freq Define



Note:

- *Sub-block Edge and Outermost Carrier Edge in the Sub-block are not always same. e.g.) 5G NR (3GPP) defines BW_channel,block which calculates F_offset,high and F_offset,low asymmetrically with SCS shift.*
  (*) For MSR, F_offset,high (or ,low) = F_offset,RAT,high (or ,low)

Offset Freq

This parameter determines the frequency difference between the center of the main channel and the center of the carrier. When set to Offset to Edge, this parameter determines the frequency difference between the center of the main channel and the near edge of the offset.

Each **Offset Freq** state value is entered individually by selecting the desired carrier. Use the Enabled checkbox to turn the Offset Freq State on and off.

The list contains up to six (6) entries, depending on the mode selected, for offset frequencies. Each offset frequency in the list corresponds to a reference bandwidth in the bandwidth list.

An offset frequency of zero turns the display of the measurement for that offset off, but the measurement is still made and reported. You can turn off (not use) specific offsets with the [:SENSe]:ACP:OFFSet[n]:INNer:LIST:STATe command.

Turning the offset off has the same effect as setting the frequency of the offset to 0 Hz and will cause it to be removed from the results screen.

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:STATe OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1` `[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:STATe?`

Example	`:ACP:OFFS1:INN:LIST 0,0,0,0,0,0`
	`:ACP:OFFS1:INN:LIST?`
	`:ACP:OFFS2:INN:LIST:STAT 1,1,0,0,0,0`
	`:ACP:OFFS2:INN:LIST:STAT?`

Notes	When setting these values remotely, the position in the list sent corresponds to the offset. Missing values are not permitted, unless the number of values sent is greater than the number of carriers, then subsequent values will be ignored Offset subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS
Couplings	Changing Offset Frequency might affect the Span. See the Span control section for details
Preset	2.5MHz,7.5MHz,0,0,0,0|2.5MHz,7.5MHz,0,0,0,0 5G NR: 10 MHz, 30 MHz, 0 Hz, 0 Hz, 0 Hz, 0 Hz|100 MHz, 200 MHz, 0 Hz, 0 Hz, 0 Hz, 0 Hz `ON, ON, OFF, OFF, OFF, OFF | ON, OFF, OFF, OFF, OFF, OFF`
State Saved	Saved in instrument state Yes
Min/Max	0 Hz/Depends on instrument maximum frequency. Same as the Max Span of Swept SA Measurement

Integ BW

Sets the Integration Bandwidth for the offsets. Each resolution bandwidth in the list corresponds to an offset frequency in the list defined by `[:SENSe]:ACP:OFFSet[n]:INNer:LIST[:FREQuency]`.

Enter each value individually by selecting the desired offset on the **Offset** menu key using the up down arrows, the knob, or the numeric keypad, then enter the Offset Integration Bandwidth using the **Offset Integration Bandwidth** menu key.

You can turn off (not use) specific offsets with the `[:SENSe]:ACP:OFFSet[n]:INNer:LIST:STATe` command.

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:BANDwidth[:INTegration] <freq>, <freq>, <freq>, <freq>, <freq>, <freq>`

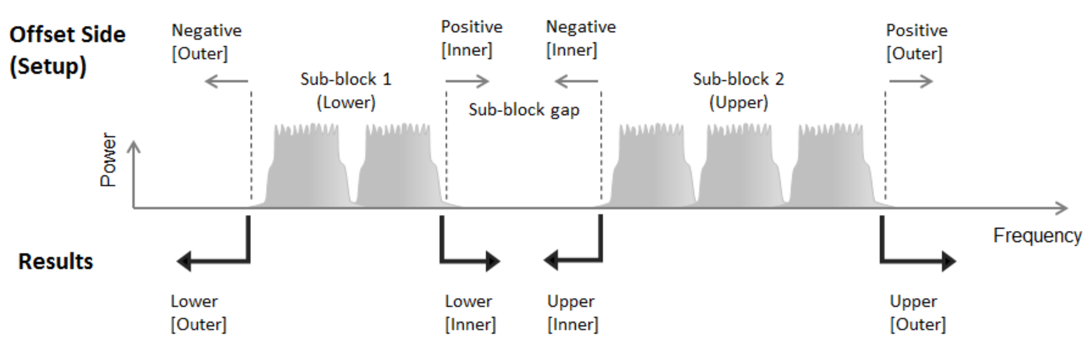
	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:BANDwidth[:INTegration]?`
Example	`:ACP:OFFS2:INN:LIST:BAND 2MHz,2MHz,2MHz,2MHz,2MHz,2MHz` `:ACP:OFFS2:INN:LIST:BAND?`
Notes	When setting these values remotely, the position in the list sent corresponds to the offset. Missing values are not permitted i.e. if you want to change the second value you must send all values up to it. Subsequent values will remain unchanged Offset subopcode. 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS
Couplings	Changing Integ BW might affect the Span. See Span section for details
Preset	LTEAFDD:3.84MHz, 3.84MHz, 3.84MHz, 3.84MHz, 3.84MHz, 3.84MHz|3.84MHz, 3.84MHz, 3.84MHz, 3.84MHz, 3.84MHz, 3.84MHz MSR, LTEATDD: 4.515MHz, 4.515MHz, 4.515MHz, 4.515MHz, 4.515MHz, 4.515MHz|4.5MHz, 4.5MHz, 4.5MHz, 4.5MHz, 4.5MHz, 4.5MHz 5G NR: 19.08 MHz, 19.08 MHz, 19.08 MHz, 19.08 MHz, 19.08 MHz, 19.08 MHz|98.31 MHz, 98.31 MHz, 98.31 MHz, 98.31 MHz, 98.31 MHz, 98.31 MHz
State Saved	Saved in instrument state
Min/Max	10 Hz/Depends on instrument maximum frequency. Same as the Max Span on Swept SA Measurement

Offset Side

Enables you to turn off (not use) specific offsets with `[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:SIDE`.

- `NEGative` - The upper side in the sub-block gap only (i.e. negative sideband of the upper sub-block) is enabled
- `BOTH` - Both sides in the sub-block gap are enabled
- `POSitive` - The lower side in the sub-block gap only (i.e. positive sideband of the lower sub-block) is enabled

The figure below shows the relation between the negative/positive offset side setups and the upper/lower results in the MSR and LTE-Advanced FDD/TDD Mode.



Remote	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:SIDE NEGative	BOTH |`

Command	POSitive,NEGative | BOTH | POSitive,NEGative | BOTH | POSitive,NEGative | BOTH | POSitive,NEGative | BOTH | POSitive,NEGative | BOTH | POSitive [:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:SIDE?
Example	:ACP:OFFS:INN:LIST:SIDE BOTH :ACP:OFFS:INN:LIST:SIDE?
Notes	OFFSet1 is for BTS, 2 for MS. Default is BTS If you set POS or NEG in an offset, result of the inactive side returns -999
Preset	BOTH, BOTH, BOTH, BOTH, BOTH, BOTH | BOTH, BOTH, BOTH, BOTH, BOTH, BOTH
State Saved	Saved in instrument state
Range	NEGative|BOTH|POSitive

Method

Enables you to turn RRC filtering of each offset on or off. The value (roll off) for the filter will be set to the value of the Filter Alpha parameter.

Remote Command	[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:FILTer[:RRC][:STATe] ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0 [:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:FILTer[:RRC][:STATe]?
Example	:ACP:OFFS:INN:LIST:FILT 1,0,0 :ACP:OFFS:INN:LIST:FILT?
Notes	1|ON = RRC Weighted, 0|OFF = Integ BW
Preset	LTEAFDD: 1,1,1,1,1,1|1,1,1,1,1,1 MSR, LTEATDD, 5G NR: 0,0,0,0,0,0|0,0,0,0,0,0
State Saved	Saved in instrument state
Range	Integ BW|RRC Weighted

Filter Alpha

Sets the alpha value for the RRC Filter for each offset.

Remote Command	[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:FILTer:ALPHa <real>, <real>, <real>, <real>, <real>, <real> [:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:FILTer:ALPHa?
Example	:ACP:OFFS:INN:LIST:FILT:ALPH 0.5,0.5,0.5,0.5,0.5,0.5 :ACP:OFFS:INN:LIST:FILT:ALPH?
Preset	0.22,0.22,0.22,0.22,0.22,0.22|0.22,0.22,0.22,0.22,0.22,0.22

State Saved	Saved in instrument state
Min/Max	0.01/1.00

Offset Freq

This column is the same as on the main **Inner Offset** menu tab. See"Offset Freq" on page 1204

Res BW

Sets the resolution bandwidth. If an unavailable bandwidth is entered with the numeric keypad, the closest available bandwidth is selected.

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:BANDwidth:RESolution:AUTO ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0` `[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:BANDwidth:RESolution:AUTO?`

Example	`:ACP:OFFS2:INN:LIST:BAND:RES 220kHz,220kHz,220kHz,220kHz,220kHz,220kHz`
	`:ACP:OFFS2:INN:LIST:BAND:RES?`
	`:ACP:OFFS2:INN:LIST:BAND:RES:AUTO 1,1,1,1,1,1`
	`:ACP:OFFS2:INN:LIST:BAND:RES:AUTO?`

Notes	Offset subopcode. 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS
Dependencies	When **Meas Method** is RBW, FAST or Fast Power, this control is grayed out and disabled. If the cell is pressed, an advisory message is generated. If the equivalent SCPI remote command is sent, a "Setting conflict" warning is generated
Couplings	When Res BW Mode is AUTO, this value is exactly the same as Res BW under the **BW** key. When you change this value, Res BW Mode is also changed to Man
Preset	100 kHz,100 kHz,100 kHz,100k Hz,100 kHz|100 kHz,100 kHz,100 kHz,100 kHz,100 kHz,100 kHz 1, 1, 1, 1, 1, 1
State Saved	Saved in instrument state Yes
Min/Max	1 Hz/8 MHz

Video BW

Enables you to change the instrument post-detection filter (VBW).

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:BANDwidth:VIDeo:AUTO OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF |`

	ON | 0 | 1, OFF | ON | 0 | 1 [:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:BANDwidth:VIDeo:AUTO?
Example	:ACP:OFFS2:INN:LIST:BAND:VID 5MHz,5MHz,5MHz,5MHz,5MHz,5MHz :ACP:OFFS2:INN:LIST:BAND:VID? :ACP:OFFS2:INN:LIST:BAND:VID:AUTO 0,0,0,0,1,1 :ACP:OFFS2:INN:LIST:BAND:VID:AUTO?
Notes	The values shown in this table reflect the conditions after a Mode Preset Offset subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS
Dependencies	When **Meas Method** is RBW, FAST or Fast Power, this cell is grayed-out and disabled. If the cell is pressed, an advisory message is generated. If the equivalent remote command is sent, a "Setting conflict" warning is generated
Preset	1 MHz,1 MHz,1 MHz,1 MHz,1 MHz,1 MHz ON, ON, ON, ON, ON, ON
State Saved	Yes Yes
Min/Max	1 Hz/50 MHz

Filter Type

Selects the type of bandwidth filter that is used.

Remote Command	[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:BANDwidth:SHAPe GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop [:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:BANDwidth:SHAPe?
Example	:ACP:OFFS2:INN:LIST:BAND:SHAP FLAT,GAUS,GAUS,GAUS,GAUS,GAUS :ACP:OFFS2:INN:LIST:BAND:SHAP?
Notes	Offset subopcode: 1 for BTS (Downlink), 2 for MS (Uplink)
Dependencies	When Res BW Mode for the offset is Auto, this cell is grayed-out and disabled. Since Res BW Mode for the offset is preset to Auto on changing **Meas Method** to RBW, FAST or Fast Power, this cell is grayed-out and disabled. If the cell is pressed, an advisory message is generated. If the equivalent remote command is sent, a "Setting conflict" warning is generated
Preset	GAUSsian, GAUSsian, GAUSsian, GAUSsian, GAUSsian, GAUSsian
State Saved	Saved in instrument state
Range	GAUSsian|FLATtop

Filter BW

Selects a Gaussian filter based on its –3 dB (Normal) bandwidth or its –6 dB bandwidth.

Remote Command	[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:BANDwidth:TYPE DB3 | DB6, DB3 | DB6, DB3 | DB6, DB3 | DB6, DB3 | DB6, DB3 | DB6 [:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:BANDwidth:TYPE?
Example	:ACP:OFFS2:INN:LIST:BAND:TYPE DB3,DB3,DB3,DB3,DB3,DB3 :ACP:OFFS2:INN:LIST:BAND:TYPE?
Notes	Offset subopcode: 1 for BTS (Downlink), 2 for MS (Uplink)
Dependencies	When Filter Type if FLATtop or Res BW Mode for the offset is Auto, this cell is grayed-out and disabled. Since Res BW Mode for the offset is preset to Auto on changing **Meas Method** to RBW, FAST or Fast Power, this cell is grayed-out and disabled too. If the cell is pressed, an advisory message is generated. If the equivalent remote command is sent, a "Setting conflict" warning is generated
Preset	DB3, DB3, DB3, DB3, DB3, DB3
State Saved	Saved in instrument state
Range	–3 dB (Normal)| –6 dB

Power Ref Type

Enables you to set reference types of inner offsets.

CUMulative	Cumulated power of the upper and lower sub-block carriers is the reference level. This selection is effective only when one of the following "Power Ref" on page 1217 values is selected: Left & Right Carriers — LRCarriers Max Power Carrier in Sub-block — MPCSubblock Min Power Carrier in Sub-block — MINSubbloc Left & Right Sub-blocks — LRSubblocks Manual — MANual When one of the other **Power Ref** values is selected, carrier powers are not cumulated and the reference level is equivalent to Normal
NORMal	Power of specified carrier or the manual reference level is the reference level

Remote Command	[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:PREFerence CUMulative | NORMal, CUMulative | NORMal, CUMulative | NORMal, CUMulative | NORMal, CUMulative | NORMal, CUMulative | NORMal [:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:PREFerence?
Example	:ACP:OFFS:INN:LIST:PREF CUM,CUM,NORM,NORM,NORM,NORM :ACP:OFFS:INN:LIST:PREF?
Preset	NORMal, NORMal, NORMal, NORMal, NORMal, NORMal
State Saved	Saved in instrument state
Range	CUMulative|NORMal

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:PREFerence:AUTO OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1` `[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:PREFerence:AUTO?`
Example	`:ACP:OFFS:INN:LIST:PREF:AUTO OFF,OFF,OFF,OFF,OFF,OFF` `:ACP:OFFS:INN:LIST:PREF:AUTO?`
Dependencies	This is available only in LTE/LTE-Advanced FDD/TDD and 5G NR ACP measurement

Couplings

When in the LTE-Advanced FDD/TDD mode, the inner power ref type is set automatically when the power ref type state is auto according to the scopes of the sub-block gap in the following table

Sub-block Gap	Inner ACP offset	Power Ref Type
Wgap <5MHz	1st (2.5MHz)	Normal
	2nd (7.5MHz)	Normal
5MHz≤ Wgap <10MHz	1st (2.5MHz)	Cumulative
	2nd (7.5MHz)	Normal
10MHz≤ Wgap <15MHz	1st (2.5MHz)	Cumulative
	2nd (7.5MHz)	Cumulative
15MHz≤ Wgap <20MHz	1st (2.5MHz)	Normal
	2nd (7.5MHz)	Cumulative
20MHz≤ Wgap	1st (2.5MHz)	Normal
	2nd (7.5MHz)	Normal

When in the 5G NR mode, Power Ref Type “Auto” sets the power reference type of inner-ACLR offset automatically.

Downlink: “Cumulative” or “Normal” is selected accordingly when the inner-offsets are configured to meet the test requirements as follows:

FR1, 3GPP TS 38.141-1 v16.5.0 (2020-09) Section 6.6.3.5.3 BS type 1-C:

- Table 6.6.3.5.2-3: Base Station ACLR limit in non-contiguous spectrum or multiple bands
- Table 6.6.3.5.2-4: Base station CACLR limit

FR2, 3GPP TS 38.141-2 v16.5.0 (2020-09) Section 6.7.3.5.3 BS type 2-O:

- Table 6.7.3.5.2-3: BS type 2-O ACLR limit in non-contiguous spectrum
- Table 6.7.3.5.2-4: BS type 2-O CACLR limit in non-contiguous spectrum

Uplink: “Normal” is always selected.

Preset	`ON, ON, ON, ON, ON, ON | OFF, OFF, OFF, OFF, OFF, OFF`
State Saved	Saved in instrument state
Range	Auto|Man

Limit Test

This checkbox is the same as the **Limit Test** control on the **Meas Setup**, **Settings** tab. See "Limit Test" on page 1197.

Offset Freq

This column is the same as the **Offset Freq** column on the **Offset** index tab, see "Offset Freq" on page 1189.

Abs Limit

Enters an absolute limit value, which sets the absolute amplitude levels to test against for each of the custom offsets. The list must contain six (6) entries. If there is more than one offset, the offset closest to the carrier channel is the first one in the list. `[:SENSe]:ACP:OFFSet[n]:INNer:LIST:TEST` selects the type of testing to be done at each offset.

You can turn off (not use) specific offsets with the `[:SENSe]:ACP:OFFSet[n]:INNer:LIST:STATe` command.

The query returns the six (6) sets of real numbers that are the current absolute amplitude test limits.

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:ABSolute <real>, <real>, <real>, <real>, <real>, <real>` `[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:ABSolute?`
Example	`:ACP:OFFS2:INN:LIST:ABS -10,-10,-10,-10,-10,-10` `:ACP:OFFS2:INN:LIST:ABS?`
Notes	Offset subopcode. 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS
Preset	-8.45, -8.45, -8.45, -8.45, -8.45, -8.45 | -50.0, -50.0, -50.0, -50.0, -50.0, -50.0 5G NR: -2.2, -2.2, -2.2, -2.2, -2.2, -2.2|-50.0,-50.0,-50.0,-50.0,-50.0,-50.0
State Saved	Saved in instrument state
Min/Max	-200.0 dBm/50.0 dBm

Rel Limit (Car)

Enters a relative limit value for the carrier level. This sets the amplitude levels to test against for the specified offsets.

The amplitude level is relative to the carrier amplitude. If multiple offsets are available, the list contains six (6) entries. The offset closest to the carrier channel is the first one in the list. `[:SENSe]:ACP:OFFSet[n]:INNer:LIST:TEST` selects the type of testing to be done at each offset.

You can turn off (not use) specific offsets with the [:SENSe]:ACP:OFFSet[n]:INNer:LIST:STATe command.

The query returns the six (6) sets of real numbers that are the current amplitude test limits, relative to the carrier, for each offset.

Offset[n] n = 1 is base station and n = 2 is mobiles. The default is base station (1).

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:RCARrier <real>, <real>, <real>, <real>, <real>, <real>` `[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:RCARrier?`
Example	`:ACP:OFFS2:INN:LIST:RCAR 0,0,0,0,0,0` `:ACP:OFFS2:INN:LIST:RCAR?`
Notes	Offset subopcode. 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS
Preset	-44.2, -44.2,-44.2,-44.2,-44.2,-44.2|-29.2, -29.2, -29.2, -29.2, -29.2, -29.2 5G NR: -43.8, -43.8, 43.8, -43.8, -43.8, -43.8|-29.2, -29.2, -29.2, -29.2, -29.2, -29.2
State Saved	Saved in instrument state
Min/Max	-150/50.0

Rel Limit (PSD)

Enters a relative limit value for the level of the power spectral density. This sets the amplitude levels to test against for any custom offsets. The amplitude level is relative to the power spectral density. If multiple offsets are available, the list contains six (6) entries. The offset closest to the carrier channel is the first one in the list.

[:SENSe]:ACP:OFFSet[n]:INNer:LIST:TEST selects the type of testing to be done at each offset.

You can turn off (not use) specific offsets with the [:SENSe]:ACP:OFFSet[n]:INNer:LIST:STATe command.

The query returns the six (6) sets of real numbers that are the current amplitude test limits, relative to the power spectral density, for each offset.

Offset[n] n = 1 is base station and n = 2 is mobiles. The default is base station (1).

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:RPSDensity <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl>` `[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:RPSDensity?`
Example	`:ACP:OFFS2:INN:LIST:RPSD 10,10,10,10,10,10` `:ACP:OFFS2:INN:LIST:RPSD?`
Notes	Offset subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS
Preset	0, 0, 0, 0, 0, 0|0, 0, 0, 0, 0, 0
State Saved	Saved in instrument state
Min/Max	-150.0 dB/50.0 dB

Fail Mask

Accesses a menu that enables you to select one of the logics for the fail conditions between the measurement results and the test limits. The setting defines the type of testing to be done at any custom offset frequencies. The measured powers are tested against the absolute values defined with `[:SENSe]:ACP:OFFSet[n]:INNer:LIST:ABSolute`, or the relative values defined with `[:SENSe]:ACP:OFFSet[n]:INNer:LIST:RPSDensity` and `[:SENSe]:ACP:OFFSet[n]:INNer:LIST:RCARrier`.

You can turn off (not use) specific offsets with the `[:SENSe]:ACP:OFFSet[n]:INNer:LIST:STATe` command.

- Absolute – Fail is shown if one of the absolute ACP measurement results is larger than the limit for Abs Limit
- Relative – Fail is shown if one of the relative ACP measurement results is larger than the limit for Rel Lim (Car) or Rel Lim (PSD)
- Abs AND Rel – Fail is shown if one of the absolute ACP measurement results is larger than the limit for Abs Limit *and* one of the relative ACP measurement results is larger than the limit for Rel Lim (Car) or Rel Lim (PSD)
- Abs OR Rel– Fail is shown if one of the absolute ACP measurement results is larger than the limit for Abs Limit *or* one of the relative ACP measurement results is larger than the limit for Rel Lim (Car) or Rel Lim (PSD)

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:TEST ABSolute	AND	OR	RELative, ABSolute	AND	OR	RELative, ABSolute	AND	OR	RELative, ABSolute	AND	OR	RELative, ABSolute	AND	OR	RELative, ABSolute	AND	OR	RELative` `[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:TEST?`
Example	`:ACP:OFFS2:INN:LIST:TEST ABS,ABS,ABS,ABS,ABS,ABS` `:ACP:OFFS2:INN:LIST:TEST?`
Notes	Offset subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS
Preset	`AND, AND, AND, AND, AND, AND	AND, AND, AND, AND, AND, AND`
State Saved	Saved in instrument state
Range	Absolute|Relative|Abs AND Rel (fail if both fail)|Abs OR Rel (fail if either fails)

Limit Test

Turns limit checking for each offset On or Off. The limits may be specified within the Offset menu, for each offset, both sides of the carrier. For results that fail the limit, a red F is appended. In the Combined view, the bar turns red.

Remote	`:CALCulate:ACPower:LIMit:STATe OFF	ON	0	1`

Command	:CALCulate:ACPower:LIMit:STATe?
Example	:CALC:ACP:LIM:STAT OFF :CALC:ACP:LIM:STAT?
Preset	SA: OFF WCDMA, LTE, LTETDD, LTEAFDD, LTEATDD, 5G NR, MSR: ON
State Saved	Saved in instrument state
Range	ON|OFF
Backwards Compatibility SCPI	[:SENSe]:MCPower:LIMit[:STATe] [:SENSe]:ACPower:LIMit[:STATe]

Spur Avoidance

Because the VXT models M9410A/11A/15A are direct-conversion (zero-IF) receivers, feedthrough leakage from the local oscillator appears as a spurious signal (spur) at the center frequency. The **Spur Avoidance** function is provided to eliminate this spur, at the expense of some measurement speed.

When **Spur Avoidance** is enabled (the default), the instrument uses a software algorithm to remove this spur from the displayed measurement data, but the algorithm only operates under certain conditions. Specifically, it only operates in multiple capture case.

You can disable this function to speed up your measurement by setting Spur Avoidance to “Disabled.”

Note that when Spur Avoidance is not in effect, either because you have disabled it or because you are not in multiple capture, the following warning message appears in the status bar:

`Settings Alert;Spur Avoidance Off`

This is to alert you that measurement accuracy might be impacted by the fact that Spur Avoidance is not in effect.

Remote Command	[:SENSe]:ACPower:SAVoid[:STATe] ON | OFF | 0 | 1 [:SENSe]:ACPower:SAVoid[:STATe]?
Example	:ACP:SAVoid ON :ACP:SAVoid?
Dependencies	This control only appears in VXT models M9410A/11A/15A
Preset	OFF
State Saved	Saved in instrument state
Range	ON|OFF

Meas Setup Summary Table

Lets you view and access many of the parameters in the Meas Setup menus on one screen.

Auto Couple

Immediately puts all Auto/Man functions into Auto. The **Auto Couple** action is confined to the current measurement only. It does not affect other measurements in the mode.

In the Auto state, Auto/Man functions are said to be "coupled", meaning their values change as you make changes to other values in the measurement. This helps ensure accurate measurements and optimum dynamic range. Auto Couple is an immediate action function, and when it is executed, all the Auto/Man controls for the current measurement are set to Auto, and all measurement settings coupled to the Auto/Man parameters are automatically set to their optimal value.

For further details of measurement-specific settings (if any), see "Measurement-Specific Details" on page 1179 below.

Remote Command	`:COUPle ALL`
Example	`:COUP ALL`
Backwards Compatibility SCPI	`:COUPLE ALL | NONE`
Backwards Compatibility Notes	`:COUP:NONE` puts all Auto/Man parameters in manual mode, decoupling all the coupled instrument parameters. It is retained for backwards compatibility and is *not* recommended for making measurements or new designs

All Auto/Man parameter couplings in the measurement are set to Auto. This includes couplings that may be unavailable or grayed-out due to the current state. For example, in the Swept SA measurement, there is no Auto/Man coupling for RBW while in Zero Span. Nonetheless, if **Auto Couple** were executed while in Zero Span it would set RBW to Auto "behind the scenes" so that, on exit from Zero Span, it would be in Auto.

Any Auto/Man selection specific (local) to the other measurements in the current Mode will not be affected by **Auto Couple**. Any functions that are *not* coupled with other instrument parameters, such as ranging or leveling variables, such as "AutoRange" or "AutoScale", will not be affected.

Executing the **Auto Couple** command generates the informational message, "All Auto/Man functions have been set to Auto".

Each parameter, upon being set to Auto, selects and sets the appropriate auto-coupled value based on that parameter's coupling rules. The Dependency Resolver orchestrates the couplings for parameters that are dependent on one or more other parameters. The coupling and dependency rules for each parameter are defined in the chapter describing that parameter.

Executing the **Auto Couple** command *does not* affect markers, marker functions, trace or display attributes, or any other instrument setting other than those specifically mentioned above.

Measurement-Specific Details

TOI

Parameters affected by Auto Couple are:

- Center Frequency Step
- Resolution Bandwidth
- Span/RBW Ratio
- Sweep Time
- Video BandwidthVBW/RBW ratio
- Upper and Lower Tone (set to Sense
-)Zero span measurement Resolution Bandwidth
- Zero span measurement Dwell Time

Harmonics

For Harmonics, these parameters are:

- Resolution Bandwidth
- Fundamental Frequency
- Dwell Time
- Range Table Resolution Bandwidths
- Range Table Dwell Times

Meas Preset

Restores all measurement parameters to their default values.

Remote Command	`:CONFigure:ACPower`

Example	:CONF:ACP
Couplings	Selecting **Meas Preset** restores all measurement parameters to their default values

3.9.8.2 Reference

All ACP measurements are taken relative to a specific carrier frequency, relative to whose power the offset channel power is measured.

The controls on this tab let you specify the reference carrier frequency and other parameters relevant to the reference carrier.

Number of Carriers

Specifies the number of carriers to be measured.

Remote Command	[:SENSe]:ACPower:CARRier[1]|2:COUNt <integer> [:SENSe]:ACPower:CARRier[1]|2:COUNt?
Example	:ACP:CARR:COUN 1 :ACP:CARR:COUN?
Notes	Carrier subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Note that Carrier subopcode 2 is not supported in some Modes. In those cases, Carrier subopcode 1 is used for both BTS and MS and commands with subopcode 2 are accepted without error but ignored
Dependencies	When Number of Carriers is 1, Ref Carrier is grayed out If N9060A-5FP license is enabled, Max of Carrier is 18, otherwise, Max of Carrier is 12 This control does not appear in the MSR, LTE-A FDD/TDD and 5G NR modes. In order to maintain backwards compatibility with the legacy LTE FDD/TDD modes, the SCPI command is supported in the LTE-A converged application
Couplings	Changing this parameter might affect the Span
Preset	1
State Saved	Saved in instrument state
Min/Max	1/18 when N9060A-5FP license is enabled 1/12 when N9060A-5FP license is disabled
Backwards Compatibility SCPI	[:SENSe]:MCPower:CARRier[1]|2:COUNt (Power Suite)

Carrier/Offset/Limits Config

This is the same dialog that appears on the **Settings** menu panel tab. See "Carrier/Offset/Limits Config" on page 1143

Carrier

Lets you configure your carriers, carrier spacing, noise bandwidth and measurement method.

Dependencies	This index tab appears in all Modes but the MSR, LTE-A FDD/TDD and 5G NR modes

Number of Carriers

Specifies the number of carriers to be measured.

Remote Command	`[:SENSe]:ACPower:CARRier[1]|2:COUNt <integer>` `[:SENSe]:ACPower:CARRier[1]|2:COUNt?`
Example	`:ACP:CARR:COUN 1` `:ACP:CARR:COUN?`
Notes	Carrier subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Note that Carrier subopcode 2 is not supported in some Modes. In those cases, Carrier subopcode 1 is used for both BTS and MS and commands with subopcode 2 are accepted without error but ignored
Dependencies	When Number of Carriers is 1, Ref Carrier is grayed out If N9060A-5FP license is enabled, Max of Carrier is 18, otherwise, Max of Carrier is 12 This control does not appear in the MSR, LTE-A FDD/TDD and 5G NR modes. In order to maintain backwards compatibility with the legacy LTE FDD/TDD modes, the SCPI command is supported in the LTE-A converged application
Couplings	Changing this parameter might affect the Span
Preset	1
State Saved	Saved in instrument state
Min/Max	1/18 when N9060A-5FP license is enabled 1/12 when N9060A-5FP license is disabled
Backwards Compatibility SCPI	`[:SENSe]:MCPower:CARRier[1]|2:COUNt` (Power Suite)

Couple to #1

Couples carrier settings to carrier #1. The coupled parameters are Carrier Power Present, Carrier Spacing, Measurement Noise Bandwidth, Method, and Filter Alpha.

Remote Command	`[:SENSe]:ACPower:CARRier[1]|2:LIST:COUPle OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1`

	[:SENSe]:ACPower:CARRier[1]|2:LIST:COUPle?
Example	:ACP:CARR:LIST:COUP OFF :ACP:CARR:LIST:COUP?
Notes	Carrier subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Carrier subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored For LTE-Advanced FDD/TDD mode, this control is not shown. In order to maintain backwards compatibility with the legacy LTE FDD/TDD, the SCPI command is supported in LTE & LTE-A converged application
Couplings	When set to On, the carrier settings are coupled to carrier #1. Coupled parameters are Carrier Power Present, Carrier Spacing, Measurement Noise Bandwidth, Method and Filter Alpha When a setting is changed, the couple is set to Off automatically Carrier #1 is always set to On and cannot be changed
Preset	ON
State Saved	Saved in instrument state

Carrier Pwr Present

Configures the carriers for this measurement. It allows spaces to be inserted between carriers. Carriers with the power present parameter set to YES are carriers, and those with the power present parameter set to NO are spaces. Each carrier power present is set to YES or NO. The individual carrier can be set by selecting the desired carrier.

The query for this parameter returns the current values for all of the carriers. If a carrier is defined as having no power present, the power displayed will be relative to the reference carrier, otherwise the absolute power will be displayed.

If you change the carrier power present to no and that carrier is currently configured as the reference carrier, the next carrier to the left (or the right if there are no carriers to the left) will be assigned as the reference carrier. This also applies to the scenario where there are only two carriers configured as having power present and you configure only one carrier to have no power present.

Remote Command	[:SENSe]:ACPower:CARRier[1]|2:LIST:PPResent YES | NO, YES | NO, YES | NO, YES | NO, YES | NO, YES | NO [:SENSe]:ACPower:CARRier[1]|2:LIST:PPResent?
Example	:ACP:CARR2:LIST:PPR YES :ACP:CARR2:LIST:PPR?
Notes	Carrier subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Carrier subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored When setting these values remotely, the position in the list sent corresponds to the carrier. Missing values are not permitted, therefore if you want to change values 2 and 6 you must send all values up to

	6. Subsequent values will remain unchanged, unless the number of values sent is greater than the number of carriers, then subsequent values will be ignored For LTE-Advanced FDD/TDD modes, this control is not shown. In order to maintain backwards compatibility with the legacy LTE FDD/TDD modes, the SCPI command is supported in the LTE & LTE-A converged application
Couplings	Coupled to the number of carriers. When the SCPI command is sent, the number of carriers will be set to the number of entries in the parameter list
Preset	`YES`
State Saved	Saved in instrument state
Backwards Compatibility SCPI	`[:SENSe]:MCPower:CARRier[1]|2:LIST:PPResent` `:(Power Suite)`

Carrier Spacing

Sets the width of the carrier spacing. This will be the value applied to all the current slots, whether they are carriers or spaces.

Enter each carrier spacing value individually by selecting the desired carrier, and then enter the carrier width.

Remote Command	`[:SENSe]:ACPower:CARRier[1]|2:LIST:WIDTh <freq>, <freq>, <freq>, <freq>, <freq>, <freq>` `[:SENSe]:ACPower:CARRier[1]|2:LIST:WIDTh?`
Example	`:ACP:CARR2:LIST:WIDT 25kHz` `:ACP:CARR2:LIST:WIDT?`
Notes	Carrier subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Carrier subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored When setting these values remotely, the position in the list sent corresponds to the carrier. Missing values are not permitted, therefore if you want to change values 2 and 6 you must send all values up to 6. Subsequent values will remain unchanged, unless the number of values sent is greater than the number of carriers, then subsequent values will be ignored For LTE-Advanced FDD/TDD modes, this control is not shown. In order to maintain backwards compatibility with the legacy LTE FDD/TDD modes, the SCPI command is supported in the LTE & LTE-A converged application
Couplings	Coupled to the number of carriers. When the SCPI command is sent, the number of carriers will be set to the number of entries in the parameter list Changing Carrier Spacing might affect the Span See the Span section for details
Preset	SA, WCDMA, LTE, LTETDD: 5 MHz Radio Test: 25 kHz

State Saved	Saved in instrument state
Min/Max	0 Hz/Depends on instrument maximum frequency. Same as the Max Span of Swept SA Measurement
Backwards Compatibility SCPI	`[:SENSe]:MCPower:CARRier[1]|2:LIST:WIDTh` (Power Suite, WCDMA)

Measurement Noise Bandwidth

Specifies the **Measurement Noise Bandwidth** used to calculate the power in the carriers.

Each Measurement Noise Bandwidth value is entered individually by selecting the desired carrier. Enter the measurement noise bandwidth on the Carrier page of the Carr/Offset/Limits Config dialog.

Remote Command	`[:SENSe]:ACPower:CARRier[1]|2:LIST:BANDwidth[:INTegration] <freq>, <freq>, <freq>, <freq>, <freq>, <freq>` `[:SENSe]:ACPower:CARRier[1]|2:LIST:BANDwidth[:INTegration]?`
Example	`:ACP:CARR2:LIST:BAND 25kHz` `:ACP:CARR2:LIST:BAND?`
Notes	In the WCDMA mode, the preset/default value is defined as 3.84 MHz. But internally, 4.6848 MHz is used as the default value Carrier subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Carrier subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored When setting these values remotely, the position in the list sent corresponds to the carrier. Missing values are not permitted, therefore if you want to change values 2 and 6 you must send all values up to 6. Subsequent values will remain unchanged, unless the number of values sent is greater than the number of carriers, then subsequent values will be ignored For LTE-Advanced FDD/TDD modes, this control is not shown. In order to maintain backwards compatibility with the legacy LTE FDD/TDD modes, the SCPI command is supported in the LTE & LTE-A converged application
Couplings	Coupled to the number of carriers. When the SCPI command is sent, the number of carriers is set to the number of entries in the parameter list
Preset	SA: 2 MHz WCDMA: 3.84 MHz LTE, LTETDD: 4.515 MHz|4.5 MHz Radio Test: 25 kHz
State Saved	Saved in instrument state
Min/Max	10 Hz/Depends on instrument maximum frequency. Same as the Max Span of Swept SA Measurement
Backwards Compatibility	`[:SENSe]:ACPower:BANDwidth:INTegration` `[:SENSe]:ACPower:BWIDth:INTegration`

SCPI	[:SENSe]:ACPower:CARRier[1]|2:LIST:BWIDth[:INTegration] Power Suite, WCDMA [:SENSe]:MCPower:CARRier[1]|2:LIST:BANDwidth[:INTegration] [:SENSe]:MCPower:CARRier[1]|2:LIST:BWIDth[:INTegration]

Method for Carrier

Accesses the carrier configuration method settings.

Remote Command	[:SENSe]:ACPower:CARRier[1]|2:LIST:FILTer[:RRC][:STATe] ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0 [:SENSe]:ACPower:CARRier[1]|2:LIST:FILTer[:RRC][:STATe]?
Example	:ACP:CARR:LIST:FILT 0,0,0,0 :ACP:CARR:LIST:FILT?
Notes	The binary values translate as follows: 1|ON = RRC Weighted 0|OFF = Integ BW Maximum of Array length depends on the number of carriers Some modes do not support Carrier subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored For LTE-Advanced FDD/TDD modes, this control is not shown. In order to maintain backwards compatibility with the legacy LTE FDD/TDD modes, the SCPI command is supported in the LTE & LTE-A converged application
Preset	SA, LTE, LTETDD: OFF WCDMA: ON Radio Test: OFF
State Saved	Saved in instrument state
Range	Integration BW|RRC Weighted

Filter Alpha for Carrier

Inputs the alpha value for the filter used in the current carrier configuration.

Remote Command	[:SENSe]:ACPower:CARRier[1]|2:LIST:FILTer:ALPHa <real>, <real>, <real>, <real>, <real>, <real> [:SENSe]:ACPower:CARRier[1]|2:LIST:FILTer:ALPHa?
Example	:ACP:CARR2:LIST:FILT:ALPH 0.5 :ACP:CARR2:LIST:FILT:ALPH?
Notes	Some modes do not support Carrier subopcode 2. In those cases, commands with subopcode 2 are

	accepted without error but ignored For LTE-Advanced FDD/TDD modes, this control is not shown. In order to maintain backwards compatibility with the legacy LTE FDD/TDD modes, the SCPI command is supported in the LTE & LTE-A converged application
Preset	0.22
State Saved	Saved in instrument state
Min/Max	0.01/1.0

Offset

Lets you configure the spacing of the offset regions.

Offset Frequency Define

Enables you to select offset frequency definition. Each standard defines each offset frequency from Carrier.

For example, 3GPP2 requires the “From Carrier Center to Integ BW Closer Edge” definition. LTE conformance test requires “From Carrier Edge to Integ BW Center” and/or “From Carrier Edge to Integ BW Closer Edge” definition.

`CTOCenter`	From the lowermost carrier center frequency (for lower offset), the uppermost carrier center frequency (for upper offset) to the center frequency of each Offset Integ BW
`CTOEdge`	From the lowermost carrier center frequency (for lower offset), the uppermost carrier center frequency (for upper offset) to the closest edge frequency of each Offset Integ BW
`ETOCenter`	From the lowermost carrier center frequency - spacing of this carrier /2 (for lower offset), the uppermost carrier center frequency + spacing of this carrier /2 (for upper offset) to the center frequency of each Offset Integ BW
`ETOEdge`	From the lowermost carrier center frequency - spacing of this carrier /2 (for lower offset), the uppermost carrier center frequency + spacing of this carrier /2 (for upper offset) to the closest edge of each Offset Integ BW
`RTOCenter` 5G NR, LTEA, MSR	From either the lower or upper RF BW** edge frequency to the center frequency of each Offset Integ BW
`RTOEdge` 5G NR, LTEA, MSR	From either the lower or upper RF BW** edge frequency to the closest edge frequency of each Offset Integ BW
`RCTOCenter` 5G NR only	From the center frequency of RF BW to the center frequency of each Offset Integ BW

** RF BW = $BW_{channel,CA}$ which is defined in each 3GPP standard, regardless of “Measure Carrier” for the uppermost and the lowermost carriers being Enabled or

Disabled. When the Number of Component Carrier = 1, RF BW = $BW_{channel}$ = 2 x $F_{offset,RAT}$

See "Diagrams for Offset Freq Define" on page 1188.

Modes other than MSR, LTE-A, 5G NR

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:TYPE CTOCenter | CTOEdge | ETOCenter | ETOEdge` `[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:TYPE?`
Example	`:ACP:OFFS:TYPE ETOC` `:ACP:OFFS:TYPE?`
Notes	Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored.
Preset	`CTOCenter`
State Saved	Saved in instrument state
Range	Carrier Center to Integ BW Center|Carrier Center to Integ BW Edge|Carrier Edge to Integ BW Center-|Carrier Edge to Integ BW Edge

Mode: MSR, LTEAFDD, LTEATDD

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:TYPE CTOCenter | CTOEdge | ETOCenter | ETOEdge | RTOCenter | RTOEdge` `[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:TYPE?`
Example	`:ACP:OFFS:TYPE ETOC` `:ACP:OFFS:TYPE?`
Preset	`CTOCenter`
State Saved	Saved in instrument state
Range	Carrier Center to Integ BW Center|Carrier Center to Integ BW Edge|Carrier Edge to Integ BW Center-|Carrier Edge to Integ BW Edge|RF BW Edge to Integ BW Center|RF BW Edge to Integ BW Edge

Mode: 5G NR

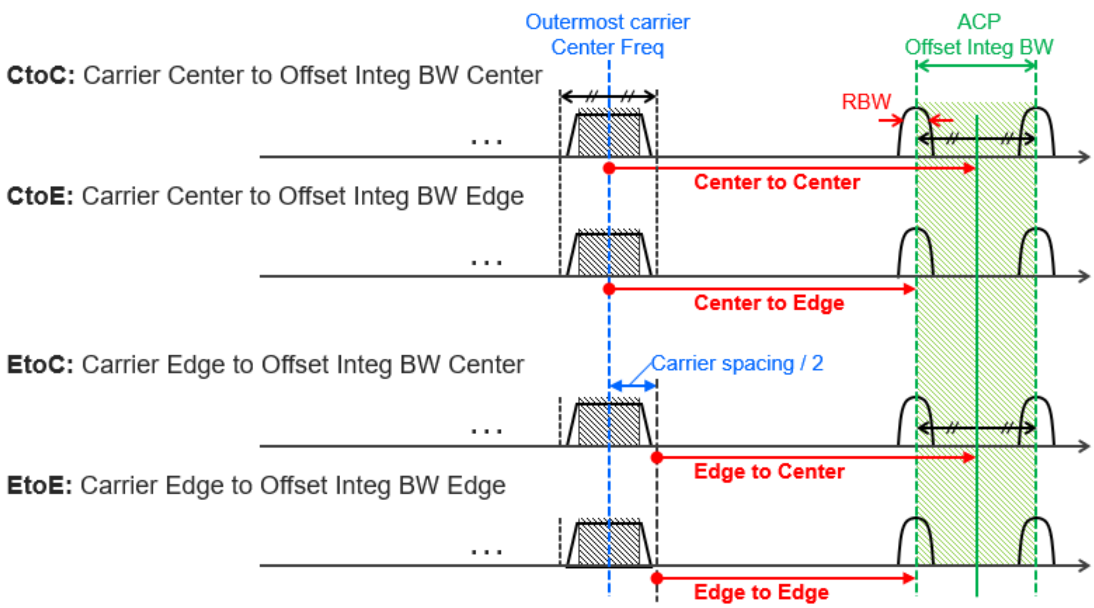
Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:TYPE CTOCenter | CTOEdge | ETOCenter | ETOEdge | RTOCenter | RTOEdge | RCTOCenter` `[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:TYPE?`
Example	`:ACP:OFFS:TYPE ETOC` `:ACP:OFFS:TYPE?`
Preset	`CTOCenter`
State Saved	Saved in instrument state

Range	Carrier Center to Integ BW Center|Carrier Center to Integ BW Edge|Carrier Edge to Integ BW Center-|Carrier Edge to Integ BW Edge|RF BW Edge to Integ BW Center|RF BW Edge to Integ BW Edge|RF BW Center to Integ BW Center

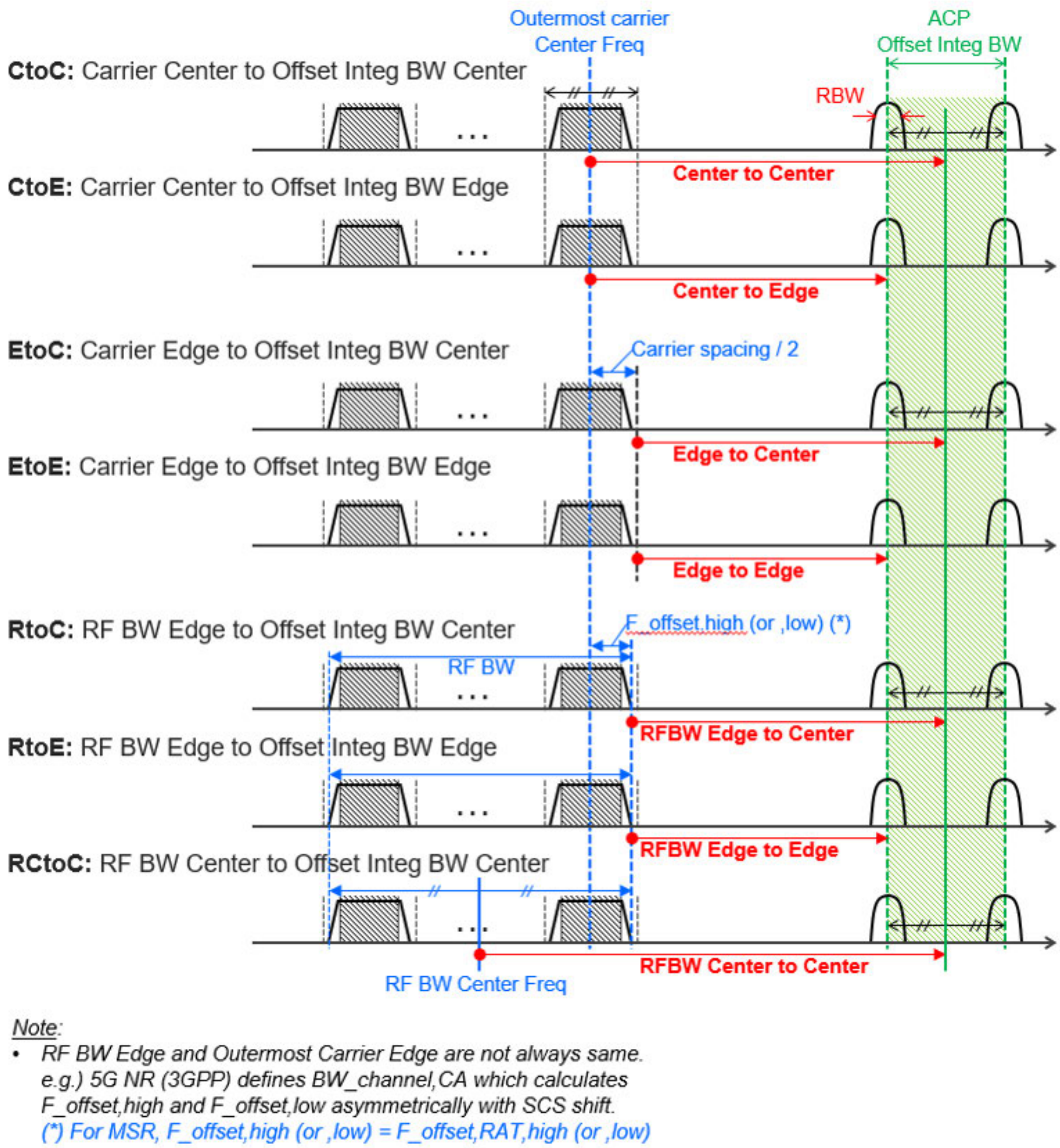
Diagrams for Offset Freq Define

Details depend on the selected mode.

Diagrams for Modes other than MSR, LTE-A, 5G NR



Diagrams for MSR, LTE-A, 5G NR



Offset Freq

This parameter determines the frequency difference between the center of the main channel and the center of the carrier.

Each **Offset Freq** state value is entered individually by selecting the desired carrier.

The list contains up to six (6) entries, depending on the mode selected, for offset frequencies. Each offset frequency in the list corresponds to a reference bandwidth in the bandwidth list.

An offset frequency of zero turns the display of the measurement for that offset off, but the measurement is still made and reported. You can turn off (not use) specific offsets with the `[:SENSe]:ACP:OFFSet:LIST:STATe` command.

Turning the offset off has the same effect as setting the frequency of the offset to 0 Hz and will cause it to be removed from the results screen.

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:STATe OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1` `[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:STATe?`

Example	`:ACP:OFFS1:LIST 0,0,0,0,0,0`
	`:ACP:OFFS1:LIST?`
	`:ACP:OFFS2:LIST:STAT 1,1,0,0,0,0`
	`:ACP:OFFS2:LIST:STAT?`

Notes	Offset subopcode. 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored When setting these values remotely, the position in the list sent corresponds to the offset. Missing values are not permitted, unless the number of values sent is greater than the number of carriers, then subsequent values will be ignored
Couplings	Changing Offset Frequency might affect the Span. See the Span control section for details
Preset	SA: 3 MHz, 0 Hz, 0 Hz, 0 Hz, 0 Hz, 0 Hz|3 MHz, 0 Hz, 0 Hz, 0 Hz, 0 Hz, 0 Hz WCDMA: 5.0 MHz, 10.0 MHz, 0 Hz, 0 Hz, 0 Hz, 0 Hz|5.0 MHz, 10.0 MHz, 0 Hz, 0 Hz, 0 Hz, 0 Hz LTE, LTETDD, LTEAFDD, LTEATDD, MSR: 5.0 MHz, 10.0 MHz, 0 Hz, 0 Hz, 0 Hz, 0 Hz|5.0 MHz, 10.0 MHz, 0 Hz, 0 Hz, 0 Hz, 0 Hz 5G NR: 100 MHz, 200 MHz, 0 Hz, 0 Hz, 0 Hz, 0 Hz|100 MHz, 200 MHz, 0 Hz, 0 Hz, 0 Hz, 0 Hz Radio Test: 25 kHz, 50 kHz, 75 kHz, 0 Hz, 0 Hz, 0 Hz SA: ON, OFF, OFF, OFF, OFF, OFF|ON, OFF, OFF, OFF, OFF, OFF WCDMA: ON, ON, OFF, OFF, OFF, OFF|ON, ON, OFF, OFF, OFF, OFF LTE, LTETDD, LTEAFDD, LTEATDD, MSR: ON, ON, OFF, OFF, OFF, OFF|ON, OFF, OFF, OFF, OFF, OFF 5G NR: ON, ON, OFF, OFF, OFF, OFF|ON, OFF, OFF, OFF, OFF, OFF Radio Test: ON, ON, ON, OFF, OFF, OFF
State Saved	Saved in instrument state Yes
Range	`OFF|ON`
Min/Max	0 Hz/Depends on instrument maximum frequency. Same as the Max Span of Swept SA Measurement
Backwards Compatibility SCPI	`[:SENSe]:MCPower:OFFSet[1]|2:LIST[:FREQuency]`

Integ BW

Sets the Integration Bandwidth for the offsets. Each resolution bandwidth in the list corresponds to an offset frequency in the list defined by [:SENSe]:ACP:OFFSet[n][:OUTer]:LIST[:FREQuency].

Enter each value individually by selecting the desired offset, then enter the Offset Integration Bandwidth.

You can turn off (not use) specific offsets with the [:SENSe]:ACP:OFFSet[n][:OUTer]:LIST:STATe command.

Remote Command	[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth[:INTegration] <freq>, <freq>, <freq>, <freq>, <freq>, <freq> [:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth[:INTegration]?
Example	:ACP:OFFS2:LIST:BAND 2MHz,2MHz,2MHz,2MHz,2MHz,2MHz :ACP:OFFS2:LIST:BAND?
Notes	Offset subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored When setting these values remotely, the position in the list sent corresponds to the offset. Missing values are not permitted i.e. if you want to change the second value, you must send all values up to it. Subsequent values will remain unchanged, unless the number of values sent is greater than the number of carriers, then subsequent values will be ignored
Couplings	Changing Integ BW might affect the Span. See Span section for details
Preset	SA: 2 MHz, 2 MHz, 2 MHz, 2 MHz, 2 MHz, 2 MHz|2 MHz, 2 MHz, 2 MHz, 2 MHz, 2 MHz, 2 MHz WCDMA: 3.84 MHz, 3.84 MHz, 3.84 MHz, 3.84 MHz, 3.84 MHz, 3.84 MHz|3.84 MHz, 3.84 MHz, 3.84 MHz, 3.84 MHz, 3.84 MHz, 3.84 MHz LTE, LTETDD, LTEAFDD,LTEATDD, MSR: 4.515 MHz, 4.515 MHz, 4.515 MHz, 4.515 MHz, 4.515 MHz, 4.515 MHz|4.5 MHz, 4.5 MHz, 4.5 MHz, 4.5 MHz, 4.5 MHz, 4.5 MHz 5G NR: 98.28 MHz, 98.28 MHz, 98.28 MHz, 98.28 MHz, 98.28 MHz, 98.28 MHz|98.31 MHz, 98.31 MHz, 98.31 MHz, 98.31 MHz, 98.31 MHz, 98.31 MHz Radio Test: 25 kHz, 25 kHz, 25 kHz, 25 kHz, 25 kHz, 25 kHz
State Saved	Saved in instrument state
Min/Max	10 Hz/Depends on instrument maximum frequency. Same as the Max Span on Swept SA Measurement
Backwards Compatibility SCPI	[:SENSe]:ACPower:OFFSet[1]|2:LIST:BWIDth[:INTegration] [:SENSe]:ACPR:OFFSet[1]|2:LIST:BANDwidth [:SENSe]:ACPR:OFFSet[1]|2:LIST:BWIDth (Power Suite, WCDMA) [:SENSe]:MCPower:OFFSet[1]|2:LIST:BANDwidth[:INTegration] [:SENSe]:MCPower:OFFSet[1]|2:LIST:BWIDth[:INTegration]

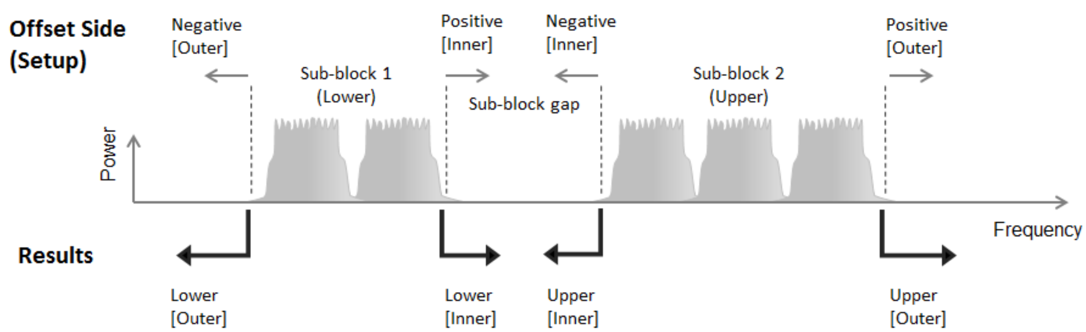
Offset Side

Specifies which offset side to measure.

Enables you to turn off (not use) specific offsetswith [:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:SIDE.

NEGative	Negative (lower) sideband only
BOTH	Both of the negative (lower) and positive (upper) sidebands
POSitive	Positive (upper) sideband only

The figure below shows the relation between the negative/positive offset side setups and the upper/lower results in the MSR and LTE-Advanced FDD/TDD Mode.



Remote Command	[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:SIDE NEGative | BOTH | POSitive,NEGative | BOTH | POSitive,NEGative | BOTH | POSitive,NEGative | BOTH | POSitive,NEGative | BOTH | POSitive,NEGative | BOTH | POSitive [:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:SIDE?
Example	:ACP:OFFS:LIST:SIDE BOTH :ACP:OFFS:LIST:SIDE?
Notes	OFFSet1 is for BTS, 2 for MS. Default is BTS Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored If you set POS or NEG in an offset, result of the inactive side returns -999
Preset	BOTH, BOTH, BOTH, BOTH, BOTH, BOTH | BOTH, BOTH, BOTH, BOTH, BOTH, BOTH
State Saved	Saved in instrument state
Range	NEGative|BOTH|POSitive

Method

Allows you to turn RRC filtering of each offset on or off. The value (roll off) for the filter will be set to the value of the **Filter Alpha** parameter.

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:FILTer[:RRC][:STATe] ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0` `[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:FILTer[:RRC][:STATe]?`
Example	`:ACP:OFFS:LIST:FILT 1,0,0` `:ACP:OFFS:LIST:FILT?`
Notes	`1|ON` = RRC Weighted, `0|OFF` = Integ BW Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored
Preset	(see table below)
State Saved	Saved in instrument state
Range	Integ BW|RRC Weighted

Preset:

Mode	Values
SA	0, 0, 0, 0, 0, 0|0, 0, 0, 0, 0,0
WCDMA	1, 1, 1, 1, 1, 1|1, 1, 1, 1, 1, 1
LTE, LTETDD, LTEAFDD, LTEATDD, 5G NR, MSR	0, 0, 0, 0, 0, 0|0, 0, 0, 0, 0,0
Radio Test	0, 0, 0, 0, 0, 0

Filter Alpha

Sets the alpha value for the RRC Filter for each offset.

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:FILTer:ALPHa <real>, <real>, <real>, <real>, <real>, <real>` `[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:FILTer:ALPHa?`
Example	`:ACP:OFFS:LIST:FILT:ALPH 0.5,0.5,0.5,0.5,0.5,0.5` `:ACP:OFFS:LIST:FILT:ALPH?`
Notes	Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored
Preset	(see table below)
State Saved	Saved in instrument state
Min/Max	0.01/1.00

Preset:

SA	0.22,0.22,0.22,0.22,0.22,0.22|0.22,0.22,0.22,0.22,0.22,0.22
WCDMA	0.22,0.22,0.22,0.22,0.22,0.22|0.22,0.22,0.22,0.22,0.22,0.22
LTE, LTETDD, LTEAFDD, LTEATDD, 5G NR, MSR	0.22,0.22,0.22,0.22,0.22,0.22|0.22,0.22,0.22,0.22,0.22,0.22

Advanced (Offset)

This control on the **Offset** dialog page opens up another menu page which lets you set advanced properties of the Inner Offset, such as Res BW, Video BW, and Filter parameters.

Offset Freq

This column is the same as on the main **Offset** menu page. See "Offset Freq" on page 1189

Res BW

Sets the resolution bandwidth. If an unavailable bandwidth is entered with the numeric keypad, the closest available bandwidth is selected.

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:RESolution:AUTO ON	OFF	1	0, ON	OFF	1	0, ON	OFF	1	0, ON	OFF	1	0, ON	OFF	1	0, ON	OFF	1	0` `[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:RESolution:AUTO?`

Example	`:ACP:OFFS2:LIST:BAND:RES 220kHz,220kHz,220kHz,220kHz,220kHz,220kHz`
	`:ACP:OFFS2:LIST:BAND:RES?`
	`:ACP:OFFS2:LIST:BAND:RES:AUTO 1,1,1,1,1,1`
	`:ACP:OFFS2:LIST:BAND:RES:AUTO?`

Notes	Offset subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored
Dependencies	When **Meas Method** is RBW, FAST or Fast Power, this cell is grayed out and disabled. If the cell is pressed, an advisory message is generated. If the equivalent SCPI remote command is sent, a "Setting conflict" warning is generated
Couplings	When Res BW Mode is AUTO, this value is exactly same as Res BW under BW key. When you change this value, Res BW Mode is also changed to Man
Preset	SA: 220 kHz, 220 kHz, 220 kHz, 220 kHz, 220 kHz, 220 kHz WCDMA: 100 kHz, 100 kHz, 100 kHz, 100 kHz, 100 kHz, 100 kHz LTE, LTETDD, LTEAFDD, LTEATDD, 5G NR, MSR: 100 kHz, 100 kHz, 100 kHz, 100 kHz, 100 kHz, 100 kHz|100 kHz, 100 kHz, 100 kHz, 100 kHz, 100 kHz, 100 kHz 1, 1, 1, 1, 1, 1
State Saved	Saved in instrument state

	Yes
Min/Max	1 Hz/8 MHz
Backwards Compatibility SCPI	`[:SENSe]:ACPower:OFFSet[1]|2:LIST:BWIDth:RESolution` `[:SENSe]:ACPower:OFFSet[1]|2:LIST:BWIDth:RESolution:AUTO`

Video BW

Enables you to change the instrument post-detection filter (VBW).

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:VIDeo:AUTO OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1` `[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:VIDeo:AUTO?`

Example	`:ACP:OFFS2:LIST:BAND:VID 5MHz,5MHz,5MHz,5MHz,5MHz,5MHz`
	`:ACP:OFFS2:LIST:BAND:VID?`
	`:ACP:OFFS2:LIST:BAND:VID:AUTO 0,0,0,0,1,1`
	`:ACP:OFFS2:LIST:BAND:VID:AUTO?`

Notes	The values shown in this table reflect the conditions after a Mode Preset Offset subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored
Dependencies	When Meas Method is RBW, FAST or Fast Power, this cell is grayed out and disabled. If the cell is pressed, an advisory message is generated. If the equivalent remote command is sent, a "Setting conflict" warning is generated
Preset	SA: 22 kHz, 22 kHz, 22 kHz, 22 kHz, 22 kHz, 22 kHz WCDMA: 1 MHz, 1 MHz, 1 MHz, 1 MHz, 1 MHz, 1 MHz LTE, LTETDD, LTEAFDD, LTEATDD, 5G NR, MSR: 1 MHz, 1 MHz, 1 MHz, 1 MHz, 1 MHz, 1 MHz `ON, ON, ON, ON, ON, ON`
State Saved	Saved in instrument state Yes
Min/Max	1 Hz/50 MHz
Backwards Compatibility SCPI	`[:SENSe]:ACPower:OFFSet[1]|2:LIST:BWIDth:VIDeo` `[:SENSe]:ACPower:OFFSet[1]|2:LIST:BWIDth:VIDeo:AUTO`

Filter Type

Selects the type of bandwidth filter that is used.

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:SHAPe GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop,`

	GAUSsian | FLATtop, GAUSsian | FLATtop [:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:SHAPe?
Example	:ACP:OFFS2:LIST:BAND:SHAP FLAT,GAUS,GAUS,GAUS,GAUS,GAUS :ACP:OFFS2:LIST:BAND:SHAP?
Notes	Offset subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored
Dependencies	When Res BW Mode for the offset is Auto, this cell is grayed out and disabled. Since Res BW Mode for the offset is preset to Auto on changing Meas Method to RBW, FAST or Fast Power, this cell is grayed out and disabled too. If the cell is pressed, an advisory message is generated. If the equivalent remote command is sent, a "Setting conflict" warning is generated
Preset	GAUSsian, GAUSsian, GAUSsian, GAUSsian, GAUSsian, GAUSsian
State Saved	Saved in instrument state
Range	GAUSsian|FLATtop
Backwards Compatibility SCPI	[:SENSe]:ACPower:OFFSet[1]|2:LIST:BWIDth:SHAPe

Filter BW

Selects a Gaussian filter based on its –3 dB (Normal) bandwidth or its –6 dB bandwidth.

Remote Command	[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:TYPE DB3 | DB6, DB3 | DB6, DB3 | DB6, DB3 | DB6, DB3 | DB6, DB3 | DB6 [:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:TYPE?
Example	:ACP:OFFS2:LIST:BAND:TYPE DB3,DB3,DB3,DB3,DB3,DB3 :ACP:OFFS2:LIST:BAND:TYPE?
Notes	Offset subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored
Dependencies	When Filter Type if Flattop or Res BW Mode for the offset is Auto, this cell is grayed out and disabled. Since Res BW Mode for the offset is preset to Auto on changing Meas Method to RBW, FAST or Fast Power, this cell is grayed out and disabled too. If the cell is pressed, an advisory message is generated. If the equivalent remote command is sent, a "Setting conflict" warning is generated
Preset	DB3, DB3, DB3, DB3, DB3, DB3
State Saved	Saved in instrument state
Range	–3 dB (Normal)| –6 dB
Backwards Compatibility SCPI	[:SENSe]:ACPower:OFFSet[1]|2:LIST:BWIDth:TYPE

Limits

Lets you configure the limits that are used to determine whether the offset regions PASS or FAIL the limit test.

Limit Test

This checkbox is the same as the Limit test control on the **Meas Setup, Settings** tab. See "Limit Test" on page 1197.

Offset Freq

This column is the same as the **Offset Freq** column on the **Offset** index tab, see "Offset Freq" on page 1189.

Abs Limit

Enters an absolute limit value, which sets the absolute amplitude levels to test against for each of the custom offsets. The list must contain six (6) entries. If there is more than one offset, the offset closest to the carrier channel is the first one in the list. [:SENSe]:ACP:OFFSet[n][:OUTer]:LIST:TEST selects the type of testing to be done at each offset.

You can turn off (not use) specific offsets with the [:SENSe]:ACP:OFFSet[n][:OUTer]:LIST:STATe command.

The query returns the six (6) sets of real numbers that are the current absolute amplitude test limits.

Remote Command	[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:ABSolute <real>, <real>, <real>, <real>, <real>, <real> [:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:ABSolute?
Example	:ACP:OFFS2:LIST:ABS -10,-10,-10,-10,-10,-10 :ACP:OFFS2:LIST:ABS?
Notes	Offset subopcode. 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored
Preset	SA: 0dBm, 0 dBm, 0 dBm, 0 dBm, 0 dBm, 0 dBm|0dBm, 0 dBm, 0 dBm, 0 dBm, 0 dBm, 0 dBm WCDMA: 50 dBm, 50 dBm, 50 dBm, 50 dBm, 50 dBm, 50 dBm|50 dBm, 50 dBm, 50 dBm, 50 dBm, 50 dBm, 50 dBm LTE, LTETDD, LTEAFDD,LTEATDD, MSR: -8.45, -8.45, -8.45, -8.45, -8.45, -8.45|-50.0, -50.0, -50.0, -50.0, -50.0, -50.0 5G NR: 4.92, 4.92, 4.92, 4.92, 4.92, 4.92|-50.0, -50.0, -50.0, -50.0, -50.0, -50.0

State Saved	Saved in instrument state
Min/Max	-200.0 dBm/50.0 dBm

Backwards Compatibility SCPI	`[:SENSe]:ACPR:OFFSet[1]|2:LIST:ABSolute`
	SA, W-CDMA
	`[:SENSe]:MCPower:OFFSet[1]|2:LIST:ABSolute`
	SA, W-CDMA

Rel Limit (Car)

Enters a relative limit value for the carrier level. This sets the amplitude levels to test against for the specified offsets.

The amplitude level is relative to the carrier amplitude. If multiple offsets are available, the list contains six (6) entries. The offset closest to the carrier channel is the first one in the list. `[:SENSe]:ACP:OFFSet[n]:INNer:LIST:TEST` selects the type of testing to be done at each offset.

You can turn off (not use) specific offsets with the `[:SENSe]:ACP:OFFSet[n]:INNer:LIST:STATe` command.

The query returns the six (6) sets of real numbers that are the current amplitude test limits, relative to the carrier, for each offset.

Offset[n] n = 1 is base station and n = 2 is mobiles. The default is base station (1).

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:RCARrier <real>, <real>, <real>, <real>, <real>, <real>` `[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:RCARrier?`
Example	`:ACP:OFFS2:INN:LIST:RCAR 0,0,0,0,0,0` `:ACP:OFFS2:INN:LIST:RCAR?`
Notes	Offset subopcode. 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS
Preset	-44.2, -44.2,-44.2,-44.2,-44.2,-44.2|-29.2, -29.2, -29.2, -29.2, -29.2, -29.2 5G NR: -43.8, -43.8, 43.8, -43.8, -43.8, -43.8|-29.2, -29.2, -29.2, -29.2, -29.2, -29.2
State Saved	Saved in instrument state
Min/Max	-150/50.0

Positive Offset Limit (SCPI only)

Enables you to set the upper limit for the upper segment of the specified offset pair.

Remote Command	`:CALCulate:ACPower:OFFSet[1]|2[:OUTer]:LIST:LIMit:POSitive[:UPPer-]:DATA <real>, <real>, <real>, <real>, <real>, <real>` `:CALCulate:ACPower:OFFSet[1]|2[:OUTer]:LIST:LIMit:POSitive[:UPPer-`

	]:DATA?
Example	:CALC:ACP:OFFS:LIST:LIM:POS:DATA 0,0,0,0,0,0 :CALC:ACP:OFFS:LIST:LIM:POS:DATA?
Notes	Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored
Preset	SA: -45, -60, 0, 0, 0, 0|-45, -60, 0, 0, 0, 0 WCDMA: -44.2, -49.2, -49.2, -49.2, -49.2, -49.2|-32.2, -42.2, -42.2, -42.2, -42.2, -42.2 LTE, LTETDD, LTEAFDD,LTEATDD, MSR: -44.2,-44.2,-44.2,-44.2,-44.2,-44.2|-29.2, -29.2, -29.2, -29.2, -29.2, -29.2 5G NR: -43.8, -43.8, -43.8, -43.8, -43.8, -43.8|-29.2, -29.2, -29.2, -29.2, -29.2, -29.2 Radio Test: -60, -60, -60, 0, 0, 0
State Saved	Saved in instrument state
Min/Max	-150.0/50.0
Backwards Compatibility SCPI	:CALCulate:MCPower:OFFSet:LIST:LIMit:POSitive[:UPPer]:DATA (Power Suite)

Negative Offset Limit(SCPI only)

Enables you to set the upper limit for the lower segment of the specified offset pair.

Remote Command	:CALCulate:ACPower:OFFSet[1]|2[:OUTer]:LIST:LIMit:NEGative[:UPPer-]:DATA <real>, <real>, <real>, <real>, <real>, <real> :CALCulate:ACPower:OFFSet[1]|2[:OUTer]:LIST:LIMit:NEGative[:UPPer-]:DATA?
Example	:CALC:ACP:OFFS:LIST:LIM:NEG:DATA 0,0,0,0,0,0 :CALC:ACP:OFFS:LIST:LIM:NEG:DATA?
Notes	Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored
Preset	SA: -45, -60, 0, 0, 0, 0|-45, -60, 0, 0, 0, 0 WCDMA: -44.2, -49.2, -49.2, -49.2, -49.2, -49.2|-32.2, -42.2, -42.2, -42.2, -42.2, -42.2 LTE, LTETDD, LTEAFDD,LTEATDD, MSR: -44.2, -44.2, -44.2, -44.2, -44.2, -44.2|-29.2, -29.2, -29.2, -29.2, -29.2, -29.2 5G NR: -43.8, -43.8, -43.8, -43.8, -43.8, -43.8|-29.2, -29.2, -29.2, -29.2, -29.2, -29.2 Radio Test: -60, -60, -60, 0, 0, 0
State Saved	Saved in instrument state
Min/Max	-150.0/50.0
Backwards Compatibility SCPI	:CALCulate:MCPower:OFFSet:LIST:LIMit:NEGative[:UPPer]:DATA (Power Suite, WCDMA)

Rel Limit (PSD)

Enters a relative limit value for the level of the power spectral density. This sets the amplitude levels to test against for any custom offsets. The amplitude level is relative to the power spectral density. If multiple offsets are available, the list contains six (6) entries. The offset closest to the carrier channel is the first one in the list.

[:SENSe]:ACP:OFFSet[n][:OUTer]:LIST:TEST selects the type of testing to be done at each offset.

You can turn off (not use) specific offsets with the [:SENSe]:ACP:OFFSet[n][:OUTer]:LIST:STATe command.

The query returns the six (6) sets of real numbers that are the current amplitude test limits, relative to the power spectral density, for each offset.

Offset[n] n = 1 is base station and n = 2 is mobiles. The default is base station (1).

Remote Command	[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:RPSDensity <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl> [:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:RPSDensity?
Example	:ACP:OFFS2:LIST:RPSD 10,10,10,10,10,10 :ACP:OFFS2:LIST:RPSD?
Notes	Offset subopcode. 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored
Preset	SA: -28.87 dB, -43.87 dB, 0 dB, 0 dB, 0 dB, 0 dB|-28.87 dB, -43.87 dB, 0 dB, 0 dB, 0 dB, 0 dB WCDMA: -44.2 dB, -49.2 dB, -49.2 dB, -49.2 dB, -49.2 dB, -49.2 dB|-32.2 dB, -42.2 dB, -42.2 dB, -42.2 dB, -42.2 dB, -42.2 dB LTE, LTETDD, LTEAFDD,LTEATDD, 5G NR, MSR: 0, 0, 0, 0, 0, 0|0, 0, 0, 0, 0, 0 Radio Test: -60, -60, -60, 0, 0, 0
State Saved	Saved in instrument state
Min/Max	-150.0 dB/50.0 dB

Fail Mask

Accesses a menu that enables you to select one of the logics for the fail conditions between the measurement results and the test limits. The setting defines the type of testing to be done at any custom offset frequencies. The measured powers are tested against the absolute values defined with [:SENSe]:ACP:OFFSet[n][:OUTer]:LIST:ABSolute, or the relative values defined with [:SENSe]:ACP:OFFSet[n][:OUTer]:LIST:RPSDensity and [:SENSe]:ACP:OFFSet[n][:OUTer]:LIST:RCARrier.

You can turn off (not use) specific offsets with the `[:SENSe]:ACP:OFFSet[n][:OUTer]:LIST:STATe` command.

Absolute	`ABSolute`	Fail is shown if one of the absolute ACP measurement results is larger than the limit for **Abs Limit**
Relative	`RELative`	Fail is shown if one of the relative ACP measurement results is larger than the limit for **Rel Lim (Car)** or **Rel Lim (PSD)**
Abs AND Rel	`AND`	Fail is shown if one of the absolute ACP measurement results is larger than the limit for **Abs Limit***and* one of the relative ACP measurement results is larger than the limit for **Rel Lim (Car)** or **Rel Lim (PSD)**
Abs OR Rel	`OR`	Fail is shown if one of the absolute ACP measurement results is larger than the limit for **Abs Limit***or* one of the relative ACP measurement results is larger than the limit for **Rel Lim (Car)** or **Rel Lim (PSD)**

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:TEST ABSolute | AND | OR | RELative, ABSolute | AND | OR | RELative, ABSolute | AND | OR | RELative, ABSolute | AND | OR | RELative, ABSolute | AND | OR | RELative, ABSolute | AND | OR | RELative` `[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:TEST?`
Example	`:ACP:OFFS2:LIST:TEST ABS,ABS,ABS,ABS,ABS,ABS` `:ACP:OFFS2:LIST:TEST?`
Notes	Offset subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored
Preset	SA, WCDMA: REL, REL, REL, REL, REL, REL|REL, REL, REL, REL, REL, REL LTE, LTETDD, LTEAFDD,LTEATDD, 5G NR, MSR: AND, AND, AND, AND, AND, AND|AND, AND, AND, AND, AND, AND Radio Test: REL, REL, REL, REL, REL, REL
State Saved	Saved in instrument state
Range	Absolute|Relative|Abs AND Rel (fail if both fail)|Abs OR Rel (fail if either fails)
Backwards Compatibility SCPI	`[:SENSe]:MCPower:OFFSet[1]|2:LIST:TEST`

Offset Frequency Define

This control allows you to select “Offset” definition:

`CTOCenter`	From the lowermost carrier center frequency (for lower offset), the uppermost carrier center frequency (for upper offset) to the center frequency of each Offset Integ BW

CTOEdge	From the lowermost carrier center frequency (for lower offset), the uppermost carrier center frequency (for upper offset) to the closest edge frequency of each Offset Integ BW
ETOCenter	From the lowermost carrier center frequency - spacing of this carrier /2 (for lower offset), the uppermost carrier center frequency + spacing of this carrier /2 (for upper offset) to the center frequency of each Offset Integ BW
ETOEdge	From the lowermost carrier center frequency - spacing of this carrier /2 (for lower offset), the uppermost carrier center frequency + spacing of this carrier /2 (for upper offset) to the closest edge frequency of each Offset Integ BW
STOCenter	From either the lower or upper sub-block edge frequency to the center frequency of each Offset Integ BW
STOEdge	From either the lower or upper sub-block edge frequency to the closest edge frequency of each Offset Integ BW
SCTOCenter 5G NR only	From the center frequency of sub-block** to the center frequency of each Offset Integ BW

** sub-block (bandwidth) = $BW_{channel,block}$ which is defined in each 3GPP standard, regardless of "Measure Carrier" for the uppermost and the lowermost carriers being Enabled or Disabled. When the Number of Component Carrier within each sub-block = 1, sub-block (bandwidth) = $BW_{channel}$ = 2 x $F_{offset,RAT}$.

See "Diagrams for Offset Freq Define" on page 1203"Diagrams for Offset Freq Define" on page 1188

Mode: MSR, LTEAFDD, LTEATDD

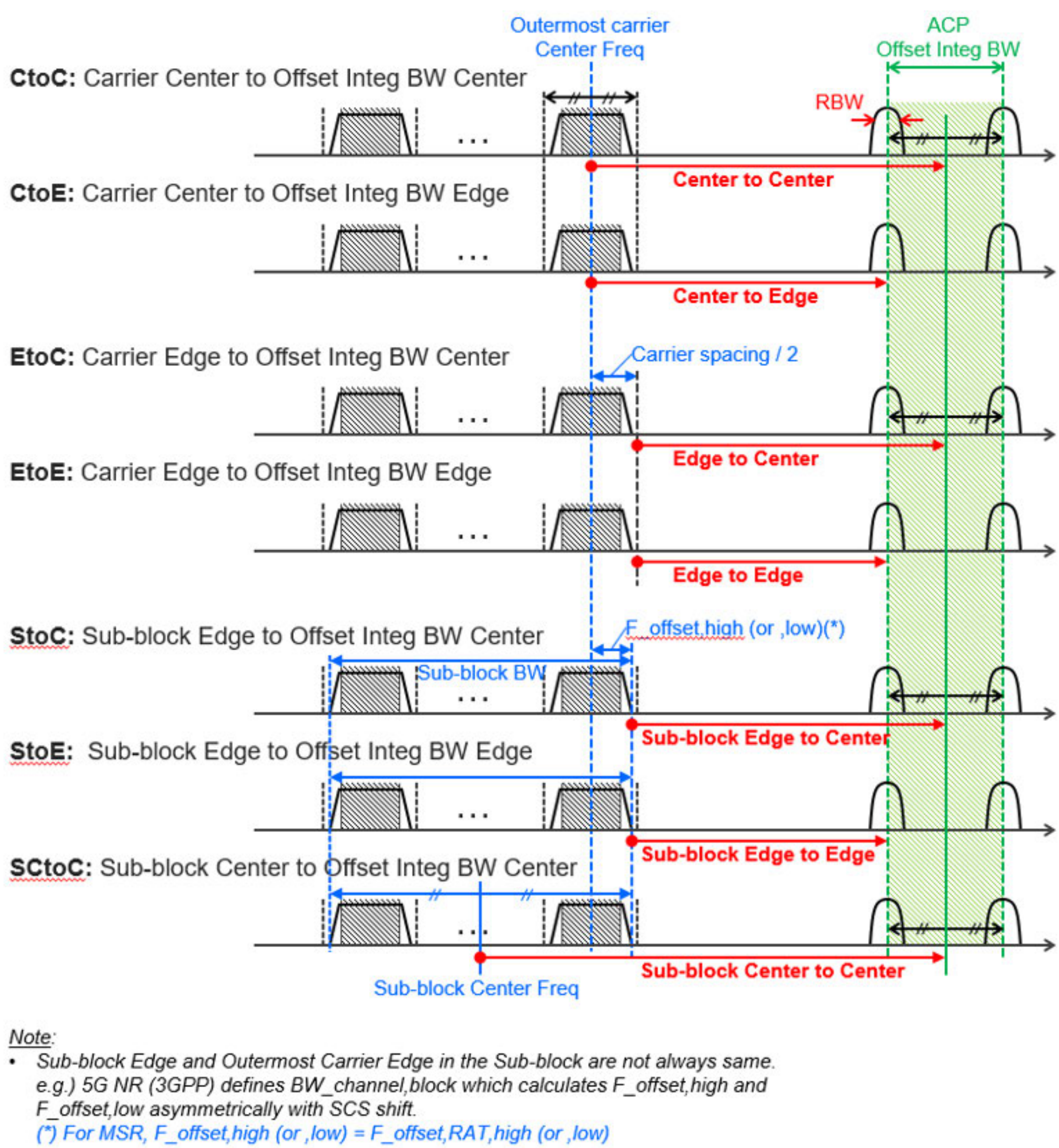
Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:TYPE CTOCenter	CTOEdge	ETOCenter	ETOEdge	STOCenter	STOEdge` `[:SENSe]:ACPower:OFFSet[1]|2:INNer:TYPE?`
Example	`:ACP:OFFS:INN:TYPE ETOC` `:ACP:OFFS:INN:TYPE?`
Preset	`STOCenter`
State Saved	Saved in instrument state
Range	Carrier Center to Integ BW Center|Carrier Center to Integ BW Edge|Carrier Edge to Integ BW Center-|Carrier Edge to Integ BW Edge|Sub-block Edge to Integ BW Center|Sub-block Edge to Integ BW Edge

Mode: 5G NR

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:TYPE CTOCenter	CTOEdge	ETOCenter	ETOEdge	STOCenter	STOEdge	SCTOCenter` `[:SENSe]:ACPower:OFFSet[1]|2:INNer:TYPE?`
Example	`:ACP:OFFS:INN:TYPE ETOC`

	`:ACP:OFFS:INN:TYPE?`
Preset	`STOCenter|CTOCenter`
State Saved	Saved in instrument state
Range	Carrier Center to Integ BW Center|Carrier Center to Integ BW Edge|Carrier Edge to Integ BW Center-|Carrier Edge to Integ BW Edge|Sub-block Edge to Integ BW Center|Sub-block Edge to Integ BW Edge|Sub-block Center to Integ BW Center

Diagrams for Offset Freq Define



Offset Freq

This parameter determines the frequency difference between the center of the main channel and the center of the carrier. When set to Offset to Edge, this parameter determines the frequency difference between the center of the main channel and the near edge of the offset.

Each **Offset Freq** state value is entered individually by selecting the desired carrier. Use the Enabled checkbox to turn the Offset Freq State on and off.

The list contains up to six (6) entries, depending on the mode selected, for offset frequencies. Each offset frequency in the list corresponds to a reference bandwidth in the bandwidth list.

An offset frequency of zero turns the display of the measurement for that offset off, but the measurement is still made and reported. You can turn off (not use) specific offsets with the [:SENSe]:ACP:OFFSet[n]:INNer:LIST:STATe command.

Turning the offset off has the same effect as setting the frequency of the offset to 0 Hz and will cause it to be removed from the results screen.

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:STATe OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1` `[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:STATe?`

Example	`:ACP:OFFS1:INN:LIST 0,0,0,0,0,0`
	`:ACP:OFFS1:INN:LIST?`
	`:ACP:OFFS2:INN:LIST:STAT 1,1,0,0,0,0`
	`:ACP:OFFS2:INN:LIST:STAT?`

Notes	When setting these values remotely, the position in the list sent corresponds to the offset. Missing values are not permitted, unless the number of values sent is greater than the number of carriers, then subsequent values will be ignored Offset subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS
Couplings	Changing Offset Frequency might affect the Span. See the Span control section for details
Preset	2.5MHz,7.5MHz,0,0,0,0|2.5MHz,7.5MHz,0,0,0,0 5G NR: 10 MHz, 30 MHz, 0 Hz, 0 Hz, 0 Hz, 0 Hz|100 MHz, 200 MHz, 0 Hz, 0 Hz, 0 Hz, 0 Hz `ON, ON, OFF, OFF, OFF, OFF | ON, OFF, OFF, OFF, OFF, OFF`
State Saved	Saved in instrument state Yes
Min/Max	0 Hz/Depends on instrument maximum frequency. Same as the Max Span of Swept SA Measurement

Integ BW

Sets the Integration Bandwidth for the offsets. Each resolution bandwidth in the list corresponds to an offset frequency in the list defined by `[:SENSe]:ACP:OFFSet[n]:INNer:LIST[:FREQuency]`.

Enter each value individually by selecting the desired offset on the **Offset** menu key using the up down arrows, the knob, or the numeric keypad, then enter the Offset Integration Bandwidth using the **Offset Integration Bandwidth** menu key.

You can turn off (not use) specific offsets with the `[:SENSe]:ACP:OFFSet[n]:INNer:LIST:STATe` command.

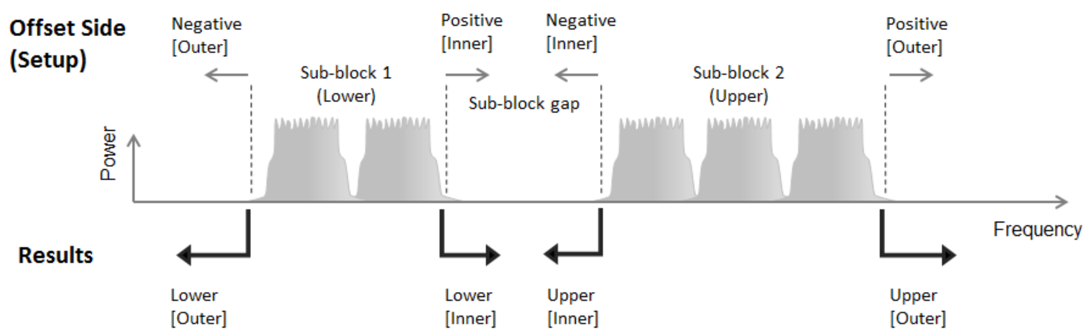
Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:BANDwidth[:INTegration] <freq>, <freq>, <freq>, <freq>, <freq>, <freq>` `[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:BANDwidth[:INTegration]?`
Example	`:ACP:OFFS2:INN:LIST:BAND 2MHz,2MHz,2MHz,2MHz,2MHz,2MHz` `:ACP:OFFS2:INN:LIST:BAND?`
Notes	When setting these values remotely, the position in the list sent corresponds to the offset. Missing values are not permitted i.e. if you want to change the second value you must send all values up to it. Subsequent values will remain unchanged Offset subopcode. 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS
Couplings	Changing Integ BW might affect the Span. See Span section for details
Preset	LTEAFDD:3.84MHz, 3.84MHz, 3.84MHz, 3.84MHz, 3.84MHz, 3.84MHz|3.84MHz, 3.84MHz, 3.84MHz, 3.84MHz, 3.84MHz, 3.84MHz MSR, LTEATDD: 4.515MHz, 4.515MHz, 4.515MHz, 4.515MHz, 4.515MHz, 4.515MHz|4.5MHz, 4.5MHz, 4.5MHz, 4.5MHz, 4.5MHz, 4.5MHz 5G NR: 19.08 MHz, 19.08 MHz, 19.08 MHz, 19.08 MHz, 19.08 MHz, 19.08 MHz|98.31 MHz, 98.31 MHz, 98.31 MHz, 98.31 MHz, 98.31 MHz, 98.31 MHz
State Saved	Saved in instrument state
Min/Max	10 Hz/Depends on instrument maximum frequency. Same as the Max Span on Swept SA Measurement

Offset Side

Enables you to turn off (not use) specific offsets with `[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:SIDE`.

- `NEGative` - The upper side in the sub-block gap only (i.e. negative sideband of the upper sub-block) is enabled
- `BOTH` - Both sides in the sub-block gap are enabled
- `POSitive` - The lower side in the sub-block gap only (i.e. positive sideband of the lower sub-block) is enabled

The figure below shows the relation between the negative/positive offset side setups and the upper/lower results in the MSR and LTE-Advanced FDD/TDD Mode.



Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:SIDE NEGative | BOTH | POSitive,NEGative | BOTH | POSitive,NEGative | BOTH | POSitive,NEGative | BOTH | POSitive,NEGative | BOTH | POSitive,NEGative | BOTH | POSitive` `[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:SIDE?`
Example	`:ACP:OFFS:INN:LIST:SIDE BOTH` `:ACP:OFFS:INN:LIST:SIDE?`
Notes	OFFSet1 is for BTS, 2 for MS. Default is BTS If you set `POS` or `NEG` in an offset, result of the inactive side returns -999
Preset	`BOTH, BOTH, BOTH, BOTH, BOTH, BOTH | BOTH, BOTH, BOTH, BOTH, BOTH, BOTH`
State Saved	Saved in instrument state
Range	`NEGative|BOTH|POSitive`

Method

Enables you to turn RRC filtering of each offset on or off. The value (roll off) for the filter will be set to the value of the Filter Alpha parameter.

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:FILTer[:RRC][:STATe] ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0` `[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:FILTer[:RRC][:STATe]?`
Example	`:ACP:OFFS:INN:LIST:FILT 1,0,0` `:ACP:OFFS:INN:LIST:FILT?`
Notes	`1|ON` = RRC Weighted, `0|OFF` = Integ BW
Preset	LTEAFDD: 1,1,1,1,1,1|1,1,1,1,1,1 MSR, LTEATDD, 5G NR: 0,0,0,0,0,0|0,0,0,0,0,0

State Saved	Saved in instrument state
Range	Integ BW|RRC Weighted

Filter Alpha

Sets the alpha value for the RRC Filter for each offset.

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:FILTer:ALPHa <real>, <real>, <real>, <real>, <real>, <real>` `[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:FILTer:ALPHa?`
Example	`:ACP:OFFS:INN:LIST:FILT:ALPH 0.5,0.5,0.5,0.5,0.5,0.5` `:ACP:OFFS:INN:LIST:FILT:ALPH?`
Preset	0.22,0.22,0.22,0.22,0.22,0.22|0.22,0.22,0.22,0.22,0.22,0.22
State Saved	Saved in instrument state
Min/Max	0.01/1.00

Offset Freq

This column is the same as on the main **Inner Offset** menu tab. See "Offset Freq" on page 1204

Res BW

Sets the resolution bandwidth. If an unavailable bandwidth is entered with the numeric keypad, the closest available bandwidth is selected.

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:BANDwidth:RESolution:AUTO ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0` `[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:BANDwidth:RESolution:AUTO?`

Example	`:ACP:OFFS2:INN:LIST:BAND:RES 220kHz,220kHz,220kHz,220kHz,220kHz,220kHz`
	`:ACP:OFFS2:INN:LIST:BAND:RES?`
	`:ACP:OFFS2:INN:LIST:BAND:RES:AUTO 1,1,1,1,1,1`
	`:ACP:OFFS2:INN:LIST:BAND:RES:AUTO?`

Notes	Offset subopcode. 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS
Dependencies	When **Meas Method** is RBW, FAST or Fast Power, this control is grayed out and disabled. If the cell is pressed, an advisory message is generated. If the equivalent SCPI remote command is sent, a "Setting conflict" warning is generated
Couplings	When Res BW Mode is AUTO, this value is exactly the same as Res BW under the **BW** key. When you

	change this value, Res BW Mode is also changed to Man
Preset	100 kHz,100 kHz,100 kHz,100k Hz,100 kHz|100 kHz,100 kHz,100 kHz,100 kHz,100 kHz,100 kHz 1, 1, 1, 1, 1, 1
State Saved	Saved in instrument state Yes
Min/Max	1 Hz/8 MHz

Video BW

Enables you to change the instrument post-detection filter (VBW).

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:BANDwidth:VIDeo:AUTO OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1` `[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:BANDwidth:VIDeo:AUTO?`

Example	`:ACP:OFFS2:INN:LIST:BAND:VID 5MHz,5MHz,5MHz,5MHz,5MHz,5MHz`
	`:ACP:OFFS2:INN:LIST:BAND:VID?`
	`:ACP:OFFS2:INN:LIST:BAND:VID:AUTO 0,0,0,0,1,1`
	`:ACP:OFFS2:INN:LIST:BAND:VID:AUTO?`

Notes	The values shown in this table reflect the conditions after a Mode Preset Offset subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS
Dependencies	When **Meas Method** is RBW, FAST or Fast Power, this cell is grayed-out and disabled. If the cell is pressed, an advisory message is generated. If the equivalent remote command is sent, a "Setting conflict" warning is generated
Preset	1 MHz,1 MHz,1 MHz,1 MHz,1 MHz,1 MHz `ON, ON, ON, ON, ON, ON`
State Saved	Yes Yes
Min/Max	1 Hz/50 MHz

Filter Type

Selects the type of bandwidth filter that is used.

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:BANDwidth:SHAPe GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop` `[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:BANDwidth:SHAPe?`
Example	`:ACP:OFFS2:INN:LIST:BAND:SHAP FLAT,GAUS,GAUS,GAUS,GAUS,GAUS` `:ACP:OFFS2:INN:LIST:BAND:SHAP?`

Notes	Offset subopcode: 1 for BTS (Downlink), 2 for MS (Uplink)
Dependencies	When Res BW Mode for the offset is Auto, this cell is grayed-out and disabled. Since Res BW Mode for the offset is preset to Auto on changing **Meas Method** to RBW, FAST or Fast Power, this cell is grayed-out and disabled. If the cell is pressed, an advisory message is generated. If the equivalent remote command is sent, a "Setting conflict" warning is generated
Preset	`GAUSsian, GAUSsian, GAUSsian, GAUSsian, GAUSsian, GAUSsian`
State Saved	Saved in instrument state
Range	`GAUSsian|FLATtop`

Filter BW

Selects a Gaussian filter based on its –3 dB (Normal) bandwidth or its –6 dB bandwidth.

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:BANDwidth:TYPE DB3 | DB6, DB3 | DB6, DB3 | DB6, DB3 | DB6, DB3 | DB6, DB3 | DB6` `[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:BANDwidth:TYPE?`
Example	`:ACP:OFFS2:INN:LIST:BAND:TYPE DB3,DB3,DB3,DB3,DB3,DB3` `:ACP:OFFS2:INN:LIST:BAND:TYPE?`
Notes	Offset subopcode: 1 for BTS (Downlink), 2 for MS (Uplink)
Dependencies	When Filter Type if `FLATtop` or Res BW Mode for the offset is Auto, this cell is grayed-out and disabled. Since Res BW Mode for the offset is preset to Auto on changing **Meas Method** to RBW, FAST or Fast Power, this cell is grayed-out and disabled too. If the cell is pressed, an advisory message is generated. If the equivalent remote command is sent, a "Setting conflict" warning is generated
Preset	`DB3, DB3, DB3, DB3, DB3, DB3`
State Saved	Saved in instrument state
Range	–3 dB (Normal)| –6 dB

Power Ref Type

Enables you to set reference types of inner offsets.

`CUMulative` Cumulated power of the upper and lower sub-block carriers is the reference level. This selection is effective only when one of the following "Power Ref" on page 1217 values is selected:

Left & Right Carriers	`LRCarriers`
Max Power Carrier in Sub-block	`MPCSubblock`
Min Power Carrier in Sub-block	`MINSubbloc`
Left & Right Sub-blocks	`LRSubblocks`
Manual	`MANual`

When one of the other **Power Ref** values is selected, carrier powers are not cumulated and the reference level is equivalent to Normal

NORMal	Power of specified carrier or the manual reference level is the reference level

Remote Command	[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:PREFerence CUMulative | NORMal, CUMulative | NORMal, CUMulative | NORMal, CUMulative | NORMal, CUMulative | NORMal, CUMulative | NORMal [:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:PREFerence?
Example	:ACP:OFFS:INN:LIST:PREF CUM,CUM,NORM,NORM,NORM,NORM :ACP:OFFS:INN:LIST:PREF?
Preset	NORMal, NORMal, NORMal, NORMal, NORMal, NORMal
State Saved	Saved in instrument state
Range	CUMulative|NORMal

Remote Command	[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:PREFerence:AUTO OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1 [:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:PREFerence:AUTO?
Example	:ACP:OFFS:INN:LIST:PREF:AUTO OFF,OFF,OFF,OFF,OFF,OFF :ACP:OFFS:INN:LIST:PREF:AUTO?
Dependencies	This is available only in LTE/LTE-Advanced FDD/TDD and 5G NR ACP measurement
Couplings	When in the LTE-Advanced FDD/TDD mode, the inner power ref type is set automatically when the power ref type state is auto according to the scopes of the sub-block gap in the following table

Sub-block Gap	Inner ACP offset	Power Ref Type
Wgap <5MHz	1st (2.5MHz)	Normal
	2nd (7.5MHz)	Normal
5MHz≤ Wgap <10MHz	1st (2.5MHz)	Cumulative
	2nd (7.5MHz)	Normal
10MHz≤ Wgap <15MHz	1st (2.5MHz)	Cumulative
	2nd (7.5MHz)	Cumulative
15MHz≤ Wgap <20MHz	1st (2.5MHz)	Normal
	2nd (7.5MHz)	Cumulative
20MHz≤ Wgap	1st (2.5MHz)	Normal
	2nd (7.5MHz)	Normal

When in the 5G NR mode, Power Ref Type “Auto” sets the power reference type of inner-ACLR offset automatically.

Downlink: “Cumulative” or “Normal” is selected accordingly when the inner-offsets are configured to meet the test requirements as follows:

FR1, 3GPP TS 38.141-1 v16.5.0 (2020-09) Section 6.6.3.5.3 BS type 1-C:

	– Table 6.6.3.5.2-3: Base Station ACLR limit in non-contiguous spectrum or multiple bands – Table 6.6.3.5.2-4: Base station CACLR limit FR2, 3GPP TS 38.141-2 v16.5.0 (2020-09) Section 6.7.3.5.3 BS type 2-O: – Table 6.7.3.5.2-3: BS type 2-O ACLR limit in non-contiguous spectrum – Table 6.7.3.5.2-4: BS type 2-O CACLR limit in non-contiguous spectrum Uplink: “Normal” is always selected.
Preset	`ON, ON, ON, ON, ON, ON | OFF, OFF, OFF, OFF, OFF, OFF`
State Saved	Saved in instrument state
Range	Auto|Man

Limit Test

This checkbox is the same as the **Limit Test** control on the **Meas Setup**, **Settings** tab. See "Limit Test" on page 1197.

Offset Freq

This column is the same as the **Offset Freq** column on the **Offset** index tab, see "Offset Freq" on page 1189.

Abs Limit

Enters an absolute limit value, which sets the absolute amplitude levels to test against for each of the custom offsets. The list must contain six (6) entries. If there is more than one offset, the offset closest to the carrier channel is the first one in the list. `[:SENSe]:ACP:OFFSet[n]:INNer:LIST:TEST` selects the type of testing to be done at each offset.

You can turn off (not use) specific offsets with the `[:SENSe]:ACP:OFFSet[n]:INNer:LIST:STATe` command.

The query returns the six (6) sets of real numbers that are the current absolute amplitude test limits.

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:ABSolute <real>, <real>, <real>, <real>, <real>, <real>` `[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:ABSolute?`
Example	`:ACP:OFFS2:INN:LIST:ABS -10,-10,-10,-10,-10,-10` `:ACP:OFFS2:INN:LIST:ABS?`
Notes	Offset subopcode. 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS
Preset	-8.45, -8.45, -8.45, -8.45, -8.45, -8.45 | -50.0, -50.0, -50.0, -50.0, -50.0, -50.0

	5G NR: -2.2, -2.2, -2.2, -2.2, -2.2, -2.2|-50.0,-50.0,-50.0,-50.0,-50.0,-50.0
State Saved	Saved in instrument state
Min/Max	-200.0 dBm/50.0 dBm

Rel Limit (Car)

Enters a relative limit value for the carrier level. This sets the amplitude levels to test against for the specified offsets.

The amplitude level is relative to the carrier amplitude. If multiple offsets are available, the list contains six (6) entries. The offset closest to the carrier channel is the first one in the list.

`[:SENSe]:ACP:OFFSet[n][:OUTer]:LIST:TEST` selects the type of testing to be done at each offset.

You can turn off (not use) specific offsets with the `[:SENSe]:ACP:OFFSet[n][:OUTer]:LIST:STATe` command.

The query returns the six (6) sets of real numbers that are the current amplitude test limits, relative to the carrier, for each offset.

Offset[n] n = 1 is base station and n = 2 is mobiles. The default is base station (1).

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:RCARrier <real>, <real>, <real>, <real>, <real>, <real>` `[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:RCARrier?`
Example	`:ACP:OFFS2:LIST:RCAR 0,0,0,0,0,0` `:ACP:OFFS2:LIST:RCAR?`
Notes	Offset subopcode. 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Some modes do not support Offset subopcode 2. In those cases, commands with subopcode 2 are accepted without error but ignored
Preset	SA: -45, -60, 0, 0, 0, 0|-45, -60, 0, 0, 0, 0 WCDMA: -44.2, -49.2, -49.2, -49.2, -49.2, -49.2|-32.2, -42.2, -42.2, -42.2, -42.2, -42.2 LTE, LTETDD, LTEAFDD,LTEATDD, MSR: -44.2, -44.2, -44.2, -44.2, -44.2, -44.2|-29.2, -29.2, -29.2, -29.2, -29.2, -29.2 5G NR: -43.8, -43.8, -43.8, -43.8, -43.8, -43.8|-29.2, -29.2, -29.2, -29.2, -29.2, -29.2 Radio Test: -60, -60, -60, 0, 0, 0
State Saved	Saved in instrument state
Min/Max	-150/50.0
Backwards Compatibility SCPI	`[:SENSe]:MCPower:OFFSet[1]|2:LIST:RCARrier`

Rel Limit (PSD)

Enters a relative limit value for the level of the power spectral density. This sets the amplitude levels to test against for any custom offsets. The amplitude level is relative to the power spectral density. If multiple offsets are available, the list contains six (6) entries. The offset closest to the carrier channel is the first one in the list.

`[:SENSe]:ACP:OFFSet[n]:INNer:LIST:TEST` selects the type of testing to be done at each offset.

You can turn off (not use) specific offsets with the `[:SENSe]:ACP:OFFSet[n]:INNer:LIST:STATe` command.

The query returns the six (6) sets of real numbers that are the current amplitude test limits, relative to the power spectral density, for each offset.

Offset[n] n = 1 is base station and n = 2 is mobiles. The default is base station (1).

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:RPSDensity <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl>` `[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:RPSDensity?`
Example	`:ACP:OFFS2:INN:LIST:RPSD 10,10,10,10,10,10` `:ACP:OFFS2:INN:LIST:RPSD?`
Notes	Offset subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS
Preset	0, 0, 0, 0, 0, 0|0, 0, 0, 0, 0, 0
State Saved	Saved in instrument state
Min/Max	-150.0 dB/50.0 dB

Fail Mask

Accesses a menu that enables you to select one of the logics for the fail conditions between the measurement results and the test limits. The setting defines the type of testing to be done at any custom offset frequencies. The measured powers are tested against the absolute values defined with `[:SENSe]:ACP:OFFSet[n]:INNer:LIST:ABSolute`, or the relative values defined with `[:SENSe]:ACP:OFFSet[n]:INNer:LIST:RPSDensity` and `[:SENSe]:ACP:OFFSet[n]:INNer:LIST:RCARrier`.

You can turn off (not use) specific offsets with the `[:SENSe]:ACP:OFFSet[n]:INNer:LIST:STATe` command.

- Absolute – Fail is shown if one of the absolute ACP measurement results is larger than the limit for Abs Limit
- Relative – Fail is shown if one of the relative ACP measurement results is larger than the limit for Rel Lim (Car) or Rel Lim (PSD)

- Abs AND Rel – Fail is shown if one of the absolute ACP measurement results is larger than the limit for Abs Limit *and* one of the relative ACP measurement results is larger than the limit for Rel Lim (Car) or Rel Lim (PSD)
- Abs OR Rel– Fail is shown if one of the absolute ACP measurement results is larger than the limit for Abs Limit *or* one of the relative ACP measurement results is larger than the limit for Rel Lim (Car) or Rel Lim (PSD)

Remote Command	`[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:TEST ABSolute | AND | OR | RELative, ABSolute | AND | OR | RELative, ABSolute | AND | OR | RELative, ABSolute | AND | OR | RELative, ABSolute | AND | OR | RELative, ABSolute | AND | OR | RELative` `[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:TEST?`
Example	`:ACP:OFFS2:INN:LIST:TEST ABS,ABS,ABS,ABS,ABS,ABS` `:ACP:OFFS2:INN:LIST:TEST?`
Notes	Offset subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS
Preset	`AND, AND, AND, AND, AND, AND | AND, AND, AND, AND, AND, AND`
State Saved	Saved in instrument state
Range	Absolute|Relative|Abs AND Rel (fail if both fail)|Abs OR Rel (fail if either fails)

Reference Carrier (Carrier Index)

Sets the reference carrier. Relative power measurements are made from the reference carrier.

If set to Auto, the measurement selects the carrier with the highest power as the reference carrier and the Ref Carrier parameter is updated. If a value is entered when Ref Carrier Mode is set to Auto, the mode changes to Man.

If set to Man, the value that you enter for the Ref Carrier is used as the reference carrier.

In MSR, LTE-A FDD/TDD and 5G NR modes, this control is called **Carrier Index** and has a different SCPI command. In these modes, it sets the carrier index of the reference power. The power of the carrier selected by this index becomes reference power when Power Ref is Carrier Index. Any value up to the MAX can be set though the measurement only deals with number of carriers specified by Carrier. If the index is larger than Carrier, reference power in this measurement becomes NaN and therefore all relative power results are NaN.

For more information, see "Carrier Index (Modes: MSR, LTEAFDD, LTEATDD, and 5GNR)" on page 1215.

Remote Command	`[:SENSe]:ACPower:CARRier[1]|2:RCARrier <integer>`
	`[:SENSe]:ACPower:CARRier[1]|2:RCARrier?`
	`[:SENSe]:ACPower:CARRier[1]|2:RCARrier:AUTO OFF | ON | 0 | 1`

	[:SENSe]:ACPower:CARRier[1]|2:RCARrier:AUTO?
Example	:ACP:CARR:RCAR 1 :ACP:CARR:RCAR? :ACP:CARR:RCAR:AUTO OFF :ACP:CARR:RCAR:AUTO?
Notes	Carrier subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Note that Carrier subopcode 2 is not supported in some Modes. In those cases, Carrier subopcode 1 is used for both BTS and MS and commands with subopcode 2 are accepted without error but ignored For LTE-Advanced FDD/TDD modes, this control is not shown. In order to maintain backwards compatibility with the legacy LTE FDD/TDD modes, the SCPI command is supported in the LTE & LTE-A converged application
Dependencies	If there is only one carrier, this control is grayed out This control does not appear in the MSR, LTE-A FDD/TDD and 5G NR modes
Couplings	If you enter a carrier value that is currently configured as having no power present, that carrier will be changed to having power present If you enter a ref carrier this parameter will be set to manual
Preset	Auto determined 1
State Saved	Saved in instrument state Yes
Range	Auto|Man
Min/Max	1/Number of available carriers
Backwards Compatibility SCPI	[:SENSe]:MCPower:RCARrier[1]|2 [:SENSe]:MCPower:RCARrier[1]|2:AUTO (Power Suite)

Carrier Index (Modes: MSR, LTEAFDD, LTEATDD, and 5GNR)

Remote Command	[:SENSe]:ACPower:CARRier[1]|2:INDex <integer> [:SENSe]:ACPower:CARRier[1]|2:INDex?
Example	:ACP:CARR:IND 1 :ACP:CARR:IND?
Notes	Carrier subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Note that Carrier subopcode 2 is not supported in some Modes. In those cases, Carrier subopcode 1 is used for both BTS and MS and commands with subopcode 2 are accepted without error but ignored
Dependencies	This control only appears in the MSR, LTE-A FDD/TDD and 5G NR modes

Preset	1
State Saved	Saved in instrument state
Min/Max	LTE-A: 1/Dependent on Num Component Carriers 5G NR: 1/Dependent on Num Component Carriers MSR: 1/100

Ref Carrier Freq

Sets the reference carrier frequency.

Remote Command	`[:SENSe]:ACPower:CARRier[1]|2:RCFRequency <freq>`
	`[:SENSe]:ACPower:CARRier[1]|2:RCFRequency?`
	`[:SENSe]:ACPower:CARRier[1]|2:RCFRequency:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:ACPower:CARRier[1]|2:RCFRequency:AUTO?`

Example	`:ACP:CARR:RCFR 250 MHz`
	`:ACP:CARR:RCFR?`
	`:ACP:CARR:RCFR:AUTO OFF`
	`:ACP:CARR:RCFR:AUTO?`

Notes	Carrier subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Note that Carrier subopcode 2 is not supported in some Modes. In those cases, Carrier subopcode 1 is used for both BTS and MS and commands with subopcode 2 are accepted without error but ignored For LTE-Advanced FDD/TDD modes, this control is not shown. In order to maintain backwards compatibility with the legacy LTE FDD/TDD modes, the SCPI command is supported in the LTE & LTE-A converged application
Dependencies	This control does not appear in the MSR, LTE-A FDD/TDD and 5G NR modes
Couplings	LTE-Advanced FDD/TDD do not support the following couplings Coupled to the Center Frequency If the center frequency changes, the Ref Carrier Frequency is calculated using the following three steps; 1. Ref Freq1 = Ctr Freq - (Total of all Carrier Widths / 2) 2. Ref Freq2 = Ref Freq1 + (Total of all Carrier Widths up to Ref Carrier) 3. Ref Freq = Ref Freq2 + (0.5 * Carrier Width of Ref Carrier) If reference carrier frequency changes the Center Frequency is calculated using the following three steps; 1. Ctr Freq1 = Ref Freq - (0.5 * Carrier Width of Ref Carrier) 2. Ctr Freq2 = Ctr Freq1 - (Total of all Carrier Widths up to Ref Carrier)

	3. Ctr Freq = Ctr Freq2 + (Total of all Carrier Widths / 2) This ensures that the carriers are always centered on the screen If there is only one carrier present, the Reference Carrier Frequency will be the same as the Center Frequency
Preset	Calculated based on the current Center Frequency ON
State Saved	Saved in instrument state Yes
Range	Auto|Man
Min/Max	-79.999995 MHz/Hardware Dependent: – Option 503 = 3.699999995 GHz – Option 508 = 8.499999995 GHz – Option 513 = 13.799999995 GHz – Option 526 = 26.999999995 GHz
Backwards Compatibility SCPI	`[:SENSe]:MCPower:RCFRequency[1]|2 (Power Suite)` `[:SENSe]:MCPower:RCFRequency[1]|2:AUTO`

Measurement Type

Changes the reference used for the measurement. This allows you to make absolute and relative power measurements of either total power or the power normalized to the measurement bandwidth.

- Total Pwr Ref (`TPRef`) sets the reference to the total carrier power
- PSD Ref (`PSDRef`) sets the reference to the power spectral density of the carrier

Remote Command	`[:SENSe]:ACPower:TYPE TPRef | PSDRef` `[:SENSe]:ACPower:TYPE?`
Example	`:ACP:TYPE PSDR` `:ACP:TYPE?`
Preset	`TPRef`
State Saved	Saved in instrument state
Range	Total Power Ref|PSD Ref

Power Ref

Selects the power reference type. This control has two different forms, depending on the currently-selected Mode:

– "Power Ref (Modes: SA, WCDMA, VMA, SRComms)" on page 1218

– "Power Ref (Modes: LTE-A FDD/TDD, 5G NR, MSR)" on page 1218

Power Ref (Modes: SA, WCDMA, VMA, SRComms)

Type	Option	Description
Ref Carrier	`RCARrier`	Power of the specified carrier is the reference of measurement. Use the Reference Carrier control to select Carrier Index
Manual Power	`MANual`	Power or PSD specified by the user is the reference of measurement
Total Multicarriers	`TMCarriers`	Total Power of multi carriers is the power reference of measurement. Each carrier power is calculated with its own carrier configuration settings

Remote Command	`[:SENSe]:ACPower:CARRier[1]|2:PREFerence:TYPE RCARrier	MANual	TMCarriers` `[:SENSe]:ACPower:CARRier[1]|2:PREFerence:TYPE?`
Example	`:ACP:CARR:PREF:TYPE RCARrier` `:ACP:CARR:PREF:TYPE?`
Notes	This command is available only in SA, WCDMA, VMA and Short Range Comms Carrier subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Note that Carrier subopcode 2 is not supported in some Modes. In those cases, Carrier subopcode 1 is used for both BTS and MS and commands with subopcode 2 are accepted without error but ignored
Preset	`RCARrier`
State Saved	Saved in instrument state
Range	Reference Carrier | Manual Power | Total Multicarriers

Power Ref (Modes: LTE-A FDD/TDD, 5G NR, MSR)

Selects the power reference type:

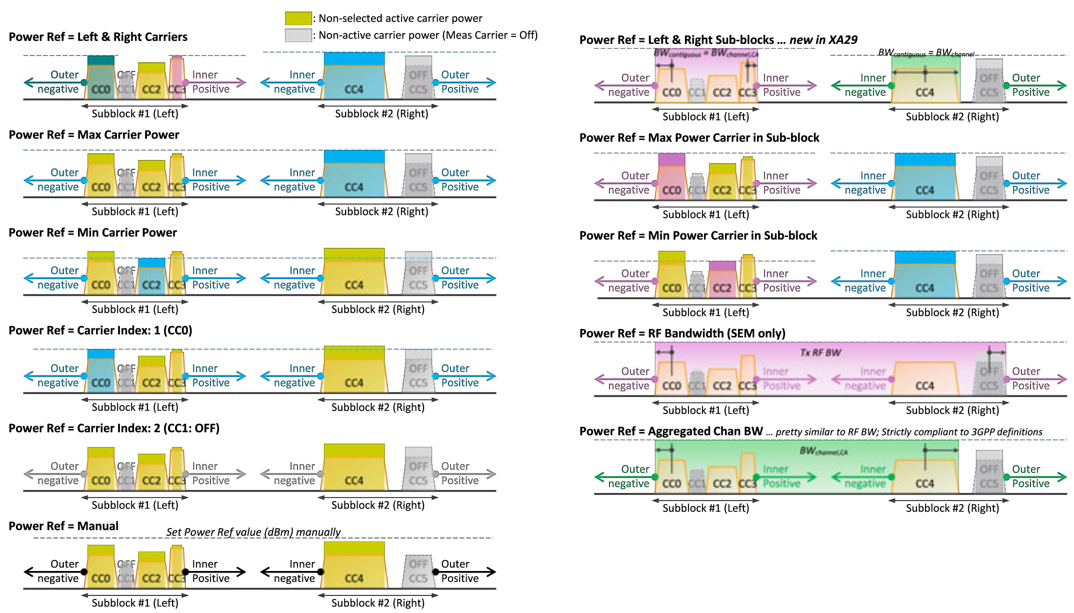
Type	Option	Description
Left & Right Carriers	`LRCarriers`	Powers of leftmost and rightmost carriers with Measure Carrier On in a sub-block are the references of left and right sides respectively. Left and right carriers are determined based on the carrier center frequencies. If Measure Carriers of all the carriers in a sub-block are off, the reference power in a sub-block and all the relative power results are NaN. Relative limits are not evaluated

Type	Option	Description
Max Power Carrier	MPCarrier	Maximum carrier power among the carriers of Measure Carrier On is the reference of measurement. If Measure Carriers of all the carriers are off, the reference power and all the relative power results are NAN. Relative limits are not evaluated
Min Power Carrier 5G NR only	MINPcarrier	Minimum carrier power among the carriers of Measure Carrier On is the reference of measurement. If Measure Carriers of all the carriers are off, the reference power and all the relative power results are NAN. Relative limits are not evaluated
Carrier Index	CINDex	Power of the specified carrier is the reference of measurement. If Measure Carriers of this carrier index is off, the reference power and all the relative power results are NAN. Relative limits are not evaluated
Manual	MANual	Power or PSD specified by the user is the reference of measurement
Aggregated Chan BW LTE-A and 5G NR only	ACBandwidth	The assigned aggregated channel bandwidth power which is measured with a rectangular filter with measurement bandwidth specified as aggregated channel bandwidth based on the definition of each 3GPP standard. Calculated from the carrier configuration including SCS (Power Meas), the smallest SCS among the enabled SCSs of the selected component carrier. If Measure Carriers of all the carriers are off, the reference power and all the relative power results are NAN. Relative limits are not evaluated
Max Power Carrier in Sub-block	MPCSubblock	Maximum carrier power among the sub-block carriers of Measure Carrier On is the reference of measurement. If Measure Carriers of all the carriers in a sub-block are off, the reference power of the sub-block and all the relative power results referring to this sub-block are NAN, and these relative limits are not evaluated
Total Multicarriers MSR only	TMCarriers	Total power of multi carriers is the power reference of measurement. Each carrier power is calculated with its own carrier configuration settings
Min Power Carrier in Sub-block 5G NR only	MINSubbloc	Minimum carrier power among the sub-block carriers of Measure Carrier On is the reference of measurement. If Measure Carriers of all the carriers in a sub-block are off, the reference power of the sub-block and all the relative power results referring to this sub-block are NAN, and these relative limits are not evaluated
Left & Right Sub-blocks 5G NR only	LRSubblocks	The reference depends on the number of Component Carriers (CC) and Carrier Allocation as follows: – Num of CC is 1: the carrier power is the reference – Num of CC is 2 or more & Carrier Allocation is Contiguous: Aggregated Channel power is the reference

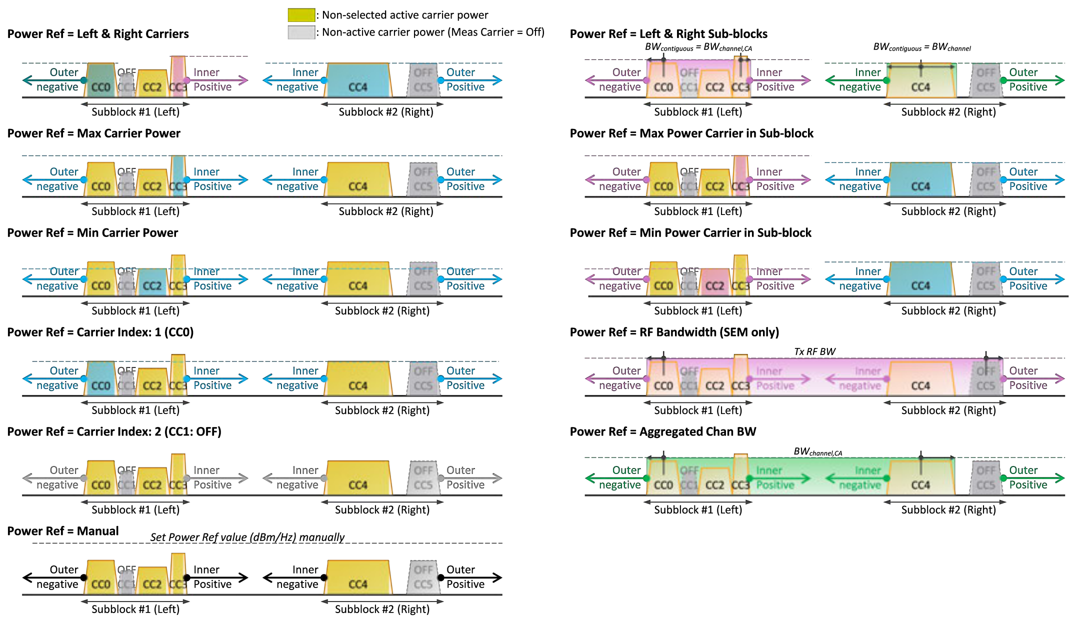
Type	Option	Description
		– Num of CC is 2 or more & Carrier Allocation is Non-Contiguous: Aggregated powers of left and right sub-blocks are the references. Left and right sub-blocks are determined by component carrier configuration

The powers of carriers are not included in the reference power when their Measure Carriers are Off. When Measure Carriers of all the carriers in a sub-block are Off, the reference power and all the relative power results are NaN. Therefore, relative limits are not evaluated.

Meas Type = Total Power Ref



Meas Type = PSD Ref



Remote Command	`[:SENSe]:ACPower:CARRier[1]|2:PREFerence:TYPE LRCarriers | MPCarrier | CINDex | MANual | MPCSubblock | ACBandwidth | TMCarriers | MINPcarrier | MINSubblock | LRSubblocks` `[:SENSe]:ACPower:CARRier[1]|2:PREFerence:TYPE?`
Example	`:ACP:CARR:PREF:TYPE CIND` `:ACP:CARR:PREF:TYPE?`
Notes	This command is available only in the MSR, LTE-A FDD/TDD and 5G NR modes `ACBandwidth` is available only in LTE-A and 5G NR `TMCarriers` is available only in MSR `MINPcarrier,MINSubblock`, and `LRSubblocks` are available only in 5G NR Carrier subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Note that Carrier subopcode 2 is not supported in some Modes. In those cases, Carrier subopcode 1 is used for both BTS and MS and commands with subopcode 2 are accepted without error but ignored
Preset	`MPCarrier`
State Saved	Saved in instrument state

Power Ref State SCPI Only

Remote Command	`[:SENSe]:ACPower:CARRier[1]|2:AUTO[:STATe] OFF | ON | 0 | 1` `[:SENSe]:ACPower:CARRier[1]|2:AUTO[:STATe]?`
Example	`:ACP:CARR:AUTO OFF`

	:ACP:CARR:AUTO?
Preset	ON
State Saved	Saved in instrument state
Range	Auto|Man
Backwards Compatibility SCPI	[:SENSe]:MCPower:CARRier[1]|2:AUTO[:STATe]

Total Power Ref

Sets manual total power reference.

This control has two different forms, depending on the currently-selected Mode:

– "Total Power Ref (Modes: SA, WCDMA, VMA, SRComms)" on page 1222

– "Total Power Ref (Modes: LTE-A FDD/TDD, 5G NR, MSR)" on page 1223

Total Power Ref (Modes: SA, WCDMA, VMA, SRComms)

This is used when Power Ref is Manual and Meas Type is Total Power.

Remote Command	[:SENSe]:ACPower:CARRier[1]|2[:POWer] <real> [:SENSe]:ACPower:CARRier[1]|2[:POWer]?
Example	:ACP:CARR 10 :ACP:CARR?
Notes	Although the default value is defined, the value is recalculated by the measurement result just after measurement Carrier subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Note that Carrier subopcode 2 is not supported in some Modes. In those cases, Carrier subopcode 1 is used for both BTS and MS and commands with subopcode 2 are accepted without error but ignored The Unit Terminators differ depending on whether or not the mode supports Y Axis Unit and also which Y Axis Unit is selected
Dependencies	This control is available only when **Meas Type** is TPRef. If **Meas Type** is not TPRef, this is grayed-out
Preset	0.0
State Saved	Saved in instrument state
Min/Max	-200 dBm/200 dBm
Backwards Compatibility SCPI	[:SENSe]:MCPower:CARRier[1]|2[:POWer]

Total Power Ref (Modes: LTE-A FDD/TDD, 5G NR, MSR)

Sets the multi-carrier power reference. This is used when Power Ref is Manual and Meas Type is Total Power.

When set to Auto, the carrier power result reflects the measured power value in the selected reference carrier.

When set to Man, the result is referenced to the last measured value, or you may specify the reference for the multi-carrier power measurement. Relative values are displayed, referenced to the “Power Reference” value.

Remote Command	`[:SENSe]:ACPower:CARRier[1]|2[:POWer] <real>` `[:SENSe]:ACPower:CARRier[1]|2[:POWer]?`
Example	`:ACP:CARR 10` `:ACP:CARR?`
Notes	Although the default value is defined, the value is recalculated by the measurement result just after measurement Carrier subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Note that Carrier subopcode 2 is not supported in some Modes. In those cases, Carrier subopcode 1 is used for both BTS and MS and commands with subopcode 2 are accepted without error but ignored The Unit Terminators differ depending on whether or not the mode supports Y Axis Unit and also which Y Axis Unit is selected
Dependencies	This control is enabled when Measurement Type is Total Power and Power Ref is Manual
Preset	0.0
State Saved	Saved in instrument state
Min/Max	-200 dBm/200 dBm
Backwards Compatibility SCPI	`[:SENSe]:MCPower:CARRier[1]|2[:POWer]`

PSD Ref

Sets manual PSD reference.

This control has two different forms, depending on the currently-selected Mode:

– "PSD Ref (Modes: SA, WCDMA, VMA, SRComms)" on page 1223

– "PSD Ref (Modes: LTEAFDD, LTEATDD, 5GNR, MSR)" on page 1225

PSD Ref (Modes: SA, WCDMA, VMA, SRComms)

This is used when Power Ref is Manual and Meas Type is PSD.

Sets the power spectral density in the carrier (main channel) that is used to compute the relative power spectral density values for the offsets when Meas Type is set to PSD Ref.

Remote Command	`[:SENSe]:ACPower:CARRier[1]|2:CPSD <real>` `[:SENSe]:ACPower:CARRier[1]|2:CPSD?`
Example	`:ACP:CARR:CPSD 25` `:ACP:CARR:CPSD?`
Notes	Although the default value is defined, the value is recalculated by the measurement result just after measurement Carrier subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Note that Carrier subopcode 2 is not supported in some Modes. In those cases, Carrier subopcode 1 is used for both BTS and MS and commands with subopcode 2 are accepted without error but ignored
Dependencies	This control is available only when Meas Type is `PSDRef`. If **Meas Type** is not `PSDRef`, this is grayed-out
Couplings	The value of PSD Ref is automatically converted when PSD Unit is changed
Preset	0.0
State Saved	Saved in instrument state
Min/Max	-999/999

Power Ref State (Backwards Compatibility SCPI)

Sets the Power Reference State to auto or manual.

Example	`:ACP:CARR:AUTO OFF`
	`:ACP:CARR:AUTO?`
	`:MCP:CARR:AUTO ON`
	`:MCP:CARR:AUTO?`

Notes	For backwards compatibility with legacy SA and WCDMA, this command is supported When the mode is `ON`, it corresponds to the Ref Carrier of the Power Ref selection When the mode is `OFF`, it corresponds to the Manual of the Power Ref selection
Preset	`ON`
State Saved	Saved in instrument state
Range	Auto|Man

Backwards Compatibility SCPI	`[:SENSe]:ACPower:CARRier[1]|2:AUTO[:STATe] OFF | ON | 0 | 1`
	`[:SENSe]:ACPower:CARRier[1]|2:AUTO[:STATe]?`
	`[:SENSe]:MCPower:CARRier[1]|2:AUTO[:STATe] OFF | ON | 0 | 1`
	`[:SENSe]:MCPower:CARRier[1]|2:AUTO[:STATe]?`

PSD Ref (Modes: LTEAFDD, LTEATDD, 5GNR, MSR)

Sets manual PSD reference. This is used when Power Ref is **Manual** and Meas Type is **PSD**.

Sets the power spectral density in the carrier (main channel) that is used to compute the relative power spectral density values for the offsets when Meas Type is set to **PSD Ref**. When the **PSD Ref** state is set to **Auto**, this will be set to the measured carrier power spectral density.

Remote Command	`[:SENSe]:ACPower:CARRier[1]|2:CPSD <real>` `[:SENSe]:ACPower:CARRier[1]|2:CPSD?`
Example	`:ACP:CARR:CPSD 25` `:ACP:CARR:CPSD?`
Notes	Although the default value is defined, the value is recalculated by the measurement result just after measurement Carrier subopcode: 1 for BTS (Downlink), 2 for MS (Uplink). Default is BTS Note that Carrier subopcode 2 is not supported in some Modes. In those cases, Carrier subopcode 1 is used for both BTS and MS and commands with subopcode 2 are accepted without error but ignored
Dependencies	This control is enabled when **Measurement Type** is PSD Reference and **Power Ref** is Manual
Couplings	The value of PSD is automatically converted when PSD Unit is changed
Preset	0.0
State Saved	Saved in instrument state
Min/Max	-999/999

PSD Unit

Sets the unit bandwidth for Power Spectral Density. The available units are dBm/Hz and dBm/MHz.

Remote Command	`:UNIT:ACPower:POWer:PSD DBMHZ | DBMMHZ` `:UNIT:ACPower:POWer:PSD?`
Example	`:UNIT:ACP:POW:PSD DBMMHZ` `:UNIT:ACP:POW:PSD?`
Dependencies	This control is enabled when Measurement Type is PSD Reference
Couplings	When the PSD unit is changed, the PSD reference result of the “MEAS|READ|FETCH:ACP[n]?” is also changed by the PSD unit basis (in either dBm/Hz or dBm/MHz)
Preset	`DBMHZ`
State Saved	Saved in instrument state
Range	dBm/Hz|dBm/MHz

3.9.8.3 Radio

The Radio tab contains controls to select the Radio Device, and enable or disable HSPA/HSPA+ options.

Radio Device

Allows you to specify the device to be used.

Remote Command	`[:SENSe]:RADio:STANdard:DEVice BTS | MS` `[:SENSe]:RADio:STANdard:DEVice?`
Example	`:RAD:STAN:DEV MS` `:RAD:STAN:DEV?`
Preset	BTS
State Saved	Saved in instrument state.
Range	BTS | MS
Backwards Compatibility SCPI	`[:SENSe]:RADio:DEVice`

HSPA Enable

Allows you to turn on or off the HSDPA/HSUPA option enable. This selection is necessary because some of the auto detection functions that expect an HSPA signal are less tolerant when the signal is noisy or distorted. When the HSPA signal is not expected, turn HSPA Enable off.

Remote Command	`[:SENSe]:RADio:CONFigure:HSDPa[:STATe] 0 | 1 | OFF | ON` `[:SENSe]:RADio:CONFigure:HSDPa[:STATe]?`
Example	`:RAD:CONF:HSDP 0` `:RAD:CONF:HSDP?`
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

HSPA+ Enable

Allows you to turn on or off the HSPA+ option enable. This selection is necessary because some of the auto detection functions that expect an HSPA+ signal are less tolerant when the signal is noisy or distorted. When the HSPA+ signal is not expected, turn HSPA+ Enable off.

Remote Command	`[:SENSe]:RADio:CONFigure:EHSPa[:STATe] OFF | ON | 0 | 1` `[:SENSe]:RADio:CONFigure:EHSPa[:STATe]?`
Example	`:RAD:CONF:EHSP 0` `:RAD:CONF:EHSP?`
Notes	When HSPA enable is OFF, HSPA+ function is disabled too.
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

3.9.8.4 Advanced

Contains controls for setting advanced functions of the instrument.

This tab does *not* appear in the following instruments:

- EXM
- VXT models M9420A/21A
- M9393A, M9391A

Phase Noise Opt

Selects the LO (local oscillator) phase noise behavior for various operating conditions.

Remote Command	`[:SENSe]:ACPower:FREQuency:SYNThesis[:STATe] 1 | ... | 5`
	For the meaning of each numeric option value, see "Ranges for Installed Options" on page 1228 below
	`[:SENSe]:ACPower:FREQuency:SYNThesis[:STATe]?`
	`[:SENSe]:ACPower:FREQuency:SYNThesis:AUTO[:STATe] OFF | ON | 0 | 1`
	`[:SENSe]:ACPower:FREQuency:SYNThesis:AUTO[:STATe]?`

Example	`:ACP:FREQ:SYNT 1` `:ACP:FREQ:SYNT?`

	`:ACP:FREQ:SYNT:AUTO 1` `:ACP:FREQ:SYNT:AUTO?`
Dependencies	Does not appear in all models. For models that do not display this control, the SCPI command is accepted for compatibility (although no action is taken) This control is not available in VXT models M9410A/11A/15A
Preset	Because this function is in Auto after preset, the state of this function after Preset will be automatically calculated ON
State Saved	Saved in instrument state
Range	See table of "Ranges for Installed Options" on page 1228 below

Ranges for Installed Options

Option	Option #	Phase Noise Option	Range
No EPx Option	1	Best Close-in	[offset < 20 kHz]
	2	Best Wide-offset	[offset > 30 kHz]
	3	Fast Tuning	[same as Best Close-In]
EP0	4	Best Close-in	[offset < 600 kHz]
	1	Balanced	[offset < 600 kHz]
	5	Best Spurs	[offset < 600 kHz]
	2	Best Wide-offset	[offset > 800 kHz]
	3	Fast Tuning	[same as Best Close-In]
EP1	1	Best Close-in	[offset < 140 kHz]
	2	Best Wide-offset	[offset > 160 kHz]
	3	Fast Tuning	[single loop]
EP2, EP3, EP5	1	Best Close-in	[offset < 70 kHz]
	2	Best Wide-offset	[offset > 100 kHz]
	3	Fast Tuning	[medium loop bw]
EP4	1	Best Close-in	[offset < 90 kHz]
	2	Best Wide-offset	[offset > 130 kHz]
	3	Fast Tuning	[same as Best Close-In]

Noise Correction

Sets the measurement noise floor correction function to On or Off. On enables measurement noise correction when the measured power in the reference channel or any offset is close to the noise floor of the instrument. Off turns these corrections off.

In instruments with the noise floor extensions option (option NFE) enabled, there are two ways to compensate for the analyzer noise floor: through the NFE and through this noise corrections control. The techniques are results are similar but not identical. NFE uses a model of the analyzer noise floor, adapted to the current conditions such as center frequency, RBW and ambient temperature. The parameters of this model are measured in the factory or field calibration in a highly averaged measurement. So they are consistent. However, because the model is imperfect, the corrections are imperfect. Using NFE is very convenient; the user need not wait for the ACP noise corrections calibration to occur. The ACP NC calibration, though, has advantages of being measured very recently, at the current ambient, and the exact center frequency, with no requirement that the model be perfect. So it will often (but not always) have slightly better dynamic range. If both ACP NC is turned on and NFE is turned on, the instrument uses only the ACP NC. When ACP NC is turned off but NFE is on, NFE is used and performance should still be excellent.

When **Meas Method** is Fast Power, HW supported noise correction works when either or both of Noise Correction and NFE is on.

Remote Command	`[:SENSe]:ACPower:CORRection:NOISe[:AUTO] OFF | ON | 0 | 1` `[:SENSe]:ACPower:CORRection:NOISe[:AUTO]?`
Example	`:ACP:CORR:NOIS OFF` `:ACP:CORR:NOIS?`
Dependencies	This parameter is unavailable when Meas Method is set to RBW or Fast
Preset	0
State Saved	Saved in instrument state
Range	`OFF|ON`

Fast Power RBW Mode

Specifies RBW behavior of Fast Power under **Meas Method**. When `SPEed` is selected, the acquisition RBW is set to be configured for best speed. The RBW is automatically calculated, and is not configurable. When `EXPLicit` is selected, you can configure RBW manually.

Remote Command	`[:SENSe]:ACPower:BANDwidth[:RESolution]:FPOWer:MODE SPEed | EXPLicit` `[:SENSe]:ACPower:BANDwidth[:RESolution]:FPOWer:MODE?`
Example	`:ACP:BAND:FPOW:MODE EXPL` `:ACP:BAND:FPOW:MODE?`
Dependencies	When **Meas Method** is not Fast Power, this control is grayed-out This control is not available in VXT models M9410A/11A/15A
Couplings	If `EXPLicit` is selected, Res BW is configurable. If not, Res BW is grayed-out
Preset	`SPEed`
State Saved	Saved in instrument state
Range	`SPEed|EXPLicit`

Fast Power IF Gain Offset

Allows you to optimize for dynamic range versus input signal level.

Remote Command	`[:SENSe]:ACPower:IF:GAIN:FPOWer <integer>` `[:SENSe]:ACPower:IF:GAIN:FPOWer?`
Example	`:ACP:IF:GAIN:FPOW 10` `:ACP:IF:GAIN:FPOW?`
Dependencies	When **Meas Method** is not Fast Power, this control is grayed-out This control is not available in VXT models M9410A/11A/15A
Preset	0
State Saved	Saved in instrument state
Min/Max	-20/20

Integration BW

Selects an Integration BW passband from either -3 dB or -6 dB.

Remote Command	`[:SENSe]:ACPower:FILTer:BANDwidth[:INTegration] DB3 | DB6` `[:SENSe]:ACPower:FILTer:BANDwidth[:INTegration]?`
Example	`:ACP:FILT:BAND DB3` `:ACP:FILT:BAND?`
Dependencies	Applicable for carriers and offsets whose filter method is not RRC and when **Meas Method** is other than RBW
Preset	`DB3`
State Saved	Saved in instrument state
Range	-3 dB|-6 dB

3.9.8.5 Global

The controls in this menu apply to all Modes in the instrument.

Some controls (for example, **Global Center Freq**) allow you to switch certain Meas Global parameters to a Mode Global state. These switches apply to all Modes that support global settings. For example, no matter what Mode you are in when you set **Global Center Freq** to `ON`, it applies to all Modes that support Global Settings.

Other controls (for example, **Extend Low Band**) are actually set in this menu, but apply to all Modes.

Global Center Freq

The software maintains a Mode Global value called **Global Center Freq**.

When **Global Center Freq** is switched `ON`, the current Mode's center frequency is copied into the **Global Center Frequency**, and from then on all Modes that support global settings use the **Global Center Frequency**, so you can switch between any of these Modes and the Center Freq will remain unchanged.

Adjusting the Center Freq of any Mode that supports Global Settings, while **Global Center Freq** is `ON`, modifies the Global Center Frequency.

When **Global Center Freq** is switched `OFF`, the Center Freq of the current Mode is unchanged, but now the Center Freq of each Mode is once again independent.

When **Mode Preset** is pressed while **Global Center Freq** is `ON`, the Global Center Freq is preset to the preset Center Freq of the current Mode.

This function is reset to `OFF` when "Restore Defaults" on page 1737 (in this tab) is pressed, or when **System**, **Restore Defaults**, **All Modes** is pressed.

Remote Command	`:INSTrument:COUPle:FREQuency:CENTer ALL | NONE` `:INSTrument:COUPle:FREQuency:CENTer?`
Example	`:INST:COUP:FREQ:CENT ALL` `:INST:COUP:FREQ:CENT?`
Preset	Set to `OFF` on **Global** Settings, **Restore Defaults** and **System, Restore Defaults, All Modes**
Range	`ALL|NONE`

Preset	`OFF`
Backwards Compatibility SCPI	`:GLOBal:FREQuency:CENTer[:STATe] 1 | 0 | ON | OFF` `:GLOBal:FREQuency:CENTer[:STATe]?`

Global EMC Std

When this control is switched `ON`, the current Mode's EMC Std is copied into the **Global EMC Std**, and from then on all Modes that support global settings use the Global EMC Std, so you can switch between any of these Modes and the EMC Std will remain unchanged.

Adjusting the EMC Std of any Mode that supports Global Settings, while Global EMC Std is `ON`, will modify the **Global EMC Std**.

When **Global EMC Std** is switched `OFF`, the EMC Std of the current Mode is unchanged, but now the EMC Std of each Mode is once again independent. When

Mode Preset is pressed while **Global EMC Std** is ON, the Global EMC Std is preset to the preset EMC Std of the current Mode.

This function is reset to OFF when "Restore Defaults" on page 1737 (in this tab) is pressed, or when **System, Restore Defaults, All Modes** is pressed.

Remote Command	:INSTrument:COUPle:EMC:STANdard ALL | NONE :INSTrument:COUPle:EMC:STANdard?
Example	:INST:COUP:EMC:STAN ALL :INST:COUP:EMC:STAN?
Dependencies	Only available if option EMC is installed
Preset	Set to OFF on **Global** Settings, **Restore Defaults** and **System, Restore Defaults, All Modes**
Range	ALL|NONE

Extend Low Band

The software maintains a Mode Global value called **Extend Low Band**.

Under the current sweep configuration crossing over two bands, when **Extend Low Band** is turned ON, the instrument checks whether one band can cover the whole sweep frequency range or not. If it can, then the instrument locks the band; otherwise, it does nothing (the band crossover occurs).

This function does *not* work when **Band Lock** under **System** > **Service** > **Lock Functions** is not -1 (no Band Lock). In that case, **Band Lock** takes priority over **Extend Low Band**.

This function is reset to OFF when "Restore Defaults" on page 1737 (in this tab) is pressed, or when **System**, **Restore Defaults**, **All Modes** is pressed.

This parameter is available for SA, RTSA, WCDMA, WIMAX OFDMA, LTEAFDD, LTEATDD Modes.

Remote Command	:INSTrument:COUPle:FREQuency:BAND:EXTend 0 | 1 | ON | OFF :INSTrument:COUPle:FREQuency:BAND:EXTend?
Example	:INST:COUP:FREQ:BAND:EXT 1 :INST:COUP:FREQ:BAND:EXT?
Dependencies	Only applies to UXA, PXA, MXA and EXA
Preset	Set to OFF by **Global** Settings > **Restore Defaults** and **System** > **Restore Defaults** > **All Modes**
Range	ON|OFF

Restore Defaults

Resets all of the functions in the **Global** Settings menu to OFF. This also occurs when **System**, **Restore Defaults**, **All Modes** is pressed.

Remote Command	:INSTrument:COUPle:DEFault
Example	:INST:COUP:DEF
Backwards Compatibility SCPI	:GLOBal:DEFault

3.9.8.6 Offset RRC Weighting (Backwards Compatibility SCPI)

Example	:ACP:FILT OFF :ACP:FILT?
Couplings	This command is an alias to [:SENSe]:ACPower:OFFSet[1]|2:LIST:FILTer[:RRC][:STATe] Sending the commands to set values of all offsets for BS and MS, however, sending the query always return a value of BS Offset A
Preset	SA, LTEAFDD, LTEATDD, MSR: OFF WCDMA: ON
State Saved	Yes
Backwards Compatibility SCPI	[:SENSe]:ACPower:FILTer[:RRC][:STATe] OFF | ON | 0 | 1 [:SENSe]:ACPower:FILTer[:RRC][:STATe]? [:SENSe]:ACPR:FILTer[:RRC][:STATe] [:SENSe]:MCPower:FILTer[:RRC][:STATe]

3.9.8.7 Offset Filter Alpha (Backward Compatibility SCPI)

Example	:ACP:FILT:ALPH 0.5 :ACP:FILT:ALPH?
Couplings	This command is an alias to [:SENSe]:ACPower:OFFSet[1]|2:LIST:FILTer:ALPHa Sending the commands to set values of all offsets for BS and MS, however, sending the query always returns a value of BS Offset A
Preset	SA, WCDMA, LTE, LTETDD, LTEAFDD, LTEATDD, MSR: 0.22 Digital Cable TV: 0.15
State Saved	Saved in instrument state
Min/Max	0.01/1.00
Backwards Compatibility SCPI	[:SENSe]:ACPower:FILTer[:RRC]:ALPHa <real> [:SENSe]:ACPower:FILTer[:RRC]:ALPHa? [:SENSe]:ACPR:FILTer[:RRC]:ALPHa [:SENSe]:MCPower:FILTer[:RRC]:ALPHa

3.9.8.8 Method for Carrier (Backward Compatibility SCPI)

Example	`:ACP:CARR2:LIST:METH RRC` `:ACP:CARR2:LIST:METH?`
Notes	Maximum of Array length depends on the number of carriers
Couplings	This command is an alias to: `[:SENSe]:ACPower:CARRier[1]|2:LIST:FILTer[:RRC][:STATe]` The enum value translates as follows: – RRC Weighted = `1|ON` – Integ BW = `0|OFF` Maximum of Array length depends on the number of carriers
Preset	SA: IBW WCDMA: RRC LTE, LTETDD, LTEAFDD, LTEATDD, MSR: IBW
State Saved	Saved in instrument state
Backwards Compatibility SCPI	`[:SENSe]:ACPower:CARRier[1]|2:LIST:METHod IBW | RRC, …` `[:SENSe]:ACPower:CARRier[1]|2:LIST:METHod?`

3.9.9 Sweep

Accesses controls that enable you configure and control the acquisition of data and the X-Axis parameters of the instrument. These controls might include Sweep Time, Continuous/Single, Pause/Resume, X Scale and number of Points.

3.9.9.1 Sweep/Control

Contains controls for the Sweep and Control functions of the instrument, such as Sweep Time and Continuous/Single.

Sweep Time

Controls the time the instrument takes to sweep the current frequency span in swept measurements, displays the sweep time in swept measurements, and displays the equivalent Sweep Time in FFT measurements.

NOTE	**In instruments without sweeping hardware this control may be labelled Acquisition Time**

When **Sweep Time** is in Auto, the instrument computes a time that will give accurate measurements based on other settings of the instrument, such as RBW and VBW.

You can choose a shorter sweep time to improve the measurement throughput (with some potential unspecified accuracy reduction), but the Meas Uncal indicator will come on if the sweep time you set is less than the calculated Auto Sweep time.

You can also select a longer sweep time, which can be useful (for example) for obtaining accurate insertion loss measurements on very narrowband filters.

NOTE Significantly faster sweep times are available with Option FS1.

NOTE The Meas Uncal (measurement uncalibrated) warning is displayed in the Status Bar at the bottom of the screen when the manual Sweep time entered is faster than the time computed by the instrument's Sweep time equations, that is, the Auto Sweep Time. The instrument's computed Sweep time will give accurate measurements; if you sweep faster than this your measurements may be inaccurate. A Meas Uncal condition may be corrected by returning the Sweep Time to Auto; by entering a longer Sweep Time; or by choosing a wider RBW and/or VBW.

Remote Command	`[:SENSe]:ACPower:SWEep:TIME <time>`
	`[:SENSe]:ACPower:SWEep:TIME?`
	`[:SENSe]:ACPower:SWEep:TIME:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:ACPower:SWEep:TIME:AUTO?`

Example	`:ACP:SWE:TIME 50ms`
	`:ACP:SWE:TIME?`
	`:ACP:SWE:TIME:AUTO OFF`
	`:ACP:SWE:TIME:AUTO?`

Notes	This parameter is preset by **Meas Method** selection. Preset values are as follows: – IBW: 29 ms – IBWR: 108 ms – FAST (WCDMA): 7.5 ms
Dependencies	In certain instruments without sweeping hardware, such as VXT models M9420A/21A, the **Sweep Time** control is grayed-out, and the Auto/Man toggle disappears
Couplings	Sweep time is coupled to RBW when **Sweep Time** is set to Auto; in this case the sweep time is changed as the RBW changes, to maintain amplitude calibration **Sweep Time** is also coupled to the Video Bandwidth (VBW). As the VBW is changed, the sweep time (when set to Auto) is changed to maintain amplitude calibration. This occurs because of common hardware between the two circuits
Preset	Automatically Calculated unless noted below WCDMA: 29 ms

	ON unless noted below WCDMA: OFF, C2K: OFF (method IBW)
State Saved	Saved in instrument state
Min	Typically: 1 ms VXT models M9410A/11A: 100 ns When Meas Method is Fast Power, the minimum sweep time is 'span' dependent and automatically calculated 1.0e-6 Burst Power
Max	In swept spans: 4000 s 50 Burst Power
Annotation	The sweep time is displayed in the lower-right corner of the screen. The number of points is displayed parenthetically, as Sweep 13.3 ms (1001 points) A “#” mark appears before “Sweep” in the annotation when it is switched from Auto to Manual coupling
Status Bits/OPC dependencies	Meas Uncal is Bit 0 in the STATus:QUEStionable:INTegrity:UNCalibrated register

Sweep/Measure

Allows you to toggle between Continuous and Single sweep or measurement operation. The Single/Continuous state is Meas Global, so the setting affects *all* measurements.

The front-panel key **Single/Cont** performs exactly the same function

NOTE In the `WAVeform` measurement, this control only appears in the Meas Bar, and not in the **Sweep/Control** tab.

See "More Information" on page 1237

Remote Command	`:INITiate:CONTinuous OFF | ON | 0 | 1` `:INITiate:CONTinuous?`

Example	`:INIT:CONT 0`
	`:INIT:CONT OFF`
	puts instrument into Single measurement operation
	`:INIT:CONT 1`
	`:INIT:CONT ON`
	puts instrument into Continuous measurement operation

Preset	ON Note that `:SYST:PRES` sets `:INIT:CONT` to `ON` but `*RST` sets `:INIT:CONT` to `OFF`

State Saved	Saved in instrument state
Annunciation	The **Single/Continuous** icon in the Meas Bar changes depending on the setting: – A line with an arrow is Single – A loop with an arrow is Continuous

More Information

With **Avg/Hold Num** (in the **Meas Setup** menu) set to **Off** or set to **On** with a value of 1, a sweep is taken after the trigger condition is met; and the instrument continues to take new sweeps after the current sweep has completed and the trigger condition is again met. However, with **Avg/Hold Num** set to On with a value >1, multiple sweeps (data acquisitions) are taken for the measurement. The trigger condition must be met prior to each sweep. The sweep is not stopped when the average count k equals the number N set for Avg/Hold Num is reached, but the number k stops incrementing. A measurement average usually applies to all traces, marker results, and numeric results, but sometimes only applies to the numeric results.

If the instrument is in Single measurement, pressing the **Cont/Single** toggle control does not change k and does not cause the sweep to be reset; the only action is to put the instrument into Continuous measurement operation.

If it is already in Continuous sweep:

– the `:INIT:CONT 1` command has no effect

– the `:INIT:CONT 0` command will place the instrument in Single Sweep but will have no effect on the current sequence until k = N, at which point the current sequence will stop and the instrument will go to the idle state.

See "Restart" on page 1738 control description for details on the `:INIT:IMM` (Restart) function.

If you are already in Single sweep, the `:INIT:CONT OFF` command has no effect.

If you are already in Single Sweep, then pressing the **Cont/Single** toggle control in the middle of a sweep does not restart the sweep or sequence. Similarly, pressing the **Cont/Single** toggle control does not restart the sweep or sequence if the sweep is not in the idle state (for example, if you are taking a very slow sweep, or the instrument is waiting for a trigger). Even though pressing the **Cont/Single** toggle control in the middle of a sweep does *not* restart the sweep, sending `:INIT:IMM` *does* reset it.

Restart

The **Restart** function restarts the current sweep, or measurement, or set of averaged/held sweeps or measurements. In measurements that support pausing, if you are Paused, pressing **Restart** performs a **Resume**.

The Restart function is accessed in several ways:

– Pressing the **Restart** key

– Sending the remote command `:INIT:IMM`

– Sending the remote command `:INIT:REST`

See "More Information" on page 1238

Remote Command	`:INITiate[:IMMediate]` `:INITiate:RESTart`
Example	`:INIT:IMM` `:INIT:REST`
Notes	`:INIT:REST` and `:INIT:IMM` and the front-panel **Restart** key perform exactly the same function
Couplings	Resets average/hold count k For the first sweep, overwrites all active (update=on) traces with new current data For application modes, resets other parameters as required by the measurement
Status Bits/OPC dependencies	This is an Overlapped command The `:STATus:OPERation` register bits 0 through 8 are cleared The `:STATus:QUEStionable` register bit 9 (INTegrity sum) is cleared The `SWEEPING` bit is set The `MEASURING` bit is set
Backwards Compatibility Notes	For Spectrum Analysis mode in ESA and PSA, the **Restart** hardkey and the `:INIT:REST` command restart trace averages (displayed average count reset to 1) for a trace in **Clear Write**, but did not restart **Max Hold** and **Min Hold** In the X-Series, the **Restart** hardkey and the `:INIT:REST` command restart not only **Trace Average**, but **Max Hold** and **Min Hold** traces as well For wireless comms modes in ESA and PSA, the **Restart** hardkey and the `:INIT:REST` command restarted every measurement, including all traces and numeric results. There is no change to this operation

More Information

The **Restart** function first aborts the current sweep or measurement as quickly as possible. It then resets the sweep and trigger systems, sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is in the process of aligning when a Restart is executed, the alignment finishes before the restart function is performed.

Even when set for Single operation, multiple sweeps may be taken when **Restart** is pressed (for example, when averaging/holding is on). Thus when we say that Restart "restarts a measurement," depending on the current settings, we may mean:

- It restarts the current sweep
- It restarts the current measurement
- It restarts the current set of sweeps if any trace is in Trace Average, Max Hold or Min Hold
- It restarts the current set of measurements if Averaging, or Max Hold, or Min Hold is on for the measurement

With Average/Hold Number (in Meas Setup menu) set to 1, or Averaging off, or no trace in Trace Average or Hold, a single sweep is equivalent to a single measurement. A single sweep is taken after the trigger condition is met; and the instrument stops sweeping once that sweep has completed. However, with Average/Hold Number >1 and at least one trace set to Trace Average, Max Hold, or Min Hold (SA Measurement) or Averaging on (most other measurements), multiple sweeps/data acquisitions are taken for a single measurement. The trigger condition must be met prior to each sweep. The sweep is stopped when the average count k equals the number N set for Average/Hold Number. A measurement average usually applies to all traces, marker results, and numeric results, but sometimes only applies to the numeric results.

Once the full set of sweeps has been taken, the instrument will go to the idle state. To take one more sweep without resetting the average count, increment the average count by 1, by pressing the step up key while Average/Hold Number is the active function, or by sending the remote command `:CALC:AVER:TCON UP`.

Pause/Resume

Pauses a measurement after the current data acquisition is complete.

When a measurement is paused:

- The label on this control changes to **Resume**. Pressing **Resume** un-pauses the measurement.
- Pressing **Restart** also performs a **Resume**.

Remote Command	`:INITiate:PAUSe` `:INITiate:RESume`
Example	`:INIT:PAUS` `:INIT:RES`
Dependencies	Not displayed in Modes that do not support pausing
Couplings	When Averaging is On, if the measurement is paused no more updates will occur until either a Resume or Restart occurs If the measurement is resumed, the averaging continues to use the traces from before the Pause occurred and continues to use the traces from the point where the Resume occurred. This still provides real-time traces, but they will no longer be gap free

	In a view with a Waterfall window, when the measurement is paused, the Waterfall stops updating. When Resume is selected, the Waterfall will retain the existing traces and continue updating using traces from the point at which Resume was selected. The time stamp of the individual Waterfall traces will show the time from the beginning of the measurement the trace relates to, showing there was a gap in the Waterfall capture In Density view, when the measurement is paused, the Density Display stops updating. When the measurement is resumed, if Persistence is `ON`, the persistence fading will continue from the point when the measurement was paused If a Restart occurs, the average counter is reset and all results are discarded. The measurement begins again, using traces after the Restart occurred

Abort (Remote Command Only)

This command stops the current measurement. It aborts the current measurement as quickly as possible, resets the sweep and trigger systems, and puts the measurement into an "idle" state. If the instrument is in the process of aligning when `:ABORt` is sent, the alignment finishes before the abort function is performed, so `:ABORt` does *not* abort an alignment.

If the instrument is set for Continuous measurement, it sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is set for Single measurement, it remains in the "idle" state until an `:INIT:IMM` command is received.

Remote Command	`:ABORt`
Example	`:ABOR`
Notes	If `:INIT:CONT` is `ON`, then a new continuous measurement will start immediately, with sweep (data acquisition) occurring once the trigger condition has been met If `:INIT:CONT` is `OFF`, then `:INIT:IMM` is used to start a single measurement, with sweep (data acquisition) occurring once the trigger condition has been met
Dependencies	For continuous measurement, `:ABORt` is equivalent to the **Restart** key Not all measurements support the abort command
Status Bits/OPC dependencies	The `:STATus:OPERation` register bits 0 through 8 are cleared The `:STATus:QUEStionable` register bit 9 (INTegrity sum) is cleared Since all the bits that feed into OPC are cleared by `:ABORt`, the `:ABORt` will cause the *OPC query to return true

3.9.9.2 Sweep Config

Accesses controls that enable you to configure the Sweep and Control functions of the instrument.

Sweep Time Rules

Switches the instrument between NORMal and ACCuracy sweep states.

Setting **Auto Sweep Time** to ACCuracy results in slower sweep times, usually about three times as long, but yields better amplitude accuracy for CW signals. The instrument amplitude accuracy specifications only apply when **Auto Sweep Time** is set to ACCuracy.

Additional amplitude errors that occur when **Auto Sweep Time** is set to NORMal are usually well under 0.1 dB, though this is not guaranteed. Because of the faster sweep times and still low errors, NORMal is the preferred setting of **Auto Sweep Time**. **Auto Sweep Time** is set to NORMal on a **Preset** or **Auto Couple**. This means that in the Preset or Auto Coupled state, instrument amplitude accuracy specifications do not apply.

Remote Command	`[:SENSe]:ACPower:SWEep:TIME:AUTO:RULes NORMal | ACCuracy` `[:SENSe]:ACPower:SWEep:TIME:AUTO:RULes?`
Example	`:ACP:SWE:TIME:AUTO:RUL NORM` `:ACP:SWE:TIME:AUTO:RUL?`
Dependencies	This control does not appear in Spectrum Analyzer Mode in VXT models M9420A/21A This control is not available in E7760
Couplings	Set to NORMal when **Auto Couple** is pressed or sent remotely
Preset	SA, WCDMA, C2K, TD-SCDMA, 1xEVDO, DTMB (CTTB), LTE, LTETDD, LTEAFDD, LTEATDD, MSR: ACCuracy 5G NR, WIMAX OFDMA, DVB-T/H, ISDB-T, CMMB, Digital Cable TV: NORMal 5G NR in VXT models M9410A/11A/15A: ACCuracy
State Saved	Saved in instrument state
Range	NORMal|ACCuracy

Points

Sets the number of points taken per sweep, and displayed in the traces. The current value of points is displayed parenthetically, next to the sweep time in the lower-right corner of the display. Using more points provides greater resolution. Using fewer points compacts the data and decreases the time required to access a trace over the remote interface.

Increasing the number of points does not increase the sweep time. However, it can slightly impact the trace processing time and therefore the overall measurement speed. Decreasing the number of points does not decrease the sweep time, but it may speed up the measurement, depending on the other sweep settings (for example, in FFT sweeps). Fewer points will always speed up the I/O.

Due to minimum sweep rate limitations of the hardware, the minimum sweep time available to the user will increase above its normal value of 1 ms as the number of sweep points increases above 15001.

Changing the number of sweep points has several effects on the instrument.Since markers are read at the point location, the marker reading may change.The sweep time resolution will change. Trace data for all the traces will be cleared and, if **Sweep** is in **Cont**, a new trace taken. If any trace is in average or hold, the averaging starts over.

Because of sweep time quantization issues, the knob and up/down keys cannot be used to adjust the number of points.

When in a split screen display each window may have its own value for points.

When sweep points is changed, an informational message "Sweep points changed, all traces cleared" is displayed and in the 5G NR mode, Auto Sweep Points is set to `OFF`(0).

Remote Command	`[:SENSe]:ACPower:SWEep:POINTs <integer>` `[:SENSe]:ACPower:SWEep:POINTs?`
Example	`:ACP:SWE:POIN 500` `:ACP:SWE:POIN?`
Dependencies	This function is not available when Signal ID is set to On in External Mixing Neither the knob nor the step keys can be used to change this value. If it is tried, a warning is given Not displayed in Modes that do not support Swept This parameter is automatically calculated and not configurable when **Meas Method** is set to Fast Power
Couplings	Whenever the number of sweep points change: – All trace data is erased – Any traces with Update Off will also go to Display Off – Sweep time is re-quantized – Any limit lines that are on will be updated – If averaging/hold is on, averaging/hold starts over – Auto Sweep Points is set to `OFF` (5G NR only) The resolution of setting the sweep time depends on the number of points selected
Preset	1001 unless noted below DVB-T/H, DTMB (CTTB), ISDB-T, CMMB, Digital Cable TV: 2001 5G NR in all models but VXT models M9410A/11A/15A: 5001
State Saved	Saved in instrument state
Min	1
Max	20001
Annotation	On second line of annotations, in lower right corner in parenthesis behind the sweep annotation

3.9.9.3 X Scale

Accesses controls that enable you to set the horizontal scale parameters.

Auto Scaling

Toggles the scale coupling function between On and Off.

Remote Command	`:DISPlay:ACPower:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:COUPle 0 | 1 | OFF | ON` `:DISPlay:ACPower:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:COUPle?`
Example	`:DISP:ACP:WIND:TRAC:X:COUP ON` `:DISP:ACP:WIND:TRAC:X:COUP?`
Couplings	When **Auto Scaling** is ON and the **Restart** front-panel key is pressed, this function automatically determines the scale per division and reference values based on the measurement results When you set a value to either **Scale/Div** or **Ref Valu**e manually, **Auto Scaling** automatically changes to OFF
Preset	OFF
State Saved	Saved in instrument state
Range	OFF|ON
Backwards Compatibility SCPI	`:DISPlay:ACPower:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:COUPle`

3.9.10 Trace

This menu lets you control the acquisition, display, storage, detection and manipulation of trace data for the available traces. The Trace Control tab of this menu contains radio-button selections for the trace type (**Clear/Write, Trace Average, Max Hold, Min Hold**) and **View/Blank** setting for the selected trace.

For the Spectrum Analyzer Mode, when in **Single** Mode, Measurements and their Views save the trace data from the last acquisition. This is true for multiple screens. The marker and trace data will be present whenever the measurement is brought back into focus. The measurement switches for these measurements do not clear the traces, so the data will be present until the next acquisition is completed.

3.9.10.1 Select Trace

Specifies the selected trace. The term “selected trace” is used to specify which trace will be affected when you change trace settings.

The **Select Trace** control appears above the menu panel, indicating that it applies to all controls in the menu panel. **Select Trace** is blanked if you select a tab whose controls do *not* depend on the selected trace (for example, **Normalize**).

Notes	The selected trace is remembered even when not in the trace menu
Couplings	When "Meas Method" on page 1142 is `RBW`, `FAST` or `FPOWer`, **Select Trace** is disabled
Preset	Trace 1
State Saved	Yes

3.9.10.2 Trace Control

The controls on this tab allow you to set the type of the Trace and its update mode.

There are four trace Types: **Clear/Write, Trace Average, Max Hold** and **Min Hold.** Each type handles data in a different way.

Each trace also has two values that determine whether it is being written or not and whether it is being displayed or not. These values, **Update** and **Display,** are described more fully in the "View/Blank" on page 1245 control description, but suffice it to say that when **Update** is `ON` a trace is updating and when **Update** is `OFF` it is not; and when **Display** is `ON` it is visible and when **Display** is `OFF` it is not. These terms are used throughout the descriptions below.

When Trace Annotation (see **Display** menu) is `ON`, each non-blanked trace is labeled on the trace with the detector used to take it.

For slower sweeps a visual indicator exists on the trace where the new data is being written, a green "caret" or ^ symbol, which moves across the bottom of the graticule showing the current trace point.

Trace Type

Allows you to select the type of trace you want to you use for the current measurement. There are four trace Types: Clear/Write, Trace Average, Max Hold and Min Hold.

Besides the **Trace Type**, the **View/Blank** state must be set to **Active** (**Update**`ON`, **Display**`ON`) for a trace to be updating and visible. Selecting any **Trace Type** automatically makes the trace **Active**. See also the **View/Blank** menu description.

Remote Command	`:TRACe[1]|2|3:ACPower:TYPE WRITe | AVERage | MAXHold | MINHold` `:TRACe[1]|2|3:ACPower:TYPE?`
Example	`:TRAC:ACP:TYPE MINH` `:TRAC:ACP:TYPE?`
Notes	`WRITe` = Clear Write. In **Clear/Write** type each trace update replaces the old data in the trace with new data `AVERage` = Average. In **Trace Average** type the instrument maintains and displays an average trace,

	which represents the cumulative average on a point-by-point basis of the new trace data and previous averaged trace data MAXHold = Maximum Hold. In **Max Hold** type the instrument maintains and displays a max hold trace, which represents the maximum data value on a point-by-point basis of the new trace data and previous trace data MINHold = Minimum Hold. In **Min Hold** type the instrument maintains and displays a min hold trace, which represents the minimum data value on a point-point basis of the new trace data and previous trace data
Couplings	When Detector setting is "Auto" ([:SENSe]:ACPower:DETector:AUTO?), Detector is set to what the Radio Standard defaults states for all conditions of Trace Type and for all traces. When set to Manual, all Traces use the same detector type. When Average State = Off then Trace Types AVERage, MaxHold and MinHold will not function, since Averaging must be ON for them to operate. When Meas Method is RBW or FAST, Trace Type is disabled
Preset	AVERage
State Saved	Saved in instrument state

Clear and Write | Restart Averaging | Restart Max/Min Hold

Starts the trace writing as though the trace type had just been selected. Pressing this control has exactly the same effect as selecting the current trace type again – the control is provided because it may not be obvious that re-selecting the current selection from a radio button menu will take an action.

This control takes on different labels depending on the Trace Type:

- **Clear/Write**: Clear and Write
- **Trace Average**: Restart Averaging
- **Max Hold**: Restart Max Hold
- **Min Hold**: Restart Min Hold

View/Blank

Lets you set the state of the two trace values, **Update** and **Display**. The four choices available are:

- **Active**: Update and Display both ON
- **View**: Update OFF, Display ON
- **Blank**: Update OFF, Display OFF
- **Background**: Update ON, Display OFF (this allows a trace to be blanked and continue to update "in the background", which was not possible in the past)

See the tables below for detail onthe SCPI remote commands to control these two variables.

Couplings	When Meas Method is RBW or FAST, this control is grayed out
Preset	Trace On
State Saved	Saved in instrument state
Range	Trace On|Blank

Trace Update State On/Off

Toggles a trace **Update** state between On and Off. The `OFF` selection makes the trace inactive. This does not affect whether the trace is visible or not. To change the trace visibility, see "Trace Display State On/Off" on page 1246

Remote Command	`:TRACe[1]|2|3:ACPower:UPDate[:STATe] ON | OFF | 0 | 1` `:TRACe[1]|2|3:ACPower:UPDate[:STATe]?`
Example	`:TRAC:ACP:UPD ON` `:TRAC:ACP:UPD?`
Couplings	Whenever you set **Update** to **On** for any trace**,** the **Display** is set to **On** for that trace When Meas Method is RBW or FAST, Trace Update is disabled
Preset	1|0|0 **(On** for Trace 1; **Off** for 2 & 3)
State Saved	Saved in instrument state

Trace Display State On/Off

Toggles a trace **Display** state between On and Off. The `OFF` selection makes the trace not visible. This does not affect whether the trace is updating or not.

Even when not visible, traces may be queried and markers may be placed on them.

Remote Command	`:TRACe[1]|2|3:ACPower:DISPlay[:STATe] ON | OFF | 0 | 1` `:TRACe[1]|2|3:ACPower:DISPlay[:STATe]?`
Example	`:TRAC:ACP:DISP ON` `:TRAC:ACP:DISP?`
Couplings	Whenever you set **Update** to `ON` for any trace**,** the **Display** is set to `ON` for that trace When **Meas Method** is RBW or FAST, Trace Display is disabled
Preset	1|0|0 (`ON` for Trace 1; `OFF` for 2 & 3)
State Saved	Saved in instrument state
Range	0 1

3.9.10.3 Detector

Lets you choose and configure detectors for the selected trace.

Detector

Selects a detector to be used by the instrument for the current measurement. Allows up to three (3) traces, but each use the same detector type choice. The following choices are available:

Option	Parameters	Description
Auto	See "Detector Select Auto/Man" on page 1248	Detector selected depends on marker functions, trace functions, average type, and the trace averaging function When in AUTO, the detector selected is set to AVERage, unless the Radio Standard defaults state otherwise, for example, it is set to POS for Radio Standard = PDC when Device = both MS and BTS, and when Radio Standard = NADC and Device = MS
Normal	NORMal	Detector determines the peak of the CW-like signals, and yields alternating maximums and minimums of noise-like signals. This is also referred to as Rosenfell detection
Average	AVERage RMS	Detector determines the average of the signal within the sweep points, using RMS averaging
Peak (Positive)	POSitive	Detector determines the maximum of the signal within the sweep points
Sample	SAMPle	Detector indicates the instantaneous level of the signal at the center of the sweep points represented by each display point
Negative Peak	NEGative	Detector determines the minimum of the signal within the sweep points

Because they may not find a spectral component's true peak, neither Average nor Sample detectors measure amplitudes of CW signals as accurately as Peak or Normal, but they do measure noise without the biases of peak detection.

– When **Meas Method** is Fast Power, Auto, Peak and Average are selectable

Remote Command	`[:SENSe]:ACPower:DETector[:FUNCtion] NORMal | AVERage | POSitive | SAMPle | NEGative | RMS` `[:SENSe]:ACPower:DETector[:FUNCtion]?`

Example	`:ACP:DET NORM`
	`:ACP:DET?`
	`:ACP:DET RMS`
	Sets the detector to AVERage. In ACP, AVERage uses RMS averaging, so this is equivalent to selecting an RMS detector

Notes	The query returns a name that corresponds to the detector type, as shown below The RMS selection sets the detector type to AVERage with RMS averaging. Therefore, if RMS has been selected, the query returns AVER

	String Returned	**Definition**
	NORM	Normal
	AVER	Average (RMS)
	POS	Peak
	SAMP	Sample
	NEG	Negative Peak
Couplings	When Detector setting is "Auto" ([:SENSe]:ACPower:DETector:AUTO?), Detector ([:SENSe]:ACPower:DETector[:FUNCtion]?) switches aligning with the switch of this parameter: NORMal with Clear Write, AVERage with AVERage, POSitive (Peak) with MAXHold, and NEGative (Peak) with MINHold When Detector setting is "Auto" ([:SENSe]:ACPower:DETector:AUTO?), Detector is set to what the Radio Standard defaults states for all conditions of Trace Type and for all traces. When set to Manual, all Traces use the same detector type. When Average State = Off then Trace Types AVERage, MaxHold and MinHold will not function, since Averaging must be 'on' for them to operate. Only one Detector type for all 3 traces is allowed. When Meas Method is RBW or FAST, Detector is disabled	
Preset	AVERage	
State Saved	Saved in instrument state	
Range	Normal|Average (RMS)|Peak|Sample|Negative Peak	
Annotation	The four letter mnemonic for the detector appears in the trace window next to the referenced trace	
Backwards Compatibility SCPI	[:SENSe]:ACPR:SWEep:DETector[:FUNCtion]	

Detector Select Auto/Man

Sets the Detector mode to Auto (ON|1) or Manual (OFF|0). In Auto, the proper detector is chosen based on rules that take into account the measurement settings and other instrument settings.

When you manually select any detector, this toggle is automatically set to Manual (OFF).

Remote Command	[:SENSe]:ACPower:DETector:AUTO ON | OFF | 1 | 0 [:SENSe]:ACPower:DETector:AUTO?
Example	:ACP:DET:AUTO 1 :ACP:DET?
Notes	When **Meas Method** is Fast Power, Peak and Average are selectable
Couplings	When Detector setting is "Auto" ([:SENSe]:ACPower:DETector:AUTO?), Detector ([:SENSe]:ACPower:DETector[:FUNCtion]?) switches aligning with the switch of this parameter: "NORMal" with Clear Write, "AVERage" with AVERage, "POSitive (peak)" with MAXHold, and "NEGative (peak)" with MINHold

	When Detector setting is “Auto” ([:SENSe]:ACPower:DETector:AUTO?), Detector is set to what the Radio Standard defaults states for all conditions of Trace Type and for all traces. When set to Manual, all Traces use the same detector type. When Average State = Off then Trace Types AVERage, MaxHold and MinHold will not function, since Averaging must be ON for them to operate
Preset	ON
State Saved	Yes

3.9.10.4 Math

The Math tab lets you turn on and configure trace math functions.

Math Function

Trace Math functions perform mathematical operations between traces and, in some cases, user-specified offsets. When in a Trace Math function, the indicated function is performed during the sweep with the math function used in place of a detector.

The trace operands for the math function are set using the **Trace Operands** control.

See "More Information" on page 1251.

See "How trace math is processed" on page 1253

Remote Command	For Swept SA Measurement (in SA Mode):
	`:CALCulate:MATH <trace_num>, PDIFference | PSUM | LOFFset | LDIFference | OFF, <trace_num>, <trace_num>, <real>,<real>`
	`:CALCulate:MATH? <trace_num>`
	where `<trace_num>` is any one of:
	`TRACE1|TRACE2|TRACE3|TRACE4|TRACE5|TRACE6`
	For all other measurements:
	`:CALCulate:<meas>:MATH <trace_num>, PDIFference | PSUM | LOFFset | LDIFference | OFF, <trace_num>, <trace_num>, <real>,<real>`
	`:CALCulate:<meas>:MATH? <trace_num>`
	where:
	– `<meas>` is the identifier for the current measurement, and
	– `<trace_num>` is any one of:
	`TRACe1|TRACe2|TRACe3`
	Note that the format of the `TRACe<n>` parameter differs from that for the Swept SA Measurement

Example	1. Set Trace 3 to Power Diff trace math function, and sets the First Trace operand (for Trace 3) to Trace 1 and the Second Trace operand (for Trace 3) to Trace 2: `:CALC:MATH TRACE3,PDIF,TRACE1,TRACE2,0,0` 2. Set Trace 3 to Power Sum trace math function and sets the First Trace operand (for Trace 3) to

	Trace 1 and the Second Trace operand (for Trace 3) to Trace 2:
	`:CALC:MATH TRACE3,PSUM,TRACE1,TRACE2,0,0`
	3. Set Trace 3 to Log Offset trace math function, sets the First Trace operand (for Trace 3) to Trace 1, leaves the Second Trace operand (for Trace 3) unchanged (it is irrelevant for this function) and sets the Log Offset (for Trace 3) to -6 dB:
	`:CALC:MATH TRACE3,LOFF,TRACE1,0,-6.00,0`
	4. Set Trace 3 to Log Diff trace math function, sets the First Trace operand (for Trace 3) to Trace 1, sets the Second Trace operand (for Trace 3) to Trace 2, and sets the Log Difference reference (for Trace 3) to -6 dBm:
	`:CALC:MATH TRACE3,LDIF,TRACE1,TRACE2,0,-6.00`
	5. Turn off trace math for trace 3:
	`:CALC:MATH TRACE3 OFF`

Notes	The Trace Math Function command has 6 main set of parameters:

Set	Param Name	Notes
1	Result Trace	`TRACE1|TRACE2|TRACE3|TRACE4|TRACE5|TRACE6`
2	Function	`PDIFference|PSUM|LOFFset|LDIFference|OFF`
3	Trace Operand 1	`TRACE1|TRACE2|TRACE3|TRACE4|TRACE5|TRACE6`
4	Trace Operand 2	`TRACE1|TRACE2|TRACE3|TRACE4|TRACE5|TRACE6`
5	Log Offset	in dB
6	Log Difference Reference	in dBm

	Note that the trace math mode is an enumeration; that is, when a math function is set for a trace it turns off any math function that is on for that trace and sets the new math function The parameters sent in the command are reflected in the values in the control menu. There is no default for any parameter; all 6 parameters must be sent to satisfy the parser. Failure to specify a parameter will result in a missing parameter message The query returns the math mode, the operand traces, the offset and the reference for the specified trace, all separated by commas
Dependencies	Trace Math is not available if **Normalize** is on Trace Math is not available if Signal ID is on None of the trace operands can be the destination trace. If any of the three trace math commands is sent with a destination trace number matching one of the operands a warning is generated and the function does not turn on
Couplings	Whenever a math function other than `OFF` is selected for a trace, that trace is set to Display=`ON` and Update=`ON`
Preset	`OFF,TRACE5,TRACE6,0,0 | OFF,TRACE6,TRACE1,0,0 | OFF,TRACE1,TRACE2,0,0 | OFF,TRACE2,TRACE3,0,0 | OFF,TRACE3,TRACE4,0,0 | OFF,TRACE4,TRACE5,0,0`
State Saved	The trace math function for each trace is saved in instrument state
Annunciation	An “f” is shown on the trace annunciation panel in the Measurement Bar when a math function is on; and the function is annotated on the trace if Trace Annotation is on

Status Bits/OPC dependencies	*OPC can be used to detect the completion of a sweep, which will also correspond to the completion of the math operation, since all math takes place during the sweep

More Information

IMPORTANT

To generate a trace math result, *you must take a sweep*. The trace math engine, described below, operates in concert with the sweep engine in the instrument. Until a sweep has been taken, even if the constituent traces are not in Update mode, no result is generated.

Note that certain events can affect the trace in ways that affects all points at once. This can happen in any number of ways, including:

- A trace clear taking place
- A trace being loaded from the file system
- Trace data being sent in from the remote interface
- A copy or exchange of trace data

You should try to avoid these occurrences during a sweep, as they will tend to invalidate the math result being accumulated.

The Trace Math functions are:

Power Diff (Op1 - Op2)

Calculates a power difference between the `First Trace` operand and the `Second Trace` operand and puts the result in the destination trace.

During the sweep, the following formula is executed for each point in the trace operands, and the corresponding point is generated for the destination trace:

```
DestinationTrace = 10 log(10(1/10)(FirstTrace) – 10(1/10)(SecondTrace))
```

The values of the trace points are assumed to be in a decibel scale, as they are internally stored.

If a point in `FirstTrace` is equal to `maxtracevalue`, the resultant point is also `maxtracevalue`.

Otherwise, if the result of the subtraction is less than or equal to 0, the resultant point is `mintracevalue`.

Power Sum (Op1 + Op2)

Calculates a power sum between the `First Trace` operand and the `Second Trace` operand and puts the result in the destination trace.

During the sweep, the following formula is executed for each point in the trace operands, and the corresponding point is generated for the destination trace.

```
DestinationTrace = 10 log(10(1/10)(FirstTrace) + 10(1/10)(SecondTrace))
```

The values of the trace points are assumed to be in a decibel scale, as they are internally stored.

If a point in either trace operand is equal to `maxtracevalue`, the resultant point is also `maxtracevalue`.

Log Offset (Op1 + Offset)

Calculates a log offset from the `First Trace` operand and puts the result in the destination trace. This is like the B-DL function in some older instruments. The offset is entered on the `Offset` control, which only appears when this math function is in force for the selected trace. Each destination trace has its own offset.

During the sweep, the following formula is executed for each point in the trace operand, and the corresponding point is generated for the destination trace.

```
DestinationTrace = FirstTrace + Offset
```

The values of the trace points are assumed to be in dBm (as they are internally stored) and the offset is in dB.

If a point in the trace operand is equal to `maxtracevalue`, the resultant point is also `maxtracevalue`.

If a point in the trace operand is equal to `mintracevalue`, the resultant point is also `mintracevalue`.

Example: If offset is 25 dB, then our destination trace will be higher than the operand trace by 25 dB.

Note that the `Second Trace` operand is not used for this function.

Log Diff (Op1 - Op2 + Ref)

Offsets the difference between the `First Trace` operand and the `Second Trace` operand by a reference and puts the result in the destination trace. This is like the A-B+DL function in some older instruments. The Reference is entered on the **Reference** control, which only appears when this math function is in force for the selected trace. Each destination trace has its own reference.

Offsets the difference between the `First Trace` operand and the `Second Trace` operand by a reference and puts the result in the destination trace. This is like the A-B+DL function in some older instruments. The Reference is entered on the **Reference** control, which only appears when this math function is in force for the selected trace. Each destination trace has its own reference.

During the sweep, the following formula is executed for each point in the trace operands, and the corresponding point is generated for the destination trace.

```
DestinationTrace = (FirstTrace - SecondTrace) + Reference
```

The values of the operand trace points are assumed to be in decibel units (as they are internally stored) and the reference is in dBm so the result is in dBm.

Example: If the first operand trace 1 is at 5 dBm, the second operand trace 2 is at –5 dBm, and the reference is –25 dBm, then the destination trace will be –15 dBm.

Example: If the first operand trace1 is at 60 dBuV, the second operand trace 2 is at 50 dBuV, and the reference is 35 dBuV, then the destination trace will be 45 dBuV.

If a point in `FirstTrace` is equal to `maxtracevalue`, the resultant point is also `maxtracevalue`.

If a point in `FirstTrace` is equal to `mintracevalue`, the resultant point is also `mintracevalue`.

If neither of the above is true for a given point, then:

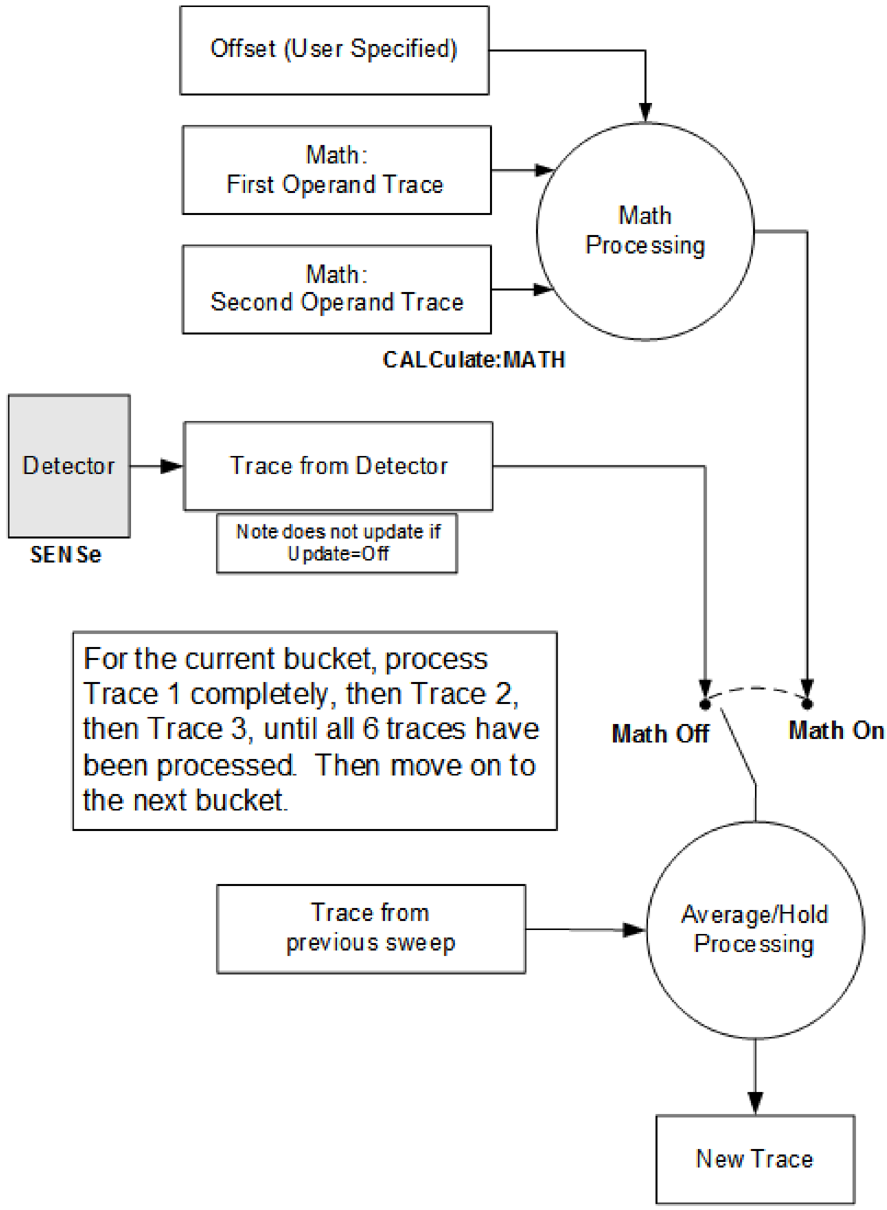
– If that point in `SecondTrace` is equal to `maxtracevalue`, the resultant point is `mintracevalue`.

– If that point in `SecondTrace` is equal to `mintracevalue`, the resultant point is `maxtracevalue`.

How trace math is processed

Whenever a trace math function is turned on, or the parameters and/or operands of an existing trace math function are changed, the destination trace is cleared. After the trace is cleared, all x-axis values in the trace, and the domain of the trace, are set to match the X-Axis settings of the first trace operand. When this is complete, a new sweep is initiated.

The process of acquiring data, processing it using the math and Average/Hold functions, and presenting it as trace data, consists of several functional blocks, as shown below:



NOTE ABOUT OFFSETS: When either External Gain or Ref Level Offset is on, an offset is applied to the trace operands, and when Trace Math is on this offset is applied before any math processing is performed. Since the operands have already been offset the result trace should NOT be offset. Therefore when any Trace Math operation is performed, the sum of (External Gain - Ref Level Offset) is added to the result before it is stored in the result trace.

For each active trace, the current trace point is processed for `Trace 1`, then `Trace 2`, then `Trace 3`, etc. Trace data is taken from either the detector for that trace, or from the mathematical result of up to two other traces and an offset, depending on whether trace math is on or not. The resultant data is then fed to the Average/Hold

processing block, where (if the trace type is **Average**, **Max Hold**, or **Min Hold**) it is processed with previous trace data. The new trace data resulting from this process is then available for display, storage or remote output.

When the processing is complete for `Trace 1`, `Trace 2` is processed, and so on until all six traces have been processed. This allows a downstream trace to use as one of its math components a fully processed upstream trace. In other words, if math is `ON` for `Trace 4`, and its operand traces are `Trace 2` and `Trace 3`, then all detector, math, average and hold processing for Traces 2 and 3 is completed before the math is performed for `Trace 4`. When the current trace point is completed for all traces, the instrument moves on to the next trace point.

This allows very flexible and powerful math functions to be configured. For example, `Trace 1` can be an average trace, which can be fed with an offset to `Trace 2`, which can also be in **Max Hold**, allowing you to obtain the **Max Hold** of an Average trace.

Note that none of this processing is performed on inactive traces.

Note also that for any active trace with math `ON`, the Operand traces should have *lower* numbers than the trace (for example, using `Trace 4` as an operand for `Trace 1` will cause the data coming from `Trace 4` to be delayed by one sweep).

Operand 1/2

Selects the first and second trace operands, respectively, to be used for the trace math functions for the destination trace.

The operands are common to all math functions for a given trace. The most recently sent `:CALCulate:MATH` command for a given trace sets the operands for that trace, and will be reflected on the trace operand controls for that trace.

Example	The following examples are for the Swept SA measurement.
	1) Set Trace 3 to Power Diff trace math function. Set the First Trace operand (for Trace 3) to Trace 1 and the Second Trace operand (for Trace 3) to Trace 2
	`:CALC:MATH TRACE3,PDIF,TRACE1,TRACE2,0,0`
	
	2) Set Trace 3 to Log Offset trace math function. Set the First Trace operand (for Trace 3) to Trace 1, leave the Second Trace operand (for Trace 3) unchanged (it is irrelevant for this function) and set the Log Offset (for Trace 3) to -6 dB
	`:CALC:MATH TRACE3,LOFF,TRACE1,TRACE2,-6.00,0`

Notes	See the Math Function section for how to specify Operand 1 and Operand 2 using the `:CALCulate:MATH` SCPI command
Dependencies	The destination trace cannot be an operand. The destination trace number is gray on the dropdown
Preset	**Operand 1**: Trace number minus 2 (wraps at 1) For example, for Trace 1, Operand 1 presets to Trace 5; for Trace 6, it presets to Trace 4 **Operand 2**: Trace number minus 1 (wraps at 1) For example, for Trace 1, Operand 2 presets to Trace 6; for Trace 6, it presets to Trace 5
State Saved	Operand 1 and Operand 2 for each trace are stored in instrument state

Offset

The Offset value is used by the Log Offset math function.

Example	The following example is for the Swept SA measurement. `:CALC:MATH TRACE3,LOFF,TRACE1,TRACE2,-6.00,0` Sets Trace 3 to Log Offset trace math function, sets the First Trace operand (for Trace 3) to Trace 1, leaves the Second Trace operand (for Trace 3) unchanged (it is irrelevant for this function) and sets the Log Offset (for Trace 3) to -6 dB
State Saved	The Log Offset value for each trace is saved in Instrument State
Min	–100 dB
Max	100 dB

Reference

The Reference value is used by the Log Diff math function.

Example	The following example is for the Swept SA measurement. `:CALC:MATH TRACE3,LDIF,TRACE1,TRACE2,0,-6.00` Sets Trace 3 to Log Diff trace math function, sets the First Trace operand (for Trace 3) to Trace 1, sets the Second Trace operand (for Trace 3) to Trace 2, and sets the Log Difference reference (for Trace 3) to -6 dBm
State Saved	The Log Difference reference value for each trace is saved in instrument state
Min/Max	Same as reference level

3.9.10.5 Trace Function

The Trace Function includes controls to:

– Copy and Exchange traces

– Preset or Clear all traces

From Trace

Selects the trace to be copied to or exchanged with the **To Trace** when a "Copy" on page 1553 or "Exchange" on page 1553 is performed

Preset	1

To Trace

Selects the trace to be copied from or exchanged with the **From Trace** when a "Copy" on page 1553 or "Exchange" on page 1553 is performed

Preset	2

Copy

This button executes a Trace Copy based on the From Trace and To Trace parameters. The Copy is done from the From Trace to the To Trace. The action is performed once.

The X-Axis settings and domain of a trace go with it when it is copied.

Remote Command	For Swept SA Measurement (in SA Mode):
	`:TRACe:COPY TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6, TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6`
	
	For all other measurements:
	`:TRACe:<meas>:COPY TRACe1 | TRACe2 | TRACe3, TRACe1 | TRACe2 | TRACe3`
	where:
	<meas> is the identifier for the current measurement.
	Note that the format of the TRACe<n> parameter differs from that for the Swept SA Measurement.

Example	`:TRAC:COPY TRACE1,TRACE3` Copies Trace 1 to Trace 3 and puts Trace 3 in Update=Off, Display=On
Notes	The `:TRACe:COPY` command is of the form: `:TRACe:COPY <source_trace>,<dest_trace>`
Dependencies	When Signal ID is on, this key is grayed out
Couplings	The destination trace is put in View (Update=Off, Display=On) after the copy

Preset	For Swept SA Measurement (in SA Mode):
	`TRACE1, TRACE2`
	For all other measurements:
	`TRACe1, TRACe2`

Exchange

This button executes a Trace Exchange based on the From Trace and To Trace parameters. The From Trace and To Trace are exchanged with each other. The action is performed once.

The X-Axis settings and domain of a trace go with it when it is exchanged with another trace.

Remote Command	For Swept SA Measurement (in SA Mode):
	`:TRACe:EXCHange TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6, TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6`
	
	For all other measurements:
	`:TRACe:<meas>:EXCHange TRACe1 | TRACe2 | TRACe3, TRACe1 | TRACe2 | TRACe3`
	where:
	<meas> is the identifier for the current measurement.
	Note that the format of the TRACe<n> parameter differs from that for the Swept SA Measurement.

Example	`:TRAC:EXCH TRACE1,TRACE2` Exchanges Trace 1 and Trace 2 and puts both traces in Update=Off, Display=On
Notes	The `TRACe[:<meas>]:EXCHange` command is of the form: `:TRACe[:<meas>]:EXCHange <trace_1>,<trace_2>`
Couplings	Both traces are put in View (Update=Off, Display=On) after the exchange
Backwards Compatibility Notes	The copy and exchange operations menu in ESA and PSA is replaced with the more general purpose Trace Function menu. The remote commands are unaffected, as they were already general

Preset All Traces

Turns on Trace 1 and blanks all other traces. Useful when you have many traces on and you want to go back to having only Trace 1 on the display. Does not affect the trace type, detector or any other aspect of the trace system.

Remote Command	`:TRACe[:<meas>]:PRESet:ALL`
Example	`:TRAC:PRES:ALL`
Dependencies	When Signal ID is on, this key is grayed out

Clear All Traces

Clears all traces. Does not affect the state of any function or variable in the instrument. Loads `mintracevalue` into all of the points all traces, except traces in **Min Hold** in which case it loads `maxtracevalue`. Does so even if Update=Off.

Remote Command	`:TRACe[:<meas>]:CLEar:ALL`
Example	`:TRAC:CLE:ALL` Clears all traces
Dependencies	When Signal ID is on, this key is grayed out

3.9.10.6 Advanced

The **Advanced** tab contains controls for setting advanced functions of the instrument.

Measure Trace

Specifies which trace's scalar results are displayed in the Metrics window and retrieved by sending a `:READ`/`:FETCh` command.

- Trace 1
- Trace 2
- Trace 3

Remote Command	`:CALCulate:ACPower:MTRace TRACe1 | TRACe2 | TRACe3` `:CALCulate:ACPower:MTRace?`
Example	`:CALC:ACP:MTR TRAC1` `:CALC:ACP:MTR?`
Dependencies	This control is grayed out when **Meas Method** is set to "RBW" or "FAST" Trace 1 is enabled only when **Meas Method** is set to "Fast Power" Trace 2 and Trace 3 are grayed out when **Meas Method** is "Integration BW" or "Filtered IBW" and its corresponding results are unavailable Trace 2 and Trace 3 are grayed-out when no trace data is available
Preset	`TRACe1`
State Saved	No
Range	`Trace1|Trace2|Trace3`

3.10 SEM Measurement

Spectrum Emission Mask measures spurious signal levels in up to six pairs of offset frequencies and relates them to the carrier power.

SEM Measurement Commands

Offsets that are turned off (inactive) return -999.0 when their results are queried via SCPI.

`:CONFigure:SEMask`

`:CONFigure:SEMask:NDEFault`

`:INITiate:SEMask`

`:FETCh:SEMask[n]?`

`:MEASure:SEMask[n]?`

`:READ:SEMask[n]?`

Remote Command Results for Spectrum Emission Mask Measurement

The following table describes the results returned by the `:FETCh`, `:MEASure`, and `:READ` queries listed above, according to the index value `n`:

Modes	n	Return Value
All except MSR, WLAN, LTEAFDD, LTEATDD, 5G NR	1	Meas Type: Total Power Reference Returns 82 comma-separated scalar results, in the following order: 1. Reserved for the future use, returns -999.0 2. Absolute power at the center frequency (reference) area (dBm) 3. Reserved for the future use, returns -999.0 4. Reserved for the future use, returns -999.0 5. Peak frequency in the center frequency (reference) area (Hz) 6. Reserved for the future use, returns -999.0 7. Reserved for the future use, returns -999.0 8. Reserved for the future use, returns -999.0 9. Reserved for the future use, returns -999.0 10. Reserved for the future use, returns -999.0 11. Relative integrated power on the negative offset A (dBc) 12. Absolute integrated power on the negative offset A (dBm) 13. Relative peak power on the negative offset A (dBc) 14. Absolute peak power on the negative offset A (dBm) 15. Peak power offset frequency from the center or carrier edge frequency in the negative offset A, depending on Offset Frequency Define settings (Hz) 16. Relative integrated power on the positive offset A (dBc)

Modes	n	Return Value
		17. Absolute integrated power on the positive offset A (dBm) 18. Relative peak power on the positive offset A (dBc) 19. Absolute peak power on the positive offset A (dBm) 20. Peak power offset frequency from the center or carrier edge frequency in the positive offset A, depending on Offset Frequency Define settings (Hz) 21. Relative integrated power on the negative offset B (dBc) --- 69. Absolute peak power on the positive offset F (dBm) 70. Peak power offset frequency from the center or carrier edge frequency in the positive offset F, depending on Offset Frequency Define settings (Hz) 71. Minimum margin from limit line on the negative offset A (dB) 72. Minimum margin from limit line on the positive offset A (dB) 73. Minimum margin from limit line on the negative offset B (dB) 74. Minimum margin from limit line on the positive offset B (dB) 75. Minimum margin from limit line on the negative offset C (dB) 76. Minimum margin from limit line on the positive offset C (dB) 77. Minimum margin from limit line on the negative offset D (dB) 78. Minimum margin from limit line on the positive offset D (dB) 79. Minimum margin from limit line on the negative offset E (dB) 80. Minimum margin from limit line on the positive offset E (dB) 81. Minimum margin from limit line on the negative offset F (dB) 82. Minimum margin from limit line on the positive offset F (dB)
All except MSR, WLAN, LTEAFDD, LTEATDD, 5G NR	1	**Meas Type: Power Spectral Density Reference** Returns 82 comma-separated scalar results, in the following order: 1. Reserved for the future use, returns -999.0 2. Absolute power at the center frequency (reference) area (dBm/Hz) 3. Reserved for the future use, returns -999.0 4. Reserved for the future use, returns -999.0 5. Peak frequency in the center frequency (reference) area (Hz) 6. Reserved for the future use, returns -999.0 7. Reserved for the future use, returns -999.0 8. Reserved for the future use, returns -999.0 9. Reserved for the future use, returns -999.0 10. Reserved for the future use, returns -999.0 11. Relative integrated power on the negative offset A (dB) 12. Absolute integrated power on the negative offset A (dBm/Hz) 13. Relative peak power on the negative offset A (dB) 14. Absolute peak power on the negative offset A (dBm/Hz)

Modes	n	Return Value
		15. Peak power offset frequency from the center or carrier edge frequency in the negative offset A, depending on Offset Frequency Define settings (Hz) 16. Relative integrated power on the positive offset A (dB) 17. Absolute integrated power on the positive offset A (dBm/Hz) 18. Relative peak power on the positive offset A (dB) 19. Absolute peak power on the positive offset A (dBm/Hz) 20. Peak power offset frequency from the center or carrier edge frequency in the positive offset A, depending on Offset Frequency Define settings (Hz) 21. Relative integrated power on the negative offset B (dB) --- 69. Absolute peak power on the positive offset F (dBm/Hz) 70. Peak power offset frequency from the center or carrier edge frequency in the positive offset F, depending on Offset Frequency Define settings (Hz) 71. Minimum margin from limit line on the negative offset A (dB) 72. Minimum margin from limit line on the positive offset A (dB) 73. Minimum margin from limit line on the negative offset B (dB) 74. Minimum margin from limit line on the positive offset B (dB) 75. Minimum margin from limit line on the negative offset C (dB) 76. Minimum margin from limit line on the positive offset C (dB) 77. Minimum margin from limit line on the negative offset D (dB) 78. Minimum margin from limit line on the positive offset D (dB) 79. Minimum margin from limit line on the negative offset E (dB) 80. Minimum margin from limit line on the positive offset E (dB) 81. Minimum margin from limit line on the negative offset F (dB) 82. Minimum margin from limit line on the positive offset F (dB)
All except MSR, WLAN, LTEAFDD, LTEATDD, 5G NR	1	**Meas Type: Spectrum Peak Reference** Returns 82 comma-separated scalar results, in the following order: 1. Reserved for the future use, returns -999.0 2. Peak power at the center frequency (reference) area (dBm) 3. Reserved for the future use, returns -999.0 4. Reserved for the future use, returns -999.0 5. Peak frequency in the center frequency (reference) area (Hz) 6. Reserved for the future use, returns -999.0 7. Reserved for the future use, returns -999.0 8. Reserved for the future use, returns -999.0 9. Reserved for the future use, returns -999.0 10. Reserved for the future use, returns -999.0

Modes	n	Return Value
		11. Reserved for the future use, returns -999.0 12. Reserved for the future use, returns -999.0 13. Relative peak power on the negative offset A (dB) 14. Absolute peak power on the negative offset A (dBm) 15. Peak power offset frequency from the center or carrier edge frequency in the negative offset A, depending on Offset Frequency Define settings (Hz) 16. Reserved for the future use, returns -999.0 17. Reserved for the future use, returns -999.0 18. Relative peak power on the positive offset A (dB) 19. Absolute peak power on the positive offset A (dBm) 20. Peak power offset frequency from the center or carrier edge frequency in the positive offset A, depending on Offset Frequency Define settings (Hz) 21. Reserved for the future use, returns -999.0 --- 69. Absolute peak power on the positive offset F (dBm) 70. Peak power offset frequency from the center or carrier edge frequency in the positive offset F, depending on Offset Frequency Define settings (Hz) 71. Minimum margin from limit line on the negative offset A (dB) 72. Minimum margin from limit line on the positive offset A (dB) 73. Minimum margin from limit line on the negative offset B (dB) 74. Minimum margin from limit line on the positive offset B (dB) 75. Minimum margin from limit line on the negative offset C (dB) 76. Minimum margin from limit line on the positive offset C (dB) 77. Minimum margin from limit line on the negative offset D (dB) 78. Minimum margin from limit line on the positive offset D (dB) 79. Minimum margin from limit line on the negative offset E (dB) 80. Minimum margin from limit line on the positive offset E (dB) 81. Minimum margin from limit line on the negative offset F (dB) 82. Minimum margin from limit line on the positive offset F (dB)
All	2	Returns the displayed frequency domain spectrum trace data for Trace 1 separated by commas
All	3	Returns the displayed frequency domain absolute limit trace data separated by commas
All	4	Returns the displayed frequency domain relative limit trace data separated by commas
All	5	**Meas Type: Total Power Reference** Returns comma-separated scalar values (in dBm) of the absolute integrated power of the segment frequencies. The length of the result depends on the number of available offset (See "Number of Offsets" on

Modes	n	Return Value
		page 1274) 1. Total power reference (dBm) 2. Reserved for the future use, returns -999.0 3. Absolute integrated power at negative offset frequency (A) 4. Absolute integrated power at positive offset frequency (A) --- 25. Absolute integrated power at negative offset frequency (L) 26. Absolute integrated power at positive offset frequency (L) In **MSR, 5G NR, and LTE-Advanced FDD/TDD** mode Returns outer offset results when Non-Contiguous Meas Region is set to Outer, and returns inner offset results when it is set to Inner, in the following order Available Power Ref selections differ depending on the mode. For details, see Section Power Ref 1. Reference power (dBm) – Power Ref: Left & Right Carriers – -> Left ref carrier power – Power Ref: Max Power Carrier in Sub-block – -> Ref carrier power of the left sub-block – Power Ref: Left & Right Sub-blocks – -> Integrated power in the left sub-block 2. Right reference power (dBm) – Power Ref: Left & Right Carriers – -> Right ref carrier power – Power Ref: Max Power Carrier in Sub-block – -> Ref carrier power of the right sub-block – Power Ref: Left & Right Sub-blocks – -> Integrated power in the right sub-block – Otherwise: -999.0 3. Absolute integrated power at negative offset frequency (A) 4. Absolute integrated power at positive offset frequency (A) --- 25. Absolute integrated power at negative offset frequency (L) 26. Absolute integrated power at positive offset frequency (L)

Modes	n	Return Value
		In **WLAN** mode. Returns 26 comma-separated scalar values (in dBm) of the absolute integrated power of the segment frequencies: 1. Ref carrier power (dBm) 2. Reserved for the future use, returns -999.0 3. Absolute integrated power at negative offset frequency (A) 4. Absolute integrated power at positive offset frequency (A) --- 25. Absolute integrated power at negative offset frequency (L) 26. Absolute integrated power at positive offset frequency (L) If the result is not available, -999.0 is returned The number of values returned is subject to change in future releases
All	5	**Meas Type: Power Spectral Density Reference** Returns comma-separated scalar values (in dBm/Hz) of the absolute integrated power of the segment frequencies. The length of the result depends on the number of available offset (See "Number of Offsets" on page 1274) 1. Power spectral density reference (dBm/Hz) 2. Reserved for the future use, returns -999.0 3. Absolute integrated power at negative offset frequency (A) 4. Absolute integrated power at positive offset frequency (A) --- 25. Absolute integrated power at negative offset frequency (L) 26. Absolute integrated power at positive offset frequency (L) In **MSR, 5G NR, and LTE-Advanced FDD/TDD** mode Returns outer offset results when Non-Contiguous Meas Region is set to Outer, and returns inner offset results when it is set to Inner, in the following order Available Power Ref selections differ depending on the mode. For details, see Power Ref 1. Reference power (dBm/Hz) – Power Ref: Left & Right Carriers – -> Left ref carrier power – Power Ref: Max Power Carrier in Sub-block – -> Ref carrier power of the left sub-block – Power Ref: Left & Right Sub-blocks – -> Integrated power in the left sub-block 2. Right reference power (dBm)

Modes	n	Return Value
		– Power Ref: Left & Right Carriers – -> Right ref carrier power – Power Ref: Max Power Carrier in Sub-block – -> Ref carrier power of the right sub-block – Power Ref: Left & Right Sub-blocks – -> Integrated power in the right sub-block – Otherwise: -999.0 3. Absolute integrated power at negative offset frequency (A) 4. Absolute integrated power at positive offset frequency (A) --- 25. Absolute integrated power at negative offset frequency (L) 26. Absolute integrated power at positive offset frequency (L) In **WLAN** mode. Returns 26 comma-separated scalar values (in dBm/Hz) of the absolute integrated power of the segment frequencies: 1. Ref carrier power (dBm/Hz) 2. Reserved for the future use, returns -999.0 3. Absolute integrated power at negative offset frequency (A) 4. Absolute integrated power at positive offset frequency (A) --- 25. Absolute integrated power at negative offset frequency (L) 26. Absolute integrated power at positive offset frequency (L) If the result is not available, -999.0 is returned The number of values returned is subject to change in future releases
All	5	**Meas Type: Spectrum Peak Reference** Returns comma-separated scalar values (in dBm) of the absolute peak power of the segment frequencies. The length of the result depends on the number of available offset (See "Number of Offsets" on page 1274) 1. Spectrum Peak Power reference (dBm) 2. Reserved for the future use, returns -999.0 3. Absolute peak power at negative offset frequency (A) 4. Absolute peak power at positive offset frequency (A) --- 25. Absolute peak power at negative offset frequency (L) 26. Absolute peak power at positive offset frequency (L) In **MSR, 5G NR, and LTE-Advanced FDD/TDD** mode Returns outer offset results when Non-Contiguous Meas Region is set to

Modes	n	Return Value
		Outer, and returns inner offset results when it is set to Inner, in the following order Available Power Ref selections differ depending on the mode. For details, see Power Ref. 1.Spectrum Peak Power reference (dBm) – Power Ref: Left & Right Carriers – -> Spectrum Peak Power reference at the left reference carrier – Power Ref: Max Power Carrier in Sub-block – -> Spectrum Peak Power reference of the left sub-block – Power Ref: Left & Right Sub-blocks – -> Spectrum Peak Power reference in the left sub-block 2. Spectrum Peak Power reference (dBm) – Power Ref: Left & Right Carriers – -> Spectrum Peak Power reference at the right reference carrier – Power Ref: Max Power Carrier in Sub-block – -> Spectrum Peak Power reference of the right sub-block – Power Ref: Left & Right Sub-blocks – -> Spectrum Peak Power reference in the right sub-block – Otherwise: -999.0 3. Absolute peak power at negative offset frequency (A) 4. Absolute peak power at positive offset frequency (A) --- 25. Absolute peak power at negative offset frequency (L) 26. Absolute peak power at positive offset frequency (L) If the result is not available, -999.0 is returned The number of values returned is subject to change in future releases
All	6	**Meas Type: Total Power Reference** Returns comma-separated scalar values (in dBc) of the integrated power relative to the carrier at the segment frequencies. The length of the result depends on the number of available offset (See "Number of Offsets" on page 1274) When in the MSR, LTE-Advanced FDD/TDD, and 5G NR modes, returns outer offset results when Non-Contiguous Meas Region is set to Outer, and returns inner offset results when it is set to Inner, in the following order 1. Reserved for the future use, returns -999.0

Modes	n	Return Value
		2. Reserved for the future use, returns -999.0 3. Relative integrated power at negative offset frequency (A) 4. Relative integrated power at positive offset frequency (A) --- 25. Relative integrated power at negative offset frequency (L) 26. Relative integrated power at positive offset frequency (L) If the result is not available, -999.0 is returned The number of values returned is subject to change in future releases
All	6	**Meas Type: Power Spectral Density Reference** Returns comma-separated scalar values (in dBc/Hz) of the integrated power relative to the carrier at the segment frequencies. The length of the result depends on the number of available offset (See "Number of Offsets" on page 1274) When in the MSR, LTE-Advanced FDD/TDD, and 5G NR modes, returns outer offset results when Non-Contiguous Meas Region is set to Outer, and returns inner offset results when it is set to Inner, in the following order Returns -999.0 for the offsets if in WLAN: 1. Reserved for the future use, returns -999.0 2. Reserved for the future use, returns -999.0 3. Relative integrated power at negative offset frequency (A) 4. Relative integrated power at positive offset frequency (A) --- 25. Relative integrated power at negative offset frequency (L) 26. Relative integrated power at positive offset frequency (L) If the result is not available, -999.0 is returned The number of values returned is subject to change in future releases
All	6	**Meas Type: Spectrum Peak Reference** Returns comma-separated scalar values (in dB) of the integrated power relative to the carrier at the segment frequencies. The length of the result depends on the number of available offset (See "Number of Offsets" on page 1274) When in the MSR, LTE-Advanced FDD/TDD, and 5G NR modes, returns outer offset results when Non-Contiguous Meas Region is set to Outer, and returns inner offset results when it is set to Inner, in the following order 1. Reserved for the future use, returns -999.0 2. Reserved for the future use, returns -999.0 3. Relative peak power at negative offset frequency (A) 4. Relative peak power at positive offset frequency (A) --- 25. Relative peak power at negative offset frequency (L)

Modes	n	Return Value
		26. Relative peak power at positive offset frequency (L) If the result is not available, -999.0 is returned The number of values returned is subject to change in future releases
All	7	Returns comma-separated pass/fail test results (0=passed, or 1=failed) determined by testing the minimum margin point from the limit line that is determined each offset's Limits setting. The length of the result depends on the number of available offset (See "Number of Offsets" on page 1274) When in the MSR, LTE-Advanced FDD/TDD, and 5G NR modes, returns outer offset results when Non-Contiguous Meas Region is set to Outer, and returns inner offset results when it is set to Inner, in the following order 1. Reserved for the future use, returns -999.0 2. Reserved for the future use, returns -999.0 3. At negative offset frequency (A) 4. At positive offset frequency (A) --- 25. At negative offset frequency (L) 26. At positive offset frequency (L) The number of values returned is subject to change in future releases
All	8	Offset Pass/Fail Returns comma-separated pass/fail test results (0=passed, or 1=failed) determined by testing the minimum margin point from the limit line that is determined each offset's Limits setting. The length of the result depends on the number of available offset (See "Number of Offsets" on page 1274) When in the MSR, LTE-Advanced FDD/TDD, and 5G NR modes, returns outer offset results when Non-Contiguous Meas Region is set to Outer, and returns inner offset results when it is set to Inner, in the following order Note: These results (n=8) are the same as n=7 result 1. Reserved for the future use, returns -999.0 2. Reserved for the future use, returns -999.0 3. At negative offset frequency (A) 4. At positive offset frequency (A) --- 25. At negative offset frequency (L) 26. At positive offset frequency (L) The number of values returned is subject to change in future releases
All	9	Offset Peak Power Freq Returns comma-separated scalar values of frequency (in Hz) that have peak power from center or carrier edge frequency in each offset, depending on Offset Frequency Define settings. The length of the result

Modes	n	Return Value
		depends on the number of available offset (See "Number of Offsets" on page 1274) When in the MSR, LTE-Advanced FDD/TDD, and 5G NR modes, returns outer offset results when Non-Contiguous Meas Region is set to Outer, and returns inner offset results when it is set to Inner, in the following order 1. Reserved for the future use, returns -999.0 2. Reserved for the future use, returns -999.0 3. Negative offset frequency (A) 4. Positive offset frequency (A) --- 25. Negative offset frequency (L) 26. Positive offset frequency (L) If the result is not available, -999.0 is returned The number of values returned is subject to change in future releases
All	10	Offset Abs Peak Power Returns comma-separated scalar values (in dBm) of the absolute peak power of the segment frequencies. The length of the result depends on the number of available offset (See "Number of Offsets" on page 1274) When in the MSR, LTE-Advanced FDD/TDD, and 5G NR modes, returns outer offset results when Non-Contiguous Meas Region is set to Outer, and returns inner offset results when it is set to Inner, in the following order 1. Reserved for the future use, returns -999.0 2. Reserved for the future use, returns -999.0 3. At negative offset frequency (A) 4. At positive offset frequency (A) --- 25. At negative offset frequency (L) 26. At positive offset frequency (L) If the result is not available, -999.0 is returned The number of values returned is subject to change in future releases
All	11	Offset Rel Peak Power Returns comma-separated scalar values in dBc (dB if MeasType = PSD) of the peak power relative to the carrier at the segment frequencies. The length of the result depends on the number of available offset (See "Number of Offsets" on page 1274) When in the MSR, LTE-Advanced FDD/TDD, and 5G NR modes, returns outer offset results when Non-Contiguous Meas Region is set to Outer, and returns inner offset results when it is set to Inner, in the following order 1. Reserved for the future use, returns -999.0

Modes	n	Return Value
		2. Reserved for the future use, returns -999.0 3. At negative offset frequency (A) 4. At positive offset frequency (A) --- 25. At negative offset frequency (L) 26. At positive offset frequency (L) If the result is not available, -999.0 is returned The number of values returned is subject to change in future releases
All	12	Returns the power result (the peak power of the signal in the ref channel) when Meas Type is Spectrum Peak reference. Otherwise, the value returned will be -999.0 When in the MSR, LTE-Advanced FDD/TDD, and 5G NR modes, returns outer offset results when Non-Contiguous Meas Region is set to Outer, and returns inner offset results when it is set to Inner
All	14	Meas Type: Total Power Reference Returns comma-separated scalar results, in the following order: When in the MSR, LTE-Advanced FDD/TDD, and 5G NR modes, returns outer offset results when Non-Contiguous Meas Region is set to Outer, and returns inner offset results when it is set to Inner, in the following order 1. Relative integrated power on the negative offset A (dBc) 2. Absolute integrated power on the negative offset A (dBm) 3. Relative peak power on the negative offset A (dBc) 4. Absolute peak power on the negative offset A (dBm) 5. Peak power offset frequency from the center or carrier edge frequency in the negative offset A, depending on Offset Frequency Define settings (Hz) 6. Relative integrated power on the positive offset A (dBc) 7. Absolute integrated power on the positive offset A (dBm) 8. Relative peak power on the positive offset A (dBc) 9. Absolute peak power on the positive offset A (dBm) 10. Peak power offset frequency from the center or carrier edge frequency in the positive offset A, depending on Offset Frequency Define settings (Hz) 11. Relative integrated power on the negative offset B (dBc) --- 119. Absolute peak power on the positive offset L (dBm) 120. Peak power offset frequency from the center or carrier edge frequency in the positive offset L, depending on Offset Frequency Define settings (Hz) If the result is not available, NaN (9.91E+37) is returned The length of the result depends on the number of available offset (See "Number of Offsets" on page 1274)

Modes	n	Return Value
		The number of values returned is subject to change in future releases
All	14	**Meas Type: Power Spectral Density Reference** Returns comma-separated scalar results, in the following order: When in the MSR, LTE-Advanced FDD/TDD, and 5G NR modes, returns outer offset results when Non-Contiguous Meas Region is set to Outer, and returns inner offset results when it is set to Inner, in the following order 1. Relative integrated power on the negative offset A (dB) 2. Absolute integrated power on the negative offset A (dBm/Hz) 3. Relative peak power on the negative offset A (dB) 4. Absolute peak power on the negative offset A (dBm/Hz) 5. Peak power offset frequency from the center or carrier edge frequency in the negative offset A, depending on Offset Frequency Define settings (Hz) 6. Relative integrated power on the positive offset A (dB) 7. Absolute integrated power on the positive offset A (dBm/Hz) 8. Relative peak power on the positive offset A (dB) 9. Absolute peak power on the positive offset A (dBm/Hz) 10. Peak power offset frequency from the center or carrier edge frequency in the positive offset A, depending on Offset Frequency Define settings (Hz) 11. Relative integrated power on the negative offset B (dB) --- 119. Absolute peak power on the positive offset L (dBm/Hz) 120. Peak power offset frequency from the center or carrier edge frequency in the positive offset L, depending on Offset Frequency Define settings (Hz) If the result is not available, NaN (9.91E+37) is returned The length of the result depends on the number of available offset (See "Number of Offsets" on page 1274) The number of values returned is subject to change in future releases
All	14	**Meas Type: Spectrum Peak Reference** Returns comma-separated scalar results, in the following order: When in the MSR, LTE-Advanced FDD/TDD, and 5G NR modes, returns outer offset results when Non-Contiguous Meas Region is set to Outer, and returns inner offset results when it is set to Inner, in the following order 1. Reserved for the future use, returns NaN (9.91E+37) 2. Reserved for the future use, returns NaN (9.91E+37) 3. Relative peak power on the negative offset A (dB) 4. Absolute peak power on the negative offset A (dBm) 5. Peak power offset frequency from the center or carrier edge frequency

Modes	n	Return Value
		in the negative offset A, depending on Offset Frequency Define settings (Hz) 6. Reserved for the future use, returns NaN (9.91E+37) 7. Reserved for the future use, returns NaN (9.91E+37) 8. Relative peak power on the positive offset A (dB) 9. Absolute peak power on the positive offset A (dBm) 10. Peak power offset frequency from the center or carrier edge frequency in the positive offset A, depending on Offset Frequency Define settings (Hz) 11. Relative integrated power on the negative offset B (dB) --- 119. Absolute peak power on the positive offset L (dBm) 120. Peak power offset frequency from the center or carrier edge frequency in the positive offset L, depending on Offset Frequency Define settings (Hz) If the result is not available, NaN (9.91E+37) is returned The length of the result depends on the number of available offset (See "Number of Offsets" on page 1274) The number of values returned is subject to change in future releases
All	15	**Meas Type: Total Power Reference** Returns comma-separated scalar results, in the following order: When in the MSR, LTE-Advanced FDD/TDD, and 5G NR modes, returns outer offset results when Non-Contiguous Meas Region is set to Outer, and returns inner offset results when it is set to Inner, in the following order 1. Minimum margin from limit line on the negative offset A (dB) 2. Minimum margin from limit line on the positive offset A (dB) 3. Minimum margin from limit line on the negative offset B (dB) 4. Minimum margin from limit line on the positive offset B (dB) --- 23. Minimum margin from limit line on the negative offset L (dB) 24. Minimum margin from limit line on the positive offset L (dB) If the result is not available, NaN (9.91E+37) is returned The length of the result depends on the number of available offset (See "Number of Offsets" on page 1274) The number of values returned is subject to change in future releases
All	18	Returns the displayed frequency domain spectrum trace data for Trace 2 separated by commas
All	19	Returns the displayed frequency domain spectrum trace data for Trace 3 separated by commas

Number of Offsets

The number of available offsets varies depending on the mode and option as below.

Mode	The number of available offsets
MSR LTEAFDD, LTEATDD, 5G NR	12 (Offset A to L)
WLAN	12 (Offset A to L)
Other modes with option N9060A-7FP	12 (Offset A to L)
Other modes without option N9060A-7FP	6 (Offset A to F)

3.10.1 Views

In the SA and WCDMA mode, there are three views. In the MSR, LTE-Advanced FDD/TDD and 5G NR modes, there are four views.

In the following table:

- The Enumerated ID is used with the remote command `:DISP:SEM:VIEW`
- The Numeric ID is used with the remote command `:DISP:SEM:VIEW:NSEL`

Enumerated ID	Numeric ID	View Name	Details
`APFReq`	1	Abs Pwr Freq	Displays the absolute power levels in dBm and the corresponding frequencies in the text window
`RPFReq`	2	Rel Pwr Freq	Displays the relative power levels in dBc and the corresponding frequencies in the text window
`IPOWer`	3	Integrated Power	Displays the absolute and relative power levels integrated throughout the bandwidths between the start and stop frequencies in the text window
`CINFormation`	4	Carrier Info	Displays the carrier info table. (Only available in MSR, LTE-Advanced FDD/TDD) and 5G NR MSR is not supported in UXM

View Selection by Name

Remote Command	`:DISPlay:SEMask:VIEW[:SELect] APFReq | RPFReq | IPOWer | CINFormation` `:DISPlay:SEMask:VIEW[:SELect]?`
Example	`:DISP:SEM:VIEW IPOW` `:DISP:SEM:VIEW?`
Dependencies	In SA mode, when "Radio Standard" is set to WLAN, `IPOWer` is not available

	CINFormation is available only in MSR, LTE-Advanced FDD/TDD and 5G NR modes
Preset	APFReq unless noted below RPFReq WLAN
State Saved	Saved in instrument state
Range	Abs Pwr Freq| Rel Pwr Freq|Integrated Power|Carrier Info

Views Selection by Number

Remote Command	`:DISPlay:SEMask:VIEW:NSELect <integer>` `:DISPlay:SEMask:VIEW:NSELect?`
Example	`:DISP:SEM:VIEW:NSEL 2` `:DISP:SEM:VIEW:NSEL?`
Dependencies	In SA mode, when "Radio Standard" is set to WLAN, Option 3 is not available Option 4 is available only in MSR, LTE-Advanced FDD/TDD and 5G NR modes
Preset	1 unless noted below: 2 WLAN
State Saved	Saved in instrument state
Min/Max	MSR, LTEAFDD, LTEATDD, 5G NR:1/4 Other modes: 1/3

3.10.1.1 Abs Pwr Freq

Displays the absolute power levels in dBm and the corresponding frequencies in the text window.

Windows: "Graph" on page 1276, "Table" on page 1281

Example	`:DISP:SEM:VIEW APFR`

3.10.1.2 Rel Pwr Freq

Displays the relative power levels in dBc and the corresponding frequencies in the text window.

Windows: "Graph" on page 1276, "Table" on page 1281

Example	`:DISP:SEM:VIEW RPFR`

3.10.1.3 Integrated Power

Displays the absolute and relative power levels integrated throughout the bandwidths between the start and stop frequencies in the text window.

Windows: "Graph" on page 1276, "Table" on page 1281

Example	`:DISP:SEM:VIEW IPOW`

3.10.2 Windows

There are four windows available in the SEM measurement. In all Modes, the Graph and Table windows are available. In the MSR, LTE-Advanced FDD/TDD and 5G NR modes, an additional window, Carrier Info, is available. When Gate View is on, the Gate window is available.

This section describes the windows.

3.10.2.1 Graph

The Graph window is used to display the spectrum being measured by the SEM measurement.

The Graph window appears in several Views, as follows:

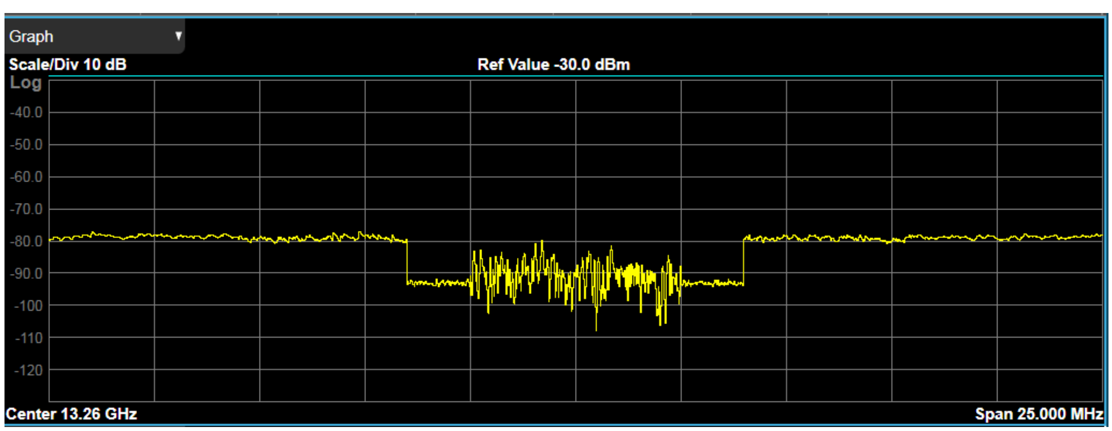
View	Size	Position
Abs Pwr Freq	Three fifth, full width	Top
Rel Pwr Freq	Three fifth, full width	Top
Integrated Power	Three fifth, full width	Top
Gate View	One third, full width	Middle

The Graph differs depending on which View you are in. The views differ depending on the setting of the measurement type (Meas Type) under the Measurement Setup menu

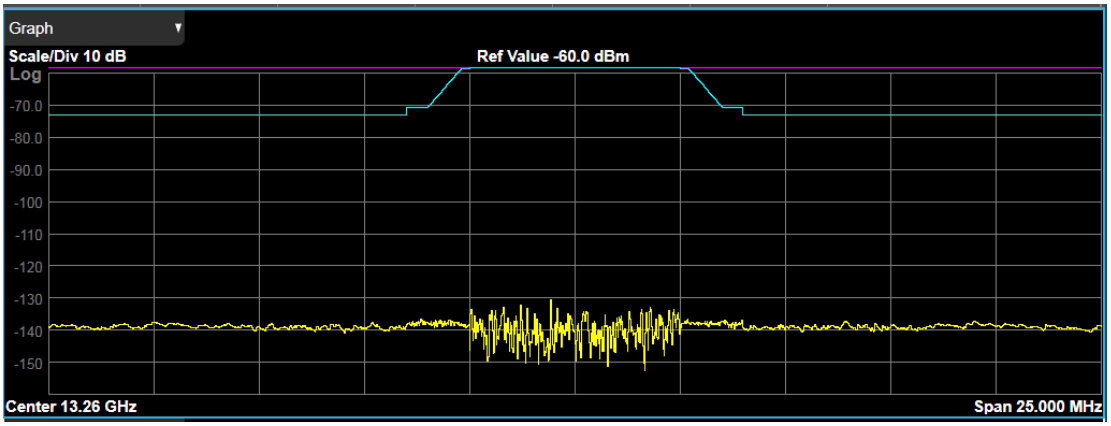
Graph Window in Abs Pwr Freq View

Corresponding Trace	yellow - Combined trace from carrier and each offset

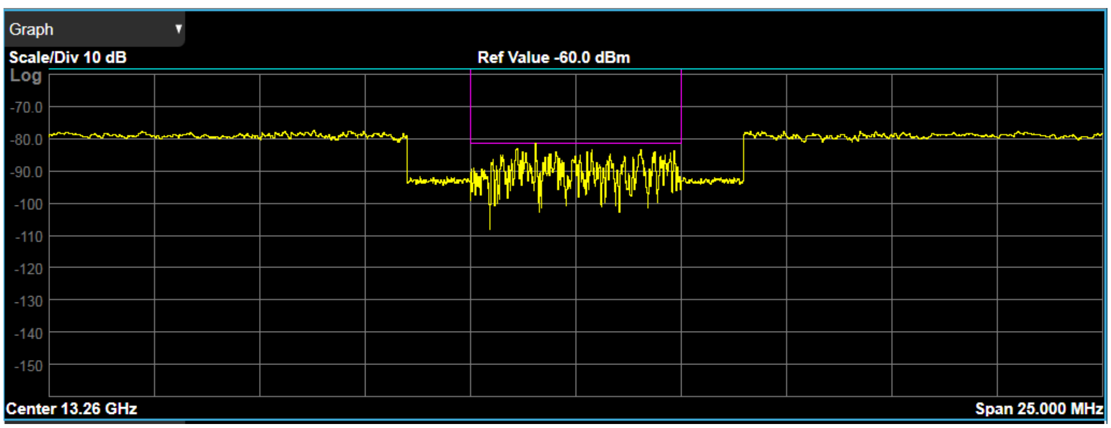
Abs Peak Pwr & Freq (Total Pwr Ref)



Abs Peak Pwr & Freq (PSD Ref)



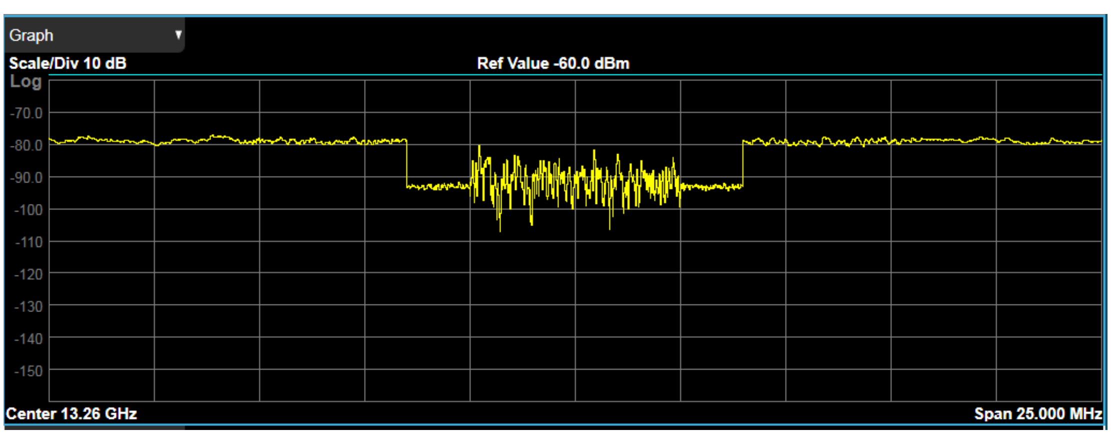
Abs Peak Pwr & Freq (Spectrum Pk Ref)



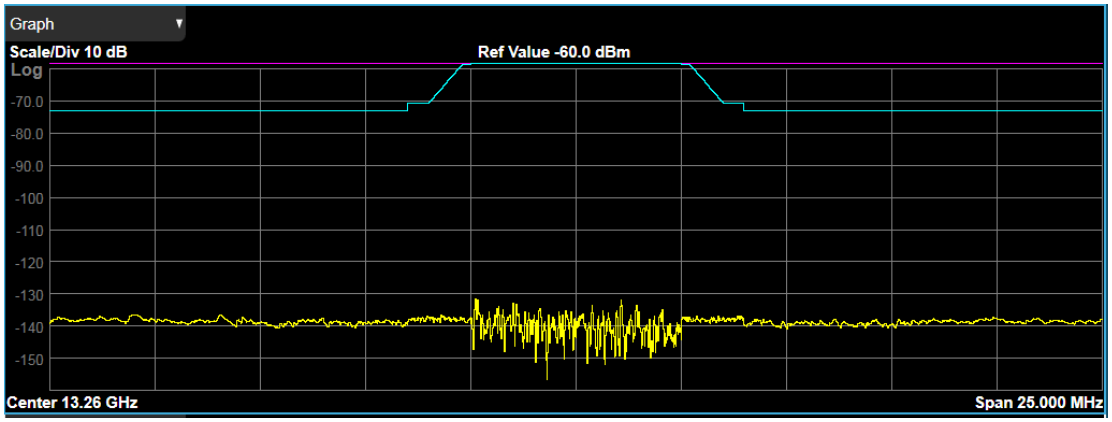
Graph Window in Rel Pwr Freq View

Corresponding Trace	yellow - Combined trace from carrier and each offset

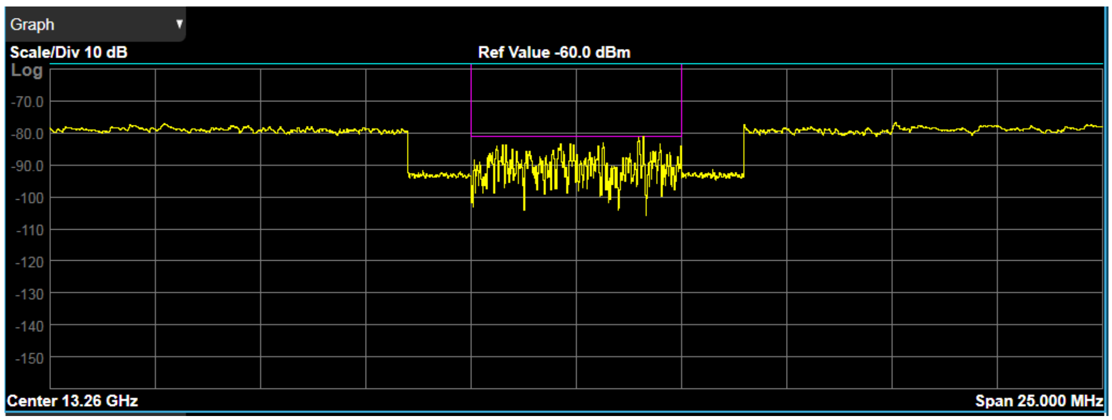
Rel Peak Pwr & Freq (Total Pwr Ref)



Rel Peak Pwr & Freq (PSD Ref)



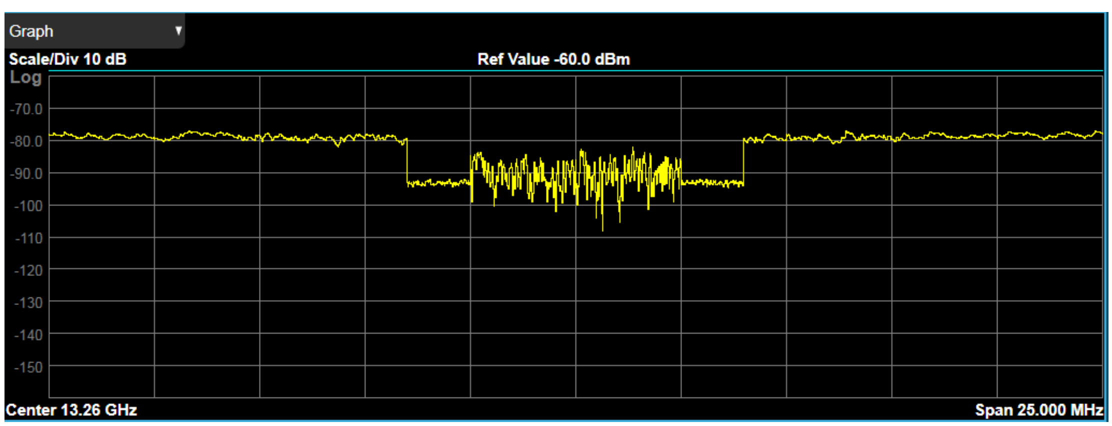
Rel Peak Pwr & Freq (Spectrum Pk Ref)



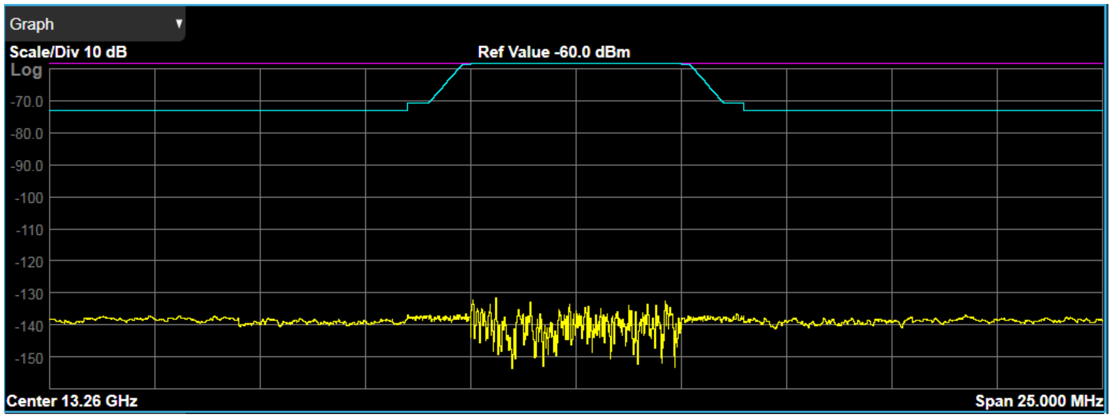
Graph Window in Integrated Power View

Corresponding Trace	yellow - Combined trace from carrier and each offset

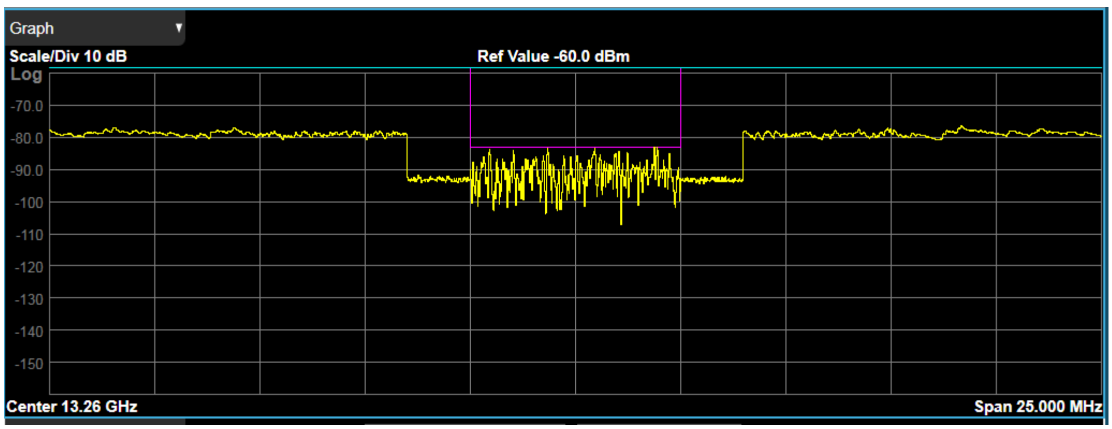
Integrated Power (Total Pwr Ref)



Integrated Power (PSD Ref)



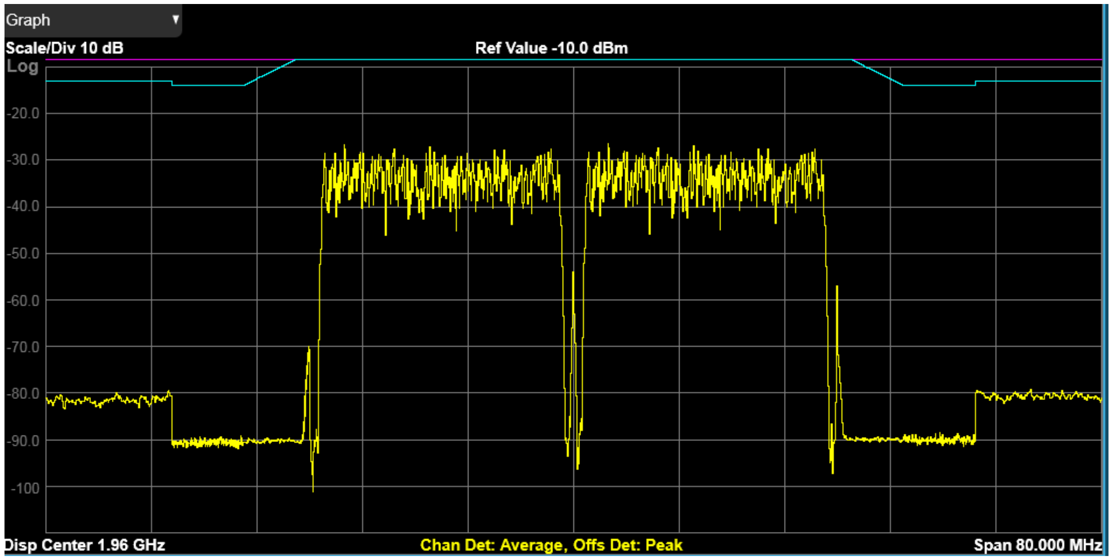
Integrated Power (Spectrum Pk Ref)



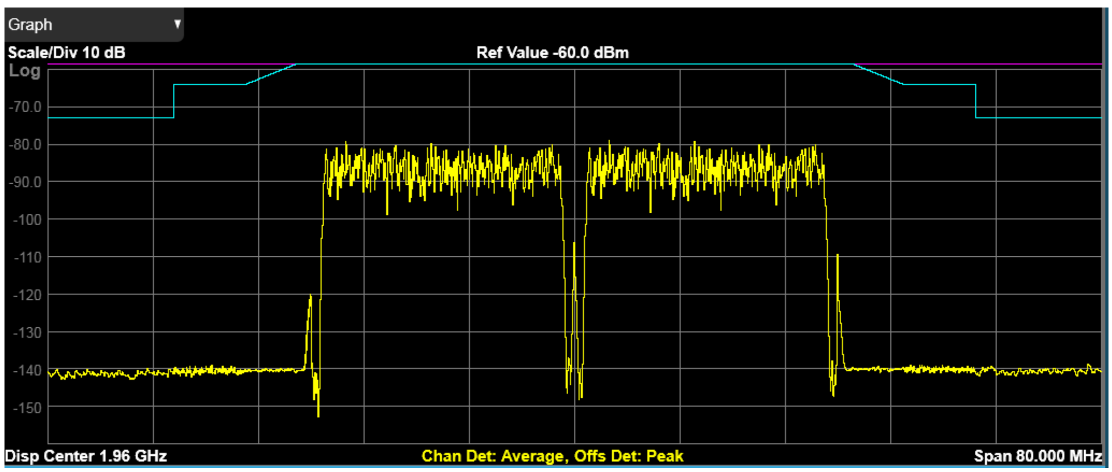
Graph Window in Carrier Info View

Sets the display to the carrier info view. The views differ depending on the setting of the measurement type (Meas Type) under the Measurement Setup menu.

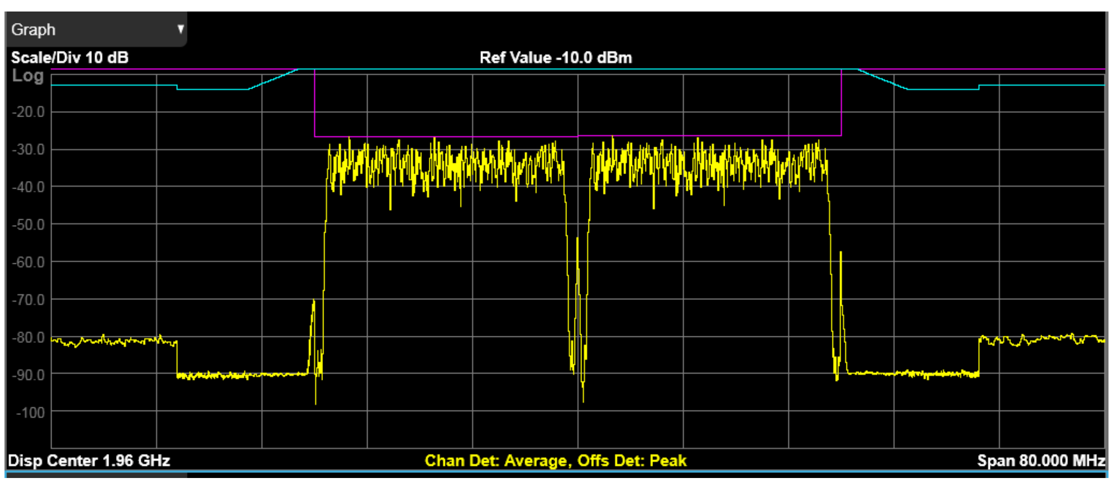
Spectrum trace (Total Pwr Ref)



Spectrum trace (PSD Ref)



Spectrum trace (Spectrum Pk Ref)



3.10.2.2 Table

The Metrics window displays the textual results of the SEM measurement. The Table differs depending on which View you are in. The views differ depending on the setting of the measurement type (Meas Type) under the Measurement Setup menu

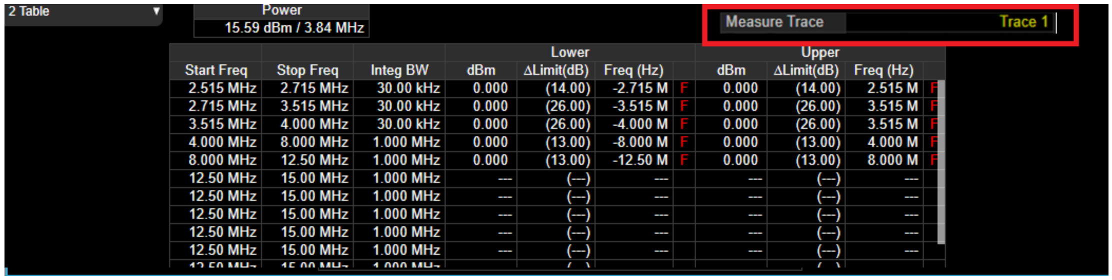
View	Size	Position
Abs Pwr Freq	Two fifth, full width	Bottom
Rel Pwr Freq	Two fifth, full width	Bottom
Integrated Power	Two fifth, full width	Bottom
Gate View	One third, full width	Bottom

Table Window in Abs Pwr Freq View

Abs Peak Pwr & Freq (Total Pwr Ref) Results Window

Name	Corresponding Results
Power	n=1 2nd element
	Absolute power at the reference area
	Channel Integration Bandwidth
Reference	In multi-carrier applications, this column displays which carrier is reference carrier
Measure Trace	See "Measure Trace" on page 1433
Start Freq (Hz)	Start frequency for offset
Stop Freq (Hz)	Stop frequency for offset
Integ BW (Hz)	Measurement bandwidth for offset
Lower Peak (dBm)	Absolute peak power on minimum margin point of the negative offset
Lower Δlim (dB)	Minimum margin from limit line which is decided by Fail Mask setting on the negative offset
Lower Freq (Hz)	Frequency on minimum margin point of the negative offset
Upper Peak (dBm)	Absolute peak power on minimum margin point of the positive offset
Upper Δlim (dB)	Minimum margin from limit line which is decided by Fail Mask setting on the positive offset
Upper Freq (Hz)	Frequency on minimum margin point of the positive offset

Metrics Window (for modes other than MSR, LTE-Advanced FDD/TDD and 5G NR)



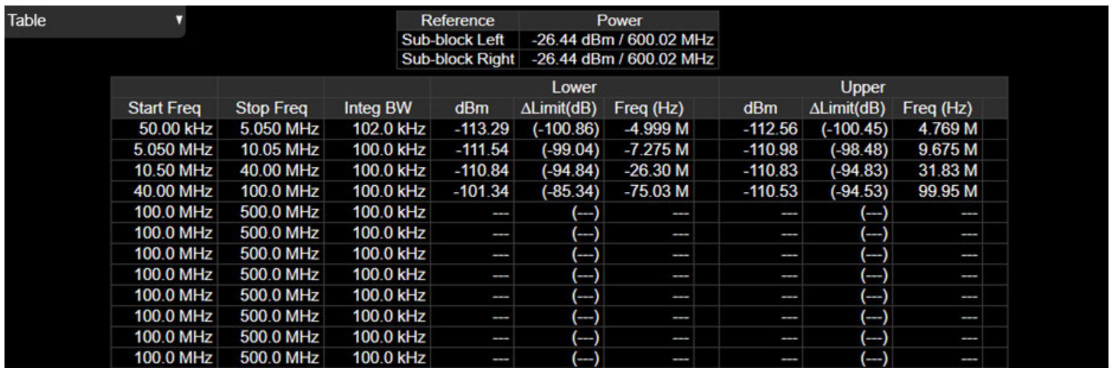
2 Table

Power
15.59 dBm / 3.84 MHz

Measure Trace: Trace 1

			Lower				Upper			
Start Freq	Stop Freq	Integ BW	dBm	ΔLimit(dB)	Freq (Hz)		dBm	ΔLimit(dB)	Freq (Hz)	
2.515 MHz	2.715 MHz	30.00 kHz	0.000	(14.00)	-2.715 M	F	0.000	(14.00)	2.515 M	F
2.715 MHz	3.515 MHz	30.00 kHz	0.000	(26.00)	-3.515 M	F	0.000	(26.00)	3.515 M	F
3.515 MHz	4.000 MHz	30.00 kHz	0.000	(26.00)	-4.000 M	F	0.000	(26.00)	3.515 M	F
4.000 MHz	8.000 MHz	1.000 MHz	0.000	(13.00)	-8.000 M	F	0.000	(13.00)	4.000 M	F
8.000 MHz	12.50 MHz	1.000 MHz	0.000	(13.00)	-12.50 M	F	0.000	(13.00)	8.000 M	F
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---		---	(---)	---	
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---		---	(---)	---	
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---		---	(---)	---	
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---		---	(---)	---	
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---		---	(---)	---	

Metrics window (for MSR, LTE-Advanced FDD/TDD and 5G NR)



Table

Reference	Power
Sub-block Left	-26.44 dBm / 600.02 MHz
Sub-block Right	-26.44 dBm / 600.02 MHz

			Lower			Upper		
Start Freq	Stop Freq	Integ BW	dBm	ΔLimit(dB)	Freq (Hz)	dBm	ΔLimit(dB)	Freq (Hz)
50.00 kHz	5.050 MHz	102.0 kHz	-113.29	(-100.86)	-4.999 M	-112.56	(-100.45)	4.769 M
5.050 MHz	10.05 MHz	100.0 kHz	-111.54	(-99.04)	-7.275 M	-110.98	(-98.48)	9.675 M
10.50 MHz	40.00 MHz	100.0 kHz	-110.84	(-94.84)	-26.30 M	-110.83	(-94.83)	31.83 M
40.00 MHz	100.0 MHz	100.0 kHz	-101.34	(-85.34)	-75.03 M	-110.53	(-94.53)	99.95 M
100.0 MHz	500.0 MHz	100.0 kHz	---	(---)	---	---	(---)	---
100.0 MHz	500.0 MHz	100.0 kHz	---	(---)	---	---	(---)	---
100.0 MHz	500.0 MHz	100.0 kHz	---	(---)	---	---	(---)	---
100.0 MHz	500.0 MHz	100.0 kHz	---	(---)	---	---	(---)	---
100.0 MHz	500.0 MHz	100.0 kHz	---	(---)	---	---	(---)	---
100.0 MHz	500.0 MHz	100.0 kHz	---	(---)	---	---	(---)	---
100.0 MHz	500.0 MHz	100.0 kHz	---	(---)	---	---	(---)	---
100.0 MHz	500.0 MHz	100.0 kHz	---	(---)	---	---	(---)	---

Abs Peak Pwr & Freq (PSD Ref) Results Window

Name	Corresponding Results
Power	n=1 2nd element Absolute power at the reference area Channel Integration Bandwidth
Reference	In multi-carrier applications, this column displays which carrier is reference carrier
Measure Trace	See "Measure Trace" on page 1433
PSD Ref	n=5 1st element Power spectral density reference at the reference area
Start Freq (Hz)	Start frequency for offset
Stop Freq (Hz)	Stop frequency for offset
Integ BW (Hz)	Measurement bandwidth for offset
Lower (dBm/Hz)	Absolute power spectrum density of the negative offset
Lower Δlim (dB)	Minimum margin from limit line which is decided by Fail Mask setting on the negative offset
Lower Freq (Hz)	Frequency on minimum margin point of the negative offset
Upper (dBm/Hz)	Absolute power spectrum density of the positive offset
Upper Δlim (dB)	Minimum margin from limit line which is decided by Fail Mask setting on the positive offset
Upper Freq (Hz)	Frequency on minimum margin point of the positive offset

Metrics window for modes other than MSR, LTE-Advanced FDD/TDD and 5G NR

Table ▾

Ref Carrier Power	PSD Ref
15.59 dBm / 3.84 MHz	-50.25 dBm/Hz

			Lower				Upper			
Start Freq	Stop Freq	Integ BW	dBm/Hz	ΔLim (dB)	Freq (Hz)		dBm/Hz	ΔLim (dB)	Freq (Hz)	
2.515 MHz	2.715 MHz	30.00 kHz	-45.02	(14.00)	-2.715 M	F	-45.02	(14.00)	2.515 M	F
2.715 MHz	3.515 MHz	30.00 kHz	-45.02	(26.00)	-3.515 M	F	-45.02	(26.00)	3.515 M	F
3.515 MHz	4.000 MHz	30.00 kHz	-45.02	(26.00)	-4.000 M	F	-45.02	(26.00)	3.515 M	F
4.000 MHz	8.000 MHz	1.000 MHz	-60.25	(13.00)	-8.000 M	F	-60.25	(13.00)	4.000 M	F
8.000 MHz	12.50 MHz	1.000 MHz	-60.25	(13.00)	-12.50 M	F	-60.25	(13.00)	8.000 M	F
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---		---	(---)	---	

Metrics window for MSR, LTE-Advanced FDD/TDD and 5G NR

Table ▾

Reference	Power	PSD Ref
Sub-block Left	-27.97 dBm / 600.02 MHz	-115.74 dBm/Hz
Sub-block Right	-27.97 dBm / 600.02 MHz	-115.74 dBm/Hz

			Lower			Upper		
Start Freq	Stop Freq	Integ BW	dBm/Hz	ΔLim (dB)	Freq (Hz)	dBm/Hz	ΔLim (dB)	Freq (Hz)
50.00 kHz	5.050 MHz	102.0 kHz	-135.03	(-63.04)	-50.00 k	-135.16	(-63.18)	50.00 k
5.050 MHz	10.50 MHz	100.0 kHz	-140.94	(-75.53)	-9.655 M	-140.29	(-74.75)	5.486 M
10.50 MHz	20.00 MHz	1.000 MHz	-141.66	(-66.86)	-11.59 M	-140.92	(-66.07)	16.63 M
4.000 MHz	8.000 MHz	1.000 MHz	---	(---)	---	---	(---)	---
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

Abs Peak Pwr & Freq (Spectrum Pk Ref) Results Window

Name	Corresponding Results
Power	Absolute power at the reference area Channel Integration Bandwidth
Reference	In multi-carrier applications, this column displays which carrier is reference carrier
Measure Trace	See "Measure Trace" on page 1433
Spectrum Peak Ref	n=5 1st element Spectrum peak power reference at the reference area
Start Freq (Hz)	Start frequency for offset
Stop Freq (Hz)	Stop frequency for offset
Integ BW (Hz)	Measurement bandwidth for offset
Lower(dBm)	Absolute peak power on minimum margin point of the negative offset
Lower Δlim (dB)	Minimum margin from limit line which is decided by Fail Mask setting on the negative offset
Lower Freq (Hz)	Frequency on minimum margin point of the negative offset
Upper (dBm)	Absolute peak power on minimum margin point of the positive offset
Upper Δlim (dB)	Minimum margin from limit line which is decided by Fail Mask setting on the positive offset
Upper Freq (Hz)	Frequency on minimum margin point of the positive offset

Metrics window for modes other than MSR, LTE-Advanced FDD/TDD and 5G NR

Table ▾

Ref Carrier Power	Spectrum Peak Ref
15.59 dBm / 3.84 MHz	0.00 dBm

			Lower				Upper			
Start Freq	Stop Freq	Integ BW	dBm	ΔLim (dB)	Freq (Hz)		dBm	ΔLim (dB)	Freq (Hz)	
2.515 MHz	2.715 MHz	30.00 kHz	0.00	(14.00)	-2.715 M	F	0.00	(14.00)	2.515 M	F
2.715 MHz	3.515 MHz	30.00 kHz	0.00	(26.00)	-3.515 M	F	0.00	(26.00)	3.515 M	F
3.515 MHz	4.000 MHz	30.00 kHz	0.00	(26.00)	-4.000 M	F	0.00	(26.00)	3.515 M	F
4.000 MHz	8.000 MHz	1.000 MHz	0.00	(13.00)	-8.000 M	F	0.00	(13.00)	4.000 M	F
8.000 MHz	12.50 MHz	1.000 MHz	0.00	(13.00)	-12.50 M	F	0.00	(13.00)	8.000 M	F
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---		---	(---)	---	

Metrics window for MSR, LTE-Advanced FDD/TDD and 5G NR

Table ▾

Reference	Power	Spectrum Peak Ref
Sub-block Left	-67.62 dBm / 600.02 MHz	-77.19 dBm
Sub-block Right	-67.62 dBm / 600.02 MHz	-77.19 dBm

			Lower			Upper		
Start Freq	Stop Freq	Integ BW	dBm	ΔLim (dB)	Freq (Hz)	dBm	ΔLim (dB)	Freq (Hz)
50.00 kHz	5.050 MHz	102.0 kHz	-69.94	(-62.94)	-50.00 k	-70.26	(-63.26)	50.00 k
5.050 MHz	10.50 MHz	100.0 kHz	-89.38	(-75.38)	-6.358 M	-88.51	(-74.51)	8.347 M
10.50 MHz	20.00 MHz	1.000 MHz	-79.74	(-66.74)	-15.68 M	-78.90	(-65.90)	19.10 M
4.000 MHz	8.000 MHz	1.000 MHz	---	(---)	---	---	(---)	---
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

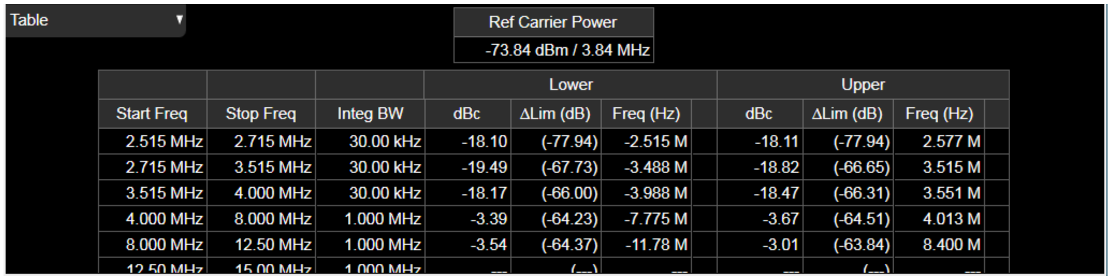
Table Window in Rel Pwr Freq View

Rel Peak Pwr & Freq (Total Pwr Ref) Results Window

Name	Corresponding Results
Power	n=1 2nd element Absolute power at the reference area Channel Integration Bandwidth
Reference	In multi-carrier applications, this column displays which carrier is reference carrier
Measure Trace	See "Measure Trace" on page 1433
Start Freq (Hz)	Start frequency for offset
Stop Freq (Hz)	Stop frequency for offset
Integ BW (Hz)	Measurement bandwidth for offset
Lower Peak (dBc)	Relative peak power on minimum margin point of the negative offset
Lower ΔLim (dB)	Minimum margin from limit line which is decided by Fail Mask setting on the negative offset
Lower Freq (Hz)	Frequency on minimum margin point of the negative offset
Upper Peak (dBc)	Relative peak power on minimum margin point of the positive offset
Upper ΔLim (dB)	Minimum margin from limit line which is decided by Fail Mask setting on the positive offset

Name	Corresponding Results
Upper Freq (Hz)	Frequency on minimum margin point of the positive offset

Metrics window for modes other than MSR, LTE-Advanced FDD/TDD and 5G NR



Table

Ref Carrier Power
-73.84 dBm / 3.84 MHz

			Lower			Upper		
Start Freq	Stop Freq	Integ BW	dBc	ΔLim (dB)	Freq (Hz)	dBc	ΔLim (dB)	Freq (Hz)
2.515 MHz	2.715 MHz	30.00 kHz	-18.10	(-77.94)	-2.515 M	-18.11	(-77.94)	2.577 M
2.715 MHz	3.515 MHz	30.00 kHz	-19.49	(-67.73)	-3.488 M	-18.82	(-66.65)	3.515 M
3.515 MHz	4.000 MHz	30.00 kHz	-18.17	(-66.00)	-3.988 M	-18.47	(-66.31)	3.551 M
4.000 MHz	8.000 MHz	1.000 MHz	-3.39	(-64.23)	-7.775 M	-3.67	(-64.51)	4.013 M
8.000 MHz	12.50 MHz	1.000 MHz	-3.54	(-64.37)	-11.78 M	-3.01	(-63.84)	8.400 M
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

Metrics window for MSR, LTE-Advanced FDD/TDD and 5G NR

Table

Reference	Power
Sub-block Left	-27.45 dBm / 600.02 MHz
Sub-block Right	-27.45 dBm / 600.02 MHz

			Lower			Upper		
Start Freq	Stop Freq	Integ BW	dBc	ΔLim (dB)	Freq (Hz)	dBc	ΔLim (dB)	Freq (Hz)
50.00 kHz	5.050 MHz	102.0 kHz	-56.74	(-63.01)	-50.00 k	-57.12	(-63.18)	50.00 k
5.050 MHz	10.50 MHz	100.0 kHz	-75.24	(-74.51)	-6.140 M	-75.53	(-74.59)	8.456 M
10.50 MHz	20.00 MHz	1.000 MHz	-66.27	(-66.54)	-11.59 M	-66.24	(-66.30)	19.95 M
4.000 MHz	8.000 MHz	1.000 MHz	---	(---)	---	---	(---)	---
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

Rel Peak Pwr & Freq (PSD Ref) Results Window

Name	Corresponding Results
Ref Carrier Power	n=1 2nd element Absolute power at the reference area Channel Integration Bandwidth
PSD Ref	n=5 1st element Power spectral density reference at the reference area
Reference	In multi-carrier applications, this column displays which carrier is reference carrier
Measure Trace	See "Measure Trace" on page 1433
Start Freq (Hz)	Start frequency for offset
Stop Freq (Hz)	Stop frequency for offset
Integ BW (Hz)	Measurement bandwidth for offset
Lower (dB)	Relative power spectrum density of the negative offset
Lower ΔLim (dB)	Minimum margin from limit line which is decided by Fail Mask setting on the negative offset
Lower Freq (Hz)	Frequency on minimum margin point of the negative offset
Upper (dB)	Relative power spectrum density of the positive offset
Upper ΔLim	Minimum margin from limit line which is decided by Fail Mask setting on the

Name	Corresponding Results
(dB)	positive offset
Upper Freq (Hz)	Frequency on minimum margin point of the positive offset

Metrics window for modes other than MSR, LTE-Advanced FDD/TDD and 5G NR

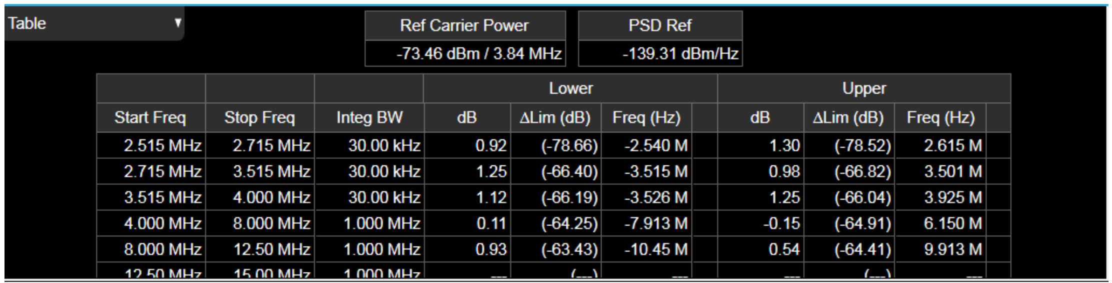


Table	Ref Carrier Power	PSD Ref
	-73.46 dBm / 3.84 MHz	-139.31 dBm/Hz

			Lower			Upper		
Start Freq	Stop Freq	Integ BW	dB	ΔLim (dB)	Freq (Hz)	dB	ΔLim (dB)	Freq (Hz)
2.515 MHz	2.715 MHz	30.00 kHz	0.92	(-78.66)	-2.540 M	1.30	(-78.52)	2.615 M
2.715 MHz	3.515 MHz	30.00 kHz	1.25	(-66.40)	-3.515 M	0.98	(-66.82)	3.501 M
3.515 MHz	4.000 MHz	30.00 kHz	1.12	(-66.19)	-3.526 M	1.25	(-66.04)	3.925 M
4.000 MHz	8.000 MHz	1.000 MHz	0.11	(-64.25)	-7.913 M	-0.15	(-64.91)	6.150 M
8.000 MHz	12.50 MHz	1.000 MHz	0.93	(-63.43)	-10.45 M	0.54	(-64.41)	9.913 M
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

Metrics window for MSR, LTE-Advanced FDD/TDD and 5G NR

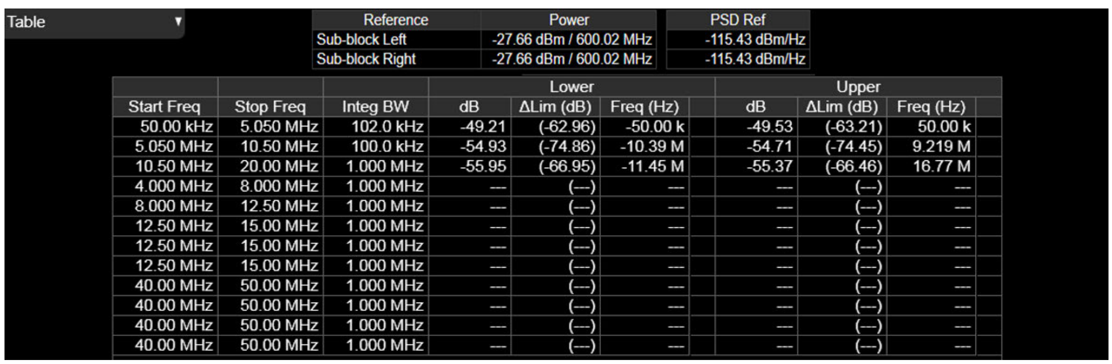


Table	Reference	Power	PSD Ref
	Sub-block Left	-27.66 dBm / 600.02 MHz	-115.43 dBm/Hz
	Sub-block Right	-27.66 dBm / 600.02 MHz	-115.43 dBm/Hz

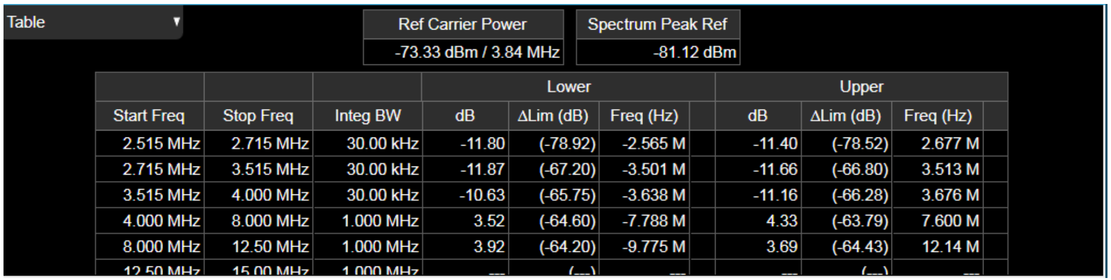
			Lower			Upper		
Start Freq	Stop Freq	Integ BW	dB	ΔLim (dB)	Freq (Hz)	dB	ΔLim (dB)	Freq (Hz)
50.00 kHz	5.050 MHz	102.0 kHz	-49.21	(-62.96)	-50.00 k	-49.53	(-63.21)	50.00 k
5.050 MHz	10.50 MHz	100.0 kHz	-54.93	(-74.86)	-10.39 M	-54.71	(-74.45)	9.219 M
10.50 MHz	20.00 MHz	1.000 MHz	-55.95	(-66.95)	-11.45 M	-55.37	(-66.46)	16.77 M
4.000 MHz	8.000 MHz	1.000 MHz	---	(---)	---	---	(---)	---
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

Rel Peak Pwr & Freq (Spectrum Pk Ref) Results Window

Name	Corresponding Results
Power	Absolute power at the reference area Channel Integration Bandwidth
Spectrum Peak Ref	n=5 1st element Spectrum peak power reference at the reference area
Reference	In multi-carrier applications, this column displays which carrier is reference carrier
Measure Trace	See "Measure Trace" on page 1433
Start Freq (Hz)	Start frequency for offset
Stop Freq (Hz)	Stop frequency for offset
Integ BW (Hz)	Measurement bandwidth for offset
Lower Peak (dB)	Relative peak power on minimum margin point of the negative offset
Lower ΔLim (dB)	Minimum margin from limit line which is decided by Fail Mask setting on the negative offset
Lower Freq (Hz)	Frequency on minimum margin point of the negative offset

Name	Corresponding Results
Upper Peak (dB)	Relative peak power on minimum margin point of the positive offset
Upper ΔLim (dB)	Minimum margin from limit line which is decided by Fail Mask setting on the positive offset
Upper Freq (Hz)	Frequency on minimum margin point of the positive offset

Metrics window for modes other than MSR, LTE-Advanced FDD/TDD and 5G NR

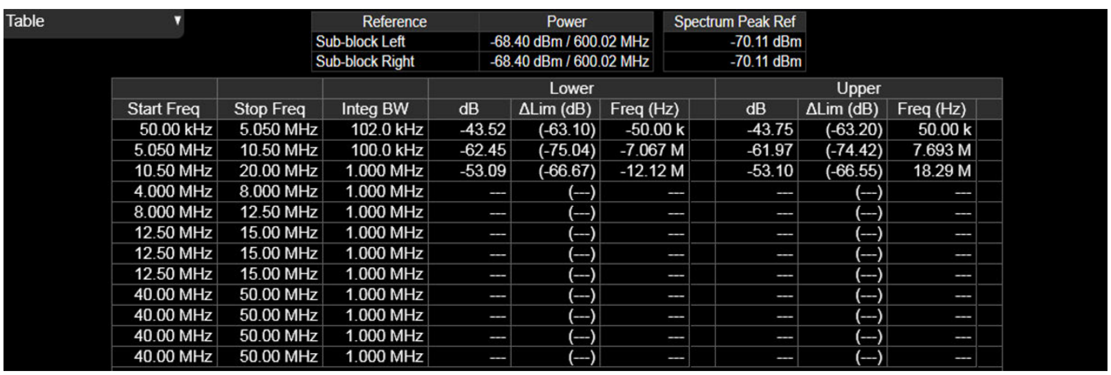


Table

Ref Carrier Power	Spectrum Peak Ref
-73.33 dBm / 3.84 MHz	-81.12 dBm

			Lower			Upper		
Start Freq	Stop Freq	Integ BW	dB	ΔLim (dB)	Freq (Hz)	dB	ΔLim (dB)	Freq (Hz)
2.515 MHz	2.715 MHz	30.00 kHz	-11.80	(-78.92)	-2.565 M	-11.40	(-78.52)	2.677 M
2.715 MHz	3.515 MHz	30.00 kHz	-11.87	(-67.20)	-3.501 M	-11.66	(-66.80)	3.513 M
3.515 MHz	4.000 MHz	30.00 kHz	-10.63	(-65.75)	-3.638 M	-11.16	(-66.28)	3.676 M
4.000 MHz	8.000 MHz	1.000 MHz	3.52	(-64.60)	-7.788 M	4.33	(-63.79)	7.600 M
8.000 MHz	12.50 MHz	1.000 MHz	3.92	(-64.20)	-9.775 M	3.69	(-64.43)	12.14 M
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

Metrics window for MSR, LTE-Advanced FDD/TDD and 5G NR



Table

Reference	Power	Spectrum Peak Ref
Sub-block Left	-68.40 dBm / 600.02 MHz	-70.11 dBm
Sub-block Right	-68.40 dBm / 600.02 MHz	-70.11 dBm

			Lower			Upper		
Start Freq	Stop Freq	Integ BW	dB	ΔLim (dB)	Freq (Hz)	dB	ΔLim (dB)	Freq (Hz)
50.00 kHz	5.050 MHz	102.0 kHz	-43.52	(-63.10)	-50.00 k	-43.75	(-63.20)	50.00 k
5.050 MHz	10.50 MHz	100.0 kHz	-62.45	(-75.04)	-7.067 M	-61.97	(-74.42)	7.693 M
10.50 MHz	20.00 MHz	1.000 MHz	-53.09	(-66.67)	-12.12 M	-53.10	(-66.55)	18.29 M
4.000 MHz	8.000 MHz	1.000 MHz	---	(---)	---	---	(---)	---
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

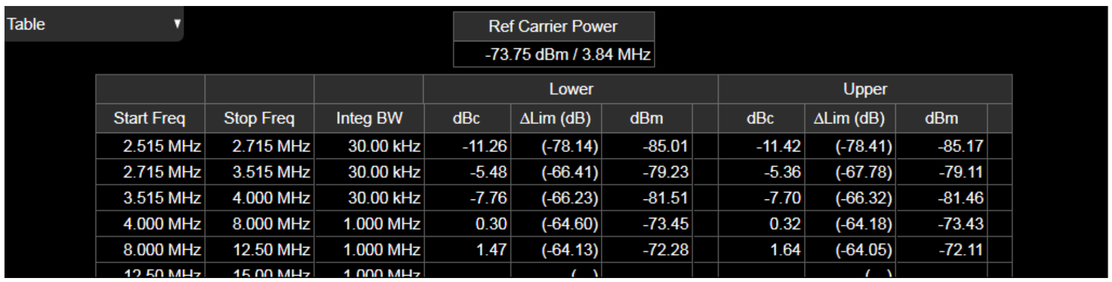
Table Window in Integrated Power View

Integrated Power (Total Pwr Ref)

Name	Corresponding Results
Power	n=1 2nd element Absolute power at the reference area Channel Integration Bandwidth
Reference	In multi-carrier applications, this column displays which carrier is reference carrier
Measure Trace	See "Measure Trace" on page 1433
Start Freq (Hz)	Start frequency for offset
Stop Freq (Hz)	Stop frequency for offset
Integ BW (Hz)	Measurement bandwidth for offset
Lower Integ (dBc)	Relative integrated power on the negative offset
Lower ΔLim (dB)	Minimum margin from limit line which is decided by Fail Mask setting on the

Name	Corresponding Results
	negative offset
Lower Integ (dBm)	Absolute integrated power on the negative offset
Upper Integ (dBc)	Relative integrated power on the positive offset
Upper ΔLim (dB)	Minimum margin from limit line which is decided by Fail Mask setting on the positive offset
Upper Integ (dBm)	Absolute integrated power on the positive offset

Metrics window for modes other than MSR, LTE-Advanced FDD/TDD and 5G NR

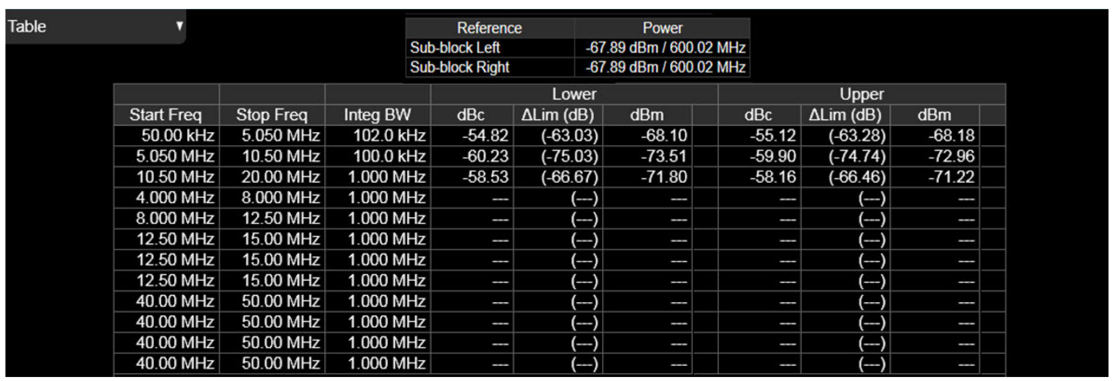


Table

Ref Carrier Power
-73.75 dBm / 3.84 MHz

			Lower			Upper		
Start Freq	Stop Freq	Integ BW	dBc	ΔLim (dB)	dBm	dBc	ΔLim (dB)	dBm
2.515 MHz	2.715 MHz	30.00 kHz	-11.26	(-78.14)	-85.01	-11.42	(-78.41)	-85.17
2.715 MHz	3.515 MHz	30.00 kHz	-5.48	(-66.41)	-79.23	-5.36	(-67.78)	-79.11
3.515 MHz	4.000 MHz	30.00 kHz	-7.76	(-66.23)	-81.51	-7.70	(-66.32)	-81.46
4.000 MHz	8.000 MHz	1.000 MHz	0.30	(-64.60)	-73.45	0.32	(-64.18)	-73.43
8.000 MHz	12.50 MHz	1.000 MHz	1.47	(-64.13)	-72.28	1.64	(-64.05)	-72.11

Metrics window for MSR, LTE-Advanced FDD/TDD and 5G NR



Table

Reference	Power
Sub-block Left	-67.89 dBm / 600.02 MHz
Sub-block Right	-67.89 dBm / 600.02 MHz

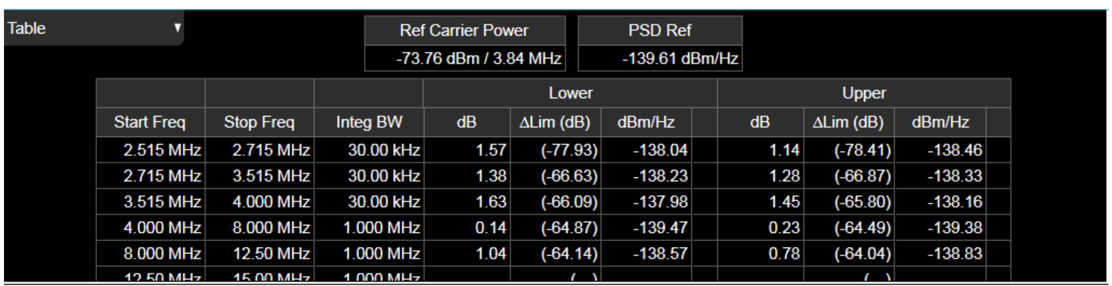
			Lower			Upper		
Start Freq	Stop Freq	Integ BW	dBc	ΔLim (dB)	dBm	dBc	ΔLim (dB)	dBm
50.00 kHz	5.050 MHz	102.0 kHz	-54.82	(-63.03)	-68.10	-55.12	(-63.28)	-68.18
5.050 MHz	10.50 MHz	100.0 kHz	-60.23	(-75.03)	-73.51	-59.90	(-74.74)	-72.96
10.50 MHz	20.00 MHz	1.000 MHz	-58.53	(-66.67)	-71.80	-58.16	(-66.46)	-71.22
4.000 MHz	8.000 MHz	1.000 MHz	---	(---)	---	---	(---)	---
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

Integrated Power (PSD Ref)

Name	Corresponding Results
Power	n=1 2nd element
	Absolute power at the reference area
	Channel Integration Bandwidth
PSD Ref	n=5 1st element
	Power spectral density reference at the reference area
Reference	In multi-carrier applications, this column displays which carrier is reference carrier
Measure Trace	See "Measure Trace" on page 1433
Start Freq (Hz)	Start frequency for offset

Name	Corresponding Results
Stop Freq (Hz)	Stop frequency for offset
Integ BW (Hz)	Measurement bandwidth for offset
Lower (dB)	Relative power spectrum density of the negative offset
Lower ΔLim (dB)	Minimum margin from limit line which is decided by Fail Mask setting on the negative offset
Lower (dBm/Hz)	Absolute power spectrum density of the negative offset
Upper (dB)	Relative power spectrum density of the positive offset
Upper ΔLim (dB)	Minimum margin from limit line which is decided by Fail Mask setting on the positive offset
Upper (dBm/Hz)	Absolute power spectrum density of the negative offset

Metrics window for modes other than MSR, LTE-Advanced FDD/TDD and 5G NR

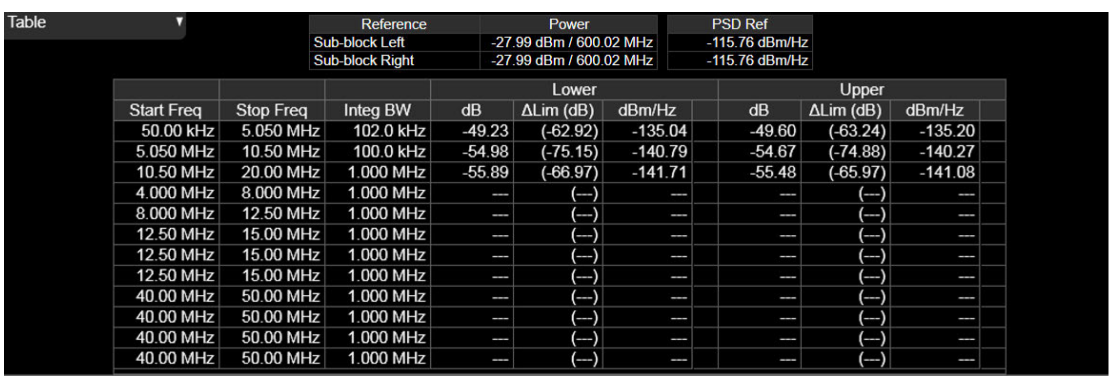


Table

Ref Carrier Power	PSD Ref
-73.76 dBm / 3.84 MHz	-139.61 dBm/Hz

			Lower			Upper		
Start Freq	Stop Freq	Integ BW	dB	ΔLim (dB)	dBm/Hz	dB	ΔLim (dB)	dBm/Hz
2.515 MHz	2.715 MHz	30.00 kHz	1.57	(-77.93)	-138.04	1.14	(-78.41)	-138.46
2.715 MHz	3.515 MHz	30.00 kHz	1.38	(-66.63)	-138.23	1.28	(-66.87)	-138.33
3.515 MHz	4.000 MHz	30.00 kHz	1.63	(-66.09)	-137.98	1.45	(-65.80)	-138.16
4.000 MHz	8.000 MHz	1.000 MHz	0.14	(-64.87)	-139.47	0.23	(-64.49)	-139.38
8.000 MHz	12.50 MHz	1.000 MHz	1.04	(-64.14)	-138.57	0.78	(-64.04)	-138.83
12.50 MHz	15.00 MHz	1.000 MHz		( )			( )	

Metrics window for MSR, LTE-Advanced FDD/TDD and 5G NR



Table

Reference	Power	PSD Ref
Sub-block Left	-27.99 dBm / 600.02 MHz	-115.76 dBm/Hz
Sub-block Right	-27.99 dBm / 600.02 MHz	-115.76 dBm/Hz

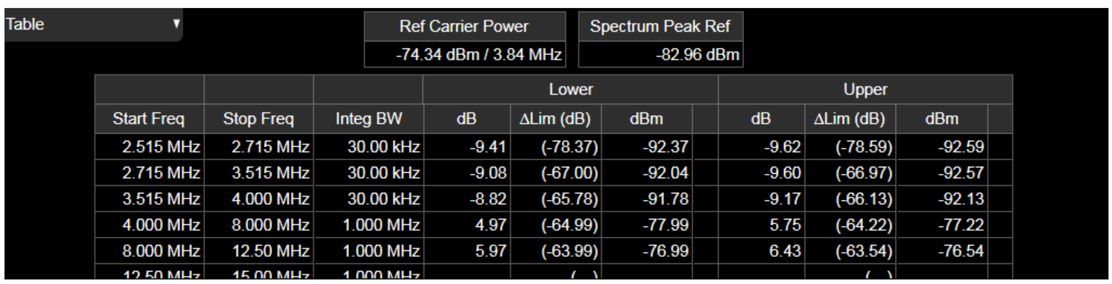
			Lower			Upper		
Start Freq	Stop Freq	Integ BW	dB	ΔLim (dB)	dBm/Hz	dB	ΔLim (dB)	dBm/Hz
50.00 kHz	5.050 MHz	102.0 kHz	-49.23	(-62.92)	-135.04	-49.60	(-63.24)	-135.20
5.050 MHz	10.50 MHz	100.0 kHz	-54.98	(-75.15)	-140.79	-54.67	(-74.88)	-140.27
10.50 MHz	20.00 MHz	1.000 MHz	-55.89	(-66.97)	-141.71	-55.48	(-65.97)	-141.08
4.000 MHz	8.000 MHz	1.000 MHz	---	(---)	---	---	(---)	---
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

Integrated Power (Spectrum Pk Ref)

Name	Corresponding Results
Power	Absolute power at the reference area Channel Integration Bandwidth
Spectrum Peak Ref	n=5 1st element Peak power at the reference area
Reference	In multi-carrier applications, this column displays which carrier is reference carrier
Measure Trace	See "Measure Trace" on page 1433

Name	Corresponding Results
Start Freq (Hz)	Start frequency for offset
Stop Freq (Hz)	Stop frequency for offset
Integ BW (Hz)	Measurement bandwidth for offset
Lower Peak (dB)	Relative peak power on minimum margin point of the negative offset
Lower Δlim (dB)	Minimum margin from limit line which is decided by Fail Mask setting on the negative offset
Lower Peak (dBm)	Absolute peak power on minimum margin point of the negative offset
Upper Peak (dB)	Relative peak power on minimum margin point of the positive offset
Upper Δlim (dB)	Minimum margin from limit line which is decided by Fail Mask setting on the positive offset
Upper Peak (dBm)	Absolute peak power on minimum margin point of the positive offset

Metrics window for modes other than MSR, LTE-Advanced FDD/TDD and 5G NR

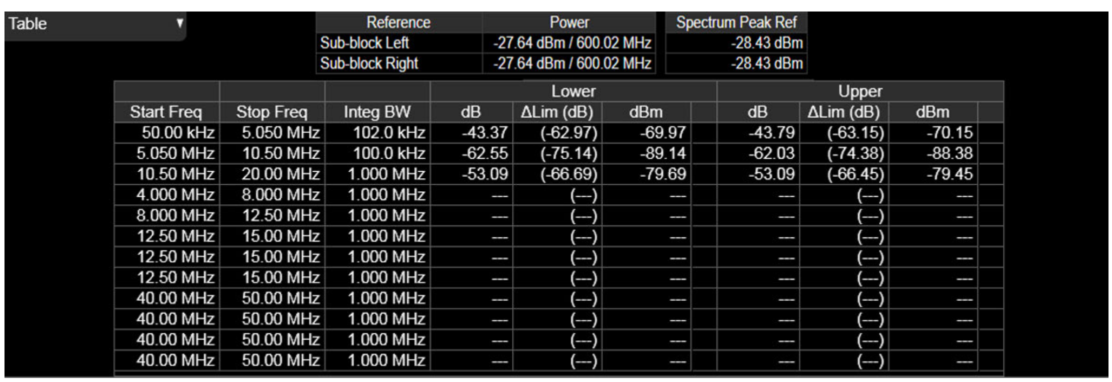


Table

Ref Carrier Power	Spectrum Peak Ref
-74.34 dBm / 3.84 MHz	-82.96 dBm

			Lower			Upper		
Start Freq	Stop Freq	Integ BW	dB	ΔLim (dB)	dBm	dB	ΔLim (dB)	dBm
2.515 MHz	2.715 MHz	30.00 kHz	-9.41	(-78.37)	-92.37	-9.62	(-78.59)	-92.59
2.715 MHz	3.515 MHz	30.00 kHz	-9.08	(-67.00)	-92.04	-9.60	(-66.97)	-92.57
3.515 MHz	4.000 MHz	30.00 kHz	-8.82	(-65.78)	-91.78	-9.17	(-66.13)	-92.13
4.000 MHz	8.000 MHz	1.000 MHz	4.97	(-64.99)	-77.99	5.75	(-64.22)	-77.22
8.000 MHz	12.50 MHz	1.000 MHz	5.97	(-63.99)	-76.99	6.43	(-63.54)	-76.54
12.50 MHz	15.00 MHz	1.000 MHz		( )			( )	

Metrics window for MSR, LTE-Advanced FDD/TDD and 5G NR



Table

Reference	Power	Spectrum Peak Ref
Sub-block Left	-27.64 dBm / 600.02 MHz	-28.43 dBm
Sub-block Right	-27.64 dBm / 600.02 MHz	-28.43 dBm

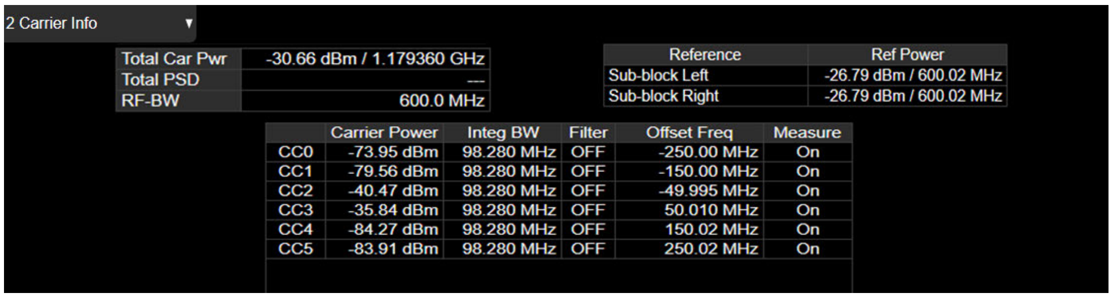
			Lower			Upper		
Start Freq	Stop Freq	Integ BW	dB	ΔLim (dB)	dBm	dB	ΔLim (dB)	dBm
50.00 kHz	5.050 MHz	102.0 kHz	-43.37	(-62.97)	-69.97	-43.79	(-63.15)	-70.15
5.050 MHz	10.50 MHz	100.0 kHz	-62.55	(-75.14)	-89.14	-62.03	(-74.38)	-88.38
10.50 MHz	20.00 MHz	1.000 MHz	-53.09	(-66.69)	-79.69	-53.09	(-66.45)	-79.45
4.000 MHz	8.000 MHz	1.000 MHz	---	(---)	---	---	(---)	---
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
40.00 MHz	50.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

Table Window in Carrier Info View

This View and this Window are only available in MSR, LTE-Advanced FDD/TDD and 5G NR modes. Carrier center frequency can be displayed in either offset or absolute frequency depending on Carrier Freq.

LTE-Advanced FDD/TDD has a different carrier info table from that in MSR in this view, which displays with measured component carrier powers and its power spectral density in the order of component carrier index in one of the view windows.

Carrier Info for LTE-Advanced FDD/TDD


2 Carrier Info

Total Car Pwr	-30.66 dBm / 1.179360 GHz
Total PSD	---
RF-BW	600.0 MHz

Reference	Ref Power
Sub-block Left	-26.79 dBm / 600.02 MHz
Sub-block Right	-26.79 dBm / 600.02 MHz

	Carrier Power	Integ BW	Filter	Offset Freq	Measure
CC0	-73.95 dBm	98.280 MHz	OFF	-250.00 MHz	On
CC1	-79.56 dBm	98.280 MHz	OFF	-150.00 MHz	On
CC2	-40.47 dBm	98.280 MHz	OFF	-49.995 MHz	On
CC3	-35.84 dBm	98.280 MHz	OFF	50.010 MHz	On
CC4	-84.27 dBm	98.280 MHz	OFF	150.02 MHz	On
CC5	-83.91 dBm	98.280 MHz	OFF	250.02 MHz	On

Name	Corresponding Results
Total Carrier Power	The total power of all the carriers with carrier measure state set to yes. The power is calculated by integrating across the bandwidth declared by the Carrier Integ Bw parameter for each carrier and then totaling the sums. The total integration bandwidth is shown as part of the result. This will be the total of the Carrier Integ Bw of the carriers used in calculating the total carrier power. If the RRC Filter is on, then the integration bandwidth used is (1 + alpha)/T where T = 1/(Carrier Integ Bw) multiplied by the number of carriers with carrier measure state set to yes
RF-BW	Displays the total bandwidth from the lowest carrier to uppermost carrier
Carrier Power (dBm)	The power in all the currently defined carriers with measure state is on. The power is calculated by integrating across the bandwidth declared by the Carrier Integ Bw parameter. The integration bandwidth is shown as part of the result. This is the value of the Carrier Integ Bw for the carrier unless the RRC Filter is on, then the integration bandwidth used is the displayed value, which is (1 + alpha)/T where T = 1/(Carrier Integ Bw)
Integration Bandwidth (Hz)	Shows carrier transmission bandwidth
Filter	Displays whether RRC filter is used or not
Offset Frequency (Hz)	Shows the offset frequency from the carrier reference frequency in multi-carrier measurements. The carrier frequency display type determines whether the relative frequency or absolute frequency will be displayed
Sub-block	Displays which sub-block the carrier belongs to in the intra-band non-contiguous aggregation mode. The column will be displayed when the carrier allocation mode is non-contiguous
Measure	Indicates whether the carrier power presents or not

3.10.2.3 Gate

Turning on Gate View shows the Gate Window, which allows you to see your Gating signal at the same time as the measured data. See the description under Gate View in the Trigger, Gate Settings section.

Views in which the Gate window appears:

View	Size	Position
Gate View	One third, full width	Top

3.10.3 Amplitude

Activates the **Amplitude** menu and selects **Reference Level** or **Reference Value** as the active function, depending on the measurement.

Some features in this menu apply to multiple measurements. Some other features apply only to specific measurements and their controls are blanked or grayed-out in measurements that do not support the feature.

3.10.3.1 Y Scale

Contains controls that pertain to the Y-Axis parameters of the measurement. These parameters control how data on the vertical (Y) axis is displayed and control instrument settings that affect the vertical axis.

Ref Value

Sets the value for the absolute power reference. The reference line is at the top, center, or bottom of the graticule, depending on the value of the Ref Position function.

Remote Command	`:DISPlay:SEMask:WINDow[1]:TRACe:Y[:SCALe]:RLEVel <real>` `:DISPlay:SEMask:WINDow[1]:TRACe:Y[:SCALe]:RLEVel?`
Example	`:DISP:SEM:WIND:TRAC:Y:RLEV 100` `:DISP:SEM:WIND:TRAC:Y:RLEV?`
Couplings	When Auto Scaling is `ON` (default), this value is automatically determined by the measurement result. When you set a value manually, Auto Scaling changes to `OFF` Attenuation is not coupled to Ref Value
Preset	0.00 dBm
State Saved	Saved in instrument state
Min/Max	-250.00 dBm / 250.00 dBm
Annotation	Ref <value> top left of graph
Backwards Compatibility SCPI	`:DISPlay:SEMask:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:RLEVel`

Scale/Div

For measurements that support a logarithmic Y-Axis, Scale/Div sets the height of one division of the graticule in the current Y-Axis unit.

Scale/Div also determines the displayed amplitude range in the log plot graph. Since there are usually 10 vertical graticule division on the display, the total amplitude range of the graph is typically 10x this amount. For example, if Scale/Div is 10 dB, then the total range of the graph is 100 dB.

Remote Command	`:DISPlay:SEMask:WINDow[1]:TRACe:Y[:SCALe]:PDIVision <rel_ampl>` `:DISPlay:SEMask:WINDow[1]:TRACe:Y[:SCALe]:PDIVision?`
Example	`:DISP:SEM:WIND:TRAC:Y:PDIV 15dB` `:DISP:SEM:WIND:TRAC:Y:PDIV?`
Couplings	When the Auto Scaling is ON, this value is automatically determined by the measurement result. When you set a value manually, Auto Scaling automatically changes to OFF
Preset	10.00 dB / Div
State Saved	Saved in instrument state
Min	0.10 dB
Max	20 dB
Annotation	<value> dB/ left upper of graph
Backwards Compatibility SCPI	`:DISPlay:SEMask:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:PDIVision`

Ref Position

Positions the reference level at the top, center, or bottom of the Y Scale display. Changing the reference position does not change the reference level value.

Remote Command	`:DISPlay:SEMask:WINDow[1]:TRACe:Y[:SCALe]:RPOSition TOP | CENTer | BOTTom` `:DISPlay:SEMask:WINDow[1]:TRACe:Y[:SCALe]:RPOSition?`
Example	`:DISP:SEM:WIND:TRAC:Y:RPOS CENT` `:DISP:SEM:WIND:TRAC:Y:RPOS?`
Preset	TOP
State Saved	Saved in instrument state
Range	TOP|CENTer|BOTTom
Annotation	The greater than (>) and less than (<) symbols are displayed on both sides of the graph to indicate the Reference Position
Backwards Compatibility SCPI	`:DISPlay:SEMask:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:RPOSition`

Auto Scaling

Toggles the Auto Scaling function between On and Off.

Remote Command	`:DISPlay:SEMask:WINDow[1]:TRACe:Y[:SCALe]:COUPle 0 | 1 | OFF | ON` `:DISPlay:SEMask:WINDow[1]:TRACe:Y[:SCALe]:COUPle?`
Example	`:DISP:SEM:WIND:TRAC:Y:COUP OFF` `:DISP:SEM:WIND:TRAC:Y:COUP?`
Couplings	When Auto Scaling is ON, and the **Restart** front-panel key is pressed, this function automatically sets the scale per division to 10 dB and determines the reference values based on the measurement results When you set a value to either Scale/Div or Ref Value manually, Auto Scaling automatically changes to OFF
Preset	1
State Saved	Saved in instrument state
Range	OFF|ON
Backwards Compatibility SCPI	`:DISPlay:SEMask:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:COUPle`

3.10.3.2 Attenuation

Controls the attenuator functions and interactions between the attenuation system components.

There are two attenuator configurations in the X-Series. One is a Dual-Attenuator configuration consisting of a mechanical attenuator and an optional electronic attenuator. The other configuration uses a single attenuator with combined mechanical and electronic sections thatcontrols all the attenuation functions. Different models in the X-Series come with different configurations.

– See "Dual-Attenuator Configurations" on page 1295

– See "Single-Attenuator Configuration" on page 1295

Most attenuation settings are the same for all measurements – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset.

This tab is only available when the hardware set includes an input attenuator, which is typically only the case when using Keysight’s box instruments. For example, this tab does not appear in:

– VXT models M9420A/21A/10A/11A

– E7760

– M9391A

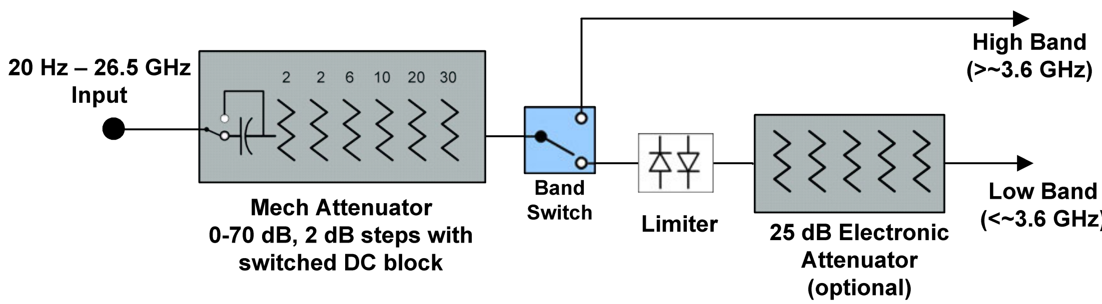
– M9393A

This tab also does not appear in UXM. In UXM all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

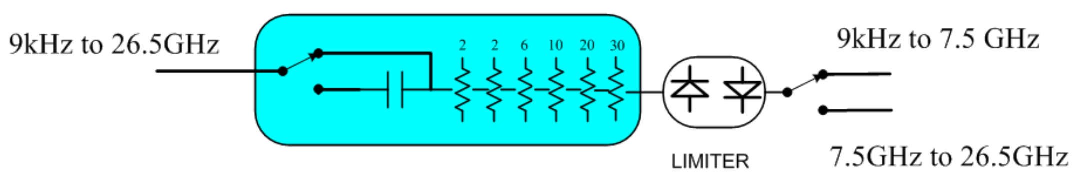
Dependencies	In measurements that support the I/Q inputs, this tab is unavailable when I/Q is the selected input, and is replaced by the Range tab in that case

Dual-Attenuator Configurations

Configuration 1: Mechanical attenuator + optional electronic attenuator

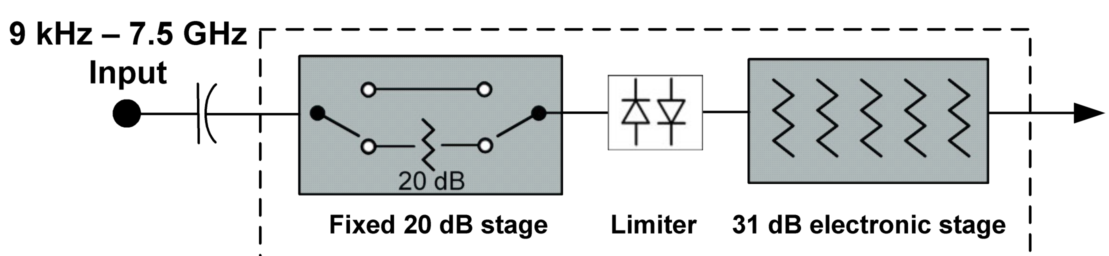


Configuration 2: Mechanical attenuator, no optional electronic attenuator



(note that Configuration 2 is not strictly speaking a dual-section attenuator, since there is no electronic section available. However, it behaves exactly like Configuration 1 without the Electronic Attenuator option EA3, therefore for the sake of this document it is grouped into the “Dual-Attenuator” configuration)

Single-Attenuator Configuration



You can tell which attenuator configuration you have by pressing the Attenuation tab, which (in most Modes) opensthe Attenuation menu. If the first control in the Attenuation menu says **Mech Atten** you have the Dual-Attenuator configuration. If the first control says **Atten** you have the Single-Attenuator configuration.

Dual Attenuator **Single Attenuator**

(Note that depending on the measurement, there may be no Auto/Man functionality on the Mech Atten control).

In the Single-Attenuator configuration, youcontrol the attenuation with a single control, as the fixed stage has only two states. In the Dual-Attenuator configuration, both stages have significant range so you are given separate control of the mechanical and electronic attenuator stages.

When you have the Dual-Attenuator configuration, you may still have only a Single-Attenuator, because unless option EA3 (the Electronic Attenuator option) is available, and you purchase it, you will have only the mechanical attenuator.

Full Range Atten

The **Full Range Atten** control and **Attenuator Summary** only appear in N9041B, when the RF input is selected and the RF Input Port is set to RF Input 2, and the Full Range Attenuator is installed. The Full Range Attenuator adds a second input attenuator at the beginning of the RF Input 2, which enhances the protection and optimizes the performance of the extra internal mixers used by RF Input 2.

Remote Command	`[:SENSe]:POWer[:RF]:FRATten <rel_ampl>` `[:SENSe]:POWer[:RF]:FRATten?`
Example	`:POW:FRAT 14` `:POW:FRAT?`
Notes	When you enter an amplitude value that falls between valid values, the value will be incremented to the next smallest valid value
Dependencies	Only appears if input RF is selected, and RF Input Port 2 is selected, and the Full Range Attenuator exists
Couplings	This value is never changed by any coupling, however other couplings use this value. See the **Reference Level** and "Mech Atten" on page 1750 command descriptions
Preset	20 dB
State Saved	Saved in instrument state

Min	0 dB
Max	Only valid values are 0, 6, 14, 20 dB
Annotation	When the Input is RF, and the Input Port is RF Input 2, and the Full Range Attenuator is installed: On the Meas Bar, the field “Atten” displays as follows: – If the sweep is entirely < 50 GHz, the value shown after “Atten:” is equal to Mech Atten + Elec Atten + Full Range Atten – If the sweep is entirely > 50 GHz, the value shown after “Atten:” is equal to Full Range Atten – If the sweep straddles 50 GHz, the value shown after “Atten:” is preceded by the symbol “>=” and is equal to Full Range Atten In the **Amplitude**, "Attenuation" on page 1747 menu, and the Atten Meas Bar dropdown menu panel, a summary is displayed as follows: “Total Atten below 50 GHz” followed by the value of Full Range Atten + Mech Atten + Elec Atten “Total Atten above 50 GHz” followed by the value of Full Range Atten For example, if Mech Atten = 6 dB, Elec Atten = 4 dB, and Full Range Atten = 20 dB, the summary below is shown: – Attenuator summary: – Total Atten below 50 GHz: 30 dB – Total Atten above 50 GHz: 20 dB

Mech Atten

This control is labeled **Mech Atten** in Dual-Attenuator models and **Atten** in Single-Attenuator models. In the Dual-Attenuator configuration, this control only affects the mechanical attenuator.

This control lets you modify the attenuation applied to the RF input signal path. This value is normally auto coupled to the Ref Level, the Internal Preamp Gain, any External Gain that is entered, and the Max Mixer Level, as described in the table below.

See "Attenuator Configurations and Auto/Man" on page 1299

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation <rel_ampl>`
	`[:SENSe]:POWer[:RF]:ATTenuation?`
	`[:SENSe]:POWer[:RF]:ATTenuation:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:POWer[:RF]:ATTenuation:AUTO?`

Example	`:POW:ATT 20` Dual-Attenuator configuration: sets the mechanical attenuator to 20 dB Single-Attenuator mode: sets the main attenuation to 20 dB (see below for definition of “main” attenuation) In either case, if the attenuator was in Auto, it is set to Manual

	`:POW:ATT:AUTO ON` Turn Auto Mech Atten **ON**
Dependencies	Some measurements do not support the Auto setting of "Mech Atten" on page 1297. In these measurements, the Auto/Man selection is not available, and the Auto/Man toggle function is not available In Dual-Attenuator configurations, when the electronic attenuator is enabled, the mechanical attenuator has no auto setting and the Auto/Man toggle function is not available. The state of Auto/Man is remembered and restored when the electronic attenuator is once again disabled. This is described in more detail in "Elec Atten" on page 1753 See "Attenuator Configurations and Auto/Man" on page 1299 for more information on the Auto/Man functionality `:POW:ATT:AUTO` is only available in measurements that support Mech Atten Auto, such as Swept SA
Couplings	If the RF Input Port is the RF Input: – If the USB Preamp is connected to USB, use 0 dB for Mech Atten – Otherwise compute the auto-selected value of Mech Atten based on **Reference Level**, Int Preamp, External Gain, Ref Level Offset, Max Mixer Level, µW Path Control and IF Gain settings. Limit this value to be no less than 6 dB (total attenuation below 6 dB can never be chosen by Auto) – In the N9041B, if the RF Input Port is RF Input 2, use the formula above and subtract the Full Range Atten value from the result to determine the Mech Atten. Limit the value so that it is never lower than 0 dB and so that total attenuation, including Full Range Atten, is never less than 6 dB (total attenuation, including Full Range Atten below 6 dB, can never be chosen by Auto) In External Mixingand BBIQ, where the Attenuator is not in the signal path, the Attenuator setting changes as described above when "Mech Atten" on page 1297 is in Auto, but no changes are made to the actual attenuator hardware setting until the input is changed back to the RF Input For CXA-m with option FSA (Fine-Step Attenuator or 2 dB steps), the FSA-like behavior is only available when the frequency setting is <= 7.5GHz. So, when the frequency is changed from below 7.5GHz to above 7.5GHz, the attenuation setting will be changed to a multiple of 10dB which will be no smaller than the previous setting. For example, 4dB attenuation will be changed to 10dB
Preset	The preset for Mech Attenuation is “Auto” The Auto value of attenuation is 10 dB **ON**
State Saved	Saved in instrument state
Min	0 dB The attenuation set by this control cannot be decreased below 6 dB with the knob or step keys. Values below 6 dB must be directly entered from the keypad or via SCPI. This protects against setting a dangerously small attenuation value, which can put the instrument at risk of damage to input circuitry. If the current mechanical attenuation is below 6 dB, it can be increased with the knob and step keys, but not decreased
Max	CXA Option 503 or 507: 50 dB EXA: 60 dB All other models: 70 dB Note that in the Single-Attenuator configuration, the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced

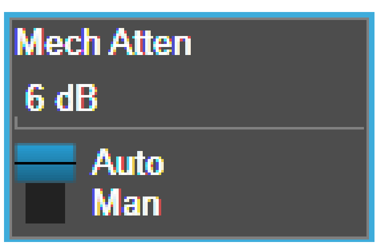
	accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB.
Annotation	The current value for Total Atten is displayed in the Measurement Bar at the top of the display. A value appears for Electronic Attenuation only if the Electronic Attenuator is enabled. The annotation appears as Atten: <total> dB (e<elec>) The e letter is in amber in Single-Attenuator configurations For example: Dual-Attenuator configuration: Atten: 24 dB (e14) Indicating the total attenuation is at 24 dB and the electronic attenuation is at 14 dB Single-Attenuator configuration: A: 24 dB (e14) Indicating the total attenuation is at 24 dB and the “soft” attenuation is at 14 dB (see below for definition of “soft” attenuation) When in Manual, a # sign appears in front of Atten in the annotation

Attenuator Configurations and Auto/Man

As described in "Attenuation" on page 1747 , there are two distinct attenuator configurations available in the X-Series, the single attenuator and Dual-Attenuator configurations. In Dual-Attenuator configurations, we have the mechanical attenuation and the electronic attenuation, and the current total attenuation is the sum of the electronic + mechanical attenuation. In Single-Attenuator configurations, we refer to the attenuation set using "Mech Atten" on page 1297 (or `:POW:ATT`) as the “main” attenuation; and the attenuation that is set by `:POW:EATT` as the “soft” attenuation (`:POW:EATT` is honored even in the Single-Attenuator configuration, for compatibility purposes). Then the current total attenuation is the sum of the main + soft attenuation. See "Elec Atten" on page 1753 for more on “soft” attenuation.

NOTE

In some measurements, the **Mech Atten** control has an Auto/Man function. In these measurements, an Auto/Man switch is shown on the **Mech Atten** control:



Note that in configurations that include an Electronic Attenuator, this switch is only shown when the Electronic Attenuator is disabled.

In other measurements, **Mech Atten** has no Auto/Man function. In these measurements, no switch is shown on the **Mech Atten** control:

Mech Atten also appears with no switch, as above, in configurations that include an Electronic Attenuator but when the Electronic Attenuator is enabled.

Elec Atten

Controls the Electronic Attenuator in Dual-Attenuator configurations. This control does not appear in Single-Attenuator configurations, as the control of both the mechanical and electronic stages of the Single-Attenuator is integrated into the single **Atten** control.

This control includes an Enable/Disable toggle switch; it is only possible to enter a value for the Electronic Attenuator when this switch is in the “Enable” position.

See "More Information" on page 1301

Remote Command	`[:SENSe]:POWer[:RF]:EATTenuation <rel_ampl>`
	`[:SENSe]:POWer[:RF]:EATTenuation?`
	`[:SENSe]:POWer[:RF]:EATTenuation:STATe OFF | ON | 0 | 1`
	`[:SENSe]:POWer[:RF]:EATTenuation:STATe?`

Example	`:POW:EATT 10`
	`:POW:EATT?`
	`:POW:EATT:STAT ON`
	`:POW:EATT:STAT?`

Notes	Electronic Attenuation’s specification is defined only when Mechanical Attenuation is 6 dB
Dependencies	This control only appears in Dual-Attenuator models with an Electronic Attenuator installed and licensed. It does not appear in models with the Single-Attenuator configuration, as in the Single-Attenuator configuration there is no “electronic attenuator” there is only a single integrated attenuator (which has both a mechanical and electronic stage). However, in the Single-Attenuator configuration, EATT SCPI commands are accepted for compatibility with other X-series instruments and set a “soft” attenuation as described in . The “soft” attenuation is treated as an addition to the “main” attenuation value set by the Atten control or the POW:ATT SCPI command and affects the total attenuation displayed on the Atten control and the Meas Bar The electronic attenuator (and the “soft” attenuation function provided in Single-Attenuator configurations) is unavailable above the low band (0-3.6 GHz, 0-3.4 GHz 0-3GHz, depending on the model). If the low band ranges from 0-3.6GHz, and Stop Frequency of the instrument is > 3.6 GHz, then the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed out If the Internal Preamp is on, meaning it is set to Low Band or Full, the electronic attenuator (and the “soft” attenuation function provided in Single-Attenuator configurations) is unavailable. In this case the

	Enabled/Disabled section of the **Elec Atten** control will be OFF and grayed out If either of the above is true, if the SCPI command is sent, an error indicating that the electronic attenuator is unavailable will be sent If both of the above are true, pressing the control will generate error message -221, in other words, the frequency range lockout takes precedence If the electronic/soft Attenuator is enabled, then the Stop Freq of the instrument is limited to 3.6 GHz and the Internal Preamp is unavailable The SCPI-only "soft" electronic attenuation for the single-attenuator configuration is not available in all measurements; in particular, it is not available in the Swept SA measurement
Couplings	Enabling and disabling the Electronic Attenuator affects the setting of the Mechanical Attenuator (in Dual-Attenuator configurations). This is described in more detail below and in the section "Attenuator Configurations and Auto/Man" on page 1752
Preset	OFF (Disabled) for Swept SA measurement ON (Enabled) for all other measurements that support the electronic attenuator
State Saved	Saved in instrument state
Min	0 dB
Max	Dual-Attenuator configuration: 24 dB Single-Attenuator configuration: the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB
Annotation	See Annotation under the **Mech Atten** control description

More Information

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear. These advantages primarily aid in remote operation and are negligible for front panel use. See "Using the Electronic Attenuator: Pros and Cons" on page 1302 for a detailed discussion of the pros and cons of using the electronic attenuator.

For the Single-Attenuator configuration, for SCPI backwards compatibility, the "soft" attenuation feature replaces the Dual-Attenuator configuration's electronic attenuator. All the same couplings and limitations apply. See "Attenuator Configurations and Auto/Man" on page 1752

Mechanical Attenuator Transition Rules

When the Electronic Attenuator is enabled, the Mechanical Attenuator transitions to a state that has no Auto function. Below are the rules for transitioning the Mechanical Attenuator. Note that the information below ONLY applies to the Dual-Attenuator configurations, and ONLY when the Electronic Attenuator is installed:

When the Electronic Attenuation is enabled from a disabled state:

The Mechanical Attenuator is initialized to 10 dB (this is its optimal performance setting). You can then set it as desired with SCPI, numeric keypad, step keys, or knob, and it behaves as it normally would in manual mode

The Auto/Man state of (Mech) Atten is saved

The Auto/Man toggle on the (Mech) Atten control disappears and the auto rules are disabled

The Electronic Attenuator is set to 10 dB less than the previous value of the Mechanical Attenuator, within the limitation that it must stay within the range of 0 to 24 dB of attenuation

Examples in the Dual-Attenuator configuration:

Mech Atten at 20 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 10 dB. New total attenuation equals the value before Elec Atten enabled

Mech Atten at 0 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 0 dB. New total attenuation does not equal the value before Elec Atten enabled

Mech Atten at 40 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 24 dB. New total attenuation does not equal the value before Elec Atten enabled

When the Electronic Attenuation is disabled from an enabled state:

The Elec Atten control is grayed out

– The Auto/Man state of (Mech) Atten is restored

If now in Auto, (Mech) Atten recouples

If now in Man, (Mech) Atten is set to the value of total attenuation that existed before the Elec Atten was disabled. The resulting value is rounded up to the smallest value possible given the (Mech) Atten Step setting - (That is, 57 dB changes to 58 dB when (Mech) Atten Step is 2 dB)

Using the Electronic Attenuator: Pros and Cons

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear.

The “finer steps” advantage of the electronic attenuator is beneficial in optimizing the alignment of the instrument dynamic range to the signal power in the front panel as well as remote use. Thus, you can achieve improved relative signal measurement accuracy. Compared to a mechanical attenuator with 2 dB steps, the 1 dB resolution of the electronic attenuator only gives better resolution when the odd-decibel steps are used. Those odd-decibel steps are less accurately calibrated than the even-decibel steps, so one tradeoff for this superior relative accuracy is reduced absolute amplitude accuracy.

Another disadvantage of the electronic attenuator is that the spectrum analyzer loses its “Auto” setting, making operation less convenient.

Also, the relationship between the dynamic range specifications (TOI, SHI, compression, and noise) and instrument performance are less well-known with the electrical attenuator. With the mechanical attenuator, TOI, SHI, and compression threshold levels increase dB-for-dB with increasing attenuation, and the noise floor does as well. With the electronic attenuator, there is an excess attenuation of about 1 to 3 dB between 0 and 3.6 GHz, making the effective TOI, SHI, and so forth, less well known. Excess attenuation is the actual attenuation relative to stated attenuation. Excess attenuation is accounted for in the instrument calibration

Adjust Atten for Min Clipping

Sets the combination of mechanical and electronic attenuation and gain based on the current measured signal level so that clipping will be at a minimum.

This is an "immediate action" function, that is, it executes once, when the control is pressed.

The algorithms that are used for the adjustment are documented under "Pre-Adjust for Min Clipping" on page 1757.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate`
Example	`:POW:RANG:OPT IMM`
Notes	Executing Adjust Atten for Min Clipping initiates the measurement.
Dependencies	Does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum measurements For the Waveform measurement, this control is available only in 5G NR Mode

Adjust Atten

Allows you to select;

- Electric attenuator only
- Combination of Electric attenuator and Mechanical attenuator

when the command `[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate` is executed.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize:TYPE EONLy | COMBined` `[:SENSe]:POWer[:RF]:RANGe:OPTimize:TYPE?`
Example	`:POW:RANG:OPT:TYPE EONL` `:POW:RANG:OPT:TYPE?`
Dependencies	Does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum measurements For the Waveform measurement, this control is available only in 5G NR Mode
Preset	`COMBined`
State Saved	Saved in instrument state

Pre-Adjust for Min Clipping

If this function is ON, it applies the adjustment described under "Adjust Atten for Min Clipping" on page 1756 each time a measurement restarts. Therefore, in Continuous measurement mode, it only executes before the first measurement.

In Dual-Attenuator models, you can set **Elec+Mech Atten**, in which case both attenuators participate in the autoranging, or **Elec Atten Only**, in which case the mechanical attenuator does not participate in the autoranging. This latter case results in less wear on the mechanical attenuator and is usually faster.

See "Adjustment Algorithm" on page 1305

Selection	Example	Note
Off	:POW:RANGe:OPT:ATT OFF	This is the default setting
Elec Atten Only	:POW:RANGe:OPT:ATT ELEC	Selects only the electric attenuator to participate in auto ranging. This offers less wear on the mechanical attenuator and is usually faster
Mech + Elec Atten	:POW:RANGe:OPT:ATT COMB	In Dual-Attenuator models, this selects both attenuators to participate in the autoranging

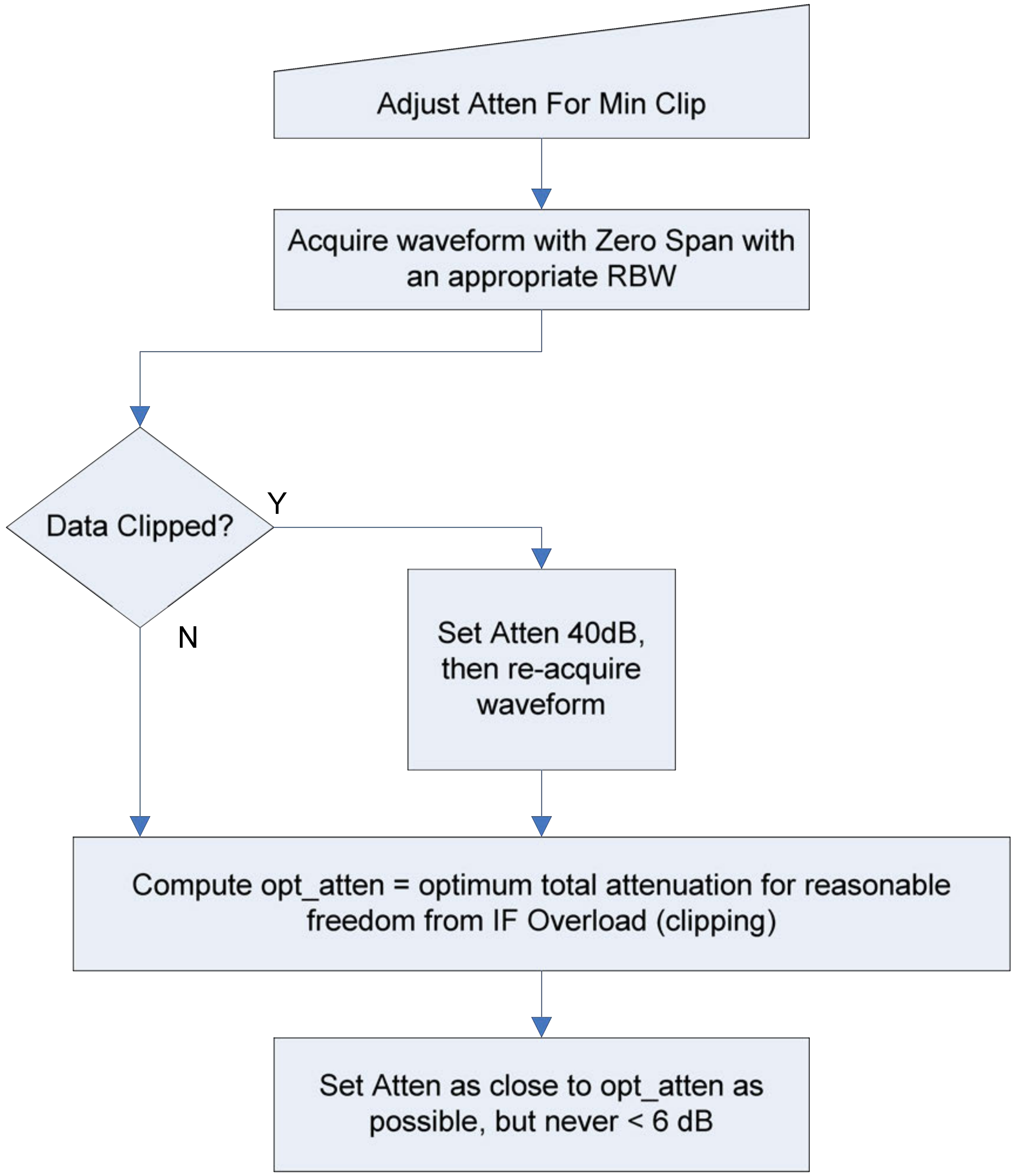
Remote Command	[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation OFF | ON | ELECtrical | COMBined [:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation?
Example	:POW:RANG:OPT:ATT OFF :POW:RANG:OPT:ATT?
Notes	The parameter option ELECtrical sets this function to ON in Single-Attenuator models The parameter option COMBined is mapped to ELECtrical in Single-Attenuator models. If you send COMBined, it sets the function to ON and returns ELEC to a query For SCPI compatibility with models that do not have an input attenuator, the ON parameter is honored and mapped to COMBined
Dependencies	This control only appears in Dual-Attenuator models with an Electronic Attenuator installed In instruments with Dual-Attenuator model, when **Enable** "Elec Atten" on page 1753 is OFF or grayed-out, "Pre-Adjust for Min Clipping" on page 1304 is grayed-out This control does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum measurements For the Waveform measurement, this control is available only in 5G NR Mode
Preset	OFF when Elec Atten is Disabled at preset, otherwise ELEC
State Saved	Saved in instrument state
Range	Dual-Attenuator models: Off | Elec Atten Only | Mech + Elec Atten Single-Attenuator models:

	Off | On
Notes	ON aliases to "Elec Atten Only" (:POW:RANG:OPT:ATT ELEC) OFF aliases to "Off" (:POW:RANG:OPT:ATT OFF) :POW:RANG:AUTO? returns true if :POW:RANG:OPT:ATT is not OFF
Backwards Compatibility SCPI	[:SENSe]:POWer[:RF]:RANGe:AUTO ON | OFF | 1 | 0 [:SENSe]:POWer[:RF]:RANGe:AUTO?

Adjustment Algorithm

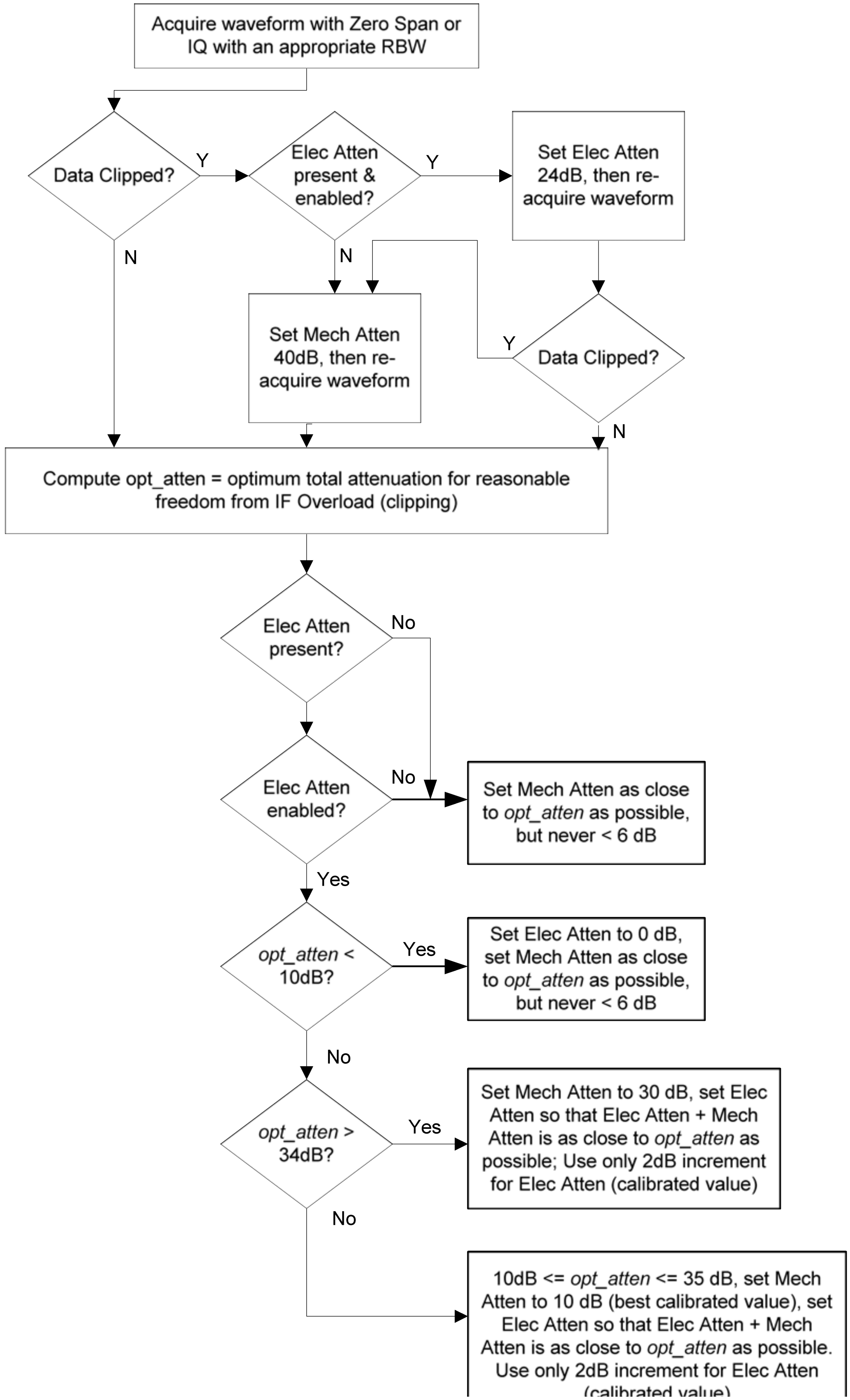
The algorithms for the adjustment are documented below:

Single-Attenuator Models

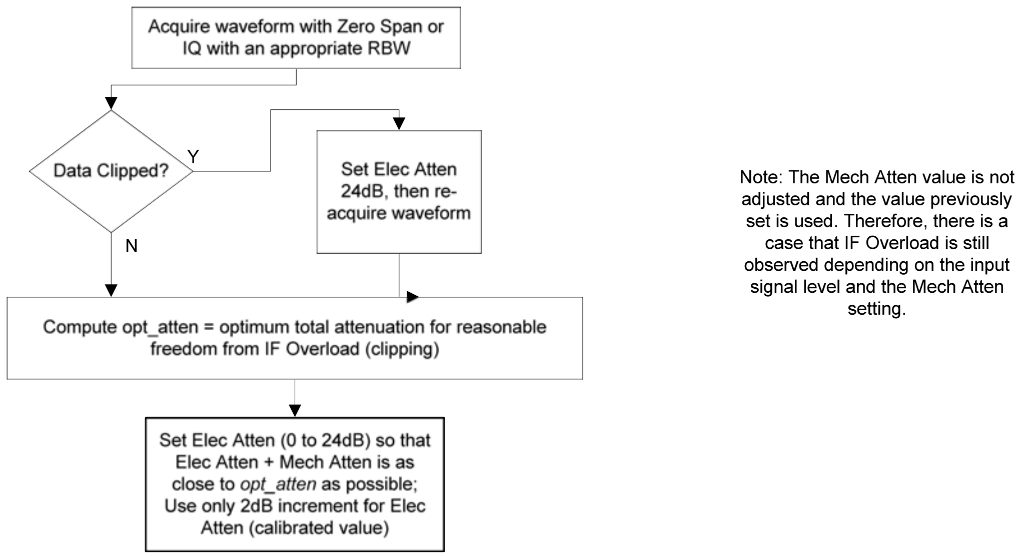


Dual-Attenuator models

"Adjust Atten for Min Clipping" on page 1756 or "Pre-Adjust for Min Clipping" on page 1304 selection is Mech + Elec Atten:


Acquire waveform with Zero Span or IQ with an appropriate RBW
Data Clipped?
Y
N
Elec Atten present & enabled?
Y
N
Set Elec Atten 24dB, then re-acquire waveform
Set Mech Atten 40dB, then re-acquire waveform
Data Clipped?
Y
N
Compute opt_atten = optimum total attenuation for reasonable freedom from IF Overload (clipping)
Elec Atten present?
No
Elec Atten enabled?
No
Set Mech Atten as close to opt_atten as possible, but never < 6 dB
Yes
opt_atten < 10dB?
Yes
Set Elec Atten to 0 dB, set Mech Atten as close to opt_atten as possible, but never < 6 dB
No
opt_atten > 34dB?
Yes
Set Mech Atten to 30 dB, set Elec Atten so that Elec Atten + Mech Atten is as close to opt_atten as possible; Use only 2dB increment for Elec Atten (calibrated value)
No
10dB <= opt_atten <= 35 dB, set Mech Atten to 10 dB (best calibrated value), set Elec Atten so that Elec Atten + Mech Atten is as close to opt_atten as possible. Use only 2dB increment for Elec Atten

"Pre-Adjust for Min Clipping" on page 1304 selection is Elec Only:



vsd04

Mech Atten Step

Controls thestep size used when making adjustments to the input attenuation.

This control is labeled **Mech Atten Step** in Dual-Attenuator models and **Atten Step** in Single-Attenuator models. In the Dual-Attenuator configuration, this control only affects the step size of the mechanical attenuator.

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement] 10 dB | 2 dB` `[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement]?`
Example	`:POW:ATT:STEP 2` `:POW:ATT:STEP?`
Notes	This feature has a toggle choice from the front panel, but it takes a specific value (in dB) when used remotely. The only valid values are 2 and 10
Dependencies	Blanked in EXA, CXA and CXA-m if option FSA (2 dB steps) is not present. If blanked, attempts to set it via SCPI yield an error
Couplings	When the attenuation step size changes, the current mechanical attenuation value is adjusted (if necessary) to be quantized to the new step size. That is, if step is set to 10 dB, mech atten is increased if necessary so it is a multiple of 10 dB
Preset	EXA, CXA and CXA-m: 10 dB (2 dB with option FSA) All other models: 2 dB
State Saved	Saved in instrument state

3.10.3.3 Range (Non-attenuator models)

This tab is only available for Keysight's modular signal analyzers and certain other Keysight products. Examples include:

- VXT
- E7760
- M9391A
- M9393A

This tab also does not appear in UXM. In UXM, all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

State Saved	No

Range

Represents the amplitude of the largest sinusoidal signal that could be present within the IF without being clipped by the ADC. For signals with high peak-to-average ratios, the range may need to exceed the rms signal power by a significant amount to avoid clipping.

This is a measurement global setting.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe <real>` `[:SENSe]:POWer[:RF]:RANGe?`
Example	`:POW:RANG 10 dBm` `:POW:RANG?`
Notes	The MIN and MAX values are affected by the External Gain parameters, and by the **Center Frequency** The hardware compensates for frequency response and alters the Range setting
Preset	0 dBm
State Saved	Yes
Min	-100
Max	100
Annotation	Meas Bar

Adjust Range for Min Clipping

Sets the combination of attenuation and gain based on the current measured signal level so that clipping will be at a minimum.

This is an "immediate action" function, that is, it executes once, when the key is pressed.

This key does not appear in measurements that do not support this functionality.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate`
Notes	Executing Adjust Range for Min Clipping initiates the measurement
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760

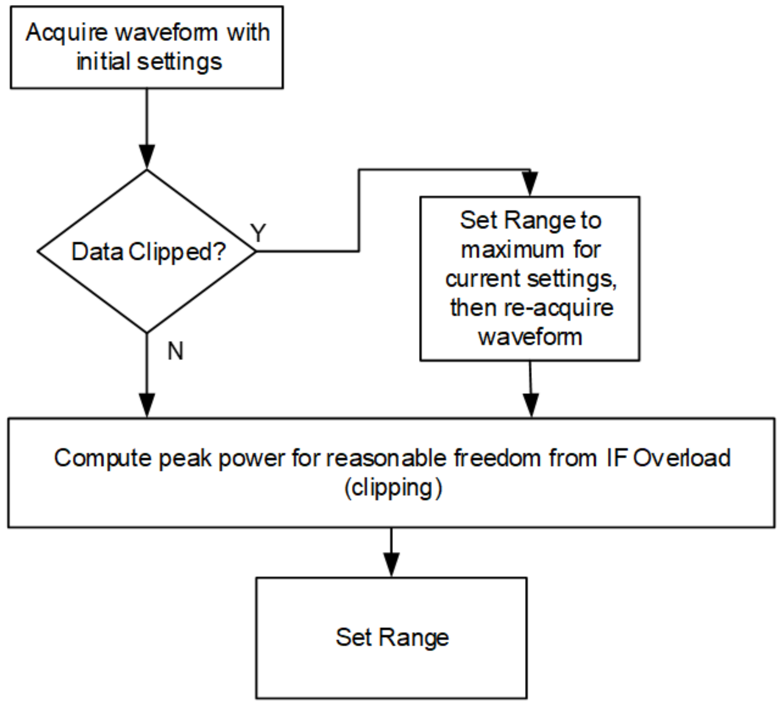
Pre-Adjust for Min Clipping

If this function is `ON`, it applies the adjustment described under Adjust Range For Min Clipping each time a measurement restarts. Therefore, in Continuous measurement mode, it only executes before the first measurement.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation OFF | ON | ELECtrical | COMBined` `[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation?`
Notes	Because there is no attenuator control available in these models, the control displays only `ON` and `OFF` choices. However, for SCPI compatibility with other platforms, all three parameters (`ELECtrical`, `COMBined`, and `ON`) are honored and all are mapped to `ELECtrical`, so if any of these three parameters is sent, a subsequent query will return `ELEC`
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760
Preset	`OFF` for Swept SA measurement; `ON` for all other measurements that support **Pre-Adjust for Min Clipping**
State Saved	Saved in instrument state

Adjustment Algorithm

The algorithm for the adjustment is documented below:



Peak-to-Average Ratio

Used with "Range (Non-attenuator models)" on page 1864 to optimize the level control in the instrument. The value is the ratio, in dB, of the peak power to the average power of the signal to be measured. A ratio of 0 should be used for sinusoidal signals; for 802.11g OFDM signals use 9 dB.

All Applications (Modes) show the current value of Peak-to-Average ratio on the control. However, some applications do not permit changing the value. In these situations, the control is grayed-out.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:PARatio <real>` `[:SENSe]:POWer[:RF]:RANGe:PARatio?`
Example	`:POW:RANG:PAR 12 dB`
Notes	In some Applications (Modes) this parameter is read-only; meaning the value will appear on the control and query via SCPI, but is not changeable. In such applications the control is grayed-out. Attempting to change the value via SCPI will be ignored but no error message will be generated
Dependencies	This control does not appear in Spectrum Analyzer Mode
Preset	10 dB VXT Models M9410A/11A: 0 dB
State Saved	Saved in instrument state
Min	0 dB
Max	20 dB VXT Models M9410A/11A: 50 dB

Mixer Lvl Offset

This is an advanced setting to adjust target Range at the input mixer, which in turn affects the signal level in the instrument's IF. This setting can be used when additional optimization is needed after setting "Peak-to-Average Ratio" on page 1866. Positive values of offset optimize noise performance over distortion, negative values optimize distortion performance over noise.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet <real>` `[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet?`
Example	`:POW:RANG:MIX:OFFS -5 dB`
Preset	0 dB
State Saved	Saved in instrument state
Min	-35 dB VXT Models M9410A/11A: -34 dB
Max	30 dB

3.10.3.4 Signal Path

Contains controls that pertain to the routing of the signal through the frontend of the instrument.

In general, this tab only appears in instruments whose hardware supports this signal routing. For example, this tab does not appear in many of the modular instrument products, including VXT Models M9420/21A. It also does not appear in UXM.

This tab *does* appear in VXT Models M9410A/11A because the Software Preselection control is in this tab, and VXT Models M9410A/11A implement a version of Software Preselection.

Presel Center

Pressing this control adjusts the centering of the preselector filter to optimize the amplitude accuracy at the frequency of the selected marker. If the selected marker is not on when **Presel Center** is pressed, the instrument turns on the selected marker, performs a peak search, and then performs centering on the marker's center frequency. If the selected marker is already on and between the start and stop frequencies of the instrument, the instrument performs the preselector calibration on that marker's frequency. If the selected marker is already on, but outside the frequency range between Start Freq and Stop Freq, the instrument first performs a peak search, and then performs centering on the marker's center frequency.

The value displayed on "Preselector Adjust" on page 1869 will change to reflect the new preselector tuning.

A number of considerations should be observed to ensure proper operation. See "Proper Preselector Operation" on page 1313.

Remote Command	`[:SENSe]:POWer[:RF]:PCENter`
Example	`:POW:PCEN`
Notes	Note that the rules outlined above under the control description apply for the remote command as well as the key. The result of the command is dependent on marker position, etc. Any message shown by the control press is also shown in response to the remote command
Dependencies	Does not appear in CXA-m Does not appear in VXT Models M9410A/11A Grayed-out if the microwave preselector is off – If the selected marker's frequency is below Band 1, an advisory message is generated "Preselector not used in this frequency range" and no action is taken – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz – Blank in models that do not include a preselector, such as option 503. If the remote command is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View
Couplings	The active marker position determines where the centering will be attempted If the instrument is in a measurement such as averaging when centering is initiated, the act of centering the preselector restarts averaging, but the first average trace will not be taken until the centering is completed The offset applied to do the centering reads out on the "Preselector Adjust" on page 1869 control
Status Bits/OPC dependencies	When centering the preselector, `*OPC` will not return true until the process is complete and a subsequent measurement has completed, nor will results be returned to `:READ` or `:MEASure` queries The Measuring bit should remain set while this command is operating and should not go false until the subsequent sweep/measurement has completed

Proper Preselector Operation

A number of considerations should be observed to ensure proper operation:

1 If the selected marker is off, the instrument turns on a marker, performs a peak search, and adjusts the preselector using the selected marker's frequency. It uses the "highest peak" peak search method unqualified by threshold or excursion, so that there is no chance of a 'no peak found' error. It continues with that peak, even if it is the peak of just noise. Therefore, for this operation to work properly, there should be a signal on screen in a preselected range for the peak search to find

2 If the selected marker is already on, the instrument attempts the centering at that marker's frequency. There is no preselector for signals below about 3.6 GHz, so if the marker is on a signal below 3.6 GHz, no centering will be attempted and an advisory message generated

3 In some models, the preselector can be bypassed. If it is bypassed, no centering will be attempted in that range and a message will be generated

Preselector Adjust

Allows you to manually adjust the preselector filter frequency to optimize its response to the signal of interest. This function is only available when "Presel Center" on page 1868is available.

For general purpose signal analysis, using **Presel Center** is recommended. Centering the filter minimizes the impact of long-term preselector drift. **Preselector Adjust** can be used instead to manually optimize the preselector. One application of manual optimization would be to peak the preselector response, which both optimizes the signal-to-noise ratio and minimizes amplitude variations due to small (short-term) preselector drifting.

When **Presel Center** is performed, the offset applied to do the centering becomes the new value of **Preselector Adjust**.

Remote Command	`[:SENSe]:POWer[:RF]:PADJust <freq>` `[:SENSe]:POWer[:RF]:PADJust?`
Example	`:POW:PADJ 100KHz` `:POW:PADJ?`
Notes	The value on the control reads out to 0.1 MHz resolution
Dependencies	– Does not appear in CXA-m – Does not appear in VXT Models M9410A/11A – Grayed-out if microwave preselector is off – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz – Blank in models that do not include a preselector, such as option 503. If the SCPI is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View
Preset	0 MHz
State Saved	The **Preselector Adjust** value set by "Presel Center" on page 1868, or by manually adjusting **Preselector Adjust** It is not saved in instrument state, and does not survive a Preset or power cycle
Min	-500 MHz
Max	500 MHz
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PADJust` `[:SENSe]:POWer[:RF]:MMW:PADJust`

Notes	PSA had multiple preselectors, and you could select which preselector to adjust. Since the X-Series has only one mm/uW preselector, the preselector selection control is no longer available. However, to provide backward compatibility, we accept the legacy remote commands The command form has no effect, the query always returns `MWAVe`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:PADJust:PRESelector MWAVe | MMWave | EXTernal` `[:SENSe]:POWer[:RF]:PADJust:PRESelector?`

Internal Preamp

Accesses a menu of controls for the internal preamps. Turning on the preamp gives a better noise figure, but a poorer inter-modulation distortion (TOI) to noise floor dynamic range. You can optimize this setting for your particular measurement.

The instrument takes the preamp gain into account as it sweeps. If you sweep outside of the range of the preamp, the instrument will also account for that. The displayed result always reflects the correct gain.

For some measurements, when the preamp is on and any part of the displayed frequency range is below the lowest frequency for which the preamp has specifications, a warning condition message appears in the status line. For example, for a preamp with a 9 kHz lowest specified frequency: "Preamp: Accy unspec'd below 9 kHz".

Selection	Example	Note
Off	`:POW:GAIN OFF`	
Low Band	`:POW:GAIN ON` `:POW:GAIN:BAND LOW`	Sets the internal preamp to use only the low band. The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Low Band selection in the dropdown
Full Range	`:POW:GAIN ON` `:POW:GAIN:BAND FULL`	Sets the internal preamp to use its full range. The low band (0-3.6 GHz, 0-3.4 GHz, 0-3GHz, depending on the model) is supplied by the low band preamp and the frequencies above low band are supplied by the high band preamp The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Full Range selection in the dropdown. If the high band option is not installed the Full Range selection does not appear

Remote Command	`[:SENSe]:POWer[:RF]:GAIN:BAND LOW | FULL` `[:SENSe]:POWer[:RF]:GAIN:BAND?`

	`[:SENSe]:POWer[:RF]:GAIN[:STATe] OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:GAIN[:STATe]?`

Example	`:POW:GAIN:BAND LOW`
	`:POW:GAIN:BAND?`
	`:POW:GAIN OFF`
	`:POW:GAIN?`

Dependencies	Preamp is not available on all hardware platforms. If the preamp is not present or is unlicensed, the control is not shown Does not appear in VXT Models M9410A/11A/15A If `:POW:GAIN:BAND FULL` is sent when a low band preamp is available, the preamp band parameter is set to `LOW` instead of `FULL`, and an "Option not installed" message is generated The preamp is not available when the electronic/soft attenuator is enabled
Preset	`LOW` `OFF`
State Saved	Saved in instrument state
Annotation	When the USB Preamp is not connected to USB, the Preamp annotation in the Meas Bar says "Off" if the preamp is off and displays the frequency range of the low band or full range preamp depending on the setting. For example, if the Preamp is set to Low Band and the Low Band is 3.6 GHz the annotation says "3.6 GHz". If it is a 13.6 GHz preamp and it is set to Full Range the annotation says "13.6 GHz" When the USB Preamp is connected to USB, the Preamp annotation says "Preamp: USB" if the internal preamp is off or "Preamp: USB, Int" if the internal preamp is on (only for measurements that support the USB preamp)

LNA

Lets you turn the Low Noise Amplifier (**LNA**) on or off.

The LNA is an additional preamplifier that provides superior DANL and frequency range compared to the Internal Preamp. The LNA provides lower system noise figure, especially at frequencies above 100 MHz, and can be operated up to the full range of 50 GHz instruments.

For best possible sensitivity, the LNA can be turned on together with the "Internal Preamp" on page 1870, although if you operate both preamps together, note that the TOI (distortion) specifications are impacted. The sensitivity improvement of this combination is substantial when operating in high band (frequencies above 3.6 GHz).

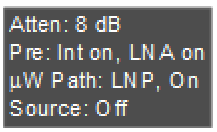
See "More Information" on page 1317

Remote Command	`[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe] OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe]?`
Example	`:POW:GAIN:LNA ON`

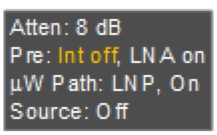
Dependencies	Requires option LNA Option LNA is not required by VXT model M9415A Does not appear in VXT models M9420A/21A/10A/11A May not appear in some measurements
Preset	OFF
State Saved	Saved in State

More Information

When the LNA is installed, the preamp annotation changes to show the state of both the LNA and the Internal Preamp. Below is an example:



Note that when operating entirely in the low band (below about 3.6 GHz), if the LNA is on, the Internal Preamp is switched off (even if you have its switch set to ON). This is because the noise performance is actually degraded in low band if both preamps are on. In this case, the annotation reflects the actual state of the two preamps, but the Internal Preamp annotation displays in amber, to warn you that the actual state of the Internal Preamp does not match the **Internal Preamp** switch control display:



µW Path Control

Options for this control include **µW Preselector Bypass** (Option MPB), **Low Noise Path** (Option LNP) and **Full Bypass Enable** in the High Band path circuits.

When the µW Preselector is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. When **Low Noise Path Enable** is selected, the instrument automatically bypasses certain circuitry in the high frequency bands that can contribute to noise, when it is appropriate based on other instrument settings.

For most applications, the preset state is **Standard Path**, which provides the best remote-control throughput, minimizes acoustic noise from switching and minimizes the risk of wear in the hardware switches, particularly in remote test scenarios where both low band and high band setups will follow in rapid succession. In this path, the bypass of the low band/high band switch and microwave preamp is never activated, which can cause some noise degradation but preserves the life of the bypass switch.

For applications that utilize the wideband IF paths, the preset state is **µW Preselector Bypass**, if option MPB is present. This is because, when using a wideband IF such as the 140 MHz IF, the µW Preselector's bandwidth can be narrower than the available IF bandwidth, causing degraded amplitude flatness and phase linearity, so it is desirable to bypass the preselector in the default case.

You may choose **Low Noise Path Enable** for a lower noise floor, especially in the 21-26.5 GHz region, though without improving many measures of dynamic range, and without giving the best possible noise floor. The preamp, if purchased and used, gives better noise floor than does **Low Noise Path Enable**, but the preamp's compression threshold and third-order intercept are much poorer than that of **Low Noise Path Enable**.

A fourth choice is **Full Bypass Enable**, which combines **µW Preselector Bypass** and **Low Noise Path Enable**. Because this can bypass most of the circuitry between the input and the first mixer, care should be taken when using this setting to avoid damaging the mixer. **Full Bypass Enable** is only available if both options LNP and MPB are present, as well as option FBP.

Path	Example	Note
Standard Path	`:POW:MW:PATH STD`	Normal setting for most measurements. µW Preselector in circuit, Low Noise Path disabled
Low Noise Path Enable	`:POW:MW:PATH LNP`	See "Low Noise Path Enable" on page 1322
µW Preselector Bypass	`:POW:MW:PATH MPB`	See "µW Preselector Bypass" on page 1324
Full Bypass Enable	`:POW:MW:PATH FULL`	See "Full Bypass Enable" on page 1324

Remote Command	`[:SENSe]:POWer[:RF]:MW:PATH STD | LNPath | MPBypass | FULL` `[:SENSe]:POWer[:RF]:MW:PATH?`

Example	`:POW:MW:PATH LNP`
	Enables the Low Noise path
	`:POW:MW:PATH?`

Notes	If "Presel Center" on page 1868 is performed, the instrument will momentarily switch to the Standard Path, regardless of the setting of **µW Path Control** The DC Block will always be switched in when the low noise path is switched in, to protect succeeding circuitry from DC. Note that this does not mean "when the low noise path is enabled" but when, based on the Low Noise Path rules, the path is actually switched in. This can happen when the selection is **Low Noise Path Enable** or **Full Bypass Enable**. In the case where the DC Block is switched in the instrument is now AC coupled. However, if you selected DC coupling, the UI would still behave as though it were DC coupled, including all annunciation, warnings, status bits, and responses to SCPI queries. This is because, based on other settings, the instrument could switch out the low noise path at any time and hence go back to being DC coupled Alignment switching ignores the settings in this menu, and restores them when finished
Dependencies	Does not appear in CXA-m

	Does not appear in VXT Models M9410A/11A Does not appear in BBIQ and External Mixing The **Low Noise Path Enable** selection does not appear unless Option LNP is present and licensed The **µW Preselector Bypass** selection does not appear unless Option MPB is present and licensed The **Full Bypass Enable** selection does not appear unless options LNP and MPB are both present as well as option FBP In any of these cases, if the required options are not present and the SCPI command is sent, error -241, "Hardware missing; Option not installed" is generated **Low Noise Path Enable** and **Full Bypass Enable** are grayed-out if the current measurement does not support them **Low Noise Path Enable** and **Full Bypass Enable** are not supported in Avionics and MMR Modes. In any of these cases (that is, the feature is not supported in either measurement or mode), if the SCPI command is sent, the following error is generated: -221, “Setting Conflict; Feature not supported for this measurement”
Preset	All except modes specified below: `STD` IQ Analyzer, VXA, Pulse and Avionics mode: – MPB option present and licensed: `MPB` – MPB option not present and licensed: `STD`
State Saved	Save in instrument state
Range	Standard Path|Low Noise Path Enable|µW Presel Bypass|Full Bypass Enable
Annotation	In the Meas Bar, if the Standard path is chosen, it says: µW Path: Standard If Low Noise Path is enabled but the LNP switch is not thrown, it shows: µW Path: LNP,Off If the Low Noise Path is enabled and the LNP switch IS thrown, it shows: µW Path: LNP,On If the preselctor is bypassed, it says: µW Path: Bypass If Full Bypass Enable is selected but the LNP switch is not thrown, it shows: µW Path: FByp,Off If Full Bypass Enable is selected and the LNP switch IS thrown, it shows: µW Path: FByp,On

µW Path Control Auto [Mode: VMA, WLAN, NR5G, CQM]

In VMA, WLAN, 5G NR, CQM modes, an Auto/Man switch is added to **µW Path Control**:

This allows the function to automatically switch based on certain Auto Rules as shown below:

VMA Mode

Measurement	When µW Path Control is in Auto:
Digital Demod	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Custom OFDM	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Presel Bypass
SEM	Always Presel Bypass
Spurious Emissions	Always Standard Path

WLAN Mode

Measurement	When µW Path Control is in Auto:
Modulation Analysis	Always Presel Bypass
Spectral Flatness	Always Presel Bypasss
Power vs Time	Always Presel Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Always Presel Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Always Presel Bypass
SEM	1. For 11be 320M, when 'Enabled Wideband IF for FFT' is OFF or 'Sweep Type Rule' is Best Dynamic Range, auto µW path is standard. 2. For other cases, auto µW path is presel bypass if presel bypass is enabled,

Measurement	When µW Path Control is in Auto:
	auto µW path is standard if presel bypass is not enabled.
Spurious Emissions	Always Standard Path

5G NR Mode

Measurement	When µW Path Control is in Auto:
Modulation Analysis	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and “Allow Full Bypass in Auto” is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and “Allow Full Bypass in Auto” is On), otherwise choose Preselector Bypass
Channel Power	Always Standard Path
Occupied BW	Always Standard Path
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Standard Path
SEM	Always Standard Path
Spurious Emissions	Always Standard Path
Transmit On|Off Power	Use Standard Path unless tuned frequency > 3.6 GHz and Info BW > 15 MHz, in which case choose Preselector Bypass

Channel Quality Mode

Measurement	When µW Path Control is in Auto:
Group Delay	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and “Allow Full Bypass in Auto” is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass

Remote Command	`[:SENSe]:POWer[:RF]:MW:PATH:AUTO ON | OFF | 1 | 0` `[:SENSe]:POWer[:RF]:MW:PATH:AUTO?`
Example	`:POW:MW:PATH:AUTO ON` `:POW:MW:PATH:AUTO?`

Dependencies	Only appears in VMA, WLAN, 5G NR and CQM modes
Couplings	See the tables above
Preset	ON
Range	ON|OFF

Low Noise Path Enable

You may select **Low Noise Path Enable**, which gives a lower noise floor under some circumstances, particularly when operating in the 21-26.5 GHz region. With the Low Noise Path enabled, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

- The instrument is not in the Low Band, meaning:
- the start frequency is above 3.5 GHz and
- the stop frequency is above 3.6 GHz
- the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Low Noise Path Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Low Noise Path Enable** is selected in the user interface. The only time the Low Noise Path is used is when **Low Noise Path Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

For measurements that use IQ acquisition, the low noise path is used when **Center Frequency** is in High Band (> 3.6 GHz) and no preamp is in use. In other words, the rules above are modified to use only the center frequency to qualify which path to switch in. This is not the case for FFTs in the Swept SA measurement; they use the same rules as swept measurements.

Note that the Low Noise Path, while giving improved DANL, has the disadvantage of decreased TOI performance and decreased gain compression performance relative to the standard path.

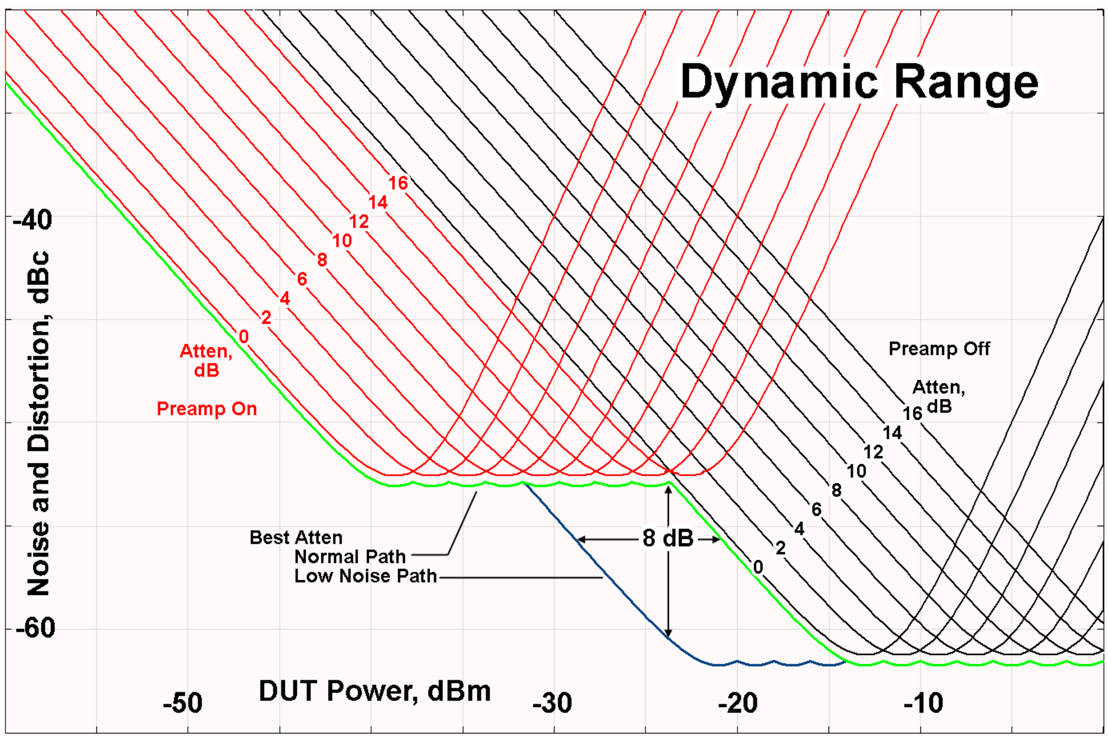
Note also that the bypass switch is a mechanical switch and has finite life, so if the **Low Noise Path Enable** is selected, it is possible to cause frequent cycling of this switch by frequently changing instrument settings such that the above conditions hold true only some of the time. A user making tests of this nature should consider opting for the **Standard Path**, which will never throw the bypass switch, at the expense of some degraded noise performance.

The low noise path is useful for situations where the signal level is so low that the instrument performance is dominated by noise even with 0 dB attenuation, but still high enough that the preamp option would have excessive third-order intermodulation or compression. The preamp, if purchased and used, gives better

noise floor than does the “Low Noise Path.” However, its compression threshold and third-order intercept are much poorer than that of the non-preamp path.

There are some applications, typically for signals around –30 dBm, for which the third-order dynamic range of the standard path is good enough, but the noise floor is not low enough even with 0 dB input attenuation. When the third-order dynamic range of the preamp path is too little and the noise floor of the standard path is too high, the Low Noise Path can provide the best dynamic range

The graph below illustrates the concept. It shows, in red, the performance of an instrument at different attenuation settings, both with the preamp on and off, in a measurement that is affected by both instrument noise and instrument TOI. The green shows the best available dynamic range, offset by 0.5 dB for clarity. The blue shows how the best available dynamic range improves for moderate signal levels with the low noise path switched in. In this illustration, the preamp improves the noise floor by 15 dB while degrading the third-order intercept by 30 dB, and the low noise path reduces loss by 8 dB. The attenuator step size is 2 dB.



There are other times where selecting the low noise path improves performance, too. Compression-limited measurements such as finding the nulls in a pulsed-RF spectrum can profit from the low noise path in a way similar to the TOI-limited measurement illustrated. Accuracy can be improved when the low noise path allows the optimum attenuation to increase from a small amount like 0, 2 or 4 dB to a larger amount, giving better return loss at the instrument input. Harmonic measurements, such as second and third harmonic levels, are much improved using the low noise path because of the superiority of that path for harmonic (though not intermodulation) distortion performance.

µW Preselector Bypass

Toggles the preselector bypass switch for band 1 and higher. When the microwave presel is on, the signal path is preselected. When the microwave preselector is off, the signal path is not preselected. The preselected path is the normal path for the instrument.

The preselector is a tunable bandpass filter which prevents signals away from the frequency of interest from combining in the mixer to generate in-band spurious signals (images). The consequences of using a preselector filter are its limited bandwidth, the amplitude and phase ripple in its passband, and any amplitude and phase instability due to center frequency drift.

Option MPB or pre-selector bypass provides an unpreselected input mixer path for certain X-Series signal analyzers with frequency ranges above 3.6 GHz. This signal path allows a wider bandwidth and less amplitude variability, which is an advantage when doing modulation analysis and broadband signal analysis. The disadvantage is that, without the preselector, image signals will be displayed. Another disadvantage of bypassing the preselector is increased LO emission levels at the front panel input port.

Image responses are separated from the real signal by twice the 1st IF. For IF Paths of 10 MHz and 25 MHz, the 1st IF is 322.5 MHz, so the image response and the real signal will be separated by 645 MHz. The 1^{st} IF will be different for other IF Path settings. When viewing a real signal and its corresponding image response in internal mixing, the image response will be to the left of the real signal.

Also, the image response and the real signal typically have the same amplitude and exhibit the same shape factor.

However, if Option FS1, Fast Sweep Capability, is enabled, the image response in the Swept SA measurement appears lower in amplitude and has a much wider shape factor compared to the real signal.

Full Bypass Enable

With **Full Bypass Enable** selected, the microwave preselector is bypassed. In addition, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

- The instrument is not in the Low Band, meaning:
- the start frequency is above 3.5 GHz and
- the stop frequency is above 3.6 GHz.
- the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. The only time the Low

Noise Path is used is when **Full Bypass Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

CAUTION When **Full Bypass Enable** is selected, and "Attenuation" on page 1747 is set to 0 dB, there will be a direct AC connection between the input and the first converter when the Low Noise Path switches in (when Start Freq >3.6 GHz and the Preamp is either not licensed, set to Low Band, or Off). This puts the first converter at high risk to be damaged by high AC power. Consequently, whenever **Full Bypass Enable** is selected, a warning message appears in the status bar:

Full Bypass Enabled, maximum safe input power reduced

Microwave Preselector Bypass Backwards Compatibility

Example	`:POW:MW:PRES OFF` Bypasses the microwave preselector
Notes	Included for Microwave Preselector Bypass backwards compatibility The `ON` parameter sets the `STD` path (`:POW:MW:PATH STD`) The `OFF` parameter sets path `MPB` (`:POW:MW:PATH MPB`)
Preset	`ON`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe] ON | OFF | 0 | 1` `[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe]?`

Frequency Extender Preselection Bypass

Frequency Extender Preselection Bypass only applies to the high frequency path of the Frequency Extender and only if the Frequency Extender allows it. For example, the V3050A high frequency path is 50 – 110 GHz and does allow control of the preselector bypass.

When the Frequency Extender’s preselection is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. For bandwidths greater than 2.5 [GHz], it is recommended that the signal bypass the Frequency Extender Preselector since the max bandwidth of the Preselector can be as narrow as 2.5 [GHz].

For most applications, the preset state is `OFF`, which gives the best remote-control throughput, minimizes acoustic noise from switching, minimizes out of band spurs, and minimizes the risk of wear in the hardware switches.

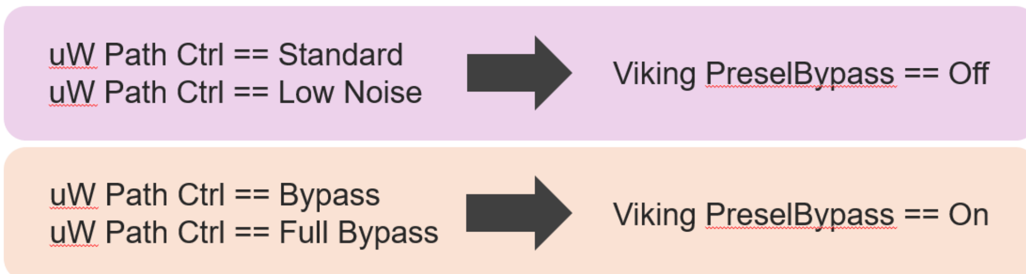
Coupling with Microwave Preselector Control

The control of whether to apply or bypass the Frequency Extender’s preselection is dependent on the Microwave Path Control setting.

The coupling between the Microwave Path Control and Frequency Extender Preselector Bypass is described below.

UW PATH CTRL	UW PRESELECTOR	VIKING PRESELECTOR
Standard Path	On	**On**
Low Noise Path Enable	On	**On**
uW Presel Bypass	Off	**Off**
Full Bypass Enable	Off	**Off**

In other words…



For the Frequency Extender Preselector Bypass to take effect, it requires a Frequency Extender device (such as V3050A) be connected and External RF (ERFIN) selected as the input.

The Frequency Extender Preselector is applied or bypassed depending on the Microwave Path Control setting only when the acquisition is above 50 [GHz]. Hence, it will be bypassed only when the acquisition is above 50 [GHz].

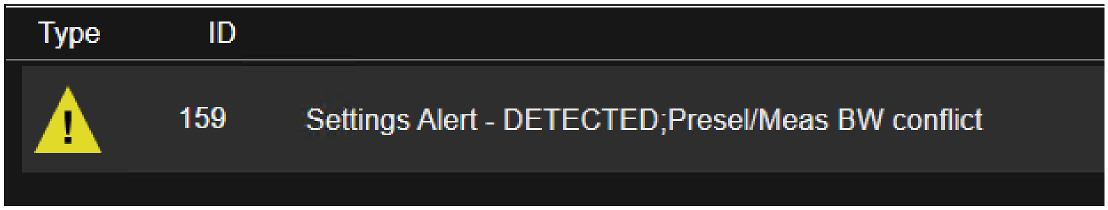
Preselector and Bandwidth Conflict

When the Frequency Extender Preselector is applied and the signal bandwidth is greater than 2.5 [GHz], then a settings alert message will show to warn the user that the signal may be distorted due to the limitation of the Frequency Extender Preselector bandwidth.

An example of the settings alert message is shown below.

Settings Alert message in the Status Bar at the bottom of the display.

Settings Alert message in the error queue



Software Preselection

Software Preselection is provided in some instruments, either to compensate for issues with provided hardware preselection or to provide the preselection function when there is no hardware preselector.

N9041B

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 50 GHz, software preselection must be used to suppress and separate images above 50 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

In the N9041B, Software Preselection only applies for frequencies above 50 GHz, therefore it is only used for RF Input 2. Even if it is turned on, it will not be used for other inputs and never for frequencies below 50 GHz. This is why the label of this control contains the parenthetical note “(>~50 GHz)”.

Note that in the N9041B, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

N9042B+V3050A

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 88 GHz, software preselection must be used to suppress and separate images above 88 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

For N9042B+V3050A, Software Preselection only applies for frequencies above 88 GHz, therefore it is only used for External RF. Even if it is turned on, it will not be used for other inputs and never for frequencies below 88 GHz. This is why the label of this control contains the parenthetical note “(>~88 GHz)”.

Note that for N9042B+V3050A, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

VXT models M9410A/11A

Software Preselection is used to provide the preselection function, as there is no hardware preselector in these models. Two background traces are taken and compared point by point, and the point with the lowest amplitude from the two traces is used. This provides a method to reduce spurs that are internally generated within the VXT, but the user should note the following when using Software Preselection:

- There is some speed cost due to the need to take multiple captures
- Taking the point with the lowest amplitude in each trace will make the average noise level lower at all points that do not have a spur. This can reduce the accuracy of the measurement of noise and noise-like signals.

Because of the difficulty in identifying spurs manually, you are encouraged to leave Software Preselection ON at all times in VXT models M9410A/11A. If you turn it off in order to speed up your measurement or improve noise accuracy, be aware of unwanted onscreen spurs.

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel:STATe 0 | 1 | ON | OFF` `[:SENSe]:POWer[:RF]:SWPresel:STAT?`
Example	`:POW:SWPR:STAT 1` `:POW:SWPR:STAT?`
Dependencies	Only appears in N9041B, N9042B+V2050A, and VXT models M9410A/11A. Does not appear in all measurements
Couplings	Sweep Time is affected by SW Preselection. Also Auto Tune supports SW Preselection, so set SW Preselection state and then do Auto Tune
Preset	N9041B: OFF N9042B+V3050A: ON M9410A/11A: ON
State Saved	Saved in instrument state

SW Preselection Type

Specifies the algorithm used for software preselection.

Two hidden sweeps are taken in succession. The second sweep is offset in LO frequency by 2*IF/N. For each point in each trace, the smaller amplitude from the two traces is taken and placed in that point in the selected trace. The Peak detector is auto-selected to improve the image suppression effectiveness. Responses of each trace that lie on top of one another will remain and are valid signals. Other signals are images and are suppressed. The action of taking the smaller of the two traces will make the average noise level lower in all points that do not have an image, thus reducing the accuracy of the measurement of noise and noise-like signals.

- NORMal - mathematically removes all image and multiple responses of signals present at the input
- ADVanced - any trace processing (such as “max hold” or trace averaging) is performed on the points of both candidate traces before the “select minimum” operation occurs. This form of processing works better for non-stationary signals, such as pulsed-RF signals

Remote Command	[:SENSe]:POWer[:RF]:SWPResel NORMal | ADVanced [:SENSe]:POWer[:RF]:SWPResel?
Example	:POW:SWPR NORM :POW:SWPR?
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed-out. Its grayout message is “Unavailable unless SW Presel enabled”
Preset	N9041B: ADVanced N9042B+V3050A: NORMal
State Saved	Saved in instrument state

SW Preselection BW

Specifies the effective bandwidth to be used for Software Preselection.

The choices are:

- NORMal – when making Swept measurements, a software preselection algorithm is used which takes up to 4 background acquisitions, then post-processes the result. This algorithm can remove images from signals with an occupied bandwidth up to around 3 GHz. (Default/Preset setting). When making FFT measurements, this algorithm is not used, instead the same algorithm is used as for NARRow (below)
- NARRow– a software preselection algorithm is used which takes two background acquisitions, then post-processes the result to detect and remove images from wideband signals with occupied bandwidths up to 2 GHz. This increases the risk of images failing to be rejected, but improves the measurement speed

Remote Command	[:SENSe]:POWer[:RF]:SWPResel:BW NORMal | NARRow [:SENSe]:POWer[:RF]:SWPResel:BW?
Example	:POW:SWPR:BW NARR
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed out. Its grayout message is “Unavailable unless SW Presel enabled” For N9042B+V3050A the parameter is SCPI only and always set to NARRow when Software

	Preselection is enabled
Preset	N9041B: NORMal N9042B+V3050A: NARRow
State Saved	Saved in instrument state

High Freq Prefilter

Lets you set the state of Prefilter for Center Frequencies above 1310 MHz.

In VXT Models M9410A/11A, the Receiver RF path has a bank of filters that come after the RF Attenuator in the signal path. Since this bank of filters precedes the mixer they are known as the “Prefilter” bank. Their purpose is to eliminate unwanted in-band mixing products by filtering out all but the desired frequencies before the signals get to the mixer. There are 13 prefilter bands to cover the frequencies between 9 kHz and 6000 MHz. The Prefilter provides the necessary rejection of the unwanted signal.

Remote Command	[:SENSe]:<measurement>:PFILter[:STATe] ON | OFF | 1 | 0 [:SENSe]:<measurement>:PFILter[:STATe]?
Example	For example, to enable High Freq Prefilter in IQ Analyzer Mode: For the Complex Spectrum Measurement: :SPEC:PFIL ON For the IQ Waveform Measurement: :WAV:PFIL ON :
Dependencies	This control only appears in VXT models M9410A/11A with center frequency above 1310 MHz
Preset	See “Prefilter Presets” below
State Saved	Saved in instrument state

Prefilter Presets

Meas	Mode	Preset
SPEC	BASIC	OFF
WAV	BASIC, WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
MON	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
RHO	WCDMA	OFF
CDP	WCDMA	OFF
PCON	WCDMA	OFF
EVMQ	WCDMA	OFF
CHP	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF

Meas	Mode	Preset
OBW	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
ACP	WCDMA, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
SEM	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PST	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PVT	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF
EVM	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF
FLAT	WLAN	OFF
EVMM	WLAN	OFF
CEVM	LTEAFDD, LTEATDD	OFF
PAVT	5GNR, VMA	OFF
DDEM	VMA	OFF
OFDM	VMA	OFF
SAN	SA	ON
HARM	SA	ON

3.10.4 BW

Opens the Bandwidth (BW) menu, which contains controls for the Resolution Bandwidth functions of the instrument.

The Resolution BW functions control filter type. There are two filter types, Gaussian and Flattop. The Gaussian filters have a response curve that is parabolic on a log scale. The Flattop filter shape is a close approximation of a rectangular filter.

3.10.4.1 Settings

Contains the basic Bandwidth functions. It is the only tab under BW.

RBW Filter Type

Selects the type of bandwidth filter that is used in Carriers and Offsets:

- When GAUSsian or FLATtop is selected, the selected filter is applied to carriers and all offsets
- When Auto Sense (ASENse) is selected, filter type is automatically selected for each carrier and offset, so that measurement speed and accuracy are optimized

For WLAN, RBW Filter Type is coupled to “Flattop” when “Enable Wideband IF for FFT” is on, and is coupled to “Auto Sense” when “Enable Wideband IF for FFT” is off.

Remote Command	[:SENSe]:SEMask:BANDwidth:SHAPe ASENse | GAUSsian | FLATtop [:SENSe]:SEMask:BANDwidth:SHAPe?
Example	:SEM:BAND:SHAP GAUS

	:SEM:BAND:SHAP?
Couplings	When ASENse is selected, the filter type is automatically selected for each carrier and offset, so that measurement speed and accuracy are optimized For WLAN, RBW Filter Type is coupled to FLATtop when “Enable Wideband IF for FFT” is on, and is coupled to “Auto Sense” when “Enable Wideband IF for FFT” is off
Preset	ASENse
State Saved	Saved in instrument state
Range	Auto Sense (each offset and carrier) | Gaussian (all offsets and carriers) | Flattop (all offsets and carriers)

3.10.5 Display

Opens the **Display** Menu, which lets you configure display items for the current Mode, Measurement View or Window.

3.10.5.1 Meas Display

Contains controls for setting up the display for the current Measurement, View or Window.

Limit Lines

Toggles the limit lines display function for the Spectrum Emission Mask measurement On and Off.

Remote Command	:CALCulate:SEMask:LLINe:STATe ON | OFF | 1 | 0 :CALCulate:SEMask:LLINe:STATe?
Example	:CALC:SEM:LLIN:STAT OFF :CALC:SEM:LLIN:STAT?
Preset	ON
State Saved	Saved in instrument state
Range	ON|OFF

3.10.5.2 View

Contains controls for selecting the current **View**, and for editing User Views.

Views

In the SA and WCDMA mode, there are three views. In the MSR, LTE-Advanced FDD/TDD and 5G NR modes, there are four views.

In the following table:

- The Enumerated ID is used with the remote command :DISP:SEM:VIEW
- The Numeric ID is used with the remote command :DISP:SEM:VIEW:NSEL

Enumerated ID	Numeric ID	View Name	Details
APFReq	1	Abs Pwr Freq	Displays the absolute power levels in dBm and the corresponding frequencies in the text window
RPFReq	2	Rel Pwr Freq	Displays the relative power levels in dBc and the corresponding frequencies in the text window
IPOWer	3	Integrated Power	Displays the absolute and relative power levels integrated throughout the bandwidths between the start and stop frequencies in the text window
CINFormation	4	Carrier Info	Displays the carrier info table. (Only available in MSR, LTE-Advanced FDD/TDD) and 5G NR MSR is not supported in UXM

View Selection by Name

Remote Command	:DISPlay:SEMask:VIEW[:SELect] APFReq | RPFReq | IPOWer | CINFormation :DISPlay:SEMask:VIEW[:SELect]?
Example	:DISP:SEM:VIEW IPOW :DISP:SEM:VIEW?
Dependencies	In SA mode, when "Radio Standard" is set to WLAN, IPOWer is not available CINFormation is available only in MSR, LTE-Advanced FDD/TDD and 5G NR modes
Preset	APFReq unless noted below RPFReq WLAN
State Saved	Saved in instrument state
Range	Abs Pwr Freq| Rel Pwr Freq|Integrated Power|Carrier Info

Views Selection by Number

Remote Command	:DISPlay:SEMask:VIEW:NSELect <integer> :DISPlay:SEMask:VIEW:NSELect?
Example	:DISP:SEM:VIEW:NSEL 2 :DISP:SEM:VIEW:NSEL?
Dependencies	In SA mode, when "Radio Standard" is set to WLAN, Option 3 is not available Option 4 is available only in MSR, LTE-Advanced FDD/TDD and 5G NR modes

Preset	1 unless noted below: 2 WLAN
State Saved	Saved in instrument state
Min/Max	MSR, LTEAFDD, LTEATDD, 5G NR:1/4 Other modes: 1/3

Abs Pwr Freq

Displays the absolute power levels in dBm and the corresponding frequencies in the text window.

Windows: "Graph" on page 1276, "Table" on page 1281

Example	`:DISP:SEM:VIEW APFR`

Rel Pwr Freq

Displays the relative power levels in dBc and the corresponding frequencies in the text window.

Windows: "Graph" on page 1276, "Table" on page 1281

Example	`:DISP:SEM:VIEW RPFR`

Integrated Power

Displays the absolute and relative power levels integrated throughout the bandwidths between the start and stop frequencies in the text window.

Windows: "Graph" on page 1276, "Table" on page 1281

Example	`:DISP:SEM:VIEW IPOW`

User View

Lets you choose a View from the saved User Views for the current measurement. This panel only appears if a User View exists for the current measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:SELect <alphanumeric>` `:DISPlay:VIEW:ADVanced:SELect?`
Example	Select Baseband as the current View `:DISP:VIEW:ADV:SEL “Baseband”`
Notes	You must be in the measurement whose View you are trying to set to send the command. You can only set Views for the current measurement using this command

	For predefined views, the parameter is derived from the view name that is shown in the View list in the user interface. For example, if you are trying to select the Trace Zoom view in the Swept SA measurement, you send:
	`:DISP:VIEW:ADV:SEL "Trace Zoom"`
	because "Trace Zoom" is the name of the View as seen in the Mode/Meas dialog or in the Display, View menu
	You *cannot* use the legacy View parameter (which in this case would be `TZOom`) with `:DISP:VIEW:ADV:SEL`
	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case. Thus, both of the following forms work:
	`:DISP:VIEW:ADV:SEL "Trace Zoom"`
	`:DISP:VIEW:ADV:SEL "TRACE ZOOM"`
	If the specified view is not a valid View, the query returns the error message "-224, Illegal parameter value; View with the name <alphanumeric> does not exist"
	If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Backwards Compatibility SCPI	The legacy node `:DISPlay:VIEW[:SELect]` is retained for backwards compatibility, but it only supports predefined views

Restore Layout to Default

Restores the Layout to the default for Basic.

Modified Views are very temporary; if you exit the current measurement they are discarded, and they are not saved in State. To retain this View for later use, and to be able to return easily to your original Basic View, you can save your edited View as a "User View".

Save Layout as New View

Saves your new View as a User View. An alpha keyboard appears, which lets you name your new View; the default is the old View name plus a number.

Remote Command	`:DISPlay:VIEW:ADVanced:NAME <alphanumeric>`
Example	`:DISP:VIEW:ADV:NAME "Baseband"` Creates a new View named `Baseband` from the current View, and selects it as the current View
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If `<alphanumeric>` name already exists as a View, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; User View SCPI cannot be used while Display is disabled" is generated

Re-Save User View

You can re-edit a User View; if you make changes, then an asterisk will appear next to the User View's name. You can then tap **Re-Save User View** to save it back to its existing name, or **Save Layout as New View** to add another, new User View.

This is a front panel function only, there is no remote command available to perform this function. To do this remotely, you must first perform **Save Layout as New View**, then delete the old User View and rename the new one with the name of the View you just deleted.

Rename User View

You can rename the current View by giving it a new unique name. Only User Views can be renamed, if the current View is a Predefined View, an error occurs.

Remote Command	`:DISPlay:VIEW:ADVanced:REName <alphanumeric>`
Example	`:DISP:VIEW:ADV:REN "Baseband"`
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the `<alphanumeric>` specifying the new name is already present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot rename a Predefined View" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete User View

You can delete the current View if it is a User View. The default view becomes the current view for the Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:DELete`
Example	`:DISP:VIEW:ADV:DEL`
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the `<alphanumeric>` is not present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> does not exist" is generated If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot delete a Predefined View" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete All User Views

Deletes all previously saved User Views. The default view becomes the current view for the Measurement if a User View was the current view when this command was executed.

Remote Command	`:DISPlay:VIEW:ADVanced:DELete:ALL`
Example	`:DISP:VIEW:ADV:DEL:ALL`
Notes	Disabled if there are no User Views

View Editor Remote Commands

The following remote commands help you manage Views and User Views. Note that the SCPI node for User Views handles both Predefined and User Views. The legacy nodes, `:DISPlay:VIEW[:SELect]` and `:DISPlay:VIEW:NSEL`, are retained for backwards compatibility, but they only support predefined views.

View Listing Query

Returns a string containing a comma-separated list of names for *all* the Views, including User Views, available for the current Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:CATalog?`
Example	`:DISP:VIEW:ADV:CAT?`
Notes	Returns a quoted string of the available Views for the current measurement, separated by commas. The list includes names for *all* the Views, including User Views, available for the current Measurement Example: `"Normal,Trace Zoom,Spectrogram,Baseband,myView1,yourView1"` No distinction is made between Predefined and User Views If you switch measurements with the display disabled (via `:DISP:ENAB OFF`), then query the list of available Views, the result is undefined

User View Listing Query

Returns a string containing a comma-separated list of names for *only* the User Views available for the current Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:USER:CATalog?`
Example	`:DISP:VIEW:ADV:USER:CAT?`
Notes	Returns a quoted string of the available User Views for the current measurement, separated by commas.

Example:

"Baseband,myView1,yourView1"

If you switch measurements with the display disabled (see "Display Enable (Remote Command Only)" on page 1894), then query the list of available Views, the result is undefined

3.10.5.3 Annotation

Contains controls for setting up the annotation for the current Mode or Measurement.

Graticule

Turns the display graticule On or Off for all windows with graticules in all measurements in the current Mode. Also turns the graticule Y-Axis annotation on and off.

Remote Command	:DISPlay:GRATicule[:STATe] OFF | ON | 0 | 1 :DISPlay:GRATicule[:STATe]?
Example	:DISP:GRAT OFF
Notes	The graticule is the set of horizontal and vertical lines that make up the grid/divisions for the X-Axis and Y-Axis
Preset	ON
State Saved	Saved in instrument state
Backwards Compatibility SCPI	:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe] OFF | ON | 0 | 1 :DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe]? This command is accepted for backwards compatibility with older instruments, but the WINDow, TRACe and GRID parameters are ignored

Screen Annotation

Controls the display of the annunciation and annotation around the graticule, including any annotation on lines (such as the display line, the threshold line, etc.) and the Y-Axis annotation, for all windows with screen annotation in all measurements in the current Mode.

This does *not* include marker annotation (or the N dB result). When OFF, the graticule expands to fill the entire graticule area, leaving only the 1.5% gap above the graticule, as described in the Trace section.

Remote Command	:DISPlay:ANNotation:SCReen[:STATe] OFF | ON | 0 | 1 :DISPlay:ANNotation:SCReen[:STATe]?

Example	`:DISP:ANN:SCR OFF`
Dependencies	Grayed-out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Trace Annotation

Turns on and off the labels on the traces, showing their detector (or their Math Mode) as described in the **Trace** section, for all windows in all measurements in the current Mode for which Trace Annotation on/off is supported.

If Trace Math is being performed on a trace, then the Trace Math annotation replaces the detector annotation.

For measurements that support limit lines, this key also turns on and off the labels on the Limit Lines. The label is the Limit number annotation and Limit Comment displayed on the graph. If the length of the comment is greater than 20 characters, the first 8 characters and the last 8 characters are displayed, joined with ….

Remote Command	`:DISPlay:ANNotation:TRACe[:STATe] ON | OFF | 1 | 0` `:DISPlay:ANNotation:TRACe[:STATe]?`
Example	`:DISP:ANN:TRAC OFF`
Preset	`OFF`
State Saved	Saved in instrument state

Control Annotation

Turns on and off the display of values on the Active Function controls for all measurements in the current Mode. This is a security feature.

Remote Command	`:DISPlay:ACTivefunc[:STATe] ON | OFF | 1 | 0` `:DISPlay:ACTivefunc[:STATe]?`
Example	`:DISP:ACT OFF`
Dependencies	Grayed out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Meas Bar

Turns the Measurement Bar at the top of the screen on and off for all measurements in the current Mode. When OFF, the graticule area expands to fill the area formerly occupied by the Measurement Bar.

Remote Command	:DISPlay:ANNotation:MBAR[:STATe] OFF | ON | 0 | 1 :DISPlay:ANNotation:MBAR[:STATe]?
Example	:DISP:ANN:MBAR OFF
Dependencies	Grayed out and forced to OFF when **System Display Settings**, **Annotation** is OFF
Preset	ON This remains OFF through a Preset when **System Display Settings**, **Annotation** is set to OFF
State Saved	Saved in instrument state

Display Enable (Remote Command Only)

Turns the display on/off, including the display drive circuitry. The backlight stays lit to confirm that the instrument is on. The display enable setting is mode global. Theare three reasons for turning the display off:

1. To increase speed as much as possible by freeing the instrument from having to update the display
2. To reduce emissions from the display, drive circuitry
3. For security purposes

If you have turned off the display:

– and you are in local operation, the display can be turned back on by pressing any key or by sending :SYSTem:DEFaults MISC or :DISPlay:ENABle ON (neither *RST nor :SYSTem:PRESet enable the display)

– and you are in remote operation, the display can be turned back on by pressing the **Local** or **Esc** keys, or by sending :SYSTem:DEFaults MISC or :DISPlay:ENABle ON (neither *RST nor :SYSTem:PRESet enable the display)

– and you are using either the :SYSTem:KLOCk command or GPIB local lockout, then *no* front-panel key press will turn the display back on. You must turn it back on remotely.

If the display is OFF, many SCPI commands related to User Views and Multiscreen functionality do not work, and return the error messages "-221, Settings conflict; Screen SCPI cannot be used when Display is disabled" or "221, Settings conflict; View SCPI cannot be used while Display is disabled". These commands include:

Name	Command
Select User View	:DISPlay:VIEW:ADVanced:SELect
Rename User View	:DISPlay:VIEW:ADVanced:REName
Delete User View	:DISPlay:VIEW:ADVanced:DELete
Create User View	:DISPlay:VIEW:ADVanced:NAME
Select Screen	:INSTrument:SCReen:SELect
Delete Screen	:INSTrument:SCReen:DELete
Delete All But This Screen	:INSTrument:SCReen:DELete:ALL
Add Screen	:INSTrument:SCReen:CREate
Rename Screen	:INSTrument:SCReen:REName
Sequencer On/Off	:SYSTem:SEQuencer

Remote Command	`:DISPlay:ENABle OFF | ON | 0 | 1` `:DISPlay:ENABle?`
Example	`:DISP:ENAB OFF`
Couplings	`:DISP:ENAB OFF` turns Backlight `OFF` and `:DISP:ENAB ON` turns Backlight `ON`, but changing Backlight settings does *not* change the state of `:DISP:ENAB`
Preset	`ON` Set by `:SYST:DEF MISC`, but not affected by `*RST` or `:SYSTem:PRESet`
State Saved	Not saved in instrument state
Backwards Compatibility Notes	`:SYST:PRES` no longer turns on `:DISPlay:ENABle` as it did in legacy analyzers

3.10.6 Freq

Opens the **Frequency** menu, which contains controls that allow you to control the Frequency and Channel parameters of the instrument.

Some features in the **Frequency** menu are the same for all measurements in the current Mode – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset. For example, the **Center Freq** setting is the same for all measurements - it does not change as you change measurements.

3.10.6.1 Settings

Contains controls that pertain to the X axis parameters of the measurement. These parameters control how data on the vertical (X) axis is displayed, and control instrument settings that affect the horizontal axis.

Center Frequency

Sets the frequency that corresponds to the horizontal center of the graticule. While adjusting **Center Frequency**, Span is held constant.

The Center Frequency setting is the same for all measurements within a mode, that is, it is Meas Global. Some modes are also able to share a Mode Global Center Frequency value. If this is the case, the Mode will have a **Global** tab in its **Meas Setup** menu.

The Center Frequency function sets (and queries) the Center Frequency for the currently selected input. If your instrument has multiple inputs, and you select another input, the Center Frequency changes to the value for that input. SCPI commands are available to directly set the Center Frequency for a specific input.

Center Frequency is remembered as you go from input to input. Thus you can set a Center Frequency of 10 GHz with the RF Input selected, change to BBIQ and set a Center Frequency of 20 MHz, then switch to External Mixing and set a Center Frequency of 60 GHz, and when you go back to the RF Input the Center Frequency will return to 10 GHz; back to BBIQ and it is 20 MHz; back to External Mixing and it is 60 GHz.

See:

– "Center Frequency Presets" on page 1343

– "VXT Models with Radio Heads/CIU Frequency Range" on page 1345

– "RF Center Freq" on page 1345

– "Ext Mix Center Freq" on page 1346

– "I/Q Center Freq" on page 1346

Remote Command	`[:SENSe]:FREQuency:CENTer <freq>` `[:SENSe]:FREQuency:CENTer?`

Example	`:FREQ:CENT 50 MHz`
	sets Center Frequency to 50 MHz
	`:FREQ:CENT UP`
	increments the Center Frequency by the value of CF Step
	`:FREQ:CENT?`
	returns the current value of Center Frequency

Notes	This command sets the RF, External Mixing or I/Q Center Frequency depending on the selected input For RF input it is equivalent to `:FREQ:RF:CENT` For I/Q input it is equivalent to `:FREQ:IQ:CENT` For External Mixer it is equivalent to `:FREQ:EMIX:CENT`

	Preset and Max values are dependent on Hardware Options (5xx) If no terminator (for example. MHz) is sent, the terminator Hz is used. If a terminator with unit other than Frequency is used, an invalid suffix error message is generated
Dependencies	Not available in the MSR, LTE-Advanced FDD/TDD and 5G NR modes
Preset	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 1343, and "RF Center Freq" on page 1345,, "Ext Mix Center Freq" on page 1346, "I/Q Center Freq" on page 1346 and "VXT Models with Radio Heads/CIU Frequency Range" on page 1345
State Saved	Saved in instrument state
Min/Max	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 1343, "RF Center Freq" on page 1345, "I/Q Center Freq" on page 1346 and "VXT Models with Radio Heads/CIU Frequency Range" on page 1345
Annotation	Center <value> appears in the lower left corner of the display
Status Bits/OPC dependencies	Non-overlapped

Center Frequency Presets

The following table provides the Center Frequency Presets for the Spectrum Analyzer mode, and the Max Freq, for the various frequency options:

Freq Option	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
503 (all but CXA)	1.805 GHz	3.6 GHz	3.7 GHz
503 (CXA)	1.505 GHz	3.0 GHz	3.08 GHz
507 (all but CXA)	3.505 GHz	7.0 GHz	7.1 GHz
507 (CXA)	3.755 GHz	7.5 GHz	7.58 GHz
508 (all but MXE)	1.805 GHz	3.6 GHz	8.5 GHz
508 (MXE)	4.205 GHz	8.4 GHz	8.5 GHz
513	6.805 GHz	13.6 GHz	13.8 GHz
526 (except CXA and MXE)	13.255 GHz	26.5 GHz	27.0 GHz*
526 (CXA)	13.255 GHz	26.5 GHz	26.55 GHz
526 (MXE)	1.805 GHz	3.6 GHz	27.0 GHz
532	16.005 GHz	32.0 GHz	32.5 GHz
540	20.005 GHz	40.0 GHz	40.5 GHz
543	21.505 GHz	43.0 GHz	43.0 GHz
544	22.005 GHz	44.0 GHz	45.0 GHz
550	25.005 GHz	50.0 GHz	52 GHz
F03 (CXA-m)	1.505 GHz	3.0 GHz	3.08 GHz
F07 (CXA-m)	3.755 GHz	7.5 GHz	7.575 GHz
F13 (CXA-m)	6.805 GHz	13.6 GHz	13.8 GHz
F26 (CXA-m)	13.255 GHz	26.5 GHz	26.55 GHz

Freq Option	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
504 (M9420A/21A, M8920A)	2.145 GHz	3.88GHz	3.88 GHz
506 (M9420A/21A, M8920A)	3.245 GHz	6.08GHz	6.08 GHz
F06 (M9410A/11A)	1.0 GHz	6.08 GHz	6.08 GHz
F06 (M9415A)	1 GHz	1.08 GHz	6.6 GHz
F08 (M9415A)	1 GHz	1.08 GHz	8.6 GHz
F12 (M9415A)	1 GHz	1.08 GHz	12.9 GHz

*For option 526, the Max CF in RTSA is 26.999999995 GHz.

N9041B Center Freq Presets

Input	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
Input 1, all models	25.005 GHz	50.0 GHz	52 GHz
Input 2, opt 585	42.505 GHz	85.0 GHz	86 GHz
Input 2, opt 590	45.005 GHz	90.0 GHz	92 GHz
Input 2, opt 5CX	55.005 GHz	110.0 GHz	110 GHz

Input 2, CXA and MXE

Model	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
CXA opt C75	0.7505 GHz	1.5 GHz	1.58 GHz
MXE	505 MHz	1 GHz	1.000025 GHz

Tracking Generator Frequency Limits (CXA only)

Tracking Generator Option	Min Freq (clips to this freq when turn TG on and can't tune below while TG on)	If above this Freq, Stop Freq clipped to this Freq when TG turned on	Max Freq (can't tune above) while TG on
T03	9 kHz	3.0 GHz	3.08 GHz
T06	9 kHz	6.0 GHz	6.05 GHz

Tracking Generator Frequency Limits(CXA-m only)

Tracking Generator Option	Min Freq (clips to this freq when turn TG on and can't tune below while TG on)	If above this Freq, Stop Freq clipped to this Freq when TG turned on	Max Freq (can't tune above) while TG on
T03	2 MHz	3.08 GHz	3.08 GHz

Tracking Generator Option	Min Freq (clips to this freq when turn TG on and can't tune below while TG on)	If above this Freq, Stop Freq clipped to this Freq when TG turned on	Max Freq (can't tune above) while TG on
T07	2 MHz	7.575 GHz	7.575 GHz
T13	2 MHz	13.8 GHz	13.8 GHz
T26	2 MHz	26.55 GHz	26.55 GHz

VXT Models with Radio Heads/CIU Frequency Range

The following table shows the Center Frequency Presets and Range for VXT modes with Radio Heads/CIU.

Products with Radio Heads/CIU	Preset	Start frequency	Stop frequency
M9421A + CIU	6 GHz	5.9 GHz	12 GHz
M9410A + CIU	6 GHz	5.9 GHz	12 GHz
M9410A + CIU + RRH	25 GHz	24.25 GHz	43.5 GHz

RF Center Freq

Specifies the RF Center Frequency. This command sets the Center Frequency to be used when the RF input is selected, even if the RF input is not the input that is selected at the time the command is sent. Note that the **Center Frequency** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:RF:CENTer <freq>` `[:SENSe]:FREQuency:RF:CENTer?`
Example	`:FREQ:RF:CENT 30 MHz` `:FREQ:RF:CENT?`
Notes	This command is the same in all modes, but the parameter is Measurement Global, so the value is independent in each mode and common across all the measurements in the mode
Dependencies	If the electronic/soft attenuator is enabled, any attempt to set Center Frequency such that the Stop Frequency would be >3.6 GHz fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning
Preset	See table above
State Saved	Saved in instrument state
Min	-79.999995 MHz
Max	See table above. Basically instrument maximum frequency - 5 Hz If the knob or step keys are being used, also depends on Span

Ext Mix Center Freq

Specifies the External Mixer Center Frequency. This command sets the Center Frequency to be used when the External Mixer is selected, even if the External Mixer input is not the input which is selected at the time the command is sent. Note that the **Center Frequency** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:EMIXer:CENTer <freq>` `[:SENSe]:FREQuency:EMIXer:CENTer?`
Example	`:FREQ:EMIX:CENT 60 GHz` `:FREQ:EMIX:CENT?`
Notes	This command is the same in all modes, but the parameter is Measurement Global, so the value is independent in each mode and common across all the measurements in the mode
Couplings	When returning to External Mixing after having been switched to one of the other inputs (for example, RF), you will return to the settings that you had when you left External Mixing, so you will return to the band you were in with the Center Frequency that you had. However, Span is not an input-dependent parameter, therefore the Span setting from the other input will be retained. Therefore, the instrument comes back with the Span from the previous input, limited as necessary by the current mixer setup
Preset	When a **Mode Preset** is performed while in External Mixing, the Start frequency of the current Mode is set to the nominal Min Freq of the lowest harmonic range in the Harmonic Table for the current mixer setup. Similarly, the Stop frequency of the current Mode is set to the nominal Max Freq of the highest harmonic range in the Harmonic Table. The Center Freq thus presets to the point arithmetically equidistant from these two frequencies Note that, if the current measurement has a limited Span available to it, and cannot achieve the Span shown in the table (Span=Stop Freq – Start Freq), the instrument uses the maximum Span the measurement allows, and still sets the Center Freq to the midpoint of the Start and Stop Freq values in the Harmonic Table When Restore Input/Output Defaults is performed, the mixer presets to the 11970A, whose Start and Stop frequencies are 26.5 and 40 GHz respectively. The center of these two frequencies is 33.25 GHz Therefore, after Restore Input/Output Defaults, if you go into External Mixing and do a Mode Preset while in the Spectrum Analyzer Mode, the resulting Center Freq is 33.25 GHz
State Saved	Yes
Min	The minimum frequency in the currently selected mixer band + 5 Hz If the knob or step keys are being used, also depends on Span
Max	The maximum frequency in the currently selected mixer band - 5 Hz If the knob or step keys are being used, also depends on Span

I/Q Center Freq

Specifies the I/Q Center Frequency. This command sets the Center Frequency to be used when the I/Q input is selected, even if the I/Q input is not the input which is selected at the time the command is sent. Note that the **Center Frequency** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:IQ:CENTer <freq>` `[:SENSe]:FREQuency:IQ:CENTer?`
Example	`:FREQ:IQ:CENT 30 MHz`
Notes	This command is the same in all modes, but the parameter is Measurement Global, so the value is independent in each mode and common across all the measurements in the mode
Preset	0 Hz
State Saved	Saved in instrument state
Min	-40.049995 MHz
Max	40.049995 MHz

CF Step

Changes the step size for the center frequency and start and stop frequency functions. Once a step size has been selected and the **Center Frequency** function is active, the step keys (and the UP|DOWN parameters for Center Frequency from remote commands) change the center frequency by the step-size value. The step size function is useful for finding harmonics and sidebands beyond the current frequency span of the instrument.

Note that the start and stop frequencies also step by the CF Step value.

Remote Command	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement] <freq>`
	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement]?`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO?`

Example	`:FREQ:CENT:STEP 500 MHz`
	increases the current center frequency value by 500 MHz
	`:FREQ:CENT UP`
	`:FREQ:CENT:STEP?`
	`:FREQ:CENT:STEP:AUTO ON`
	`:FREQ:CENT:STEP:AUTO?`

Notes	Preset and Max values are depending on Hardware Options
Dependencies	Not available in the MSR, LTE-A FDD/TDD and 5G NR modes If the electronic/soft attenuator is enabled, any attempt to change the value of the center frequency >3.6 GHz by pressing the Up-arrow key, fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a “-221, Settings conflict” warning
Couplings	When auto-coupled, the center frequency step size is set to 10% of the span
Preset	Auto ON

State Saved	Saved in instrument state
Min	– (The maximum frequency of the instrument) That is, 27 GHz max freq instrument has a CF step range of +/- 27 GHz. Note that this is the maximum frequency given the current settings of the instrument, so in External Mixing, for example, it is the maximum frequency of the current mixer band
Max	The maximum frequency of the instrument That is, 27 GHz max freq instrument has a CF step range of +/- 27 GHz. Note that this is the maximum frequency given the current settings of the instrument, so in External Mixing, for example, it is the maximum frequency of the current mixer band
Status Bits/OPC dependencies	non-overlapped

3.10.7 Marker

Accesses a menu that enables you to select, set up and control the markers for the current measurement. If there are no active markers, **Marker** selects Marker 1, sets it to **Normal** (`POSition`) and places it at the center of the display. If the selected marker is `OFF`, it is set to **Normal** and placed at the center of the screen, on the trace determined by the **Marker Trace** rules.

3.10.7.1 Select Marker

Specifies the selected marker. The term "selected marker" is used throughout this document to specify which marker will be affected when you change marker settings, perform a Peak Search, etc.

This control appears above the menu panel, indicating that it applies to all controls in the **Marker** menu panels. **Select Marker** is blanked if you select a tab whose controls do *not* depend on the selected marker (for example, **Counter**).

In any menu tab in which **Select Marker** appears, the first control is always **Marker Frequency|Time**.

Notes	The selected marker is remembered even when not in the Marker menu and is used if a Search is done or a Band Function is turned on or for Signal Track or Continuous Peak
Preset	Marker 1
State Saved	The number of the selected marker is saved in instrument state
Annunciation	Appears in the marker results block label for **Normal** marker

3.10.7.2 Settings

The controls on this tab include the Marker active function and a radio button selection of the marker control mode (Normal, Delta or Off) for the selected marker, as well as additional functions that help you use markers.

Marker Frequency

Sets the marker X-Axis value in the current marker X-Axis Scale unit. Has no effect if the control mode is **OFF,** but is the SCPI equivalent of entering an X value if the control mode is **Normal**.

Remote Command	`:CALCulate:SEMask:MARKer[1]|2|...|12:X <freq>` `:CALCulate:SEMask:MARKer[1]|2|...|12:X?`
Example	`:CALC:SEM:MARK3:X 1.0 GHz` `:CALC:SEM:MARK3:X?`
Notes	If no suffix is sent, uses the fundamental units for the current marker X-Axis Scale. If a suffix is sent that does not match the current marker X-Axis Scale unit, an error “Invalid suffix” is generated The query returns the marker’s absolute X-Axis value if the control mode is **Normal**, or the offset from the marker’s reference marker if the control mode is **Delta**. The query is returned in the fundamental units for the current marker X-Axis scale: Hz for **Frequency** and **Inverse Time**, seconds for **Period** and **Time**
Preset	After a preset, all markers are turned `OFF`, so Marker X-Axis Value query returns a Not A Number (`NAN`)
State Saved	Saved in instrument state
Min	-9.9E+37
Max	9.9E+37
Annotation	Mkr # <X value> and <Marker value> upper right on graph

Marker X Axis Position (Remote Command Only)

Sets the marker X-Axis Scale position in trace points. This setting has no effect if the control mode is **OFF,** but is the SCPI equivalent of entering a value if the control mode is **Normal** or **Delta** - except in trace points rather than X-Axis Scale units. The entered value is immediately translated into the current X-Axis Scale units for setting the value of the marker.

Remote Command	`:CALCulate:SEMask:MARKer[1]|2|...|12:X:POSition <real>` `:CALCulate:SEMask:MARKer[1]|2|...|12:X:POSition?`
Example	`:CALC:SEM:MARK10:X:POS 1001` `:CALC:SEM:MARK10:X:POS?`
Notes	The query returns the marker’s absolute X Axis value in trace points if the control mode is **Normal**, or the offset from the marker’s reference marker in trace points if the control mode is **Delta**. The value is returned as a real number, not an integer, corresponding to the translation from X-Axis Scale units to trace points . When a Marker is turned on, it is placed center of the screen on the trace. Therefore the default value depends on instrument condition. If the marker is **OFF**, the response is Not A Number
Preset	After a preset, all markers are turned `OFF`, so Marker X-Axis Value query returns Not A Number (`NAN`)
State Saved	Saved in instrument state
Min	-9.9E+37
Max	9.9E+37

Marker Y Axis Value (Remote Command only)

Returns the marker Y-Axis value in the current marker Y Axis unit.

Remote Command	`:CALCulate:SEMask:MARKer[1]|2|...|12:Y?`
Example	`:CALC:SEM:MARK11:Y?`
Notes	The query returns the marker Y-Axis result, if the control mode is **Normal**. If the marker is **OFF,** the response is Not A Number
Preset	Result dependent on Markers setup and signal source
State Saved	No
Backwards Compatibility SCPI	`:CALCulate:SEMask:MARKer[1]|2|...|12:FUNCtion:RESult?`

Marker Mode

Sets the marker control mode to `POSition` (Normal) or `OFF`.

If the selected marker is `OFF`, pressing **Marker** sets it to `POSition` and places it at the center of the screen, on the trace determined by the **Marker Trace** rules. At the same time, **Marker X Axis Value** appears on the Active Function area. If the current control mode for the measurement is `OFF`, there is no active function and the active function is turned off.

Remote Command	`:CALCulate:SEMask:MARKer[1]|2|...|12:MODE POSition | OFF` `:CALCulate:SEMask:MARKer[1]|2|...|12:MODE?`
Example	`:CALC:SEM:MARK:MODE POS` `:CALC:SEM:MARK:MODE?`
Notes	Default Active Function: the active function for the selected marker's current control mode. If the current control mode is `OFF`, there is no active function and the active function is turned off
Preset	`OFF|OFF|OFF|OFF|OFF|OFF|OFF|OFF|OFF|OFF|OFF|OFF`
State Saved	Saved in instrument state
Range	`POSition|OFF`
Annotation	Mkr# <X value> and <Marker value> upper right of graph

All Markers Off

Turns off all markers.

Remote Command	`:CALCulate:SEMask:MARKer:AOFF`
Example	`:CALC:SEM:MARK:AOFF`

Couple Markers

When this function is ON, moving any marker causes an equal X-Axis movement of every other marker that is not OFF. By “equal X-Axis movement” we mean that we preserve the difference between each marker’s X-Axis value (in the fundamental X-Axis units of the trace that marker is on) and the X-Axis value of the marker being moved (in the same fundamental X-Axis units).

This may result in markers going off screen.

Remote Command	`:CALCulate:SEMask:MARKer:COUPle[:STATe] ON | OFF | 1 | 0` `:CALCulate:SEMask:MARKer:COUPle[:STATe]?`
Example	`:CALC:SEM:MARK:COUP ON` `:CALC:SEM:MARK:COUP?`
Preset	OFF Presets on **Mode Preset** and **All Markers Off**
State Saved	Saved in instrument state

3.10.7.3 Properties

The controls on this tab are used to set certain properties of the selected marker.

Marker Frequency

This is the fundamental control that you use to move a marker around on the trace. This is the same as the "Marker Frequency" on page 1349 control on the **Settings** tab.

Marker Trace

Selects the trace on which you want your marker placed. A marker is associated with one and only one trace. This trace is used to determine the placement, result, and X-Axis Scale of the marker. All markers have an associated trace; it is from that trace that they determine their attributes and behaviors, and it is to that trace that they go when they become Normal markers.

Specifying a Marker Trace manually or with this command associates the marker with the specified trace. If the marker is not OFF, it moves the marker from the trace it was on to the new trace. If the marker is OFF it stays off but is now associated with the specified trace.

The query returns the number of the trace on which the marker is currently placed.

Remote Command	`:CALCulate:SEMask:MARKer[1]|2|...|12:TRACe 1 | 2 | 3` `:CALCulate:SEMask:MARKer[1]|2|...|12:TRACe?`

Example	`:CALC:SEM:MARK2:TRAC 2` `:CALC:SEM:MARK2:TRAC?`
Notes	A marker may be placed on a blanked and/or inactive trace, even though the trace is not visible and/or updating An application may register a trace name to be displayed on the control instead of a trace number
Couplings	The state of **Marker Trace** is not affected by "Auto Couple" on page 1718 Sending the remote command causes the addressed marker to become selected
Preset	1
State Saved	Saved in instrument state

3.10.8 Meas Setup

Contains functions for setting up the measurement parameters and also contains functions for setting up parameters global to all measurements in the mode.

3.10.8.1 Settings

Contains frequently used Meas Setup functions to which you will want the fastest access.

Avg/Hold Num

Toggles averaging On or Off, in addition to enabling you to set the number of measurement averages used to calculate the measurement result. The average is displayed at the end of each sweep. After the specified number of average counts, the average mode (termination control) setting determines the average action.

In the remote mode, use the "Averaging On/Off" on page 1353 command to turn Averaging on or off.

Remote Command	`[:SENSe]:SEMask:AVERage:COUNt <integer>` `[:SENSe]:SEMask:AVERage:COUNt?`
Example	`:SEM:AVER:COUN 100` `:SEM:AVER:COUN?`
Preset	10
State Saved	Saved in instrument state
Min/Max	1/10000

Spur Avoidance

Because the VXT models M9410A/11A/15A are direct-conversion (zero-IF) receivers, feedthrough leakage from the local oscillator appears as a spurious signal (spur) at the center frequency. The **Spur Avoidance** function is provided to eliminate this spur, at the expense of some measurement speed. For Spur Avoidance, the instrument uses a software algorithm to remove this spur from the displayed measurement data.

Some measurements allow you to turn off **Spur Avoidance**, but in this measurement it is always enabled. Therefore, in this measurement, the Spur Avoidance switch is unavailable (grayed-out) and set to `ON`.

Furthermore, if you press the grayed out switch, a popup message appears that says:

Always enabled in this measurement. See manual for details

Remote Command	`[:SENSe]:SEMask:SAVoid[:STATe]?`
Example	`:SEM:SAV?` Always returns `ON`
Dependencies	This control only appears in VXT models M9410A/11A/15A
Preset	`ON`
State Saved	Saved in instrument state
Range	`ON`

Averaging On/Off

Turns Averaging on or off.

NOTE: In this measurement, the **Average Type** is preset to the `Log-Pwr Avg (Video)` method. Other averaging methods are not available.

Remote Command	`[:SENSe]:SEMask:AVERage[:STATe] ON | OFF | 1 | 0` `[:SENSe]:SEMask:AVERage[:STATe]?`
Example	`:SEM:AVER ON` `:SEM:AVER?`
Preset	`OFF`
State Saved	Saved in instrument state
Range	`ON|OFF`

Meas Method

Sets the measurement method:

Method	Option	Description
Integration BW	0|OFF	Enables you to set the channel integration bandwidth
RRC Weighted	1|ON	Selects Root Raised Cosine (RRC) filtering of the carriers. The a value (rolloff) for the filter is set to the value of the Filter Alpha parameter

Remote Command	`[:SENSe]:SEMask:FILTer[:RRC][:STATe] OFF | ON | 0 | 1` `[:SENSe]:SEMask:FILTer[:RRC][:STATe]?`
Example	`:SEM:FILT ON` `:SEM:FILT?`
Dependencies	WLAN: RRC Weight is not supported when the radio standard is WLAN 802.11ac (80+80MHz)

Preset	SA, LTE, LTETDD, LTEAFDD, LTEATDD, 5G NR, WLAN, MSR:
	`OFF`
	WCDMA:
	`ON`

State Saved	Saved in instrument state
Range	Integration BW|RRC Weighted

RRC Filter Alpha

Sets the alpha value for the RRC Filter.

Remote Command	`[:SENSe]:SEMask:FILTer[:RRC]:ALPHa <real>` `[:SENSe]:SEMask:FILTer[:RRC]:ALPHa?`
Example	`:SEM:FILT:ALPH 0.3` `:SEM:FILT:ALPH?`
Dependencies	Not available in 1xEVDO or CDMA2K Modes
Preset	0.22
State Saved	Saved in instrument state
Min/Max	0.01/1.0

Non-Contiguous Meas Region

Selects the region to measure for the non-contiguous frequency allocation from either inner or outer.

Remote Command	`[:SENSe]:SEMask:NCONtiguous:REGion INNer | OUTer` `[:SENSe]:SEMask:NCONtiguous:REGion?`

Example	:SEM:NCON:REG INN :SEM:NCON:REG?
Dependencies	Only available in MSR, 5G NR and LTE-Advanced FDD/TDD
Preset	INNer
State Saved	Yes
Range	INNer|OUTer

Sweep Type Rules

Selects which set of rules will be used for Sweep Type automatic selection when Sweep Type Mode is Auto.

Rule	Option	Description
Best Dynamic Range	DRANge	Tells the instrument to choose either swept or FFT analysis with the primary goal of dynamic range optimization. If the dynamic range of swept and FFT is very close, then it chooses the faster one. In determining the Swept or FFT setting, the auto rules use the following approach: – If the RBW > 210 Hz, use swept; for the RBW <= 210 Hz, use FFT – If Sweep Time Mode is Man, the Sweep Type is always Swept for backwards compatibility
Best Speed	SPEed	Tells the instrument to choose either FFT or swept analysis based on the fastest instrument speed

Remote Command	[:SENSe]:SEMask:SWEep:TYPE:AUTO:RULes SPEed | DRANge [:SENSe]:SEMask:SWEep:TYPE:AUTO:RULes?
Dependencies	In modular products such as VXT, the value is always fixed to Best Dynamic Range and this control does not appear
Preset	DRANge
State Saved	Saved in instrument state

Offset/Limits Config Table

Accesses a menu that enables you to set up the measurement parameters for offset pairs and to set the power limits for start and stop frequencies of the selected offsets. For example, you can assign the start and stop frequencies, select the resolution bandwidth, and set the sweep time.

Before UE, the LTE-Advanced FDD/TDD standards gave the test specification requirements for BS intra-band contiguous aggregation and intra-band non-contiguous aggregation modes. However, for UE, only the requirements of intra-band contiguous aggregation modes are defined. So the standards don't support making the measurement in UE intra-band non-contiguous aggregation mode for LTE-Advanced FDD/TDD. As a result, the preset values of Inner Offset/Limits are temporarily set as those of Outer Offset/Limits for UE.

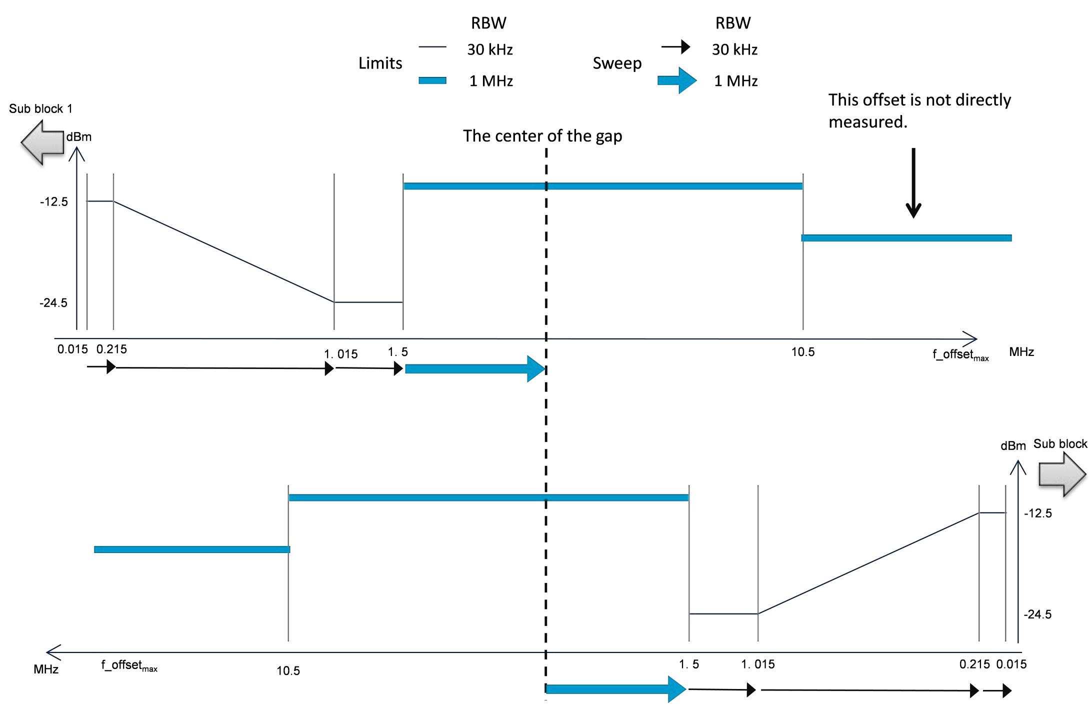
Limits for Inner Offsets

Since inner offsets are defined from the sub-block edges to the gap, limits from two sub-blocks overlap each other. Therefore the limit used for inner offsets are the cumulative sum of limits from the both sub-blocks. Offsets can have different RBWs, which must be compensated when accumulated.

For example, when offset A and D overlap, the limit of offset A is calculated as follows.

$$\text{Cumulated Limit of Offset A} = 10^{\frac{[\text{Offset A Limit in dBm}]}{10}} + \frac{\text{Offset A RBW}}{\text{Offset D RBW}} 10^{\frac{[\text{Offset D Limit in dBm}]}{10}}$$

The diagram below depicts what inner offset limits look like.



Offset (Bandwidth)

Accesses a menu that enables you to set up the bandwidth measurement parameters for offset pairs. For example, you can assign the start and stop frequencies, and select the resolution bandwidth.

Offset Freq Define

Enables you to select offset frequency definition. Each standard defines each offset frequency from Carrier.

For example, 3GPP2 requires the "Carrier Center to Meas BW Edge" definition. LTE conformance test requires "Carrier Edge to Meas BW Center" and/or "Carrier Edge to Meas BW Edge" definition. The MSR standard requires "RF BW Edge to Meas BW Center" and/or "RF BW Edge to Meas Edge" definition.

"Meas BW Edge" means the edge frequency of resolution bandwidth closer to the carrier that is represented by Meas BW and Res BW settings. Actual center frequency of Meas BW and the limit line have ½ Meas BW offset when the Meas BW Edge is selected.

Note that the outermost (lowermost, uppermost) carrier at each side is determined by which carrier edge frequency is located outermost within the RF BW or each sub-block banwidth, instead of which carrier center frequency is located outermost.

For Modes other than MSR, LTE-A, 5G NR

- CTOCenter – From carrier center to the center of offset measuring filter*
- CTOEdge - From carrier center to the nominal -3 dB point of the offset measuring filter* closer to the carrier
- ETOCenter – From Center Frequency - Span of Ref Channel / 2 (for lower offset), Center Frequency + Span of Ref Channel / 2 (for upper offset) of the carrier closest to each offset to the center of offset measuring filter*
- ETOEdge - From Center Frequency - Span of Ref Channel / 2 (for lower offset), Center Frequency + Span of Ref Channel / 2 (for upper offset) of the carrier closest to each offset to the nominal -3 dB point of the offset measuring filter* closer to the carrier

For MSR, LTE-A, 5G NR Modes

- `CTOCenter`: From the lowermost carrier center frequency (for lower offset), the uppermost carrier center frequency (for upper offset) to the center of offset measuring filter*
- `CTOEdge`: From the lowermost carrier center frequency (for lower offset), the uppermost carrier center frequency (for upper offset) to the nominal -3 dB point of the offset measuring filter* closer to the carrier
- `ETOCenter`: From the lowermost carrier center frequency - spacing of this carrier /2 (for lower offset), the uppermost carrier center frequency + spacing of this carrier /2 (for upper offset) to the center frequency of offset measuring filter*

- ETOEdge: From the lowermost carrier center frequency - spacing of this carrier /2 (for lower offset), the uppermost carrier center frequency + spacing of this carrier /2 (for upper offset) to the nominal -3 dB point of the offset measuring filter* closer to the carrier
- RTOCenter: From either the lower or upper RF BW** edge frequency to the center frequency of offset measuring filter*
- RTOEdge: From either the lower or upper RF BW** edge frequency to the nominal -3 dB point of the offset measuring filter* closer to the carrier
- RCTOCenter: (5G NR only) From the center frequency of RF BW to the center frequency of offset measuring filter*

*Measuring filter = Meas BW (N) x Res BW

** RF BW = $BW_{channel,CA}$ which is defined in each 3GPP standard, regardless of "Measure Carrier" for the uppermost and the lowermost carriers being Enabled or Disabled. When the Number of Component Carrier = 1, RF BW = $BW_{channel}$ = 2 x $F_{offset,RAT}$

See "Diagrams for Offset Freq Define" on page 1359.

Modes other than MSR, LTE-A, 5G NR

Remote Command	`[:SENSe]:SEMask:OFFSet[1]|2:TYPE CTOCenter | CTOEdge | ETOCenter | ETOEdge` `[:SENSe]:SEMask:OFFSet[1]|2:TYPE?`
Example	`:SEM:OFFS:TYPE ETOC` `:SEM:OFFS:TYPE?`
Notes	OFFSet1 is for BTS, 2 for MS. Default is BTS Note that Offset sub op code 2 is supported only in non-SA modes. In the SA mode, Offset sub op code 1 is used for both BTS and MS
Preset	CTOCenter
State Saved	Saved in instrument state
Range	Carrier Center to Meas BW Center|Carrier Center to Meas BW Edge|Carrier Edge to Meas BW Center-|Carrier Edge to Meas BW Edge

Mode: MSR, LTEAFDD, LTEATDD

Remote Command	`[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:TYPE CTOCenter | CTOEdge | ETOCenter | ETOEdge | RTOCenter | RTOEdge` `[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:TYPE?`
Example	`:SEM:OFFS:TYPE ETOC`

	`:SEM:OFFS:TYPE?`
Notes	`OFFSet1` is for BTS, 2 for MS. Default is BTS
Preset	MSR: `RTOCenter` LTEAFDD, LTEATDD: `ETOCenter`
State Saved	Saved in instrument state
Range	Carrier Center to Meas BW Center|Carrier Center to Meas BW Edge|Carrier Edge to Meas BW Center-|Carrier Edge to Meas BW Edge|RF BW Edge to Meas BW Center|RF BW Edge to Meas BW Edge

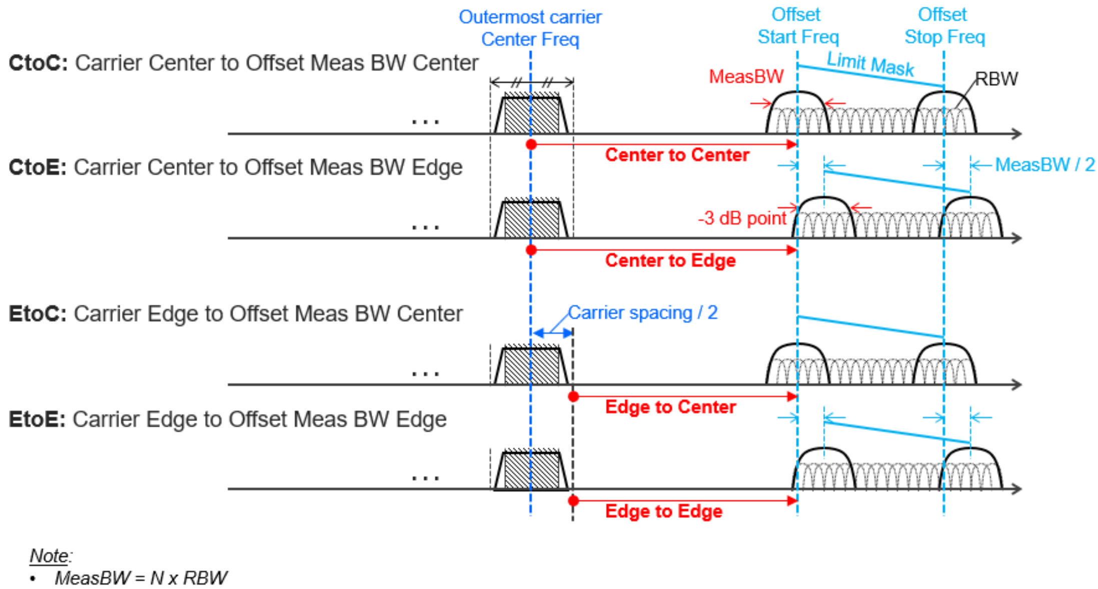
Mode: 5G NR

Remote Command	`[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:TYPE CTOCenter | CTOEdge | ETOCenter | ETOEdge | RTOCenter | RTOEdge | RCTOCenter` `[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:TYPE?`
Example	`:SEM:OFFS:TYPE ETOC` `:SEM:OFFS:TYPE?`
Notes	`OFFSet1` is for BTS, 2 for MS. Default is BTS
Preset	`ETOCenter`
State Saved	Saved in instrument state
Range	Carrier Center to Meas BW Center|Carrier Center to Meas BW Edge|Carrier Edge to Meas BW Center-|Carrier Edge to Meas BW Edge|RF BW Edge to Meas BW Center|RF BW Edge to Meas BW Edge|RF BW Center to Meas BW Center

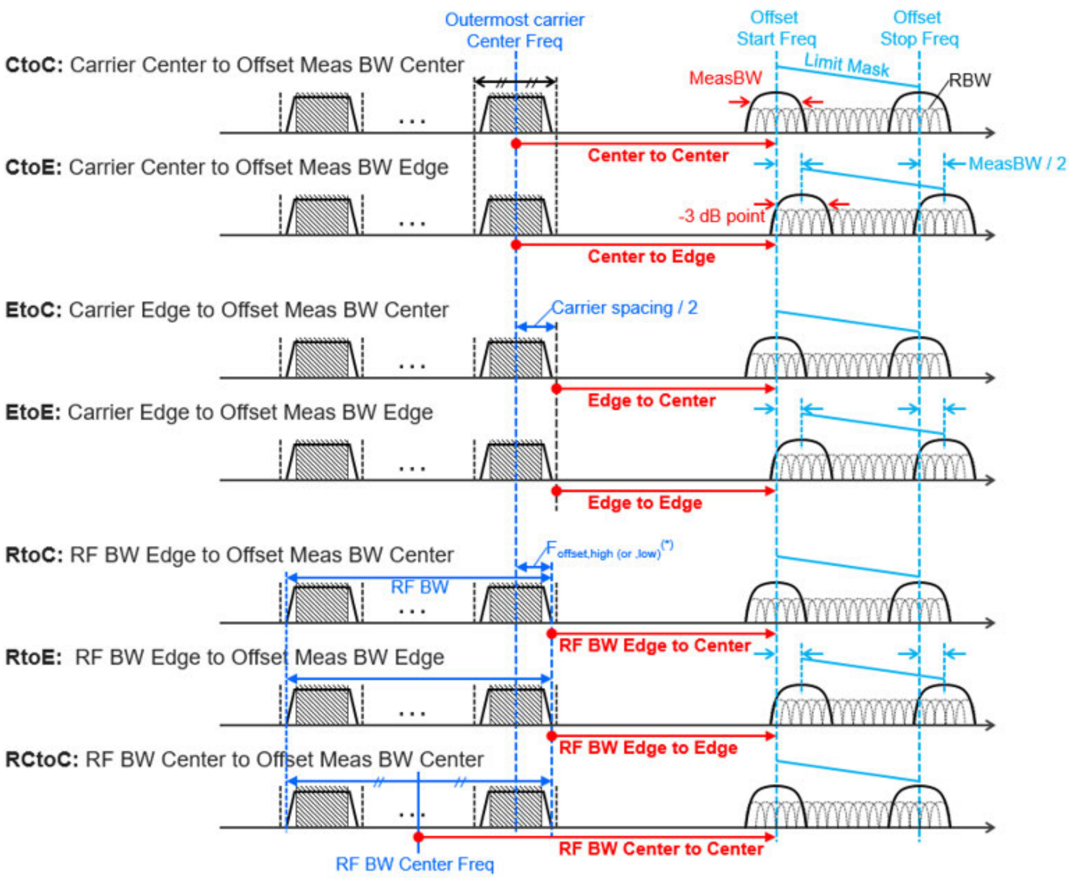
Diagrams for Offset Freq Define

Details depend on the selected mode.

Diagrams for Modes other than MSR, LTE-A, 5G NR



Diagrams for MSR, LTE-A, 5G NR



Notes:

- *MeasBW = N x RBW*
- *RF BW Edge and Outermost Carrier Edge are not always same.*
  e.g.) 5G NR (3GPP) defines BW_channel,CA which calculates F_offset,high and F_offset,low asymmetrically with SCS shift.
  (*) For MSR, F_offset,high (or ,low) = F_offset,RAT,high (or ,low)

Offset Detector

Accesses a menu that enables you to control the detector for offsets. The following choices are available:

`AUTO`	The detector selected depends on marker functions, trace functions, average type, and the trace averaging function
`NORMal`	The detector determines the peak of the CW-like signals, and it yields alternating maximums and minimums of noise-like signals. This is also referred to as Rosenfell detection
`AVERage`	The detector determines the average of the signal within the sweep points. The averaging method depends upon the Average Type selection (voltage, power or log scales)
`POSitive`	The detector determines the maximum of the signal within the sweep points

Peak	
SAMPle	The detector indicates the instantaneous level of the signal at the center of the sweep points represented by each display point
NEGative Peak	The detector determines the minimum of the signal within the sweep points

Remote Command	[:SENSe]:SEMask:DETector:OFFSet[:FUNCtion] AVERage | NEGative | NORMal | POSitive | SAMPle [:SENSe]:SEMask:DETector:OFFSet[:FUNCtion]? [:SENSe]:SEMask:DETector:OFFSet:AUTO ON | OFF | 1 | 0 [:SENSe]:SEMask:DETector:OFFSet:AUTO?
Example	:SEM:DET:OFFS AVER :SEM:DET:OFFS? :SEM:DET:OFFS:AUTO OFF :SEM:DET:OFFS:AUTO?
Notes	When you manually select a detector (instead of selecting Auto), that detector is used regardless of other instrument settings Note that this detector setting affects all offsets; there is no per-trace detector
Couplings	See Couplings in "Trace Type" on page 1419
Preset	POSitive ON
State Saved	Saved in instrument state
Range	AVERage|NEGative|NORMal|POSitive|SAMPle

Offset Average Type (SCPI Only)

Select trace average type for the offsets.

Remote Command	[:SENSe]:SEMask:AVERage:OFFSet:TYPE RMS | LOG [:SENSe]:SEMask:AVERage:OFFSet:TYPE?
Example	:SEM:AVER:OFFS:TYPE LOG :SEM:AVER:OFFS:TYPE?
Preset	RMS
State Saved	Saved in instrument state

Start Freq

Specifies the start frequency for the currently selected offset. Also enables you to toggle that offset between On and Off.

When sending the remote command, missing values are not permitted; that is, if you want to change values 2 and 6, you must send all values up to 6. Subsequent values will remain as they were. The query for this parameter always returns 12 values.

Remote Command	`[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:STATe ON | OFF | 1 | 0, …` `[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:STATe?`

Example	`:SEM:OFFS2:LIST:FREQ:STAR 2.515 MHz, 2.715 MHz, 3.515 MHz, 4.00 MHz, 8.00 MHz, 12.50 MHz`
	`:SEM:OFFS2:LIST:FREQ:STAR?`
	`:SEM:OFFS:LIST:STAT ON, ON, ON, OFF, OFF, OFF`
	`:SEM:OFFS:LIST:STAT?`

Notes	Comma separated list of values `OFFSet1` is for BTS, 2 for MS. Default is BTS Note that Offset sub op code 2 is supported only in non-SA modes. In the SA mode, Offset sub op code 1 is used for both BTS and MS If the offset is outside of the frequency range, the result spectrum will be invalid
Couplings	Coupled to Stop Freq. When the start freq goes above the stop freq, the stop freq is automatically adjusted to the start freq plus 100 Hz
Preset	For Modes (except WLAN, MSR, LTEAFDD, LTEATDD, 5G NR) without option N9060A-7FP, the preset value is as follows: **SA Mode**: 2.515 MHz, 2.715 MHz, 3.515 MHz, 4.00 MHz, 8.00 MHz, 12.50 MHz **WCDMA Mode**: 2.515 MHz, 2.715 MHz, 3.515 MHz, 4.000 MHz, 8.000 MHz, 12.50 MHz|2.515MHz, 4.000 MHz, 7.500 MHz, 8.500 MHz, 12.5 MHz, 15 MHz When option N9060A-7FP is installed in these modes, the preset value of Offset G ~ L is the same as the Offset F value **WLAN Mode**: See the table of "WLAN Mode Presets" on page 1364 below **MSR Mode**: 15 kHz, 215kHz, 1.015MHz, 1.5MHz, 10.5MHz, 15.00MHz, 30MHz, 30MHz, 30MHz, 30MHz, 30MHz, 30MHz | 15kHz, 215kHz, 1.015MHz, 1.5MHz, 10.5MHz, 15.00MHz, 30MHz, 30MHz, 30MHz, 30MHz, 30MHz, 30MHz **LTE, LTETDD, LTEAFDD, LTEATDD Modes**: 50 kHz, 5.05 MHz, 10.5 MHz, 15.00 MHz, 30 MHz, 40 MHz, 40 MHz,40 MHz, 40 MHz,40 MHz, 40 MHz, 40 MHz | 15.00 kHz,1.5 MHz, 5.5 MHz, 6.5 MHz, 10 MHz, 20MHz, 20MHz, 20MHz, 20MHz, 20MHz, 20MHz, 20MHz **5G NR Mode**: 50 kHz, 5.05 MHz, 10.5 MHz, 40.00 MHz, 100 MHz, 100 MHz, 100 MHz, 100 MHz, 100 MHz, 100 MHz, 100 MHz, 100 MHz | 15.00 kHz, 1.5 MHz, 5.5 MHz, 100.50 MHz, 105.00 MHz, 100 MHz, 100 MHz, 100 MHz, 100 MHz, 100 MHz, 100 MHz, 100 MHz Modes (except WLAN, MSR, LTEAFDD, LTEATDD, 5G NR) without option N9060A-7FP: **SA Mode**: ON, ON, ON, ON, ON, OFF **WCDMA Mode**: ON, ON, ON, ON, ON, OFF|ON, ON, ON, ON, OFF, OFF

	When option N9060A-7FP is installed in these modes, the preset value of Offset G ~ L is the same as the Offset F value **WLAN Mode**: See tables of "WLAN Mode Auto Function Presets" on page 1365 below **MSR Mode**: ON, ON, ON, ON, ON, OFF, OFF, OFF, OFF, OFF, OFF, OFF|ON, ON, ON, ON, ON, OFF, OFF, OFF, OFF, OFF, OFF, OFF **LTE, LTETDD, LTEAFDD, LTEATDD Modes**: ON, ON, ON, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF | ON, ON, ON, ON, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF **5G NR Mode**: ON, ON, ON, ON, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF | ON, ON, ON, ON, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF
State Saved	Saved in instrument state Saved in instrument state
Min/Max	0 Hz/Depends on instrument maximum frequency Always Offset Stop Freq - 100 Hz

WLAN Mode Presets

Radio Std	Presets
802.11a/g(OFDM/DSSS-OFDM)/802.11n(20MHz)	9 MHz, 11 MHz, 20 MHz, 30 MHz, 40 MHz, 216 MHz, 216 MHz, 216 MHz, 216 MHz, 216 MHz, 216 MHz, 216 MHz
802.11b/g (DSSS/CCK/PBCC)	11 MHz, 22 MHz, 50 MHz, 70 MHz, 90 MHz, 100 MHz , 100 MHz, 100 MHz, 100 MHz, 100 MHz, 100 MHz, 100 MHz
802.11n(20MHz)	9 MHz, 11 MHz, 20 MHz, 30 MHz, 40 MHz, 100 MHz, 100 MHz, 100 MHz, 100 MHz, 100 MHz, 100 MHz, 100 MHz
802.11n(40MHz)	19 MHz, 21 MHz, 40 MHz, 60 MHz, 70 MHz, 100 MHz, 200 MHz, 200 MHz, 200 MHz, 200 MHz, 200 MHz, 200 MHz
802.11ac(20MHz)	9 MHz, 11 MHz, 20 MHz, 30 MHz, 40 MHz, 40 MHz, 40 MHz, 40 MHz, 40 MHz, 40 MHz, 40 MHz, 40 MHz
802.11ac(40MHz)	19 MHz, 21 MHz, 40 MHz, 60 MHz, 70 MHz, 70 MHz, 70 MHz, 70 MHz, 70 MHz, 70 MHz, 70 MHz, 70 MHz
802.11ac(80MHz)	39 MHz, 41 MHz, 80 MHz, 120 MHz, 125 MHz, 125 MHz, 125 MHz, 125 MHz, 125 MHz, 125 MHz, 125 MHz, 125 MHz
802.11ac(160MHz)	79 MHz, 81 MHz, 160 MHz, 240 MHz, 250 MHz, 250 MHz, 250 MHz, 250 MHz, 250 MHz, 250 MHz, 250 MHz, 250 MHz
802.11ac(80 MHz + 80MHz)	0MHz, 0 MHz, 40 MHz, 79 MHz, 159 MHz, 161 MHz, 200 MHz, 240 MHz, 240 MHz, 240 MHz, 240 MHz, 240 MHz
802.11ah(1MHz)	0.45 MHz, 0.6 MHz, 1 MHz, 1.5 MHz, 1.5 MHz, 1.5 MHz, 1.5 MHz, 1.5 MHz, 1.5 MHz, 1.5 MHz, 1.5 MHz, 1.5 MHz
802.11ah(2MHz)	0.9 MHz, 1.1 MHz, 2 MHz, 3 MHz, 3 MHz, 3 MHz, 3 MHz, 3 MHz, 3 MHz, 3 MHz, 3 MHz, 3 MHz
802.11ah(4MHz)	1.9 MHz, 2.1 MHz, 4 MHz, 6 MHz, 6 MHz, 6 MHz, 6 MHz, 6 MHz, 6 MHz, 6 MHz, 6 MHz, 6 MHz
802.11ah(8MHz)	3.9 MHz, 4.1 MHz, 8 MHz, 12 MHz, 12 MHz, 12 MHz, 12 MHz, 12 MHz, 12 MHz, 12 MHz, 12 MHz, 120 MHz

Radio Std	Presets
802.11ah(16MHz)	7.9 MHz, 8.1 MHz, 16 MHz, 24 MHz, 24 MHz, 24 MHz, 24 MHz, 24 MHz, 24 MHz, 24 MHz, 24 MHz, 24 MHz
802.11j/p(10MHz)	4.5 MHz, 5MHz, 5.5 MHz, 10 MHz, 15 MHz, 216 MHz, 216MHz, 216 MHz, 216MHz, 216MHz, 216MHz, 216MHz
802.11p(5MHz)	2.25 MHz, 2.5MHz, 2.75 MHz, 5 MHz, 7.5 MHz, 216 MHz, 216MHz, 216 MHz, 216MHz, 216MHz, 216MHz, 216MHz
802.11ax/be(20MHz)	9.75 MHz, 10.5 MHz, 20 MHz, 30 MHz, 40 MHz, 40 MHz, 40 MHz, 40 MHz, 40 MHz, 40 MHz, 40 MHz, 40 MHz
802.11ax/be(40MHz)	19.5 MHz, 20.5 MHz, 40 MHz, 60 MHz, 70 MHz, 70 MHz, 70 MHz, 70 MHz, 70 MHz, 70 MHz, 70 MHz, 70 MHz
802.11ax/be(80MHz)	39.5 MHz, 40.5 MHz, 80 MHz, 120 MHz, 125 MHz, 125 MHz, 125 MHz, 125 MHz, 125 MHz, 125 MHz, 125 MHz, 125 MHz
802.11ax/be(160MHz):	79.5 MHz, 80.5 MHz, 160 MHz, 240 MHz, 250 MHz, 250 MHz, 250 MHz, 250 MHz, 250 MHz, 250 MHz, 250 MHz, 250 MHz
802.11ax(80 MHz + 80MHz)	0MHz, 0 MHz, 40 MHz, 79 MHz, 159 MHz, 161 MHz, 200 MHz, 240 MHz, 240 MHz, 240 MHz, 240 MHz, 240 MHz
802.11af(6MHz)	2.85 MHz, 3.15 MHz, 6 MHz, 9 MHz, 9 MHz, 9 MHz, 9 MHz, 9 MHz, 9 MHz, 9 MHz, 9 MHz, 9 MHz
802.11af(7MHz)	3.325 MHz, 3.675 MHz, 7 MHz, 10.5 MHz, 10.5 MHz, 10.5 MHz, 10.5 MHz, 10.5 MHz, 10.5 MHz, 10.5 MHz, 10.5 MHz, 10.5 MHz
802.11af(8MHz)	3.8 MHz, 4.2 MHz, 8 MHz, 12 MHz, 12 MHz, 12 MHz, 12 MHz, 12 MHz, 12 MHz, 12 MHz, 12 MHz, 12 MHz
802.11be (320MHz)	159.5 MHz, 160.5 MHz, 320 MHz, 480 MHz, 490 MHz, 490 MHz, 490 MHz, 490 MHz, 490MHz, 490 MHz, 490 MHz, 490 MHz

WLAN Mode Auto Function Presets

For X Series:

Radio Std	Presets
802.11b/g(DSSS/CCK/PBCC)	ON, ON, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF
802.11a/g/j/p 20MHz (OFDM/DSSS-OFDM) 802.11j/p 10MHz 802.11p 5MHz/802.11n (20MHz/40MHz)	ON, ON, ON, ON, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF
802.11ac/ax/be (20 MHz/ 40 MHz/ 80 MHz/ 160 MHz)	ON, ON, ON, ON, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF
802.11be (320 MHz)	ON, ON, ON, ON, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF
802.11ac/ax (80 MHz + 80 MHz)	OFF, ON, ON, ON, ON, ON, ON, ON, OFF, OFF, OFF, OFF
802.ah (1MHz/ 2MHz/ 4MHz/ 8MHz/ 16MHz)	ON, ON, ON, ON, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF

Radio Std	Presets
802.11af (6 MHz/ 7 MHz/ 8 MHz)	ON, ON, ON, ON, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF

For E6630A, E6640A, and M90XA:

Radio Std	Presets
802.11a/g(OFDM/DSSS-OFDM) 802.11n(20MHz/40MHz)	ON, ON, ON, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF
802.11ac/ax/be (20 MHz/ 40 MHz/ 80 MHz/ 160 MHz)	ON, ON, ON, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF
802.11be (320 MHz)	ON, ON, ON, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF
802.11ac/ax (80 MHz + 80 MHz)	ON, ON, ON, OFF, ON, ON, ON, OFF, OFF, OFF, OFF, OFF
802.11af (6 MHz/ 7 MHz/ 8 MHz)	ON, ON, ON, ON, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF

Stop Freq

Specifies the stop frequency for the currently selected offset.

When sending the remote command, missing values are not permitted; that is, if you want to change values 2 and 6, you must send all values up to 6. Subsequent values will remain as they were. The query for this parameter always returns 12 values.

Remote Command	`[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:FREQuency:STOP <freq>, …` `[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:FREQuency:STOP?`
Example	`:SEM:OFFS:LIST:FREQ:STOP 2.715 MHz, 3.515 MHz, 4.00 MHz, 8.00 MHz, 12.50 MHz, 15.0 MHz` `:SEM:OFFS:LIST:FREQ:STOP?`
Notes	Comma separated list of values `OFFSet1` is for BTS, 2 for MS. Default is BTS Note that Offset sub op code 2 is supported only in non-SA modes. In the SA mode, Offset sub op code 1 is used for both BTS and MS If the offset is outside of the frequency range, the result spectrum will be invalid
Couplings	Coupled to Start Freq. When the stop freq goes below the start freq, the start freq is automatically adjusted to the stop freq minus 100 Hz
Preset	For Modes (except WLAN, MSR, LTEAFDD, LTEATDD, 5G NR) without option N9060A-7FP: **SA Mode**: 2.715 MHz, 3.515 MHz, 4.00 MHz, 8.00 MHz, 12.50 MHz, 15.0 MHz **WCDMA Mode**: 2.715 MHz, 3.515 MHz, 4.000 MHz, 8.000 MHz, 12.50 MHz, 15.0 MHz|3.485 MHz, 7.500 MHz, 8.500 MHz, 12.00 MHz, 15.00 MHz, 18.0 MHz When option N9060A-7FP is installed in these modes, the preset value of Offset G ~ L is the same as the Offset F value

	WLAN Mode: See table of "WLAN Mode Presets" on page 1367 below **MSR Mode**: 215 kHz, 1.015 MHz, 1.5 MHz, 10.5 MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz|215 kHz, 1.015 MHz, 1.5 MHz, 10.5 MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz **LTE, LTETDD, LTEAFDD, LTEATDD Modes**: 5.05 MHz, 10.05 MHz, 15 MHz, 30 MHz, 40 MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz | 985.0 kHz, 4.50 MHz, 5.5001 MHz, 9.50 MHz, 20 MHz, 40 MHz, 40 MHz, 40 MHz, 40 MHz, 40 MHz, 40 MHz, 40 MHz **5G NR Mode**: 5.05 MHz, 10.05 MHz, 40 MHz, 100 MHz, 500 MHz, 500 MHz, 500 MHz, 500 MHz, 500 MHz, 500 MHz, 500 MHz, 500 MHz | 985.0 kHz, 4.50 MHz, 99.500 MHz, 104.5 MHz, 500 MHz, 500 MHz, 500 MHz, 500 MHz, 500 MHz, 500 MHz, 500 MHz, 500 MHz
State Saved	Saved in instrument state
Min/Max	100 Hz/Depends on instrument maximum frequency. Same as the Max Span in Swept SA Measurement

WLAN Mode Presets

Radio Std	Presets
802.11a/g (OFDM/DSSS-OFDM) 802.11n (20MHz)	11 MHz, 20 MHz, 30 MHz, 40 MHz, 100 MHz, 250 MHz, 250 MHz, 250 MHz, 250 MHz, 250 MHz, 250 MHz, 250 MHz
802.11b/g (DSSS/CCK/PBCC)	22 MHz, 50 MHz, 70 MHz, 90 MHz, 100 MHz, 120 MHz, 120 MHz, 120 MHz, 120 MHz, 120 MHz, 120 MHz, 120 MHz
802.11n (20MHz)	11 MHz, 20 MHz, 30 MHz, 40 MHz, 100 MHz, 200 MHz, 200 MHz, 200 MHz, 200 MHz, 200 MHz, 200 MHz, 200 MHz
802.11n (40MHz)	21 MHz, 40 MHz, 60 MHz, 70 MHz, 100 MHz, 200 MHz, 300 MHz, 300 MHz, 300 MHz, 300 MHz, 300 MHz, 300 MHz
802.11ac (20MHz)	11 MHz, 20 MHz, 30 MHz, 40 MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz
802.11ac (40MHz)	21 MHz, 40 MHz, 60 MHz, 70 MHz, 100 MHz, 100 MHz, 100 MHz, 100 MHz, 100 MHz, 100 MHz, 100 MHz, 100 MHz
802.11ac (80MHz)	41 MHz, 80 MHz, 120 MHz, 125 MHz, 200 MHz, 200 MHz, 200 MHz, 200 MHz, 200 MHz, 200 MHz, 200 MHz, 200 MHz
802.11ac (160MHz)	81 MHz, 160 MHz, 240 MHz, 250 MHz, 400 MHz, 400 MHz, 400 MHz, 400 MHz, 400 MHz, 400 MHz, 400 MHz, 400 MHz
802.11ac (80 MHz + 80MHz)	100Hz, 40 MHz, 79 MHz, 81 MHz, 161 MHz, 200 MHz, 240 MHz, 250 MHz, 250 MHz, 250 MHz, 250 MHz, 250 MHz
802.11ah (1MHz)	0.6MHz, 1 MHz, 1.5 MHz, 2.5MHz, 2.5 MHz, 2.5 MHz, 2.5 MHz, 2.5 MHz, 2.5 MHz, 2.5 MHz, 2.5 MHz, 2.5 MHz
802.11ah (2MHz)	1.1 MHz, 2 MHz, 3 MHz, 5MHz, 5 MHz, 5 MHz, 5 MHz, 5 MHz, 5 MHz, 5 MHz, 5 MHz, 5 MHz
802.11ah (4MHz)	2.1 MHz, 4 MHz, 6 MHz, 10 MHz, 10 MHz, 10 MHz, 10 MHz, 10 MHz, 10 MHz, 10 MHz, 10 MHz, 10 MHz
802.11ah (8MHz)	4.1 MHz, 8 MHz, 12 MHz, 20 MHz, 20 MHz, 20 MHz, 20 MHz, 20 MHz, 20 MHz, 20 MHz, 20 MHz, 20 MHz
802.11ah (16MHz)	8.1 MHz, 16 MHz, 24 MHz, 40 MHz, 40 MHz, 40 MHz, 40 MHz, 40 MHz, 40

Radio Std	Presets
	MHz, 40 MHz, 40 MHz, 40 MHz
802.11j/p (20MHz)	10MHz, 11 MHz, 20 MHz, 30 MHz, 50MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz
802.11j/p (10MHz)	5MHz, 5.5 MHz, 10 MHz, 15 MHz, 25MHz, 250MHz, 250MHz, 250MHz, 250 MHz, 250MHz, 250MHz, 250MHz
802.11p (5MHz)	2.5MHz, 2.75MHz, 5 MHz, 7.5 MHz, 12.5MHz, 250MHz, 250MHz, 250MHz, 250 MHz, 250MHz, 250MHz, 250MHz
802.11ax/be (20MHz)	10.5 MHz, 20 MHz, 30 MHz, 40 MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz, 50 MHz
802.11ax/be (40MHz)	20.5 MHz, 40 MHz, 60 MHz, 70 MHz, 100 MHz, 100 MHz, 100 MHz, 100 MHz, 100 MHz, 100 MHz, 100 MHz, 100 MHz
802.11ax/be (80MHz)	40.5 MHz, 80 MHz, 120 MHz, 125 MHz, 200 MHz, 200 MHz, 200 MHz, 200 MHz, 200 MHz, 200 MHz, 200 MHz, 200 MHz
802.11ax/be (160MHz)	80.5 MHz, 160 MHz, 240 MHz, 250 MHz, 400 MHz, 400 MHz, 400 MHz, 400 MHz, 400 MHz, 400 MHz, 400 MHz, 400 MHz
802.11ax (80 MHz + 80MHz)	100Hz, 40 MHz, 79 MHz, 81 MHz, 161 MHz, 200 MHz, 240 MHz, 250 MHz, 250 MHz, 250 MHz, 250 MHz, 250 MHz
802.11af (6MHz)	3.15MHz, 6 MHz, 9 MHz, 15MHz, 15 MHz, 15 MHz, 15 MHz, 15 MHz, 15 MHz, 15 MHz, 15 MHz, 15 MHz
802.11af (7MHz)	3.675 MHz, 7 MHz, 10.5 MHz, 17.5MHz, 17.5 MHz, 17.5 MHz, 17.5 MHz, 17.5 MHz, 17.5 MHz, 17.5 MHz, 17.5 MHz, 17.5 MHz
802.11af (8MHz)	4.2 MHz, 8 MHz, 12 MHz, 20 MHz, 20 MHz, 20 MHz, 20 MHz, 20 MHz, 20 MHz, 20 MHz, 20 MHz, 20 MHz
802.11be (320MHz)	160.5 MHz, 320 MHz, 480 MHz, 490 MHz, 800 MHz, 800 MHz, 800 MHz, 800 MHz, 800 MHz, 800 MHz, 800 MHz, 800 MHz

Res BW

Specifies which Resolution BW filter to use when measuring the currently selected offset.

Offset Res BW Mode allows the instrument to determine the optimum Resolution BW filter to use when measuring the currently selected offset.. When changing the Meas BW parameter, if the Res BW needs to be changed to adhere to the rule:

(N x Res BW) <= (Stop freq of the offset – Start freq of the offset),

where N is the multiplier, this setting will automatically be changed to manual.

When sending the remote command, missing values are not permitted; that is, if you want to change values 2 and 6, you must send all values up to 6. Subsequent values will remain as they were. The query for this parameter always returns 12 values.

Remote Command	`[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:BANDwidth[:RESolution]:AUTO OFF | ON | 1 | 0, …`

	`[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:BANDwidth[:RESolution]:AUTO?`

Example	`:SEM:OFFS2:LIST:BAND 30.0 kHz, 30.0 kHz, 30.0 kHz, 1.00 MHz,1.00 MHz, 1.00 MHz`
	`:SEM:OFFS2:LIST:BAND?`
	`:SEM:OFFS:LIST:BAND:AUTO 1,1,1,1,1,1`
	`:SEM:OFFS:LIST:BAND:AUTO?`

Notes	Comma separated list of values `OFFSet1` is for BTS, 2 for MS. Default is BTS Note that Offset sub op code 2 is supported only in non-SA modes. In the SA mode, Offset sub op code 1 is used for both BTS and MS
Couplings	Coupled to Start and Stop offset and Meas BW multiplier. This parameter must adhere to the rule (N x Res BW) <= (Stop freq of the offset - Start freq of the offset), where N is the multiplier. If the multiplier is changed, the Res BW will change to ensure this. When set manually, Res BW Coupling is set to manual The resolution bandwidth is coupled to the offset width determined by the start frequency and stop frequency
Preset	For Modes (except WLAN, MSR, LTEAFDD, LTEATDD, 5G NR) without option N9060A-7FP: **SA Mode**: 30.0 kHz, 30.0 kHz, 30.0 kHz, 1.00 MHz,1.00 MHz, 1.00 MHz **WCDMA Mode**: 30.00 kHz, 30.00 kHz, 30.00 kHz, 100.00 kHz, 1.000 MHz, 1.00 MHz|30.00 kHz, 1.000 MHz, 1.000 MHz, 1.000 MHz, 1.000 MHz, 1.00 MHz When option N9060A-7FP is installed in these modes, the preset value of Offset G ~ L is the same as the Offset F value **LTEAFDD, LTEATDD, 5G NR Modes**: 51 kHz, 100 kHz, 1.0 MHz, 1.0 MHz, 1.0 MHz, 1.0 MHz, 1.0 MHz, 1.0 MHz, 1.0 MHz, 1.0 MHz, 1.0 MHz, 1.0 MHz | 15.0 kHz, 510 kHz, 1.0 MHz, 1.0 MHz, 1.0 MHz, 1.0 MHz, 1.0 MHz, 1.0 MHz, 1.0 MHz, 1.0 MHz, 1.0 MHz, 1.0 MHz **WLAN Mode**: 100 KHz, 100 KHz, 100 KHz, 100 KHz, 100 KHz, 100 KHz, 100 KHz, 100 KHz, 100 KHz, 100 KHz, 100 KHz, 100 KHz **MSR Mode**: 30kHz, 30kHz, 30kHz, 1.0MHz,1.0MHz, 1.0MHz, 1.0MHz, 1.0MHz, 1.0MHz, 1.0MHz, 1.0MHz, 1.0MHz | 30kHz, 30kHz, 30kHz, 1.0MHz,1.0MHz, 1.0MHz, 1.0MHz, 1.0MHz, 1.0MHz, 1.0MHz, 1.0MHz,1.0MHz For Modes except WLAN, MSR, LTEAFDD, LTEATDD, 5G NR without option N9060A-7FP: OFF, OFF, OFF, OFF, OFF, OFF|OFF, OFF, OFF, OFF, OFF, OFF For Modes with option N9060A-7FP and WLAN, MSR, LTEAFDD, LTEATDD, 5G NR: OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF|OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF
State Saved	Saved in instrument state Saved in instrument state
Range	Auto|Man
Min	1 Hz
Max	Option FS1 or FS2 is installed: 10 MHz Otherwise: 8 MHz
Backwards Compatibility SCPI	`[:SENSe]:SEMask:OFFSet[1]|2:LIST:BWIDth[:RESolution]` `[:SENSe]:SEMask:OFFSet[1]|2:LIST:BWIDth[:RESolution]:AUTO`

Meas BW

Allows you to specify a multiplier of Res BW for the measurement integration bandwidth.

Meas BW is multiplier integer number. It shows a ratio between Integration BW and Resolution BW of the measurement result.

Integ BW = Meas BW * Resolution BW

Integration BW is desired resolution bandwidth and Resolution BW is actual bandwidth for sweep. Measurement sweeps with Resolution BW and Meas BW compensates sweep resolution bandwidth to Integration BW.

If you set this parameter greater than 1, you can set Resolution BW narrower to avoid carrier power leakage effect to the offset power integration.

When sending the remote command, missing values are not permitted; that is, if you want to change values 2 and 6, you must send all values up to 6. Subsequent values will remain as they were. The query for this parameter always returns 12 values.

Remote Command	`[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:IMULti <integer>, …` `[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:IMULti?`
Example	`:SEM:OFFS2:LIST:BAND:IMUL 1,1,1,1,1,1` `:SEM:OFFS2:LIST:BAND:IMUL?`
Notes	Comma separated list of values `OFFSet1` is for BTS, 2 for MS. Default is BTS Note that Offset sub op code 2 is supported only in non-SA modes. In the SA mode, Offset sub op code 1 is used for both BTS and MS
Preset	For Modes (except WLAN, MSR, LTEAFDD, LTEATDD, 5G NR) without option N9060A-7FP: SA: 1, 1, 1, 1, 1, 1 WCDMA: 1, 1, 1, 10, 1, 1|1, 1, 1, 1, 1, 1 When option N9060A-7FP is installed in these modes, the preset value of Offset G ~ L is the same as the Offset F value MSR: 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1|1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1 LTEAFDD, LTEATDD, 5G NR: 2, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1|2, 2, 1, 1, 1,1, 1, 1, 1, 1, 1, 1 WLAN: 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1
State Saved	Yes
Min/Max	1/1000
Backwards Compatibility SCPI	`[:SENSe]:SEMask:OFFSet[1]|2:LIST:BWIDth:IMULti`

Video BW

Changes the instrument post–detection filter.

When sending the remote command, missing values are not permitted; that is, if you want to change values 2 and 6, you must send all values up to 6. Subsequent values will remain as they were. The query for this parameter always returns 12 values.

Remote Command	`[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:VIDeo:AUTO OFF	ON	0	1, …` `[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:VIDeo:AUTO?`

Example	`:SEM:OFFS2:LIST:BAND:VID 3.00 kHz, 3.00 kHz, 3.00 kHz, 100.0 kHz,100.0 kHz, 100.0 kHz`
	`:SEM:OFFS2:LIST:BAND:VID?`
	`:SEM:OFFS2:LIST:BAND:VID:AUTO ON, ON, ON, ON, ON, ON`
	`:SEM:OFFS2:LIST:BAND:VID:AUTO?`

Notes	Comma separated list of values `OFFSet1` is for BTS, 2 for MS. Default is BTS Note that Offset sub op code 2 is supported only in non-SA modes. In the SA mode, Offset sub op code 1 is used for both BTS and MS
Preset	Automatically Calculated All Modes except WLAN, MSRLTEAFDD, LTEATDD, 5G NR without option N9060A-7FP: ON, ON, ON, ON, ON, ON|ON, ON, ON, ON, ON, ON All Modes except WLAN, MSRLTEAFDD, LTEATDD with option N9060A-7FP: ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON|ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON Modes MSR, LTEAFDD, LTEATDD, 5G NR: ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON|ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON Mode WLAN: ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON |ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON
State Saved	Saved in instrument state Saved in instrument state
Range	Auto|Man
Min/Max	1 Hz/50 MHz
Backwards Compatibility SCPI	`[:SENSe]:SEMask:OFFSet[1]|2:LIST:BWIDth:VIDeo` `[:SENSe]:SEMask:OFFSet[1]|2:LIST:BWIDth:VIDeo:AUTO`

VBW/RBW

Selects the ratio between the video and resolution bandwidths.

When sending the remote command, missing values are not permitted; that is, if you want to change values 2 and 6, you must send all values up to 6. Subsequent values will remain as they were. The query for this parameter always returns 12 values.

Remote Command	`[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:VIDeo:RATio:AUTO OFF | ON | 0 | 1, …` `[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:VIDeo:RATio:AUTO?`

Example	`:SEM:OFFS2:LIST:BAND:VID:RAT 0.1, 0.1, 0.1, 0.1, 0.1, 0.1`
	`:SEM:OFFS2:LIST:BAND:VID:RAT?`
	`:SEM:OFFS2:LIST:BAND:VID:RAT:AUTO ON, ON, ON, ON, ON, ON`
	`:SEM:OFFS2:LIST:BAND:VID:RAT:AUTO?`

Notes	Comma separated list of values `OFFSet1` is for BTS, 2 for MS. Default is BTS Note that Offset sub op code 2 is supported only in non-SA modes. In the SA mode, Offset sub op code 1 is used for both BTS and MS
Preset	For All Modes except WLAN, MSR, LTEAFDD, LTEATDD, 5G NR without option N9060A-7FP: **SA, WCDMA, LTE, LTETDD Modes**: 0.01, 0.01, 0.01, 0.01, 0.01, 0.01|0.01, 0.01, 0.01, 0.01, 0.01, 0.01 When option N9060A-7FP is installed in these modes, the preset value of Offset G ~ L is the same as the Offset F value **LTEAFDD, LTEATDD, 5G NR Modes**: 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01|0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01 **WLAN Mode:** 802..11 ax/be: 0.075, 0.075, 0.075, 0.075, 0.075, 0.075, 0.075, 0.075, 0.075, 0.075, 0.075, 0.075 All other formats: 0.3, 0.3, 0.3, 0.3, 0.3, 0.3, 0.3, 0.3, 0.3, 0.3, 0.3, 0.3 **MSR Mode**: 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01|0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01 For All Modes except WLAN, MSR, LTEAFDD, LTEATDD, 5G NR without option N9060A-7FP: OFF, OFF, OFF, OFF, OFF, OFF|OFF, OFF, OFF, OFF, OFF, OFF For Modes with option N9060A-7FP and MSR, LTEAFDD, LTEATDD, 5G NR: OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF|OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF Mode WLAN: OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF|OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF
State Saved	Saved in instrument state Saved in instrument state
Range	Auto|Man
Min/Max	0.00001/3000000
Backwards Compatibility SCPI	`[:SENSe]:SEMask:OFFSet[1]|2:LIST:BWIDth:VIDeo:RATio` `[:SENSe]:SEMask:OFFSet[1]|2:LIST:BWIDth:VIDeo:RATio:AUTO`

Offset (Sweep)

Accesses a menu that enables you to set up the sweep measurement parameters for offset pairs.

Offset Freq Define

Same as the Offset Freq control under Offset (Bandwidth).

See "Offset Freq Define" on page 1357.

Offset Detector

Same as the Offset Detector control under Offset (Bandwidth).

See "Offset Detector" on page 1361

Start Freq

Same as the Start Freq value under Offset (Bandwidth).

See "Start Freq" on page 1363

Stop Freq

Same as the Stop Freq value under Offset (Bandwidth).

See "Stop Freq" on page 1366

Sweep Time

Specifies the **Sweep Time** for the currently selected offset and enables you to toggle the Sweep Time mode between Auto and Man.

When sending the remote command, missing values are not permitted; that is, if you want to change values 2 and 6, you must send all values up to 6. Subsequent values will remain as they were. The query for this parameter always returns 12 values.

Remote Command	`[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:SWEep:TIME <time>, …`
	`[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:SWEep:TIME?`
	`[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:SWEep:TIME:AUTO ON | OFF | 1 | 0, …`
	`[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:SWEep:TIME:AUTO?`

Example	`:SEM:OFFS2:LIST:SWE:TIME 1.0 ms, 3.4 ms, 2.08 ms, 1.0 ms, 1.0 ms, 1.0 ms`
	`:SEM:OFFS2:LIST:SWE:TIME?`
	`:SEM:OFFS2:LIST:SWE:TIME:AUTO ON, ON, ON, ON, OFF, OFF`
	`:SEM:OFFS2:LIST:SWE:TIME:AUTO?`

Notes	Comma separated list of values

	`OFFSet1` is for BTS, 2 for MS. Default is BTS Note that Offset sub op code 2 is supported only in non-SA modes. In the SA mode, Offset sub op code 1 is used for both BTS and MS
Couplings	When the sweep timeis set manually, Sweep Time Mode is set to `MANual`
Preset	Automatically calculated For All Modes except WLAN, MSR, LTEAFDD, LTEATDD, 5G NR without option N9060A-7FP: ON,ON,ON,ON,ON,ON All Modes except WLAN, MSR, LTEAFDD, LTEATDD, 5G NR with option N9060A-7FP: ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON Modes LTEAFDD, LTEATDD, 5G NR: ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON | ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON Mode WLAN: ON,ON,ON,ON,ON,ON,ON,ON, ON,ON,ON,ON Mode MSR: ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON | ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON
State Saved	Saved in instrument state Saved in instrument state
Range	Auto|Man
Min/Max	Depends on Sweep Type: Sweep Type “Swept”: 1ms/4000s Sweep Type “FFT”: 100ns/4000s
Backwards Compatibility SCPI	`[:SENSe]:SEMask:OFFSet[1]|2:LIST:SWEep[:TIME]` `[:SENSe]:SEMask:OFFSet[1]|2:LIST:SWEep[:TIME]:AUTO`

Sweep Type

Specifies the **Sweep Type** for the currently selected offset, and enables you to toggle the **Sweep Type** mode between Auto and Man.

When sending the remote command, missing values are not permitted; that is, if you want to change values 2 and 6, you must send all values up to 6. Subsequent values will remain as they were. The query for this parameter always returns 12 values.

How to define Sweep Time and Sweep Type

- When Sweep Type Mode is Auto, Sweep Type is automatically selected depending on Sweep Type Rules.
- When Sweep Type Mode is Man, Sweep Type is selected by user.
- When Sweep Time Mode is Auto, the sweep time is automatically calculated depending on the selected sweep type.

Remote Command	`[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:SWEep:TYPE SWEep | FFT, …`
	`[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:SWEep:TYPE?`
	`[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:SWEep:TYPE:AUTO ON | OFF | 1 | 0, …`
	`[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:SWEep:TYPE:AUTO?`

Example	`:SEM:OFFS2:LIST:SWE:TYPE FFT,FFT,SWE`
	`:SEM:OFFS2:LIST:SWE:TYPE?`
	`:SEM:OFFS2:LIST:SWE:TYPE:AUTO ON, ON, ON, ON, OFF, OFF`
	`:SEM:OFFS2:LIST:SWE:TYPE:AUTO?`

Notes	Comma separated list of values `OFFSet1` is for BTS, 2 for MS. Default is BTS Note that Offset sub op code 2 is supported only in non-SA modes In the SA mode, Offset sub op code 1 is used for both BTS and MS
Dependencies	Not available in modular products, such as VXT
Couplings	When the Sweep Type is set manually, Sweep Type Mode is set to `OFF` (Manual) When Sweep Type Mode is Auto, Sweep Type is automatically selected depending on Sweep Type Rules
Preset	Automatically calculated X-series (except WLAN, MSR, LTEAFDD, LTEATDD, 5G NR) without option N9060A-7FP: ON,ON,ON,ON,ON,ON X-series (except WLAN, MSR, LTEAFDD, LTEATDD, 5G NR) with option N9060A-7FP: ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON LTEAFDD, LTEATDD, 5G NR: ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON| ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON WLAN: ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON MSR: ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON| ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON
State Saved	Saved in instrument state
Range	Auto|Man

Offset Side

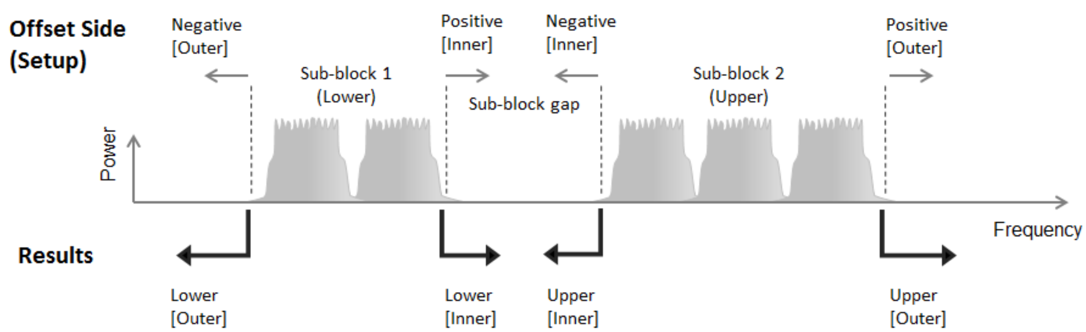
Specifies which offset side to measure.

You can turn off (not use) specific offsets with `[:SENSe]:SEMask:OFFSet[n][:OUTer]:LIST:STATe`.

- BOTH - Both of the negative (lower) and positive (upper) sidebands
- NEGative - Negative (lower) sideband only
- POSitive - Positive (upper) sideband only

When sending the remote command, missing values are not permitted; that is, if you want to change values 2 and 6, you must send all values up to 6. Subsequent values will remain as they were. The query for this parameter always returns 12 values.

The figure below shows the relation between the negative/positive offset side setups and the upper/lower results in the MSR, LTE-Advanced FDD/TDD and 5G NR.



Remote Command	`[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:SIDE BOTH | NEGative | POSitive, …`
	
	`[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:SIDE?`

Example	`:SEM:OFFS:LIST:SIDE BOTH, NEG, NEG, POS, POS, POS`
	
	`:SEM:OFFS:LIST:SIDE?`

Notes	Comma separated list of values `OFFSet1` is for BTS, 2 for MS. Default is BTS Note that Offset sub op code 2 is supported only in non-SA modes. In the SA mode, Offset sub op code 1 is used for both BTS and MS

Preset	For All Modes except WLAN, MSR, LTEAFDD, LTEATDD, 5G NR without option N9060A-7FP:
	`BOTH, BOTH, BOTH, BOTH, BOTH, BOTH`
	
	For All Modes except WLAN, MSR, LTEAFDD, LTEATDD, 5G NR with option N9060A-7FP:
	`BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH`
	
	Modes LTEAFDD,LTEATDD, 5G NR:
	`BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH | BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH`
	
	Mode MSR:
	`BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH | BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH`

	Mode WLAN: `BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH, BOTH`
State Saved	Saved in instrument state
Range	`BOTH|NEGative|POSitive`

Limits

Accesses a menu that enables you to set the power limits for start and stop frequencies of the selected offsets.

Start Freq

Same as the **Start Freq** value under Offset (Bandwidth).

See "Start Freq" on page 1363

Stop Freq

Same as the **Stop Freq** value under Offset (Bandwidth).

See "Stop Freq" on page 1366

Abs Start

Sets the absolute power level limit at the start frequency for the selected offset. The absolute power level limit ranges from –200 to +50 dBm.

The fail condition for each offset channel is set remotely by `[:SENSe]:SEMask:OFFSet[n][:OUTer]:LIST:TEST`.

You can turn off (not use) specific offset channels remotely with `[:SENSe]:SEMask:OFFSet[n][:OUTer]:LIST:STATe`.

The query returns values currently set to the absolute power test limits.

When sending the remote command, missing values are not permitted; that is, if you want to change values 2 and 6, you must send all values up to 6. Subsequent values will remain as they were. The query for this parameter always returns 12 values.

Remote Command	`[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:STARt:ABSolute <real>, …` `[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:STARt:ABSolute?`
Example	`:SEM:OFFS2:LIST:STAR:ABS -12.50 dBm, -12.50 dBm, -24.50 dBm, -11.50 dBm, -11.50 dBm, -11.50 dBm` `:SEM:OFFS2:LIST:STAR:ABS?`
Notes	Comma separated list of values `OFFSet1` is for BTS, 2 for MS. Default is BTS

	Note that Offset sub op code 2 is supported only in non-SA modes. In the SA mode, Offset sub op code 1 is used for both BTS and MS
Preset	For All Modes except WLAN, MSR, LTEAFDD, LTEATDD, 5G NR without option N9060A-7FP: **SA**: -14.00 dBm , -14.00 dBm , -26.00 dBm , -13.00 dBm , -13.00 dBm, -13.00 dBm **WCDMA Mode**: -12.50 dBm, -12.50 dBm, -24.50 dBm, -11.50 dBm, -11.50 dBm, -11.50 dBm|-69.6 dBm, -54.3 dBm, -54.3 dBm, -54.3 dBm, -54.3 dBm, -54.3 dBm **LTE, LTETDD Modes**: -5.5 dBm, -12.5 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm|-13.5 dBm, -8.5 dBm, -11.5 dBm, -23.5 dBm, -23.5 dBm, -23.5 dBm When option N9060A-7FP is installed in these modes, the preset value of Offset G ~ L is the same as the Offset F value **LTEAFDD, LTEATDD Modes**: -5.5 dBm, -12.5 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm|-13.5 dBm, -8.5 dBm, -11.5 dBm, -23.5 dBm, -23.5 dBm, -23.5 dBm, -23.5 dBm, -23.5 dBm, -23.5 dBm, -23.5 dBm, -23.5 dBm, -23.5 dBm **5G NR Mode**: -5.5 dBm, -12.5 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm|-22.5 dBm, -8.5 dBm, -11.5 dBm, -23.5 dBm, -23.5 dBm, -23.5 dBm, -23.5 dBm, -23.5 dBm, -23.5 dBm, -23.5 dBm, -23.5 dBm, -23.5 dBm **WLAN Mode**: See table of "WLAN Mode Presets" on page 1378 below **MSR Mode**: -12.5 dBm, -12.5 dBm, -24.5 dBm, -11.5 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm| -12.5 dBm, -12.5 dBm, -24.5 dBm, -11.5 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm
State Saved	Saved in instrument state
Min/Max	-200 dBm/50 dBm

WLAN Mode Presets

Radio Std	Presets
802.11b/g (DSSS/CCK/PBCC)	-10 dBm, -30 dBm, -30 dBm, -30 dBm, -30 dBm, -30 dBm, -30 dBm, -30 dBm, -30 dBm, -30 dBm, -30 dBm, -30 dBm
802.11a/g (OFDM/DSSS-OFDM) 802.11n/ac/ax/be (20MHz)	16.00 dBm, -4.00 dBm, -12.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm
802.11n/ac/ax/be (40MHz)	16.00 dBm, -4.00 dBm, -12.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm,-66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm,-66.00 dBm, -66.00 dBm
802.11ac/ax/be (80MHz/160MHz)	16.00 dBm, -4.00 dBm, -12.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm
802.11ac/ax (80 MHz + 80 MHz)	-69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm
802.11ah (1MHz)	16.00 dBm, -4.00 dBm, -12.00 dBm, -60.00 dBm, -60.00 dBm, -60.00 dBm, -60.00 dBm, -60.00 dBm, -60.00 dBm, -60.00 dBm, -60.00 dBm, -

Radio Std	Presets
	60.00 dBm
802.11ah (2MHz)	16.00 dBm, -4.00 dBm, -12.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm
802.11ah (4MHz)	16.00 dBm, -4.00 dBm, -12.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm,-66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm,-66.00 dBm, -66.00 dBm
802.11ah (8MHz/16MHz)	16.00 dBm, -4.00 dBm, -12.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm
802.11j/p (20MHz)	16.00 dBm, -4.00 dBm, -12.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm
802.11j/p (10MHz)	16.00 dBm, -4.00 dBm, -12.00 dBm, -60.00 dBm, -60.00 dBm, -60.00 dBm, -60.00 dBm, -60.00 dBm, -60.00 dBm, -60.00 dBm, -60.00 dBm, -60.00 dBm
802.11p (5MHz)	16.00 dBm, -4.00 dBm, -12.00 dBm, -57.00 dBm, -57.00 dBm, -57.00 dBm, -57.00 dBm, -57.00 dBm, -57.00 dBm, -57.00 dBm, -57.00 dBm, -57.00 dBm
802.11af (6MHz)	16.00 dBm, -4.00 dBm, -12.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm
802.11af (7MHz)	16.00 dBm, -4.00 dBm, -12.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm
802.11af (8MHz)	16.00 dBm, -4.00 dBm, -12.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm
802.11be (320MHz)	16.00 dBm, -4.00 dBm, -12.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm

Abs Stop

Sets the absolute power level limit at the stop frequency for the selected offset. The absolute power level limit ranges from –200 to +50 dBm. You can also toggle this function between Couple and Manual. If set to Couple, the **Abs Stop** power level limit is coupled to **Abs Start** to result in a flat limit line. If set to Man, Abs Start and Abs Stop take different values, resulting in a sloped limit line.

The query returns values currently set to the offset stop absolute power limits.

When sending the remote command, missing values are not permitted; that is, if you want to change values 2 and 6, you must send all values up to 6. Subsequent values will remain as they were. The query for this parameter always returns 12 values.

Remote Command	`[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:STOP:ABSolute:COUPle ON | OFF | 1 | 0, …` `[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:STOP:ABSolute:COUPle?`

Example	`:SEM:OFFS:LIST:STOP:ABS -12.50 dBm, -24.50 dBm, -24.50 dBm, -11.50 dBm, -11.50 dBm, -11.50 dBm`
	`:SEM:OFFS1:LIST:STOP:ABS?`
	`:SEM:OFFS:LIST:STOP:ABS:COUP ON, OFF, ON, ON, ON, ON`
	`:SEM:OFFS:LIST:STOP:ABS:COUP?`

Notes	Comma separated list of values OFFSet 1 is for BTS, 2 for MS. Default is BTS Note that Offset sub op code 2 is supported only in Non-SA modes. In the SA mode, Offset sub op code 1 is used for both BTS and MS
Couplings	Coupled to Abs Start if "Auto" is selected, that is, the Stop value is equal to the Start value
Preset	For Modes (except WLAN, MSR, LTEAFDD, LTEATDD, 5G NR) without option N9060A-7FP: **SA Mode**: -14.00 dBm, -26.00 dBm, -26.00 dBm, -13.00 dBm, -13.00 dBm, -13.00 dBm **WCDMA Mode**: -12.50 dBm, -24.50 dBm, -24.50 dBm, -11.50 dBm, -11.50 dBm, -11.50 dBm|-69.6 dBm, -54.3 dBm, -54.3 dBm, -54.3 dBm, -54.3 dBm, -54.3 dBm **LTE, LTETDD Modes**:-12.5 dBm, -12.5 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm| -13.5 dBm, -8.5 dBm, -11.5 dBm, -23.5 dBm, -23.5 dBm, -23.5 dBm When option N9060A-7FP is installed in these modes, the preset value of Offset G ~ L is the same as the Offset F value **LTEAFDD, LTEATDD Modes**: -12.5 dBm, -12.5 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm| -13.5 dBm, -8.5 dBm, -11.5 dBm, -23.5 dBm, -23.5 dBm, -23.5 dBm -23.5 dBm, -23.5 dBm, -23.5 dBm, -23.5 dBm, -23.5 dBm, -23.5 dBm **5G NR Mode**: -12.5 dBm, -12.5 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm| -22.5 dBm, -8.5 dBm, -11.5 dBm, -23.5 dBm, -23.5 dBm, -23.5 dBm, -23.5 dBm, -23.5 dBm, -23.5 dBm, -23.5 dBm, -23.5 dBm, -23.5 dBm **WLAN Mode**: See the table of "WLAN Mode Presets" on page 1381 below **MSR Mode**: -12.5 dBm, -24.5 dBm, -11.5 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm| -12.5 dBm, -24.5 dBm, -11.5 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm, -15.0 dBm For Modes (except WLAN, MSR, LTEAFDD, LTEATDD, 5G NR) without option N9060A-7FP: **SA Mode**: ON, OFF, ON, ON, ON, ON **WCDMA Mode**: ON, OFF, ON, ON, ON, ON|ON, ON, ON, ON, ON, ON **LTE, LTETDD Modes**: OFF, ON, ON, ON, ON, ON|ON, ON, ON, ON, ON, ON When option N9060A-7FP is installed in these modes, the preset value of Offset G ~ L is the same as the Offset F value **LTEAFDD, LTEATDD, 5G NR Modes**: OFF, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON|ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON **WLAN Mode**: See the table of "WLAN Mode Auto Function Presets" on page 1382 below **MSR Mode**: ON, OFF, OFF, OFF, ON, OFF, OFF, OFF, OFF, OFF, OFF, OFF|ON, OFF, OFF, OFF, ON, OFF,

	OFF, OFF, OFF, OFF, OFF, OFF
State Saved	Saved in instrument state Saved in instrument state
Range	Auto|Man
Min/Max	-200 dBm/50 dBm

WLAN Mode Presets

Radio Std	Presets
802.11b/g (DSSS/CCK/PBCC)	-4.00 dBm, -12.00 dBm, -24.00 dBm, -24.00 dBm, -24.00 dBm, -24.00 dBm, -24.00 dBm, -24.00 dBm, -24.00 dBm, -24.00 dBm, -24.00 dBm, -24.00 dBm, -24.00 dBm
802.11a/g (OFDM/DSSS-OFDM)	-10 dBm, -30 dBm, -30 dBm, -30 dBm, -30 dBm, -30 dBm, -30 dBm, -30 dBm, -30 dBm, -30 dBm, -30 dBm, -30 dBm
802.11n/ac/ax/be (20MHz)	-4.00 dBm, -12.00 dBm, -24.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm
802.11n/ac/ax/be (40MHz)	-4.00 dBm, -12.00 dBm, -24.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm
802.11ac/ax (80MHz/160MHz)	-4.00 dBm, -12.00 dBm, -24.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm,-69.00 dBm, -69.00 dBm, -69.00 dBm,-69.00 dBm, -69.00 dBm, -69.00 dBm
802.11ac/ax (80 + 80 MHz)	-69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm
802.11ah (1MHz)	-4.00 dBm, -12.00 dBm, -24.00 dBm, -60.00 dBm, -60.00 dBm, -60.00 dBm, -60.00 dBm, -60.00 dBm, -60.00 dBm, -60.00 dBm, -60.00 dBm, -60.00 dBm
802.11ah (2MHz)	-4.00 dBm, -12.00 dBm, -24.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm, -63.00 dBm
802.11ah (4MHz)	-4.00 dBm, -12.00 dBm, -24.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm
802.11ah (8MHz/16MHz)	-4.00 dBm, -12.00 dBm, -24.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm,-69.00 dBm, -69.00 dBm, -69.00 dBm,-69.00 dBm, -69.00 dBm, -69.00 dBm
802.11j/p (10MHz)	-4.00 dBm, -12.00 dBm, -24.00 dBm, -60.00 dBm, -60.00 dBm, -60.00 dBm, -60.00 dBm, -60.00 dBm, -60.00 dBm, -60.00 dBm, -60.00 dBm, -60.00 dBm
802.11j/p (5MHz)	-4.00 dBm, -12.00 dBm, -24.00 dBm, -57.00 dBm, -57.00 dBm, -57.00 dBm, -57.00 dBm, -57.00 dBm, -57.00 dBm, -57.00 dBm, -57.00 dBm, -57.00 dBm

Radio Std	Presets
802.11af (6MHz)	-4.00 dBm, -12.00 dBm, -24.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm
802.11af (7MHz)	-4.00 dBm, -12.00 dBm, -24.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm
802.11af (8MHz)	-4.00 dBm, -12.00 dBm, -24.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm, -66.00 dBm
802.11be (320MHz)	-4.00 dBm, -12.00 dBm, -24.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm,-69.00 dBm, -69.00 dBm, -69.00 dBm,-69.00 dBm, -69.00 dBm, -69.00 dBm

WLAN Mode Auto Function Presets

Radio Std	Presets
802.11a/g (OFDM/DSSS-OFDM) 802.11n (20MHz/40MHz) 802.11 ac/ax/be (20MHz/40MHz/80MHz/160MHz) 802.11 be (320MHz) 802.11ah (1MHz/2MHz/4MHz/8MHz/16MHz) 802.11af (6MHz/7MHz/8MHz)	OFF, OFF, OFF, ON, ON, ON, ON, ON, ON, ON, ON, ON
802.11 ac/ax (80+80 MHz)	ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON
802.11b/g (DSSS/CCK/PBCC)	ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON
802.11j/p 20M, j/p 10M, p5M	OFF, OFF, OFF, ON, ON, ON, ON, ON, ON, ON, ON, ON

Rel Start

Sets a relative power level limit at the start frequency for the selected offset. The relative power level limit ranges from –200 to +50 dBc.

The fail condition is set remotely by `[:SENSe]:SEMask:OFFSet[n][:OUTer]:LIST:TEST` for each offset channel test.

You can turn off (not use) specific offset channels remotely with `[:SENSe]:SEMask:OFFSet[n][:OUTer]:LIST:STATe`.

The SCPI query returns values currently set to the relative power test limits.

When sending the remote command, missing values are not permitted; that is, if you want to change values 2 and 6, you must send all values up to 6. Subsequent values will remain as they were. The query for this parameter always returns 12 values.

Remote Command	`[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:STARt:RCARrier <rel_ampl>, …` `[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:STARt:RCARrier?`
Example	`:SEM:OFFS:LIST:STAR:RCAR -30, -30, -30, -30, -30, -30` `:SEM:OFFS:LIST:STAR:RCAR?`
Notes	Comma separated list of values OFFSet 1 is for BTS, 2 for MS. Default is BTS Note that Offset sub op code 2 is supported only in Non-SA modes. In the SA mode, Offset sub op code 1 is used for both BTS and MS
Preset	For Modes (except WLAN, MSR, LTEAFDD, LTEATDD, 5G NR) without option N9060A-7FP: **SA Mode**: -30.00 dB, -30.00 dB,-30.00 dB, -30.00 dB, -30.00 dB, -30.00 dB **WCDMA Mode**: -30.00 dB, -30.00 dB, -30.00 dB, -30.00 dB, -30.00 dB, -30.00 dB|-33.73 dB, -34.00 dB, -37.50 dB, -47.50 dB, -47.50 dB, -47.50 dB When option N9060A-7FP is installed in these modes, the preset value of Offset G ~ L is the same as the Offset F value. **LTEAFDD, LTEATDD, 5G NR Modes**: 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB|0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB **WLAN Mode**: See table of "WLAN Mode Presets" on page 1383 below **MSR Mode**: 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB|0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB
State Saved	Saved in instrument state
Min/Max	-200 dB/50 dB

WLAN Mode Presets

802.11a/g (OFDM/DSSS-OFDM)	0 dB, -20.00 dB, -28.00 dB, -40.00 dB, -40.00 dB, -47.00 dB, -47.00 dB, -47.00 dB, -47.00 dB, -47.00 dB, -47.00 dB, -47.00 dB
802.11b/g (DSSS/CCK/PBCC)	-30 dB, -50 dB, -50 dB, -50 dB, -50 dB, -50 dB, -50 dB, -50 dB, -50 dB, -50 dB, -50 dB, -50 dB
802.11n (20MHz/40MHz)	0 dB, -20.00 dB, -28.00 dB, -45.00 dB, -45.00 dB, -45.00 dB, -45.00 dB, -45.00 dB, -45.00 dB, -45.00 dB, -45.00 dB, -45.00 dB
802.11ac/ax/be (20 MHz/ 40 MHz/ 80 MHz/ 160 MHz)	0 dB, -20.00 dB, -28.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB
802.11ac/ax (80 MHz + 80 MHz)	-40dB, -40.00 dB, -28.00 dB, -20 dB, 0 dB, - 20 dB, -28 dB, -40 dB, -40 dB, -40.00 dB, -40.00 dB, -40.00 dB
802.11ah (1 MHz/ 2 MHz/ 4 MHz/ 8 MHz/ 16 MHz)	0 dB, -20.00 dB, -28.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB
802.11j/p 20M, j/p 10M, p5M	0 dB, -20.00 dB, -28.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB

802.11af (6MHz/ 7MHz/ 8MHz)	0 dB, -20.00 dB, -28.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB
802.11be (320MHz)	-4.00 dBm, -12.00 dBm, -24.00 dBm, -69.00 dBm, -69.00 dBm, -69.00 dBm,-69.00 dBm, -69.00 dBm, -69.00 dBm,-69.00 dBm, -69.00 dBm, -69.00 dBm

Rel Stop

Sets a relative power level limit at the stop frequency for the selected offset. The relative power level limit ranges from –200 to +50 dBc.

The fail condition is set remotely by `[:SENSe]:SEMask:OFFSet[n][:OUTer]:LIST:TEST` for each offset channel.

You can turn off (not use) specific offset channels remotely with `[:SENSe]:SEMask:OFFSet[n][:OUTer]:LIST:STATe`.

The SCPI query returns values currently set to the offset stop relative power limits.

When sending the remote command, missing values are not permitted; that is, if you want to change values 2 and 6, you must send all values up to 6. Subsequent values will remain as they were. The query for this parameter always returns 12 values.

Remote Command	`[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:STOP:RCARrier:COUPle ON | OFF | 1 | 0, …` `[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:STOP:RCARrier:COUPle?`

Example	`:SEM:OFFS:LIST:STOP:RCAR -30, -30, -30, -30, -30, -30`
	`:SEM:OFFS:LIST:STOP:RCAR?`
	`:SEM:OFFS:LIST:STOP:RCAR:COUP ON, ON, ON, ON, ON, ON`
	`:SEM:OFFS:LIST:STOP:RCAR:COUP?`

Notes	Comma separated list of values OFFSet 1 is for BTS, 2 for MS. Default is BTS Note that Offset sub op code 2 is supported only in Non-SA modes. In the SA mode, Offset sub op code 1 is used for both BTS and MS
Couplings	Coupled to Rel Start if “Auto” is selected, that is, Start is made the same as Stop
Preset	For Modes (except WLAN, MSR, LTEAFDD, LTEATDD, 5G NR) without option N9060A-7FP: **SA Mode**: -30.00 dB, -30.00 dB, -30.00 dB, -30.00 dB, -30.00 dB, -30.00 dB **WCDMA Mode**: -30.00 dB, -30.00 dB, -30.00 dB, -30.00 dB, -30.00 dB, -30.00 dB|-48.28 dB, -37.50 dB, -47.50 dB, -47.50 dB, -47.50 dB, -47.50 dB When option N9060A-7FP is installed in these modes, the preset value of Offset G ~ L is the same as the Offset F value **LTEAFDD, LTEATDD, 5G NR Modes**: 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB|0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB **WLAN Mode**: See table of "WLAN Mode Presets" on page 1385 below **MSR Mode**: 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB|0 dB, 0 dB, 0 dB, 0 dB,

	0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB For Modes (except WLAN, MSR, LTEAFDD, LTEATDD, 5G NR) without option N9060A-7FP: **SA Mode**: ON, ON, ON, ON, ON, ON **WCDMA Mode**: ON, ON, ON, ON, ON, ON|OFF, OFF, OFF, ON, ON, ON **LTE, LTETDD Modes**: ON, ON, ON, ON, ON, ON When option N9060A-7FP is installed, the preset value of Offset G ~ L is the same as the Offset F value **LTEAFDD, LTEATDD, 5G NR Modes**: ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON | ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON **WLAN Mode**: See table of "WLAN Mode Presets" on page 1385 below **MSR Mode**: ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON | ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON
State Saved	Saved in instrument state Saved in instrument state
Range	Auto|Man
Min/Max	-200 dB/50 dB

WLAN Mode Presets

Radio Std	Presets
802.11a/g (OFDM/DSSS-OFDM)	-20.00 dB, -28.00 dB, -40.00 dB, -40.00 dB, -47.00 dB, -47.00 dB, -47.00 dB, -47.00 dB, -47.00 dB, -47.00 dB, -47.00 dB, -47.00 dB
802.11b/g (DSSS/CCK/PBCC)	-30 dB, -50 dB, -50 dB, -50 dB, -50 dB, -50 dB, -50 dB, -50 dB, -50 dB, -50 dB, -50 dB, -50 dB
802.11n (20MHz/40MHz)	-20.00 dB, -28.00 dB, -45.00 dB, -45.00 dB, -45.00 dB, -45.00 dB, -45.00 dB, -45.00 dB, -45.00 dB, -45.00 dB, -45.00 dB, -45.00 dB
802.11ac/ax/be (20 MHz/ 40 MHz/ 80 MHz/ 160 MHz)	-20.00 dB, -28.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB
802.11be (320 MHz)	-20.00 dB, -28.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB
802.11ac/ax (80 MHz + 80MHz)	-40dB, -28.00 dB, -20.00 dB, 0 dB, -20.00 dB, -28.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB
802.11ah (1MHz/ 2 MHz/ 4 MHz/ 8 MHz/ 16 MHz)	-20.00 dB, -28.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB
802.11 j/p 10M, p5M	-20.00 dB, -28.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -47.00 dB, -47.00 dB, -47.00 dB, -47.00 dB, -47.00 dB, -47.00 dB, -47.00 dB
802.11af (6MHz/ 7MHz/ 8MHz)	-20.00 dB, -28.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB, -40.00 dB

WLAN Mode Auto Function Presets

Radio Std	Presets
802.11a/g (OFDM/DSSS-OFDM) 802.11n (20MHz/ 40MHz)	OFF, OFF, OFF, ON, ON, ON, ON, ON, ON, ON, ON, ON
802.11b/g (DSSS/CCK/PBCC)	ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON
802.11ac/ax/be (20 MHz/ 40 MHz/ 80 MHz/ 160 MHz)	OFF, OFF, OFF, ON, ON, ON, ON, ON, ON, ON, ON, ON
802.11be (320 MHz)	OFF, OFF, OFF, ON, ON, ON, ON, ON, ON, ON, ON, ON
802.11ac/ax (80 MHz + 80MHz)	OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF
802.11ah (1MHz/2 MHz/ 4 MHz/ 8 MHz/ 16 MHz)	OFF, OFF, OFF, ON, ON, ON, ON, ON, ON, ON, ON, ON
802.11j/p (20M/ 10M) /11p(5M)	OFF, OFF, OFF, ON, ON, ON, ON, ON, ON, ON, ON, ON
802.11af (6 MHz/ 7 MHz/ 8 MHz)	OFF, OFF, OFF, ON, ON, ON, ON, ON, ON, ON, ON, ON

Fail Mask

Selects one of the logics for fail conditions between the measurement results and the test limits:

– `ABSolute` and `RELative` both check the results against the respective limit

– `OR` checks against both limits, failing if either of the limits is broken

– `AND` only displays a fail if both of the limits are broken

The absolute or relative power limit value for each offset channel can be set remotely with `[:SENSe]:SEMask:OFFSet[n][:OUTer]:LIST:ABSolute` or `[:SENSe]:SEMask:OFFSet[n][:OUTer]:LIST:RCARrier`.

You can turn off (not use) specific offset channels remotely with `[:SENSe]:SEMask:OFFSet[n][:OUTer]:LIST:STATe`.

When sending the remote command, missing values are not permitted; that is, if you want to change values 2 and 6, you must send all values up to 6. Subsequent values will remain as they were. The query for this parameter always returns 12 values.

Remote Command	`[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:TEST ABSolute | AND | OR | RELative, …` `[:SENSe]:SEMask:OFFSet[1]|2[:OUTer]:LIST:TEST?`
Example	`:SEM:OFFS:LIST:TEST ABS, ABS, ABS, ABS, ABS, ABS`

	:SEM:OFFS:LIST:TEST?
Notes	Comma separated list of values Note that Offset sub op code 2 is supported only in Non-SA modes. In the SA mode, Offset sub op code 1 is used for both BTS and MS
Preset	For Modes (except WLAN, MSR, LTEAFDD, LTEATDD, 5G NR) without option N9060A-7FP: **SA Mode**: ABS, ABS, ABS, ABS, ABS, ABS **WCDMA Mode**: ABS, ABS, ABS, ABS, ABS, ABS|AND, AND, AND, AND, AND, AND **LTE, LTETDD Modes**: ABS, ABS, ABS, ABS, ABS, ABS When option N9060A-7FP is installed in these modes, the preset value of Offset G ~ L is the same as the Offset F value **LTEAFDD, LTEATDD, 5G NR Modes**: ABS, ABS, ABS, ABS, ABS, ABS, ABS, ABS, ABS, ABS, ABS, ABS|ABS, ABS, ABS, ABS, ABS, ABS, ABS, ABS, ABS, ABS, ABS, ABS **WLAN Mode**: See the table of "WLAN Mode Presets" on page 1387 below **MSR Mode**: ABS, ABS, ABS, ABS, ABS, ABS, ABS, ABS, ABS, ABS, ABS, ABS|ABS, ABS, ABS, ABS, ABS, ABS, ABS, ABS, ABS, ABS, ABS, ABS
State Saved	Saved in instrument state
Range	Absolute|Relative|Abs AND Rel|Abs OR Rel

WLAN Mode Presets

Radio Std	Presets
802.11b/g (DSSS/CCK/PBCC)	REL, REL, REL, REL, REL, REL, REL, REL, REL, REL, REL, REL
802.11a/g (OFDM/DSSS-OFDM) or 802.11n (20MHz/40MHz)	REL, REL, REL, AND, AND, AND, AND, AND, AND, AND, AND, AND
802.11ac/ax/be (20 MHz/ 40 MHz/ 80 MHz/ 160 MHz)	REL, REL, REL, AND, AND, AND, AND, AND, AND, AND, AND, AND
802.11be (320 MHz)	REL, REL, REL, AND, AND, AND, AND, AND, AND, AND, AND, AND
802.11ac/ax (80 MHz + 80MHz)	AND, REL, REL, REL, REL, REL, REL, AND, AND, AND, AND, AND
802.11ah (1MHz/ 2 MHz/ 4 MHz/ 8 MHz/ 16 MHz)	REL, REL, REL, AND, AND, AND, AND, AND, AND, AND, AND, AND
802.11j/p 10M, p5M	REL, REL, REL, AND , AND, AND, AND, AND, AND, AND, AND, AND
802.11af (6 MHz/ 7 MHz/ 8 MHz)	REL, REL, REL, AND , AND, AND, AND, AND, AND, AND, AND, AND

Meas Setup Summary Table

The Meas Setup Summary Table lets you view and access many of the parameters in the Meas Setup menus on one screen.

Auto Couple

Immediately puts all Auto/Man functions into Auto. The **Auto Couple** action is confined to the current measurement only. It does not affect other measurements in the mode.

In the Auto state, Auto/Man functions are said to be “coupled”, meaning their values change as you make changes to other values in the measurement. This helps ensure accurate measurements and optimum dynamic range. Auto Couple is an immediate action function, and when it is executed, all the Auto/Man controls for the current measurement are set to Auto, and all measurement settings coupled to the Auto/Man parameters are automatically set to their optimal value.

For further details of measurement-specific settings (if any), see "Measurement-Specific Details" on page 1389 below.

Remote Command	`:COUPle ALL`
Example	`:COUP ALL`
Backwards Compatibility SCPI	`:COUPLE ALL | NONE`
Backwards Compatibility Notes	`:COUP:NONE` puts all Auto/Man parameters in manual mode, decoupling all the coupled instrument parameters. It is retained for backwards compatibility and is *not* recommended for making measurements or new designs

All Auto/Man parameter couplings in the measurement are set to Auto. This includes couplings that may be unavailable or grayed-out due to the current state. For example, in the Swept SA measurement, there is no Auto/Man coupling for RBW while in Zero Span. Nonetheless, if **Auto Couple** were executed while in Zero Span it would set RBW to Auto "behind the scenes" so that, on exit from Zero Span, it would be in Auto.

Any Auto/Man selection specific (local) to the other measurements in the current Mode will not be affected by **Auto Couple**. Any functions that are *not* coupled with other instrument parameters, such as ranging or leveling variables, such as "AutoRange" or "AutoScale", will not be affected.

Executing the **Auto Couple** command generates the informational message, "All Auto/Man functions have been set to Auto".

Each parameter, upon being set to Auto, selects and sets the appropriate auto-coupled value based on that parameter’s coupling rules. The Dependency Resolver orchestrates the couplings for parameters that are dependent on one or more other parameters. The coupling and dependency rules for each parameter are defined in the chapter describing that parameter.

Executing the **Auto Couple** command *does not* affect markers, marker functions, trace or display attributes, or any other instrument setting other than those specifically mentioned above.

Measurement-Specific Details

TOI

Parameters affected by Auto Couple are:

- Center Frequency Step
- Resolution Bandwidth
- Span/RBW Ratio
- Sweep Time
- Video BandwidthVBW/RBW ratio
- Upper and Lower Tone (set to Sense
-)Zero span measurement Resolution Bandwidth
- Zero span measurement Dwell Time

Harmonics

For Harmonics, these parameters are:

- Resolution Bandwidth
- Fundamental Frequency
- Dwell Time
- Range Table Resolution Bandwidths
- Range Table Dwell Times

Meas Preset

Restores all the measurement parameters to their default values.

Remote Command	`:CONFigure:SEMask`
Example	`:CONF:SEM`
Couplings	Selecting Meas Preset will restore all measurement parameters to their default values

3.10.8.2 Carrier

The Carrier tab is used to set up the parameters which define how the reference channel is measured.

Integ BW

Specifies the integration bandwidth used to calculate the power in the reference channel.

Remote Command	`[:SENSe]:SEMask:BANDwidth[1]|2:INTegration <bandwidth>` `[:SENSe]:SEMask:BANDwidth[1]|2:INTegration?`
Example	`:SEM:BAND:INT 10 MHz` `:SEM:BAND:INT?`
Notes	10% . 100% of Channel Span Parameter Value Bandwidth sub op code, 1 is for BTS, 2 for MS. Default is BTS Note that Bandwidth sub op code 2 is supported only in Non-SA modes. In the SA mode, Bandwidth sub op code 1 is used for both BTS and MS If the ref channel is outside of the frequency range, the result spectrum will be invalid
Dependencies	For the MSR, LTE-Advanced FDD/TDD and 5G NR modes, this control is not shown In order to keep backwards compatible with the legacy LTE FDD/TDD, the remote command is supported in LTE & LTE-A converged application
Couplings	Cannot be higher than the channel Span. If lower than 1/10 of channel Span, then the channel Span is reduced to be 10 times the Integ BW
Preset	**SA Mode**: 3.84 MHz **WCDMA Mode**: 3.84 MHz|3.84 MHz **LTE, LTETDD Modes**: 4.515MHz|4.5MHz **WLAN Mode**: See table of "WLAN Mode Presets" on page 1390 below
State Saved	Saved in instrument state
Min/Max	1 kHz/Depends on instrument maximum frequency. Same as the Max Span on Swept SA Measurement
Backwards Compatibility SCPI	`[:SENSe]:SEMask:BWIDth[1]|2:INTegration`

WLAN Mode Presets

Radio Std	Presets
802.11a/g (OFDM/DSSS-OFDM) 802.11n/ac (20 MHz)	18 MHz
802.11b/g (DSSS/CCK/PBCC)	22 MHz

Radio Std	Presets
802.11n (40MHz)/ 802.11ac (40 MHz)	38 MHz
802.11ac (80 MHz)	78 MHz
802.11ac (160 MHz)	158 MHz
802.11ac (80 MHz + 80 MHz)	78 MHz
802.11ah (1 MHz)	0.9 MHz
802.11ah (2 MHz)	1.8 MHz
802.11ah (4 MHz)	3.8 MHz
802.11ah (8 MHz)	7.8 MHz
802.11ah (16 MHz)	15.8 MHz
802.11j/p (20 MHz)	18 MHz
802.11j/p (10 MHz)	9 MHz
802.11p (5 MHz)	4.5 MHz
802.11ax/be (20 MHz)	19.5 MHz
802.11ax/be (40 MHz)	39.0 MHz
802.11ax/be (80 MHz)	79.0 MHz
802.11ax/be (160 MHz)	159.0 MHz
802.11be (320 MHz)	319.0 MHz
802.11ax (80 MHz + 80 MHz)	79.0 MHz
802.11af (6 MHz)	5.7 MHz
802.11af (7 MHz)	6.65 MHz
802.11af (8 MHz)	7.6 MHz

Span

Specifies the span used to calculate the power in the reference channel.

Remote Command	`[:SENSe]:SEMask:FREQuency[1]|2:SPAN <freq>`
	`[:SENSe]:SEMask:FREQuency[1]|2:SPAN?`
	`[:SENSe]:SEMask:FREQuency[1]|2:SPAN:AUTO ON | OFF | 1 | 0`
	`[:SENSe]:SEMask:FREQuency[1]|2:SPAN:AUTO?`

Example	`:SEM:FREQ:SPAN 3MHz`
	`:SEM:FREQ:SPAN?`
	`:SEM:FREQ:SPAN:AUTO OFF`
	`:SEM:FREQ:SPAN:AUTO?`

Notes	Frequency sub op code, 1 is for BTS, 2 for MS. Default is BTS Note that Frequency sub op code 2 is supported only in Non-SA modes. In the SA mode, Frequency sub op code 1 is used for both BTS and MS If the ref channel is outside of the frequency range, the result spectrum will be invalid

Dependencies	For the MSR mode, this control is not shown In order to keep backwards compatible with the legacy LTE FDD/TDD, the channel span key is supported in LTE & LTE-A converged application. The Auto/Man toggle is added to this key. This key is enabled and can be changed only in single carrier. And the span state is always kept as Auto in Multi-carriers Span Auto/Man State is only available in the LTE/LTE-Advanced FDD/TDD and 5G NR modes
Couplings	Range 1 kHz to 50 MHz (although restricted by Chan Integ BW). If you set the channel Span lower than channel Integ BW, they will both track each other. As you increase the channel Span, the Integ BW will also increase if it is less than 1/10 of the channel Span For WLAN 802.11ac (80 + 80 MHz), the channel span is coupled with the difference between the center frequencies of the two carriers. When the difference is either less than 80 MHz or greater than 565 MHz, a “setting conflict” error message is displayed Chan Span = Carrier Spacing + Chan IntegBW When the state of Span is Auto, the span value is automatically determined by multi-carrier configuration. Otherwise, the span value depends on User’s input When the span value is set manually, the state of span is automatically changes to Man This key is enabled and can be changed only in single carrier. And the span state is always kept as Auto in Multi-carriers
Preset	**SA Mode**: 5.0 MHz **WCDMA Mode**: 5.0 MHz|5.0 MHz **LTE, LTETDD, LTE-A FDD, LTE-A TDD Modes**: 5 MHz **5G NR Mode**: 100 MHz **WLAN Mode**: See table of "WLAN Mode Presets" on page 1392 below ON
State Saved	Saved in instrument state Yes
Range	Auto|Man
Min/Max	1 kHz/Depends on instrument maximum frequency. Same as the Max Span on Swept SA Measurement

WLAN Mode Presets

Radio Std	Presets
802.11a/g (OFDM/DSSS-OFDM) 802.11n/ac (20 MHz)	18 MHz
802.11b/g (DSSS/CCK/PBCC)	22 MHz
802.11n/ac (40 MHz)	38 MHz
802.11ac (80 MHz)	78 MHz
802.11ac (160 MHz)	158 MHz
802.11ac (80 MHz + 80 MHz)	320 MHz
802.11ah (1 MHz)	0.9 MHz
802.11ah (2 MHz)	1.8 MHz

Radio Std	Presets
802.11ah (4 MHz)	3.8 MHz
802.11ah (8 MHz)	7.8 MHz
802.11ah (16 MHz)	15.8 MHz
802.11j/p (20 MHz)	18 MHz
802.11j/p (10 MHz)	9 MHz
802.11p (5 MHz)	4.5 MHz
802.11ax/be (20 MHz)	19.5 MHz
802.11ax/be (40 MHz)	39.0 MHz
802.11ax/be (80 MHz)	79.0 MHz
802.11ax/be (160 MHz)	159.0 MHz
802.11be (320 MHz)	319.0 MHz
802.11ax (80 MHz + 80 MHz)	320.0 MHz
802.11af (6 MHz)	5.7 MHz
802.11af (7 MHz)	6.65 MHz
802.11af (8 MHz)	7.6 MHz

Sweep Time

Set the sweep time used to calculate the power in the reference channel. Sweep Time can be set manually or put in auto mode.

For instruments with non-sweeping acquisitions, such as VXT, the time value is the acquisition time for an individual FFT segment, not the cumulated time for all FFT segments in the channel.

Remote Command	`[:SENSe]:SEMask:SWEep[1]|2:TIME <time>`
	`[:SENSe]:SEMask:SWEep[1]|2:TIME?`
	`[:SENSe]:SEMask:SWEep[1]|2:TIME:AUTO OFF | 0 | ON | 1`
	`[:SENSe]:SEMask:SWEep[1]|2:TIME:AUTO?`

Example	`:SEM:SWE:TIME 9ms`
	`:SEM:SWE:TIME?`
	`:SEM:SWE:TIME:AUTO OFF`
	`:SEM:SWE:TIME:AUTO?`

Notes	Sub op code, 1 is for BTS, 2 for MS. Default is BTS Note that Sweep sub op code 2 is supported only in Non-SA modes. In the SA mode, Sweep sub op code 1 is used for both BTS and MS
Couplings	When the time is set manually, Auto is set to OFF Value is coupled with Channel Detector selection, Channel Resolution BW, Channel Video BW if the state is Auto When set to Auto, the Time is automatically calculated

Preset	Automatically calculated ON
State Saved	Saved in instrument state Yes
Range	OFF|ON
Min/Max	Depends on Channel Sweep Type Sweep Type "Swept": 1ms/4000 s Sweep Type "FFT": 100ns/4000 s
Backwards Compatibility SCPI	`[:SENSe]:SEMask:SWEep[1]|2[:TIME]` `[:SENSe]:SEMask:SWEep[1]|2[:TIME]:AUTO`

Sweep Type

Sets the sweep type used to calculate the power in the reference channel. Sweep Type can be set manually or put in auto mode.

How to define Channel Sweep Time and Channel Sweep Type:

- When Channel Sweep Type Mode is Auto, Channel Sweep Type is automatically selected depending on Sweep Type Rules
- When Channel Sweep Type Mode is Man, Channel Sweep Type is selected by the user
- When Channel Sweep Time Mode is Auto, the channel sweep time is automatically calculated depending on the selected sweep type

Remote Command	`[:SENSe]:SEMask:SWEep[1]|2:TYPE SWEep	FFT` `[:SENSe]:SEMask:SWEep[1]|2:TYPE?` `[:SENSe]:SEMask:SWEep[1]|2:TYPE:AUTO OFF	0	ON	1` `[:SENSe]:SEMask:SWEep[1]|2:TYPE:AUTO?`

Example	`:SEM:SWE:TYPE FFT`
	`:SEM:SWE:TYPE?`
	`:SEM:SWE:TYPE:AUTO OFF`
	`:SEM:SWE:TYPE:AUTO?`

Notes	Sub op code, 1 is for BTS, 2 for MS. Default is BTS Note that Sweep sub op code 2 is supported only in Non-SA modes. In the SA mode, Sweep sub op code 1 is used for both BTS and MS
Dependencies	This control is greyed out in VXT models M9410A/11A
Couplings	When the sweep type is set manually, Sweep Type Mode is set to `MANual` When Channel Sweep Type Mode is Auto, Sweep Type is automatically selected depending on Sweep

	Type Rules
Preset	Automatically calculated ON
State Saved	Saved in instrument state Yes
Range	OFF | ON

Res BW

Sets the resolution bandwidth used to calculate the power in the reference channel. The Channel Resolution BW can be set manually or put in to auto mode.

MSR Auto RBW:

In the MSR resolution bandwidth is predefined for each radio format. When carriers are configured with multiple radio formats, the narrowest RBW is selected.

Radio Format		RBW (kHz)
LTE	1.4 MHz	13 kHz
	3 MHz	27 kHz
	5 MHz	47 kHz
	10 MHz	91 kHz
	15 MHz	150 kHz
	20 MHz	180 kHz
W-CDMA		75 kHz

Radio Format		RBW
5G NR	5 MHz	47 kHz
	10 MHz	91 kHz
	15 MHz	150 kHz
	20 MHz	180 kHz
	25 MHz	240 kHz
	30 MHz	270 kHz
	40 MHz	390 kHz
	50 MHz	470 kHz
	60 MHz	560 kHz
	70 MHz	680 kHz
	80 MHz	750 kHz
	90 MHz	820 kHz
	100 MHz	910 kHz
	200MHz	1.8 MHz
	400 MHz	3 MHz

In the LTE-Advanced FDD/TDD, the resolution bandwidth is predefined based on the corresponding bandwidth of the single LTE carrier, which is listed above. When ResBW mode is Auto, the narrowest RBW is selected.

Remote Command	`[:SENSe]:SEMask:BANDwidth[1]|2[:RESolution] <bandwidth>`
	`[:SENSe]:SEMask:BANDwidth[1]|2[:RESolution]?`
	`[:SENSe]:SEMask:BANDwidth[1]|2[:RESolution]:AUTO OFF | ON | 1 | 0`
	`[:SENSe]:SEMask:BANDwidth[1]|2[:RESolution]:AUTO?`

Example	`:SEM:BAND 100 kHz`
	`:SEM:BAND?`
	`:SEM:BAND:AUTO ON`
	`:SEM:BAND:AUTO?`

Notes	Bandwidth sub op code, 1 is for BTS, 2 for MS. Default is BTS Note that Bandwidth sub op code 2 is supported only in Non-SA modes. In the SA mode, Bandwidth sub op code 1 is used for both BTS and MS
Couplings	When Res BW is set manually, Channel Resolution BW Mode is set to `MANual` Value is coupled with Channel Detector selection, Channel Sweep Time and Channel Video BW When set to Auto, the resolution bandwidth is automatically calculated
Preset	SA: 100 kHz WCDMA: 75 kHz LTE, LTETDD, MSR, LTEAFDD, LTEATDD: Auto (47 kHz) 5G NR: Auto WLAN: 100 kHz `ON`
State Saved	Saved in instrument state Saved in instrument state
Range	Auto|Man
Min	1 Hz
Max	When Option FS1 or FS2 is installed, the max RBW is 10 MHz. Otherwise, 8 MHz.
Backwards Compatibility SCPI	`[:SENSe]:SEMask:BWIDth[1]|2[:RESolution]` `[:SENSe]:SEMask:BWIDth[1]|2[:RESolution]:AUTO`

Video BW

Sets the video bandwidth used to calculate the power in the reference channel. The Channel Video BW can be set manually or put in to auto mode.

Remote Command	`[:SENSe]:SEMask:BANDwidth[1]|2:VIDeo <bandwidth>` `[:SENSe]:SEMask:BANDwidth[1]|2:VIDeo?`

	`[:SENSe]:SEMask:BANDwidth[1]|2:VIDeo:AUTO OFF | ON | 1 | 0` `[:SENSe]:SEMask:BANDwidth[1]|2:VIDeo:AUTO?`

Example	`:SEM:BAND:VID 100 kHz`
	`:SEM:BAND:VID?`
	`:SEM:BAND:VID:AUTO ON`
	`:SEM:BAND:VID:AUTO?`

Notes	Bandwidth sub op code, 1 is for BTS, 2 for MS. Default is BTS Note that Bandwidth sub op code 2 is supported only in Non-SA modes. In the SA mode, Bandwidth sub op code 1 is used for both BTS and MS
Couplings	When Video BW is set manually, Channel Video BW Mode is set to `MANual` Value is coupled with Channel Detector selection, Channel Sweep Time and Channel Resolution BW When set to Auto, the video bandwidth is automatically calculated
Preset	SA: 100 kHz WCDMA: 75 kHz LTE, LTEAFDD, LTETDD, LTEATDD, 5G NR, WLAN, MSR: Auto `ON`
State Saved	Saved in instrument state Yes
Range	Auto|Man
Min/Max	1 Hz/50 MHz
Backwards Compatibility SCPI	`[:SENSe]:SEMask:BWIDth[1]|2:VIDeo` `[:SENSe]:SEMask:BWIDth[1]|2:VIDeo:AUTO`

VBW/RBW

Sets the Video BW/Resolution BW Ratio to calculate the Channel Resolution BW and Channel Video BW. The VBW/RBW Ratio can be set manually or put in to auto mode.

Remote Command	`[:SENSe]:SEMask:BANDwidth[1]|2:VIDeo:RATio <real>`
	`[:SENSe]:SEMask:BANDwidth[1]|2:VIDeo:RATio`
	`[:SENSe]:SEMask:BANDwidth[1]|2:VIDeo:RATio:AUTO OFF | ON | 1 | 0`
	`[:SENSe]:SEMask:BANDwidth[1]|2:VIDeo:RATio:AUTO?`

Example	`:SEM:BAND:VID:RAT 0.1`
	`:SEM:BAND:VID:RAT?`
	`:SEM:BAND:VID:RAT:AUTO ON`
	`:SEM:BAND:VID:RAT:AUTO?`

Notes	Bandwidth sub op code, 1 is for BTS, 2 for MS. Default is BTS Note that Bandwidth sub op code 2 is supported only in Non-SA modes. In the SA mode, Bandwidth sub

	op code 1 is used for both BTS and MS
Couplings	When Video BW/Res BW is set manually, Channel VBW/RBW Ratio Mode is set to MANual When set to Auto, the VBW/RBW Ratio is automatically calculated
Preset	SA, WCDMA: 1.0 LTE, LTETDD, LTEAFDD, LTEATDD, 5G NR, WLAN, MSR:Auto ON
State Saved	Saved in instrument state Saved in instrument state
Range	Auto|Man
Min/Max	0.00001/3000000
Backwards Compatibility SCPI	[:SENSe]:SEMask:BWIDth[1]|2:VIDeo:RATio [:SENSe]:SEMask:BWIDth[1]|2:VIDeo:RATio:AUTO

Channel Detector

Accesses a menu of functions that enable you to control the detectors for reference channel. The following choices are available:

- AUTO- the detector selected depends on marker functions, trace functions, average type, and the trace averaging function
- NORMal-the detector determines the peak of the CW-like signals, and it yields alternating maximums and minimums of noise-like signals. This is also referred to as Rosenfell detection
- AVERage-the detector determines the average of the signal within the sweep points. The averaging method depends upon the Average Type selection (voltage, power or log scales)
- POSitive Peak-the detector determines the maximum of the signal within the sweep points
- SAMPle-the detector indicates the instantaneous level of the signal at the center of the sweep points represented by each display point
- NEGative Peak-the detector determines the minimum of the signal within the sweep points

Remote Command	[:SENSe]:SEMask:DETector:CARRier[:FUNCtion] AVERage | NEGative | NORMal | POSitive | SAMPle [:SENSe]:SEMask:DETector:CARRier[:FUNCtion]? [:SENSe]:SEMask:DETector:CARRier:AUTO ON | OFF | 1 | 0 [:SENSe]:SEMask:DETector:CARRier:AUTO?
Example	:SEM:DET:CARR NEG

	:SEM:DET:CARR? :SEM:DET:CARR:AUTO OFF :SEM:DET:CARR:AUTO?
Notes	When you manually select a detector (instead of selecting Auto), that detector is used regardless of other instrument settings Note: This detector setting affects the reference channel. There is not a per trace detector See Couplings in the Trace Type section
Couplings	See Couplings in the Trace Type section
Preset	AVERage ON
State Saved	Saved in instrument state
Range	AVERage|NEGative|NORMal|POSitive|SAMPle

Reference Carrier Average Type (Remote Command Only)

Select trace average type for the reference carrier.

Remote Command	[:SENSe]:SEMask:AVERage:CARRier:TYPE RMS | LOG [:SENSe]:SEMask:AVERage:CARRier:TYPE?
Example	:SEM:AVER:CARR:TYPE LOG :SEM:AVER:CARR:TYPE?
Preset	RMS
State Saved	Saved in instrument state

Offset/Limits Config Table

This function is the same as "Offset/Limits Config Table" on page 1355 under "Settings" on page 1352.

Sets the power reference in the carrier that will be used to compute the relative values for the offsets.

3.10.8.3 Reference

Lets you set the Reference Power and parameters related to the Reference Power for SEM measurements.

Measurement Type

Accesses a menu that enables you to select one of the following measurement reference types:

- **Total Pwr Ref** – Sets the reference to the total carrier power and the measured data is shown in dBc and dBm
- **PSD Ref** – Sets the reference to the mean power spectral density of the carrier and the measured data is shown in dB and dBm/Hz
- **Spectrum Peak Ref** – Sets the reference to the spectrum peak power of the carrier and the measured data is shown in dB and dBm

Remote Command	`[:SENSe]:SEMask:TYPE PSDRef | TPRef | SPRef` `[:SENSe]:SEMask:TYPE?`
Example	`:SEM:TYPE PSDR` `:SEM:TYPE?`
Preset	`TPRef` unless noted below `SPRef` WLAN
State Saved	Saved in instrument state
Range	Total Pwr Reference|PSD Reference|Spectrum Peak Reference

Reference Power

Toggles the state between Measured Power and Manual Power for Total Power Ref, PSD Ref, and Spectrum Peak Ref.

Remote Command	`[:SENSe]:SEMask:CARRier:AUTO[:STATe] OFF | ON | 1 | 0` `[:SENSe]:SEMask:CARRier:AUTO[:STATe]?`

Example	`:SEM:CARR:AUTO OFF`
	Set to Manual
	`:SEM:CARR:AUTO ON`
	Set to Measured
	`:SEM:CARR:AUTO?`

Notes	This command is available in all the Meas Type cases
Dependencies	This command is not available in the MSR, LTE-A and 5G NR modes
Preset	`ON`
State Saved	Saved in instrument state Saved in instrument state
Range	Auto|Man

Total Power Ref

Sets the power in the carrier (ref channel) that is used to compute the relative power values for the offsets. When Reference Power is set to Measured Power, this value is set to the measured carrier reference power. When set to Manual Power, the result takes on the last measured value, or can be manually entered.

For WLAN 802.11ac (80 MHz + 80 MHz), the higher of the power readouts of the two carriers is used for computing the relative power values for the offset.

Remote Command	`[:SENSe]:SEMask:CARRier[:POWer] <real>` `[:SENSe]:SEMask:CARRier[:POWer]?`
Example	`:SEM:CARR 100dBm` `:SEM:CARR?`
Notes	The min and max values given are for Meas Type = Total Pwr Ref
Couplings	This "Total Power Ref" parameter is coupled with the "Meas Type" parameter. The control is active when Meas Type is set to Total Power Ref. Otherwise, it is grayed out In MSR, LTE-A and 5G NR modes, the control is active when Meas Type is set to Total Power and Power Ref is set to Manual
Preset	Measured carrier reference power
State Saved	Saved in instrument state
Min/Max	-200 dBm/200 dBm
Annotation	Value is displayed on the left top of the Results window with the Channel Integ BW

PSD Ref

Sets the power spectral density in the carrier that is used to compute the relative power spectral density values for the offsets when Meas Type is set to PSD Ref. When the state is set to auto, this will be set to the measured carrier power spectral density.

For WLAN 802.11ac (80 MHz + 80 MHz), the higher of the power density readouts of the two carriers is used for computing the relative PSD values for the offset.

Remote Command	`[:SENSe]:SEMask:CARRier:CPSD <real>` `[:SENSe]:SEMask:CARRier:CPSD?`
Example	`:SEM:CARR:CPSD -80` `:SEM:CARR:CPSD?`
Notes	Although the default value is defined, the value is recalculated by the measurement result just after completing the measurement Carrier sub op code. 1 for BTS, 2 for MS. Default is BTS
Couplings	This "PSD" parameter is coupled with the "Meas Type" parameter. The control is active if the Meas Type is set to PSD. Otherwise, it is grayed out In MSR, LTE-A and 5G NR modes, the control is active when Meas Type is set to PSD and Power Ref is set to Manual
Preset	Measured carrier PSD reference power
State Saved	Saved in instrument state

Min/Max	-200/200
Annotation	Value is displayed on the right top of the Results window. If Meas Type selection is PSD Ref, the string is “PSD Ref” with BOLD font, otherwise, hide annotation

Spectrum Pk Ref

Sets the spectrum peak power in the carrier that is used to compute the relative power spectral density values for the offsets when **Meas Type** is set to Spectrum Peak. When the state is set to auto, this is set to the measured carrier spectrum peak power. When set to manual, the result takes on the last measured value, or can be manually entered

Remote Command	`[:SENSe]:SEMask:CARRier:PEAK[:POWer] <real>` `[:SENSe]:SEMask:CARRier:PEAK[:POWer]?`
Example	`:SEM:CARR:PEAK -80` `:SEM:CARR:PEAK:POWER?`
Notes	Although the default value is defined, the value is recalculated by the measurement result just after completing the measurement Carrier sub op code. 1 for BTS, 2 for MS. Default is BTS
Couplings	This "Spectrum Peak Ref" parameter is coupled with the "Meas Type" parameter. This control is active when the "Meas Type" is set to "Spectrum Peak Ref". Otherwise, grayout In MSR, LTE-A and 5G NR modes, the control is active when Meas Type is set to Spectrum Peak Ref and Power Ref is set to Manual
Preset	Measured carrier Spectrum Peak reference power
State Saved	Saved in instrument state
Min/Max	-200/200
Annotation	Value is displayed on the right top of the Results window. If Meas Type selection is Spectrum Peak Ref, the string is “Spectrum Peak Ref” with BOLD font, otherwise, hide annotation

Offset/Limits Config Table

This function is the same as "Offset/Limits Config Table" on page 1355 under "Settings" on page 1352.

Sets the power reference in the carrier that will be used to compute the relative values for the offsets.

3.10.8.4 Radio

The Radio tab contains controls to select the Radio Device, and enable or disable HSPA/HSPA+ options.

Radio Device

Allows you to specify the device to be used.

Remote Command	[:SENSe]:RADio:STANdard:DEVice BTS | MS [:SENSe]:RADio:STANdard:DEVice?
Example	:RAD:STAN:DEV MS :RAD:STAN:DEV?
Preset	BTS
State Saved	Saved in instrument state.
Range	BTS | MS
Backwards Compatibility SCPI	[:SENSe]:RADio:DEVice

HSPA Enable

Allows you to turn on or off the HSDPA/HSUPA option enable. This selection is necessary because some of the auto detection functions that expect an HSPA signal are less tolerant when the signal is noisy or distorted. When the HSPA signal is not expected, turn HSPA Enable off.

Remote Command	[:SENSe]:RADio:CONFigure:HSDPa[:STATe] 0 | 1 | OFF | ON [:SENSe]:RADio:CONFigure:HSDPa[:STATe]?
Example	:RAD:CONF:HSDP 0 :RAD:CONF:HSDP?
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

HSPA+ Enable

Allows you to turn on or off the HSPA+ option enable. This selection is necessary because some of the auto detection functions that expect an HSPA+ signal are less tolerant when the signal is noisy or distorted. When the HSPA+ signal is not expected, turn HSPA+ Enable off.

Remote Command	[:SENSe]:RADio:CONFigure:EHSPa[:STATe] OFF | ON | 0 | 1 [:SENSe]:RADio:CONFigure:EHSPa[:STATe]?

Example	`:RAD:CONF:EHSP 0` `:RAD:CONF:EHSP?`
Notes	When HSPA enable is OFF, HSPA+ function is disabled too.
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

3.10.8.5 Advanced

Contains controls for setting advanced functions of the instrument.

This tab does not appear in EXM, VXT, M9393A or M9391A.

Noise Floor Extension

Allows you to turn on/configure the **Noise Floor Extension** (NFE) function. Some Modes (such as Spectrum Analyzer Mode), support two states of NFE, Full and Adaptive. The ON state (in Modes which do not support Adaptive NFE) matches the FULL state (in Modes which DO support Adaptive NFE).

In ON or FULL NFE, the expected noise power of the instrument (derived from a factory calibration) is subtracted from the trace data. This will usually reduce the apparent noise level by about 10 dB in low band, and 8 dB in high band (>~3.6 GHz).

In Adaptive NFE, there is not the same dramatic visual impact on the noise floor as there is in Full NFE. Adaptive NFE controls the amount of correction that is applied based on other instrument settings like RBW, averaging and sweep time. Adaptive NFE controls the degree of potential improvement in the noise floor to give more improvement for those instrument settings that can make good use of the potential improvement, such as settings that provide more averaging. The result is that when not much averaging is being performed, the signal displays more like the NFE-off case; and when lots of averaging is being performed, the signal displays more like the full-NFE case.

Adaptive NFE (in Modes which support it) is recommended for general-purpose use. For fully ATE (automatic test equipment) applications, where the distraction of a person using the instrument is not a risk, Full NFE is recommended.

NFE works with any RBW, VBW, detector, any setting of Average Type, any amount of trace averaging, and any signal type. It is ineffective when the trace is not smoothed (smoothing processes include narrow VBWs, trace averaging, and long sweep times with the detector set to Average or Peak). It works best with extreme amounts of smoothing, and with the average detector, with the Average Type set to Power.

In those cases where the cancellation is ineffective, it nonetheless has no undesirable side-effects. There is no significant speed impact to having Noise Floor Extension on.

The best accuracy is achieved when substantial smoothing occurs in each point before trace averaging. Thus, when using the average detector, results are better with long sweep times and fewer trace averages. When using the sample detector, the VBW filter should be set narrow with less trace averaging, instead of a wide VBW filter with more trace averaging.

NOTE

Noise Floor Extensions has no effect unless the RF Input is selected, therefore it does nothing when External Mixing is selected.

In Modes which support Adaptive NFE, the default state of NFE is Adaptive. In Modes which do not support Adaptive NFE, the default state of NFE is OFF. Prior to the introduction of Adaptive NFE (firmware version A.18.00), the default state of NFE was OFF for all Modes.

With the introduction of Adaptive NFE, the menu control is changed from On|Off to Full|Adaptive|Off. For SCPI Backwards Compatibility, the existing SCPI command to turn NFE on and off was retained, and a new command was added to set the state to turn Adaptive On and Off

`[:SENSe]:CORRection:NOISe:FLOor ON|OFF|1|0` is retained, default changed to On for modes which support Adaptive NFE

`[:SENSe]:CORRection:NOISe:FLOor:ADAPtive ON|OFF|1|0` is added (for certain Modes), default=On

FULL = `:CORRection:NOISe:FLOor ON plus :CORRection:NOISe:FLOor:ADAPtive ON`

Remote Command	`[:SENSe]:CORRection:NOISe:FLOor ON | OFF | 1 | 0` `[:SENSe]:CORRection:NOISe:FLOor?`
Example	`:CORR:NOIS:FLO ON`
Dependencies	This control only appears in instruments with the NFE or NF2 license installed. In all others, the control does not appear, however the remote command will be accepted without error (but will have no effect)
Couplings	When NFE is enabled in any mode manually, a prompt will be displayed reminding you to perform the Characterize Noise Floor operation if it is needed. If NFE is enabled through SCPI and a Characterize Noise Floor operation is needed, an error will be entered in the system error queue
Preset	Unaffected by Mode Preset. Turned ON at startup and by Restore Mode Defaults in Modes which support Adaptive. Turned OFF at startup and by Restore Mode Defaults in Modes which do not support Adaptive
State Saved	No

Remote Command	`[:SENSe]:CORRection:NOISe:FLOor:ADAPtive ON | OFF | 1 | 0` `[:SENSe]:CORRection:NOISe:FLOor:ADAPtive?`
Example	`:CORR:NOIS:FLO ON`

	First turn NFE on, this is Full mode `:CORR:NOIS:FLO:ADAP ON` Then set it to Adaptive
Dependencies	Only available in Modes which support Adaptive NFE Only appears in instruments with the NFE or NF2 license installed. In all others, the control does not appear, however the remote command will be accepted without error (but will have no effect)
Couplings	Sending `:CORR:NOIS:FLO ON` turns NFE Adaptive OFF for backwards compatibility. So to turn Adaptive on, you must issue the commands in the proper order, as shown in the example above
Preset	Not affected by Mode Preset, but set to ON at startup and by Restore Mode Defaults
State Saved	No

More Information

The instrument is characterized in the factory (or during a field calibration) with a model of the noise, referred to the input mixer, versus frequency in each band and path combination. Bands are 0 (low band) and 1 through 4 (high band) in a 26.5 GHz instrument, for example. Paths include normal paths, preamp paths, the electronic attenuator, etc.

In most band/path combinations, the noise can be well characterized based on just two parameters and the instrument frequency response before compensation for frequency-dependent losses.

After the noise density at the input mixer is estimated, the effects of the input attenuator, RBW, detector, etc. are computed to get the estimated input-port-referred noise level.

In the simplest case, the measured power (signal plus analyzer noise) in each display point (bucket) is compensated by subtracting the estimated noise power, leaving just the signal power. This is the operation when the detector is Average and the Average Type is set to Power.

In other cases, operation is often not quite as good but still highly effective. With peak detection, the noise floor is estimated based on the RBW and the duration of the bucket using the same equations used in the noise marker function. The voltage of the noise is subtracted from the voltage of the observed signal-plus-noise measurement to compute the estimated signal voltage. The peak detector is one example of processing that varies with detector to give good estimates of the signal level without the analyzer noise.

For best operation, the average detector and the power scale are recommended, as already stated. Peak detection for pulsed-RF can still give excellent effectiveness. FFT analysis does not work well, and does not do NFE well, with pulsed-RF signals, so this combination is not recommended. Negative peak detection is not very useful, either. Sample detection works well, but is never better than the average detector because it doesn’t smooth as well. The Normal detector is a combination of peak and negative peak behaviors, and works about as well as these.

For best operation, extreme smoothing is desirable, as already stated. Using narrow VBWs works well, but using very long bucket durations and the average detector works best. Reducing the number of trace points will make the buckets longer.

For best operation, the power scale (Average Type = Power) is optimum. When making CW measurements in the presence of noise without NFE, averaging on the decibel scale has the advantage of reducing the effect of noise. When using NFE, the NFE does an even better job than using the log scale ever could. Using NFE with the log scale is not synergistic, though; NFE with the power scale works a little better than NFE with log averaging type.

The results from NFE with internal preamp can often be lower than the theoretical noise in a signal source at room temperature, a noise density of -174 dBm/Hz. This is expected and useful behavior, because NFE is designed to report the amount of input signal that is in excess of the thermal noise, not the amount that includes the thermal noise. This can be a useful behavior because thermal noise often interferes with what you want to measure, instead of being part of what you want to measure. Note that NFE is not adequately accurate to always be able to read below kTB.

Adaptive NFE provides an alternative to fully-on and -off NFE. Fully-on NFE can, notably in cases with little or no averaging of the spectrum, result in a display that is distractingly unfamiliar in the variability in response to low level signals. Fully-off NFE fails to achieve the potential improvement in dynamic range and associated accuracy of measurement of low level signals. Adaptive NFE controls the degree of potential improvement in the noise floor to give more improvement for those instrument settings that can make good use of the potential improvement—those settings with high degrees of variance reduction through some variant of averaging. When the potential improvement is small, the display acts like the NFE-off case, and when it is high, it acts like the fully-on case, and in-between, application is a compromise between attractiveness and effectiveness.

On instruments with the NF2 license installed, the calibrated Noise Floor used by Noise Floor Extensions should be refreshed periodically. Keysight recommends that the **Characterize Noise Floor** operation be performed after the first 500 hours of operation, and once every calendar year. The control to perform this is located in the **System, Alignments, Advanced** menu. If you have not done this yourself at the recommended interval, then when you turn on Noise Floor Extensions, the instrument will prompt you to do so with a dialog that says:

“This action will take several minutes to perform. Please disconnect all cables from the RF input and press Enter to proceed. Press ESC to cancel, or Postpone to postpone for a week”

If you Cancel, you will be prompted again the next time you turn NFE on. If you postpone, you will be prompted again after a week passes and you then turn NFE on.

Enable Wideband IF for FFT

When `OFF`, the maximum FFT BW is limited to 40 MHz. When `ON`, FFT with more wideband IF is supported depending on the instrument. For example, the max FFT

BW is 510 MHz with option B5X.

Remote Command	`[:SENSe]:SEMask:WBFFt:ENABle ON | OFF | 1 | 0` `[:SENSe]:SEMask:WBFFt:ENABle?`
Example	`:SEM:WBFF:ENAB 1` `:SEM:WBFF:ENAB?`
Dependencies	The maximum FFT BW depends on the uW preselector and the current frequency. In hi-band, the uW preselector must be disabled to apply the FFT with wideband IF. Otherwise the maximum FFT BW is limited to 40 MHz
Preset	`OFF`
State Saved	Saved in instrument state
Range	`ON|OFF`

3.10.8.6 Global

The controls in this menu apply to all Modes in the instrument.

Some controls (for example, **Global Center Freq**) allow you to switch certain Meas Global parameters to a Mode Global state. These switches apply to all Modes that support global settings. For example, no matter what Mode you are in when you set **Global Center Freq** to `ON`, it applies to all Modes that support Global Settings.

Other controls (for example, **Extend Low Band**) are actually set in this menu, but apply to all Modes.

Global Center Freq

The software maintains a Mode Global value called **Global Center Freq**.

When **Global Center Freq** is switched `ON`, the current Mode's center frequency is copied into the **Global Center Frequency**, and from then on all Modes that support global settings use the **Global Center Frequency**, so you can switch between any of these Modes and the Center Freq will remain unchanged.

Adjusting the Center Freq of any Mode that supports Global Settings, while **Global Center Freq** is `ON`, modifies the Global Center Frequency.

When **Global Center Freq** is switched `OFF`, the Center Freq of the current Mode is unchanged, but now the Center Freq of each Mode is once again independent.

When **Mode Preset** is pressed while **Global Center Freq** is `ON`, the Global Center Freq is preset to the preset Center Freq of the current Mode.

This function is reset to `OFF` when "Restore Defaults" on page 1737 (in this tab) is pressed, or when **System**, **Restore Defaults**, **All Modes** is pressed.

Remote Command	`:INSTrument:COUPle:FREQuency:CENTer ALL | NONE` `:INSTrument:COUPle:FREQuency:CENTer?`

Example	:INST:COUP:FREQ:CENT ALL :INST:COUP:FREQ:CENT?
Preset	Set to OFF on **Global** Settings, **Restore Defaults** and **System, Restore Defaults, All Modes**
Range	ALL|NONE

Preset	OFF
Backwards Compatibility SCPI	:GLOBal:FREQuency:CENTer[:STATe] 1 | 0 | ON | OFF :GLOBal:FREQuency:CENTer[:STATe]?

Global EMC Std

When this control is switched ON, the current Mode's EMC Std is copied into the **Global EMC Std**, and from then on all Modes that support global settings use the Global EMC Std, so you can switch between any of these Modes and the EMC Std will remain unchanged.

Adjusting the EMC Std of any Mode that supports Global Settings, while Global EMC Std is ON, will modify the **Global EMC Std**.

When **Global EMC Std** is switched OFF, the EMC Std of the current Mode is unchanged, but now the EMC Std of each Mode is once again independent. When **Mode Preset** is pressed while **Global EMC Std** is ON, the Global EMC Std is preset to the preset EMC Std of the current Mode.

This function is reset to OFF when "Restore Defaults" on page 1737 (in this tab) is pressed, or when **System, Restore Defaults, All Modes** is pressed.

Remote Command	:INSTrument:COUPle:EMC:STANdard ALL | NONE :INSTrument:COUPle:EMC:STANdard?
Example	:INST:COUP:EMC:STAN ALL :INST:COUP:EMC:STAN?
Dependencies	Only available if option EMC is installed
Preset	Set to OFF on **Global** Settings, **Restore Defaults** and **System, Restore Defaults, All Modes**
Range	ALL|NONE

Extend Low Band

The software maintains a Mode Global value called **Extend Low Band**.

Under the current sweep configuration crossing over two bands, when **Extend Low Band** is turned ON, the instrument checks whether one band can cover the whole sweep frequency range or not. If it can, then the instrument locks the band; otherwise, it does nothing (the band crossover occurs).

This function does *not* work when **Band Lock** under **System** > **Service** > **Lock Functions** is not -1 (no Band Lock). In that case, **Band Lock** takes priority over **Extend Low Band**.

This function is reset to `OFF` when "Restore Defaults" on page 1737 (in this tab) is pressed, or when **System**, **Restore Defaults**, **All Modes** is pressed.

This parameter is available for SA, RTSA, WCDMA, WIMAX OFDMA, LTEAFDD, LTEATDD Modes.

Remote Command	`:INSTrument:COUPle:FREQuency:BAND:EXTend 0 | 1 | ON | OFF` `:INSTrument:COUPle:FREQuency:BAND:EXTend?`
Example	`:INST:COUP:FREQ:BAND:EXT 1` `:INST:COUP:FREQ:BAND:EXT?`
Dependencies	Only applies to UXA, PXA, MXA and EXA
Preset	Set to `OFF` by **Global** Settings > **Restore Defaults** and **System** > **Restore Defaults** > **All Modes**
Range	`ON|OFF`

Restore Defaults

Resets all of the functions in the **Global** Settings menu to `OFF`. This also occurs when **System**, **Restore Defaults**, **All Modes** is pressed.

Remote Command	`:INSTrument:COUPle:DEFault`
Example	`:INST:COUP:DEF`
Backwards Compatibility SCPI	`:GLOBal:DEFault`

3.10.9 Sweep

Accesses controls that enable you configure and control the acquisition of data and the X-Axis parameters of the instrument. These controls might include Sweep Time, Continuous/Single, Pause/Resume, X Scale and number of Points.

3.10.9.1 Sweep/Control

Contains controls for the Sweep and Control functions of the instrument, such as Sweep Time and Continuous/Single.

Sweep/Measure

Allows you to toggle between Continuous and Single sweep or measurement operation. The Single/Continuous state is Meas Global, so the setting affects *all* measurements.

The front-panel key **Single/Cont** performs exactly the same function

NOTE	In the `WAVeform` measurement, this control only appears in the Meas Bar, and not in the **Sweep/Control** tab.

See "More Information" on page 1411

Remote Command	`:INITiate:CONTinuous OFF | ON | 0 | 1` `:INITiate:CONTinuous?`

Example	`:INIT:CONT 0`
	`:INIT:CONT OFF`
	puts instrument into Single measurement operation
	`:INIT:CONT 1`
	`:INIT:CONT ON`
	puts instrument into Continuous measurement operation

Preset	ON Note that `:SYST:PRES` sets `:INIT:CONT` to `ON` but `*RST` sets `:INIT:CONT` to `OFF`
State Saved	Saved in instrument state
Annunciation	The **Single/Continuous** icon in the Meas Bar changes depending on the setting: – A line with an arrow is Single – A loop with an arrow is Continuous

More Information

With **Avg/Hold Num** (in the **Meas Setup** menu) set to **Off** or set to **On** with a value of 1, a sweep is taken after the trigger condition is met; and the instrument continues to take new sweeps after the current sweep has completed and the trigger condition is again met. However, with **Avg/Hold Num** set to On with a value >1, multiple sweeps (data acquisitions) are taken for the measurement. The trigger condition must be met prior to each sweep. The sweep is not stopped when the average count k equals the number N set for Avg/Hold Num is reached, but the number k stops incrementing. A measurement average usually applies to all traces, marker results, and numeric results, but sometimes only applies to the numeric results.

If the instrument is in Single measurement, pressing the **Cont/Single** toggle control does not change k and does not cause the sweep to be reset; the only action is to put the instrument into Continuous measurement operation.

If it is already in Continuous sweep:

- the `:INIT:CONT 1` command has no effect
- the `:INIT:CONT 0` command will place the instrument in Single Sweep but will

have no effect on the current sequence until k = N, at which point the current sequence will stop and the instrument will go to the idle state.

See "Restart" on page 1738 control description for details on the `:INIT:IMM` (Restart) function.

If you are already in Single sweep, the `:INIT:CONT OFF` command has no effect.

If you are already in Single Sweep, then pressing the **Cont/Single** toggle control in the middle of a sweep does not restart the sweep or sequence. Similarly, pressing the **Cont/Single** toggle control does not restart the sweep or sequence if the sweep is not in the idle state (for example, if you are taking a very slow sweep, or the instrument is waiting for a trigger). Even though pressing the **Cont/Single** toggle control in the middle of a sweep does *not* restart the sweep, sending `:INIT:IMM` *does* reset it.

Restart

The **Restart** function restarts the current sweep, or measurement, or set of averaged/held sweeps or measurements. In measurements that support pausing, if you are Paused, pressing **Restart** performs a **Resume**.

The Restart function is accessed in several ways:

– Pressing the **Restart** key

– Sending the remote command `:INIT:IMM`

– Sending the remote command `:INIT:REST`

See "More Information" on page 1413

Remote Command	`:INITiate[:IMMediate]` `:INITiate:RESTart`
Example	`:INIT:IMM` `:INIT:REST`
Notes	`:INIT:REST` and `:INIT:IMM` and the front-panel **Restart** key perform exactly the same function
Couplings	Resets average/hold count k For the first sweep, overwrites all active (update=on) traces with new current data For application modes, resets other parameters as required by the measurement
Status Bits/OPC dependencies	This is an Overlapped command The `:STATus:OPERation` register bits 0 through 8 are cleared The `:STATus:QUEStionable` register bit 9 (INTegrity sum) is cleared The `SWEEPING` bit is set The `MEASURING` bit is set
Backwards	For Spectrum Analysis mode in ESA and PSA, the **Restart** hardkey and the `:INIT:REST` command

Compatibility Notes	restart trace averages (displayed average count reset to 1) for a trace in **Clear Write**, but did not restart **Max Hold** and **Min Hold** In the X-Series, the **Restart** hardkey and the `:INIT:REST` command restart not only **Trace Average**, but **Max Hold** and **Min Hold** traces as well For wireless comms modes in ESA and PSA, the **Restart** hardkey and the `:INIT:REST` command restarted every measurement, including all traces and numeric results. There is no change to this operation

More Information

The **Restart** function first aborts the current sweep or measurement as quickly as possible. It then resets the sweep and trigger systems, sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is in the process of aligning when a Restart is executed, the alignment finishes before the restart function is performed.

Even when set for Single operation, multiple sweeps may be taken when **Restart** is pressed (for example, when averaging/holding is on). Thus when we say that Restart "restarts a measurement," depending on the current settings, we may mean:

– It restarts the current sweep

– It restarts the current measurement

– It restarts the current set of sweeps if any trace is in Trace Average, Max Hold or Min Hold

– It restarts the current set of measurements if Averaging, or Max Hold, or Min Hold is on for the measurement

With Average/Hold Number (in Meas Setup menu) set to 1, or Averaging off, or no trace in Trace Average or Hold, a single sweep is equivalent to a single measurement. A single sweep is taken after the trigger condition is met; and the instrument stops sweeping once that sweep has completed. However, with Average/Hold Number >1 and at least one trace set to Trace Average, Max Hold, or Min Hold (SA Measurement) or Averaging on (most other measurements), multiple sweeps/data acquisitions are taken for a single measurement. The trigger condition must be met prior to each sweep. The sweep is stopped when the average count k equals the number N set for Average/Hold Number. A measurement average usually applies to all traces, marker results, and numeric results, but sometimes only applies to the numeric results.

Once the full set of sweeps has been taken, the instrument will go to the idle state. To take one more sweep without resetting the average count, increment the average count by 1, by pressing the step up key while Average/Hold Number is the active function, or by sending the remote command `:CALC:AVER:TCON UP`.

Pause/Resume

Pauses a measurement after the current data acquisition is complete.

When a measurement is paused:

– The label on this control changes to **Resume**. Pressing **Resume** un-pauses the measurement.

– Pressing **Restart** also performs a **Resume**.

Remote Command	`:INITiate:PAUSe` `:INITiate:RESume`
Example	`:INIT:PAUS` `:INIT:RES`
Dependencies	Not displayed in Modes that do not support pausing
Couplings	When Averaging is On, if the measurement is paused no more updates will occur until either a Resume or Restart occurs If the measurement is resumed, the averaging continues to use the traces from before the Pause occurred and continues to use the traces from the point where the Resume occurred. This still provides real-time traces, but they will no longer be gap free In a view with a Waterfall window, when the measurement is paused, the Waterfall stops updating. When Resume is selected, the Waterfall will retain the existing traces and continue updating using traces from the point at which Resume was selected. The time stamp of the individual Waterfall traces will show the time from the beginning of the measurement the trace relates to, showing there was a gap in the Waterfall capture In Density view, when the measurement is paused, the Density Display stops updating. When the measurement is resumed, if Persistence is `ON`, the persistence fading will continue from the point when the measurement was paused If a Restart occurs, the average counter is reset and all results are discarded. The measurement begins again, using traces after the Restart occurred

Abort (Remote Command Only)

This command stops the current measurement. It aborts the current measurement as quickly as possible, resets the sweep and trigger systems, and puts the measurement into an "idle" state. If the instrument is in the process of aligning when `:ABORt` is sent, the alignment finishes before the abort function is performed, so `:ABORt` does *not* abort an alignment.

If the instrument is set for Continuous measurement, it sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is set for Single measurement, it remains in the "idle" state until an `:INIT:IMM` command is received.

Remote Command	`:ABORt`
Example	`:ABOR`
Notes	If `:INIT:CONT` is `ON`, then a new continuous measurement will start immediately, with sweep (data acquisition) occurring once the trigger condition has been met If `:INIT:CONT` is `OFF`, then `:INIT:IMM` is used to start a single measurement, with sweep (data acquisition) occurring once the trigger condition has been met
Dependencies	For continuous measurement, `:ABORt` is equivalent to the **Restart** key Not all measurements support the abort command
Status Bits/OPC dependencies	The `:STATus:OPERation` register bits 0 through 8 are cleared The `:STATus:QUEStionable` register bit 9 (INTegrity sum) is cleared Since all the bits that feed into OPC are cleared by `:ABORt`, the `:ABORt` will cause the *OPC query to return true

3.10.9.2 X Scale

Accesses controls that enable you to set the horizontal scale parameters.

Ref Value

Sets the X reference value.

Remote Command	`:DISPlay:SEMask:WINDow[1]:TRACe:X[:SCALe]:RLEVel <freq>` `:DISPlay:SEMask:WINDow[1]:TRACe:X[:SCALe]:RLEVel?`
Example	`:DISP:SEM:WIND:TRAC:X:RLEV 10` `:DISP:SEM:WIND:TRAC:X:RLEV?`
Couplings	If Auto Scaling is set to On, this value is automatically determined by the measurement result. When you set this value manually, Auto Scaling automatically changes to Off
Preset	1.0 GHz
State Saved	Saved in instrument state
Min	-1000 GHz
Max	1000 GHz
Backwards Compatibility SCPI	`:DISPlay:SEMask:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:RLEVel`

Scale/Div

Sets the horizontal scale.

Remote Command	`:DISPlay:SEMask:WINDow[1]:TRACe:X[:SCALe]:PDIVision <freq>` `:DISPlay:SEMask:WINDow[1]:TRACe:X[:SCALe]:PDIVision?`

Example	:DISP:SEM:WIND:TRAC:X:PDIV 500 :DISP:SEM:WIND:TRAC:X:PDIV?
Couplings	If Auto Scaling is set to ON, this value is automatically determined by the measurement result. When you set this value manually, Auto Scaling automatically changes to OFF
Preset	Automatically Calculated
State Saved	Yes Saved in instrument state
Min	1 Hz
Max	100 GHz
Backwards Compatibility SCPI	:DISPlay:SEMask:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:PDIVision

Ref Position

Sets the reference position for the X axis to Left, Center or Right.

Remote Command	:DISPlay:SEMask:WINDow[1]:TRACe:X[:SCALe]:RPOSition LEFT | CENTer | RIGHt :DISPlay:SEMask:WINDow[1]:TRACe:X[:SCALe]:RPOSition?
Example	:DISP:SEM:WIND:TRAC:X:RPOS LEFT :DISP:SEM:WIND:TRAC:X:RPOS?
Preset	CENTer
State Saved	Saved in instrument state
Range	Left|Center|Right
Backwards Compatibility SCPI	:DISPlay:SEMask:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:RPOSition

Auto Scaling

Toggles the scale coupling function between On and Off.

Remote Command	:DISPlay:SEMask:WINDow[1]:TRACe:X[:SCALe]:COUPle 0 | 1 | OFF | ON :DISPlay:SEMask:WINDow[1]:TRACe:X[:SCALe]:COUPle?
Example	:DISP:SEM:WIND:TRAC:X:COUP ON :DISP:SEM:WIND:TRAC:X:COUP?
Couplings	When Auto Scaling is ON and the **Restart** front-panel key is pressed, this function automatically determines the scale per division and reference values based on the measurement results When you set a value to either Scale/Div or Ref Value manually, Auto Scaling automatically changes to OFF

Preset	ON
State Saved	Saved in instrument state
Range	OFF|ON
Backwards Compatibility SCPI	:DISPlay:SEMask:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:COUPle

3.10.9.3 Sweep Config

This tab accesses controls that enable you to configure the Sweep and Control functions of the instrument, such as Sweep Rules.

Points

Sets the number of points displayed in the traces. The current value of points is displayed in the bottom-right corner of the display.

Remote Command	[:SENSe]:SEMask:SWEep:POINts <integer> [:SENSe]:SEMask:SWEep:POINts?
Example	:SEM:SWE:POIN 4001 :SEM:SWE:POIN?
Preset	2001
State Saved	Saved in instrument state
Min	201
Max	10001
Annotation	On second line of annotations in bottom right corner

IF Dithering

Lets you turn IF Dithering on and off. IF Dithering is a technique used in unpreselected instruments (such as Keysight's modular instruments) to enhance the rejection of images and internally-generated spurious signals.

Remote Command	[:SENSe]:SWEep:IF:DITHer OFF | ON | 0 | 1 [:SENSe]:SWEep:IF:DITHer?
Dependencies	This control only appears in Spectrum Analyzer Mode in VXT
Preset	OFF
State Saved	Saved in instrument state

Image Protection

Lets you turn IF Protection on and off. IF Protection is a technique used in unpreselected instruments (such as Keysight's modular instruments) to detect and suppress images and spurs that may be present in non-preselected hardware.

IF Protection takes two sweeps and by correlating the data between them, provides a single, correct power-versus-frequency trace.

Remote Command	`[:SENSe]:SWEep:IMAGeprot OFF | ON | 0 | 1` `[:SENSe]:SWEep:IMAGeprot?`
Dependencies	This control only appears in Spectrum Analyzer Mode in VXT
Preset	`ON`
State Saved	Saved in instrument state

3.10.10 Trace

Lets you control the acquisition, display, storage, detection and manipulation of trace data for the available traces. The Trace Control tab of this menu contains radio-button selections for the trace type (**Clear/Write, Trace Average, Max Hold, Min Hold**) and **View/Blank** setting for the selected trace.

3.10.10.1 Select Trace

Specifies the *selected trace*, which is the trace that will be affected when you change trace settings.

The **Select Trace** control appears above the menu panel, indicating that it applies to *all* controls in the menu panel. **Select Trace** is blanked if you select a tab whose controls do *not* depend on the selected trace (for example, **Trace Function**).

Notes	The selected trace is remembered even when not in the **Trace** menu
Preset	Trace 1
State Saved	Yes

3.10.10.2 Trace Control

The controls on this tab allow you to set the type of the Trace and its update mode.

There are four Trace Types: **Clear/Write, Trace Average, Max Hold** and **Min Hold.** Each type handles data in a different way.

Each trace also has two values that determine whether it is being written or not and whether it is being displayed or not. These values, **Update** and **Display,** are described more fully in the "View/Blank" on page 1420 control description; when **Update** is ON a trace is updating and when **Update** is OFF it is not; and when **Display** is ON it is visible and when **Display** is OFF it is not. These terms are used throughout the descriptions below.

When Trace Annotation (see **Display** menu) is ON, each non-blanked trace is labeled on the trace with the detector used to take it.

For slower sweeps a visual indicator exists on the trace where the new data is being written, a green “caret” or ^ symbol, which moves across the bottom of the graticule showing the current trace point.

Trace Type

Allows you to select the type of trace you want to you use for the current measurement. There are four Trace Types:

Type	Option	Description
Clear Write	WRITe	Each trace update replaces the old data in the trace with new data
Trace Average	AVERage	The instrument maintains and displays an average trace, which represents the cumulative average on a point-by-point basis of the new trace data and previous averaged trace data
Max Hold	MAXHold	The instrument maintains and displays a max hold trace, which represents the maximum data value on a point-by-point basis of the new trace data and previous trace data
Min Hold	MINHold	The instrument maintains and displays a min hold trace, which represents the minimum data value on a point-point basis of the new trace data and previous trace data

Besides the **Trace Type**, the state of "View/Blank" on page 1420 must be set to **Active** (**Update**ON, **Display**ON) for a trace to be updating and visible. Selecting any **Trace Type** automatically makes the trace **Active**.

Remote Command	`:TRACe[1]|2|3:SEMask:TYPE WRITe | AVERage | MAXHold | MINHold` `:TRACe[1]|2|3:SEMask:TYPE?`
Example	`:TRAC:SEM:TYPE MINH` `:TRAC:SEM:TYPE?`
Couplings	When Detector setting is AUTO (`[:SENSe]:SEMask:DETector:AUTO?`), Detector (`[:SENSe]:SEMask:DETector[:FUNCtion]?`) switches aligning with the switch of this parameter: “NORMal” with WRITe (Clear Write), “AVERage” with AVERage, “POSitive (peak)” with MAXHold, and “NEGative (peak)” with MINHold
Preset	AVERage
State Saved	Saved in instrument state
Range	ClearWrite|Average|MaxHold|MinHold

Clear and Write | Restart Averaging | Restart Max/Min Hold

Starts the trace writing as though the trace type had just been selected. Pressing this control has exactly the same function as selecting the current trace type again – the control is provided because it may not be obvious that re-selecting the current selection from a radio button menu will take an action.

This button takes on different labels depending on the Trace Type:

- Clear/Write: Clear and Write
- Trace Average: Restart Averaging
- Max Hold: Restart Max Hold
- Min Hold: Restart Min Hold

For more details, see "Trace Type" on page 1419.

View/Blank

This control lets you set the state of the two trace variables: Update and Display. The four choices available in this dropdown menu are:

Active	Update and Display both ON
View	Update Off and Display ON
Blank	Update Off and Display OFF
Background	Update ON, Display OFF Allows a trace to be blanked *and* continue to update “in the background”, which was not possible in the past

A trace with Display OFF is indicated by a strikethrough thru the type letter in the trace annotation panel in the Measurement Bar. A trace with Update OFF is indicated by dimming the type letter in the trace annotation panel in the Measurement Bar. In the example below, Traces 3, 4, 5 and 6 have Update OFF, and Traces 4 and 6 have Display OFF.

See:

- "Trace Update State On/Off" on page 1421
- "Trace Display State On/Off" on page 1421
- "More Information" on page 1422

Notes	See tables below for detail on the SCPI to control the two variables: Update and Display
Dependencies	When Signal ID is on, this key is grayed out
Couplings	Selecting a trace type (Clear/Write, Trace Average, Max Hold, Min Hold) for a trace (pressing the key or sending the equivalent SCPI command) puts the trace in **Active** (Update ON and Display ON), even if that trace type was already selected Selecting a detector for a trace (pressing the key or sending a `[:SENS]:DET:TRAC` command) puts the trace in **Active** (Update ON and Display ON), even if that detector was already selected Selecting a "Math Function" on page 1422 other than OFF for a trace (pressing the key or sending the equivalent SCPI command) puts the trace in **Active** (Update ON and Display ON), even if that math mode was already selected Loading a trace from a file puts that trace in View regardless of the state it was in when it was saved; as does being the target of a **Copy** or a participant in an **Exchange**

Trace Update State On/Off

Remote Command	`:TRACe[1]|2|...|6[:<meas>]:UPDate[:STATe] ON | OFF | 0 | 1` `:TRACe[1]|2|...|6[:<meas>]:UPDate[:STATe]?`
Example	`:TRAC2:UPD 0` Makes trace 2 inactive (stops updating)
Couplings	Whenever you set **Update** to ON for any trace, the **Display** is set to ON for that trace
Preset	ON for Trace 1; OFF for 2–6
State Saved	Saved in instrument state
Backwards Compatibility Notes	`:TRACe:MODE VIEW` sets `:TRACe:UPDate OFF`, `:TRACe:DISPlay ON`, for the selected trace. In earlier instruments, View and Blank were trace modes, set by `:TRACe:MODE` command. In the X-Series, View and Blank are two of the states set by the `:TRACe:UPDate` and `:TRACe:DISPlay` commands. The `:TRACe:MODE VIEW` command yields the new equivalent, which is Update=OFF, Display=ON

Trace Display State On/Off

Remote Command	`:TRACe[1]|2|...|6[:<meas>]:DISPlay[:STATe] ON | OFF | 0 | 1` `:TRACe[1]|2|...|6[:<meas>]:DISPlay[:STATe]?`

Example	`:TRAC2:DISP 1`
	Makes trace 1 visible
	`:TRAC3:DISP 3`
	Blanks trace 3

Couplings	Whenever you set Update to On for any trace, the Display is set to On for that trace
Preset	ON for Trace 1; OFF for 2–6
State Saved	Saved in instrument state
Backwards Compatibility Notes	`:TRACe:MODE BLANk` sets `:TRACe:UPDate OFF`, `:TRACe:DISPlay OFF`, for the selected trace. In earlier instruments,

View and Blank were trace modes, set by `:TRACe:MODE` command. In the X-Series, View and Blank are two of the states set by the `:TRACe:UPDate` and `:TRACe:DISPlay` commands. The `:TRACe:MODE BLANk` command yields the new equivalent, which is Update=`OFF`, Display=`OFF`

More Information

When a trace becomes inactive, any update from the `:SENSe` system (detectors) immediately stops – this does not wait for the end of the sweep. The trace data remains unchanged, but stops updating. If the trace is blanked, this still does not affect the data in the trace. Traces that are blanked (Display=`OFF`) do not display nor appear on printouts, but their data stays intact, they may be queried, and markers may be placed on them.

In most cases, inactive traces are static and unchanging; however, there are cases when an inactive trace will update, specifically:

- if data is written to that trace from remote
- if trace data is loaded from mass storage
- if the trace is the target of a **Copy** or participant in an **Exchange**
- if the trace is cleared using the Clear Trace function (below)

Inactive traces that are also being displayed (traces in **View**) are displayed at half intensity. Traces in **View** display across the entire X-Axis of the instrument. Their horizontal placement does not change, even if X-Axis settings subsequently are changed, although Y-Axis settings do affect the vertical placement of data.

When a trace becomes active (Update=`ON`), the trace is cleared, the average count is reset, and a new sweep is initiated.

Note that putting a trace into Display=`OFF` and/or Update=`OFF` does *not* restart the sweep and does *not* restart Averaging or Hold functions for any traces.

3.10.10.3 Math

The Math tab lets you turn on and configure trace math functions.

Math Function

Trace Math functions perform mathematical operations between traces and, in some cases, user-specified offsets. When in a Trace Math function, the indicated function is performed during the sweep with the math function used in place of a detector.

The trace operands for the math function are set using the **Trace Operands** control.

See "More Information" on page 1424.

See "How trace math is processed" on page 1427

Remote Command	For Swept SA Measurement (in SA Mode):
	`:CALCulate:MATH <trace_num>, PDIFference | PSUM | LOFFset | LDIFference | OFF, <trace_num>, <trace_num>, <real>,<real>`
	`:CALCulate:MATH? <trace_num>`
	where `<trace_num>` is any one of:
	`TRACE1|TRACE2|TRACE3|TRACE4|TRACE5|TRACE6`
	For all other measurements:
	`:CALCulate:<meas>:MATH <trace_num>, PDIFference | PSUM | LOFFset | LDIFference | OFF, <trace_num>, <trace_num>, <real>,<real>`
	`:CALCulate:<meas>:MATH? <trace_num>`
	where:
	– `<meas>` is the identifier for the current measurement, and
	– `<trace_num>` is any one of:
	`TRACe1|TRACe2|TRACe3`
	Note that the format of the `TRACe<n>` parameter differs from that for the Swept SA Measurement

Example	1. Set Trace 3 to Power Diff trace math function, and sets the First Trace operand (for Trace 3) to Trace 1 and the Second Trace operand (for Trace 3) to Trace 2:
	`:CALC:MATH TRACE3,PDIF,TRACE1,TRACE2,0,0`
	2. Set Trace 3 to Power Sum trace math function and sets the First Trace operand (for Trace 3) to Trace 1 and the Second Trace operand (for Trace 3) to Trace 2:
	`:CALC:MATH TRACE3,PSUM,TRACE1,TRACE2,0,0`
	3. Set Trace 3 to Log Offset trace math function, sets the First Trace operand (for Trace 3) to Trace 1, leaves the Second Trace operand (for Trace 3) unchanged (it is irrelevant for this function) and sets the Log Offset (for Trace 3) to -6 dB:
	`:CALC:MATH TRACE3,LOFF,TRACE1,0,-6.00,0`
	4. Set Trace 3 to Log Diff trace math function, sets the First Trace operand (for Trace 3) to Trace 1, sets the Second Trace operand (for Trace 3) to Trace 2, and sets the Log Difference reference (for Trace 3) to -6 dBm:
	`:CALC:MATH TRACE3,LDIF,TRACE1,TRACE2,0,-6.00`
	5. Turn off trace math for trace 3:
	`:CALC:MATH TRACE3 OFF`

Notes	The Trace Math Function command has 6 main set of parameters:

Set	Param Name	Notes
1	Result Trace	TRACE1|TRACE2|TRACE3|TRACE4|TRACE5|TRACE6
2	Function	PDIFference|PSUM|LOFFset|LDIFference|OFF
3	Trace Operand 1	TRACE1|TRACE2|TRACE3|TRACE4|TRACE5|TRACE6
4	Trace Operand 2	TRACE1|TRACE2|TRACE3|TRACE4|TRACE5|TRACE6

	<table><tr><th>Set</th><th>Param Name</th><th>Notes</th></tr><tr><td>5</td><td>Log Offset</td><td>in dB</td></tr><tr><td>6</td><td>Log Difference Reference</td><td>in dBm</td></tr></table> Note that the trace math mode is an enumeration; that is, when a math function is set for a trace it turns off any math function that is on for that trace and sets the new math function The parameters sent in the command are reflected in the values in the control menu. There is no default for any parameter; all 6 parameters must be sent to satisfy the parser. Failure to specify a parameter will result in a missing parameter message The query returns the math mode, the operand traces, the offset and the reference for the specified trace, all separated by commas
Dependencies	Trace Math is not available if **Normalize** is on Trace Math is not available if Signal ID is on None of the trace operands can be the destination trace. If any of the three trace math commands is sent with a destination trace number matching one of the operands a warning is generated and the function does not turn on
Couplings	Whenever a math function other than `OFF` is selected for a trace, that trace is set to Display=`ON` and Update=`ON`
Preset	`OFF,TRACE5,TRACE6,0,0 | OFF,TRACE6,TRACE1,0,0 | OFF,TRACE1,TRACE2,0,0 | OFF,TRACE2,TRACE3,0,0 | OFF,TRACE3,TRACE4,0,0 | OFF,TRACE4,TRACE5,0,0`
State Saved	The trace math function for each trace is saved in instrument state
Annunciation	An “f” is shown on the trace annunciation panel in the Measurement Bar when a math function is on; and the function is annotated on the trace if Trace Annotation is on
Status Bits/OPC dependencies	`*OPC` can be used to detect the completion of a sweep, which will also correspond to the completion of the math operation, since all math takes place during the sweep

More Information

IMPORTANT

To generate a trace math result, *you must take a sweep*. The trace math engine, described below, operates in concert with the sweep engine in the instrument. Until a sweep has been taken, even if the constituent traces are not in Update mode, no result is generated.

Note that certain events can affect the trace in ways that affects all points at once. This can happen in any number of ways, including:

- A trace clear taking place
- A trace being loaded from the file system
- Trace data being sent in from the remote interface
- A copy or exchange of trace data

You should try to avoid these occurrences during a sweep, as they will tend to invalidate the math result being accumulated.

The Trace Math functions are:

Power Diff (Op1 - Op2)

Calculates a power difference between the `First Trace` operand and the `Second Trace` operand and puts the result in the destination trace.

During the sweep, the following formula is executed for each point in the trace operands, and the corresponding point is generated for the destination trace:

```
DestinationTrace = 10 log(10(1/10)(FirstTrace) – 10(1/10)(SecondTrace))
```

The values of the trace points are assumed to be in a decibel scale, as they are internally stored.

If a point in `FirstTrace` is equal to `maxtracevalue`, the resultant point is also `maxtracevalue`.

Otherwise, if the result of the subtraction is less than or equal to 0, the resultant point is `mintracevalue`.

Power Sum (Op1 + Op2)

Calculates a power sum between the `First Trace` operand and the `Second Trace` operand and puts the result in the destination trace.

During the sweep, the following formula is executed for each point in the trace operands, and the corresponding point is generated for the destination trace.

```
DestinationTrace = 10 log(10(1/10)(FirstTrace) + 10(1/10)(SecondTrace))
```

The values of the trace points are assumed to be in a decibel scale, as they are internally stored.

If a point in either trace operand is equal to `maxtracevalue`, the resultant point is also `maxtracevalue`.

Log Offset (Op1 + Offset)

Calculates a log offset from the `First Trace` operand and puts the result in the destination trace. This is like the B-DL function in some older instruments. The offset is entered on the `Offset` control, which only appears when this math function is in force for the selected trace. Each destination trace has its own offset.

During the sweep, the following formula is executed for each point in the trace operand, and the corresponding point is generated for the destination trace.

```
DestinationTrace = FirstTrace + Offset
```

The values of the trace points are assumed to be in dBm (as they are internally stored) and the offset is in dB.

If a point in the trace operand is equal to `maxtracevalue`, the resultant point is also `maxtracevalue`.

If a point in the trace operand is equal to `mintracevalue`, the resultant point is also `mintracevalue`.

Example: If offset is 25 dB, then our destination trace will be higher than the operand trace by 25 dB.

Note that the `Second Trace` operand is not used for this function.

Log Diff (Op1 - Op2 + Ref)

Offsets the difference between the `First Trace` operand and the `Second Trace` operand by a reference and puts the result in the destination trace. This is like the A-B+DL function in some older instruments. The Reference is entered on the **Reference** control, which only appears when this math function is in force for the selected trace. Each destination trace has its own reference.

Offsets the difference between the `First Trace` operand and the `Second Trace` operand by a reference and puts the result in the destination trace. This is like the A-B+DL function in some older instruments. The Reference is entered on the **Reference** control, which only appears when this math function is in force for the selected trace. Each destination trace has its own reference.

During the sweep, the following formula is executed for each point in the trace operands, and the corresponding point is generated for the destination trace.

```
DestinationTrace = (FirstTrace - SecondTrace) + Reference
```

The values of the operand trace points are assumed to be in decibel units (as they are internally stored) and the reference is in dBm so the result is in dBm.

Example: If the first operand trace 1 is at 5 dBm, the second operand trace 2 is at –5 dBm, and the reference is –25 dBm, then the destination trace will be –15 dBm.

Example: If the first operand trace1 is at 60 dBuV, the second operand trace 2 is at 50 dBuV, and the reference is 35 dBuV, then the destination trace will be 45 dBuV.

If a point in `FirstTrace` is equal to `maxtracevalue`, the resultant point is also `maxtracevalue`.

If a point in `FirstTrace` is equal to `mintracevalue`, the resultant point is also `mintracevalue`.

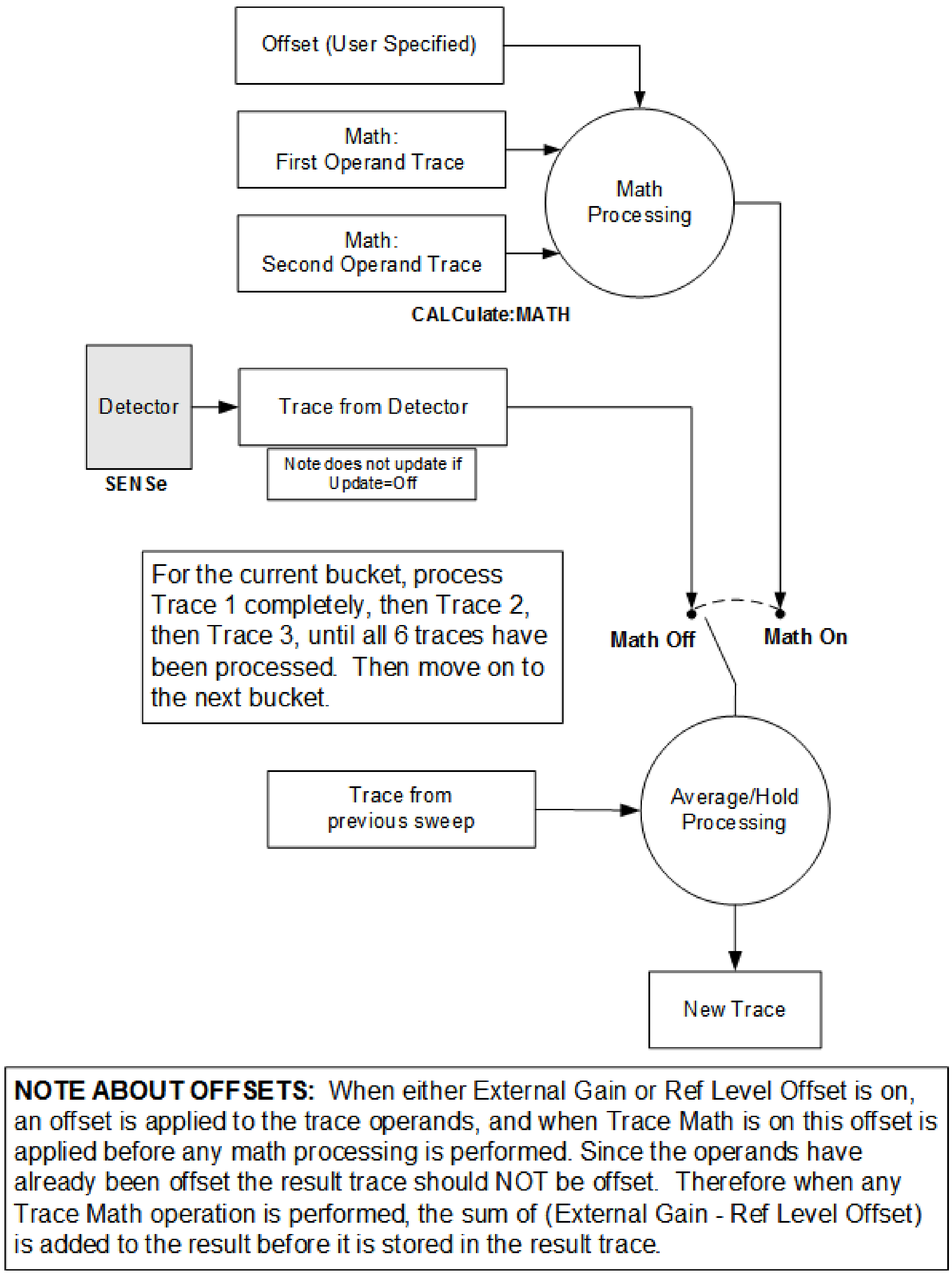
If neither of the above is true for a given point, then:

- If that point in `SecondTrace` is equal to `maxtracevalue`, the resultant point is `mintracevalue`.
- If that point in `SecondTrace` is equal to `mintracevalue`, the resultant point is `maxtracevalue`.

How trace math is processed

Whenever a trace math function is turned on, or the parameters and/or operands of an existing trace math function are changed, the destination trace is cleared. After the trace is cleared, all x-axis values in the trace, and the domain of the trace, are set to match the X-Axis settings of the first trace operand. When this is complete, a new sweep is initiated.

The process of acquiring data, processing it using the math and Average/Hold functions, and presenting it as trace data, consists of several functional blocks, as shown below:



For each active trace, the current trace point is processed for `Trace 1`, then `Trace 2`, then `Trace 3`, etc. Trace data is taken from either the detector for that trace, or from the mathematical result of up to two other traces and an offset, depending on whether trace math is on or not. The resultant data is then fed to the Average/Hold

processing block, where (if the trace type is **Average**, **Max Hold**, or **Min Hold**) it is processed with previous trace data. The new trace data resulting from this process is then available for display, storage or remote output.

When the processing is complete for `Trace 1`, `Trace 2` is processed, and so on until all six traces have been processed. This allows a downstream trace to use as one of its math components a fully processed upstream trace. In other words, if math is `ON` for `Trace 4`, and its operand traces are `Trace 2` and `Trace 3`, then all detector, math, average and hold processing for Traces 2 and 3 is completed before the math is performed for `Trace 4`. When the current trace point is completed for all traces, the instrument moves on to the next trace point.

This allows very flexible and powerful math functions to be configured. For example, `Trace 1` can be an average trace, which can be fed with an offset to `Trace 2`, which can also be in **Max Hold**, allowing you to obtain the **Max Hold** of an Average trace.

Note that none of this processing is performed on inactive traces.

Note also that for any active trace with math `ON`, the Operand traces should have *lower* numbers than the trace (for example, using `Trace 4` as an operand for `Trace 1` will cause the data coming from `Trace 4` to be delayed by one sweep).

Operand 1/2

Selects the first and second trace operands, respectively, to be used for the trace math functions for the destination trace.

The operands are common to all math functions for a given trace. The most recently sent `:CALCulate:MATH` command for a given trace sets the operands for that trace, and will be reflected on the trace operand controls for that trace.

Example	The following examples are for the Swept SA measurement.
	1) Set Trace 3 to Power Diff trace math function. Set the First Trace operand (for Trace 3) to Trace 1 and the Second Trace operand (for Trace 3) to Trace 2
	`:CALC:MATH TRACE3,PDIF,TRACE1,TRACE2,0,0`
	2) Set Trace 3 to Log Offset trace math function. Set the First Trace operand (for Trace 3) to Trace 1, leave the Second Trace operand (for Trace 3) unchanged (it is irrelevant for this function) and set the Log Offset (for Trace 3) to -6 dB
	`:CALC:MATH TRACE3,LOFF,TRACE1,TRACE2,-6.00,0`

Notes	See the Math Function section for how to specify Operand 1 and Operand 2 using the `:CALCulate:MATH` SCPI command
Dependencies	The destination trace cannot be an operand. The destination trace number is gray on the dropdown
Preset	**Operand 1**: Trace number minus 2 (wraps at 1) For example, for Trace 1, Operand 1 presets to Trace 5; for Trace 6, it presets to Trace 4 **Operand 2**: Trace number minus 1 (wraps at 1) For example, for Trace 1, Operand 2 presets to Trace 6; for Trace 6, it presets to Trace 5
State Saved	Operand 1 and Operand 2 for each trace are stored in instrument state

Offset

The Offset value is used by the Log Offset math function.

Example	The following example is for the Swept SA measurement. `:CALC:MATH TRACE3,LOFF,TRACE1,TRACE2,-6.00,0` Sets Trace 3 to Log Offset trace math function, sets the First Trace operand (for Trace 3) to Trace 1, leaves the Second Trace operand (for Trace 3) unchanged (it is irrelevant for this function) and sets the Log Offset (for Trace 3) to -6 dB
State Saved	The Log Offset value for each trace is saved in Instrument State
Min	–100 dB
Max	100 dB

Reference

The Reference value is used by the Log Diff math function.

Example	The following example is for the Swept SA measurement. `:CALC:MATH TRACE3,LDIF,TRACE1,TRACE2,0,-6.00` Sets Trace 3 to Log Diff trace math function, sets the First Trace operand (for Trace 3) to Trace 1, sets the Second Trace operand (for Trace 3) to Trace 2, and sets the Log Difference reference (for Trace 3) to -6 dBm
State Saved	The Log Difference reference value for each trace is saved in instrument state
Min/Max	Same as reference level

3.10.10.4 Trace Function

The Trace Function includes controls to:

- Copy and Exchange traces
- Preset or Clear all traces

From Trace

Selects the trace to be copied to or exchanged with the **To Trace** when a "Copy" on page 1553 or "Exchange" on page 1553 is performed

Preset	1

To Trace

Selects the trace to be copied from or exchanged with the **From Trace** when a "Copy" on page 1553 or "Exchange" on page 1553 is performed

Preset	2

Copy

This button executes a Trace Copy based on the From Trace and To Trace parameters. The Copy is done from the From Trace to the To Trace. The action is performed once.

The X-Axis settings and domain of a trace go with it when it is copied.

Remote Command	For Swept SA Measurement (in SA Mode):
	`:TRACe:COPY TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6, TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6`
	
	For all other measurements:
	`:TRACe:<meas>:COPY TRACe1 | TRACe2 | TRACe3, TRACe1 | TRACe2 | TRACe3`
	where:
	<meas> is the identifier for the current measurement.
	Note that the format of the TRACe<n> parameter differs from that for the Swept SA Measurement.

Example	`:TRAC:COPY TRACE1,TRACE3` Copies Trace 1 to Trace 3 and puts Trace 3 in Update=Off, Display=On
Notes	The `:TRACe:COPY` command is of the form: `:TRACe:COPY <source_trace>,<dest_trace>`
Dependencies	When Signal ID is on, this key is grayed out
Couplings	The destination trace is put in View (Update=Off, Display=On) after the copy

Preset	For Swept SA Measurement (in SA Mode):
	`TRACE1, TRACE2`
	For all other measurements:
	`TRACe1, TRACe2`

Exchange

This button executes a Trace Exchange based on the From Trace and To Trace parameters. The From Trace and To Trace are exchanged with each other. The action is performed once.

The X-Axis settings and domain of a trace go with it when it is exchanged with another trace.

Remote Command	For Swept SA Measurement (in SA Mode):
	`:TRACe:EXCHange TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6, TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6`
	
	For all other measurements:
	`:TRACe:<meas>:EXCHange TRACe1 | TRACe2 | TRACe3, TRACe1 | TRACe2 | TRACe3`
	where:
	<meas> is the identifier for the current measurement.
	Note that the format of the TRACe<n> parameter differs from that for the Swept SA Measurement.

Example	`:TRAC:EXCH TRACE1,TRACE2` Exchanges Trace 1 and Trace 2 and puts both traces in Update=Off, Display=On
Notes	The `TRACe[:<meas>]:EXCHange` command is of the form: `:TRACe[:<meas>]:EXCHange <trace_1>,<trace_2>`
Couplings	Both traces are put in View (Update=Off, Display=On) after the exchange
Backwards Compatibility Notes	The copy and exchange operations menu in ESA and PSA is replaced with the more general purpose Trace Function menu. The remote commands are unaffected, as they were already general

Preset All Traces

Turns on Trace 1 and blanks all other traces. Useful when you have many traces on and you want to go back to having only Trace 1 on the display. Does not affect the trace type, detector or any other aspect of the trace system.

Remote Command	`:TRACe[:<meas>]:PRESet:ALL`
Example	`:TRAC:PRES:ALL`
Dependencies	When Signal ID is on, this key is grayed out

Clear All Traces

Clears all traces. Does not affect the state of any function or variable in the instrument. Loads `mintracevalue` into all of the points all traces, except traces in **Min Hold** in which case it loads `maxtracevalue`. Does so even if Update=Off.

Remote Command	`:TRACe[:<meas>]:CLEar:ALL`
Example	`:TRAC:CLE:ALL` Clears all traces
Dependencies	When Signal ID is on, this key is grayed out

3.10.10.5 Advanced

The **Advanced** tab contains controls for setting advanced functions of the instrument.

Measure Trace

Specifies which trace's scalar results are displayed in the Metrics window and retrieved by sending a Read/Fetch query.

- Trace 1
- Trace 2
- Trace 3

Remote Command	`:CALCulate:SEMask:MTRace TRACe1 | TRACe2 | TRACe3` `:CALCulate:SEMask:MTRace?`
Example	`:CALC:SEM:MTR TRACe1` `:CALC:SEM:MTR?`
Dependencies	Trace 2 and Trace 3 are grayed out when no trace data is available
Preset	`TRACe1`
State Saved	No
Range	`Trace1|Trace2|Trace3`

3.11 Spurious Emissions Measurement

The Spurious Emissions measurement identifies and determines the power level of spurious emissions in certain frequency bands.

Spurious Emissions Measurement Commands

The following commands can be used to retrieve the measurement results:

`:CONFigure:SPURious`

`:CONFigure:SPURious:NDEFault`

`:INITiate:SPURious`

`:FETCh:SPURious[n]?`

`:READ:SPURious[n]?`

`:MEASure:SPURious[n]?`

Remote Command Results for Spurious Emissions Measurement

The following table describes the results returned by the `:FETCh`, `:MEASure`, and `:READ` queries listed above, according to the index value `n`. Note that the queries are not available when viewing the Range Table.

n	Return Value
1 (or not supplied)	Returns a variable-length (1+6*Spurs – up to 1201 entries) comma separated list containing detailed information in the following format: Number of spurs in following list (Integer) *[Repeat the following for each spur]* Spur # Range # Spur was located (Integer) Frequency of Spur (Hz, Float64) Amplitude of Spur (dBm, Float32) Absolute Limit (dBm, Float32) Pass or Fail (1|0, Boolean)
2 – 21 (Average Trace)	Regardless of the Trace selection, returns a comma separated list of the average trace data of Trace 1 for the selected range (where range number = n - 1) using Detector 1"1. If selected range is not active, SCPI_NAN is returned for each trace data element, where SCPI_NAN = 9.91E37" on page 1435
22	Returns the number of spurs found for the selected Measured Trace
23 – 42 (Average Trace)	Regardless of the Trace selection, returns a comma separated list of the average trace data of Trace 1 for the selected range (where range number = n - 22) using Detector 2"1. If selected range is not active, SCPI_NAN is returned for each trace data element, where SCPI_NAN = 9.91E37" on page 1435
43 – 62 (Maximum Hold	Regardless of the Trace selection, returns a comma separated list of the maximum hold trace data for the selected range (where range number = n - 42) using

n	Return Value
Trace)	Detector 1"1. If selected range is not active, SCPI_NAN is returned for each trace data element, where SCPI_NAN = 9.91E37" on page 1435
63 – 82 (Minimum Hold Trace)	Regardless of the Trace selection, returns a comma separated list of the minimum hold trace data for the selected range (where range number = n - 62) using Detector 1"1. If selected range is not active, SCPI_NAN is returned for each trace data element, where SCPI_NAN = 9.91E37" on page 1435
83-102	Returns a comma separated list of the trace data of Trace 2 for the selected range (where range number = n - 82) using Detector 1"1. If selected range is not active, SCPI_NAN is returned for each trace data element, where SCPI_NAN = 9.91E37" on page 1435
103-122	Reserved
123-142 (Clear/Write Trace)	Returns a comma separated list of the trace data of Trace 3 for the selected range (where range number = n - 122) using Detector 1"1. If selected range is not active, SCPI_NAN is returned for each trace data element, where SCPI_NAN = 9.91E37" on page 1435
143-162 (Clear/Write Trace)	Reserved
163-182 (Trace 1)	Returns a comma separated list of the trace data of Trace 1 for the selected range (where range number = n - 162)"1. If selected range is not active, SCPI_NAN is returned for each trace data element, where SCPI_NAN = 9.91E37" on page 1435 If selected range is not active, `SCPI_NAN` is returned for each trace data element, where `SCPI_NAN` = 9.91E37
183-202 (Trace 2)	Returns a comma separated list of the trace data of Trace 2 for the selected range (where range number = n - 182)"1. If selected range is not active, SCPI_NAN is returned for each trace data element, where SCPI_NAN = 9.91E37" on page 1435
203-222 (Trace 3)	Returns a comma separated list of the trace data of Trace 3 for the selected range (where range number = n - 202) "1. If selected range is not active, SCPI_NAN is returned for each trace data element, where SCPI_NAN = 9.91E37" on page 1435

1. If selected range is not active, `SCPI_NAN` is returned for each trace data element, where `SCPI_NAN` = 9.91E37

3.11.1 Views

The Spurious Emissions measurement has two Predefined views: Graph + Metrics (`RESult`) and `ALL` Ranges.

These Views are multiple-window Views. When in a multiple window View, you select a window by touching it. The menu controls may sometimes change depending on which window is selected.

If you have modified the current View, using the "View Editor" on page 128, an asterisk appears next to that View in the radio button panel. You can save the modified View as a User View (see "Save Layout as New View" on page 1890).

Remote Command	`:DISPlay:SPURious:VIEW[:SELect] RESult | ALL` `:DISPlay:SPURious:VIEW[:SELect]?`
Example	`:DISP:SPUR:VIEW RANG` `:DISP:SPUR:VIEW?`
Preset	`RESult`
State Saved	No
Range	Graph + Metrics | All Ranges

3.11.1.1 Graph + Metrics

Windows: "Graph" on page 1436,"Table" on page 1437

Select Graph + Metrics to view measurement results.

The upper window displays a trace of the range that contains the currently selected spur

The lower window displays a list of spurs detected in a measurement cycle. The currently selected spur, which is highlighted, can be changed by the Spur control in the Meas Setup menu

Example	`:DISP:SPUR:VIEW RES`

3.11.1.2 All Ranges

Windows: "Graph" on page 1436,"All Range Table" on page 1438

Select All Ranges to view measurement results for all the ranges.

The upper window displays a merged trace of all the ranges

The lower window displays a list of spurs detected in a measurement cycle. The currently selected spur, which is highlighted, can be changed by the Spur control in the Meas Setup menu

Example	`:DISP:SPUR:VIEW ALL`

3.11.2 Windows

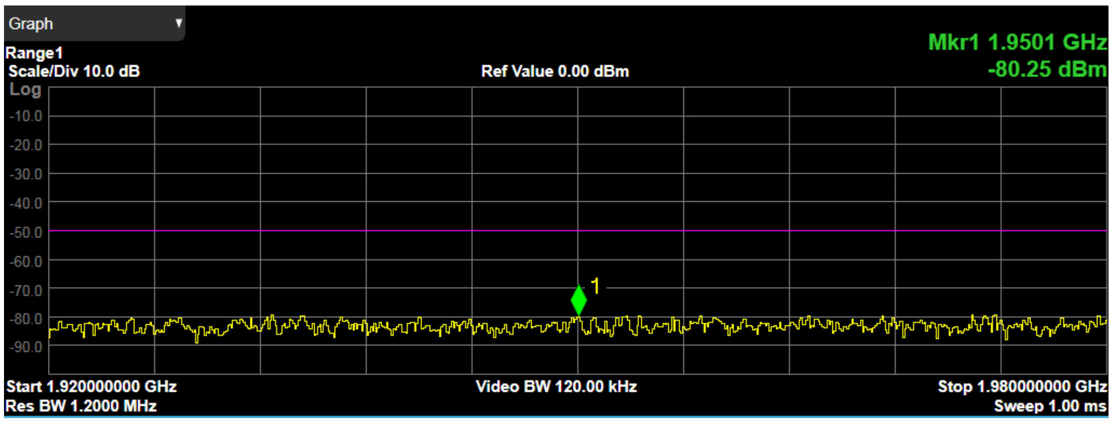
There are four windows available in the Spurious Emissions measurement. The Gate window is available only when Gate View is turned on in the Gate Settings menu under Trigger.

3.11.2.1 Graph

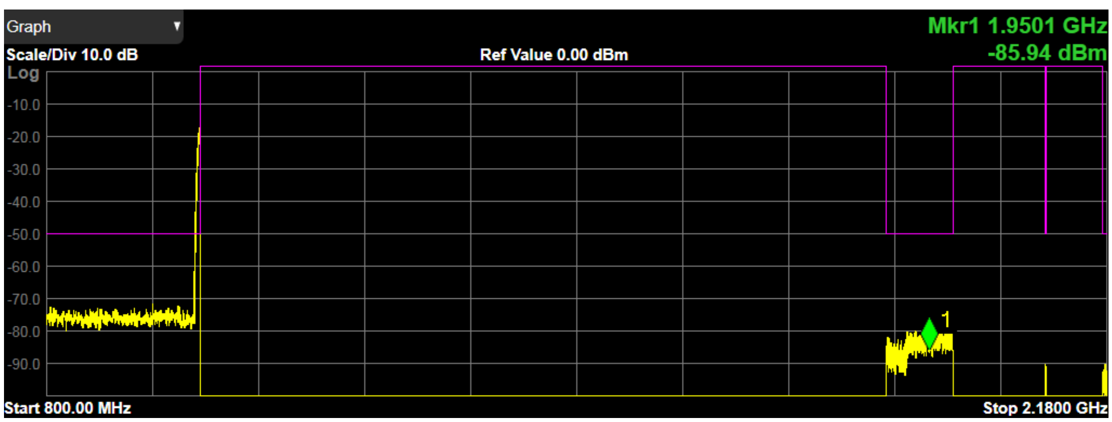
The Graph window appears in several Views, as follows:

View	Size	Position
Graph + Metrics	Three fifth, full width	Top
All Ranges	Three fifth, full width	Top
Gate View	One third, full width	Middle

When Graph + Metrics is selected



When All Ranges is selected



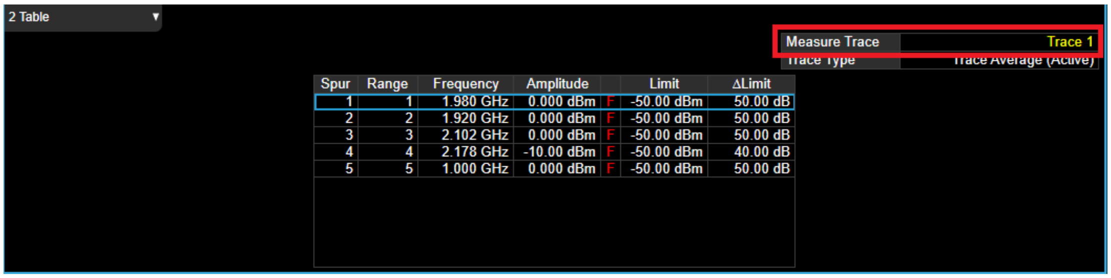
3.11.2.2 Table

The spurs listed are within the current value of the Marker Peak Excursion setting of the absolute limit. All of the spurs listed passed. Any spur that has failed the absolute limit will have an ‘F’ beside it.

Result	Units	Min	Max
Spur	N/A	0	200
Range	N/A	1	20
Frequency	Hz	Analyzer Min	Analyzer Max
Amplitude	dBm	Analyzer Min	Analyzer Max
Limit	dBm	-200	50
ΔLimit	dBm	(Limit - Amplitude)	

Views in which the Table window appears:

View	Size	Position
Graph + Metrics	Two fifth, full width	Bottom
Gate View	One third, full width	Bottom



Measure Trace

See "Measure Trace" on page 1555

Trace Type

This is the trace type (and view/blank parameter) of a trace specified by Measure Trace.

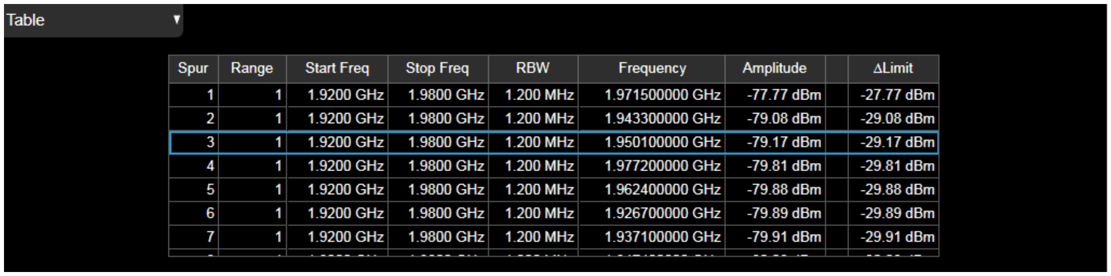
3.11.2.3 All Range Table

The spurs listed are within the current value of the Marker Peak Excursion setting of the absolute limit. All of the spurs listed passed. Any spur that has failed the absolute limit will have an 'F' beside it.

Result	Units	Min	Max
Spur	N/A	0	200
Range	N/A	1	20
Start Freq	See "Start Freq" on page 1508 under Meas Setup		
Stop Freq	See "Stop Freq" on page 1509 under Meas Setup		
RBW	See "Res BW" on page 1511 under Meas Setup		
Frequency	Hz	Analyzer Min	Analyzer Max
Amplitude	dBm	Analyzer Min	Analyzer Max
Limit	dBm	-200	50
ΔLimit	dBm	(Limit - Amplitude)	

Views in which the Table window appears:

View	Size	Position
All Ranges	Two fifth, full width	Bottom
Gate View	One third, full width	Bottom



Table

Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	ΔLimit
1	1	1.9200 GHz	1.9800 GHz	1.200 MHz	1.971500000 GHz	-77.77 dBm	-27.77 dBm
2	1	1.9200 GHz	1.9800 GHz	1.200 MHz	1.943300000 GHz	-79.08 dBm	-29.08 dBm
3	1	1.9200 GHz	1.9800 GHz	1.200 MHz	1.950100000 GHz	-79.17 dBm	-29.17 dBm
4	1	1.9200 GHz	1.9800 GHz	1.200 MHz	1.977200000 GHz	-79.81 dBm	-29.81 dBm
5	1	1.9200 GHz	1.9800 GHz	1.200 MHz	1.962400000 GHz	-79.88 dBm	-29.88 dBm
6	1	1.9200 GHz	1.9800 GHz	1.200 MHz	1.926700000 GHz	-79.89 dBm	-29.89 dBm
7	1	1.9200 GHz	1.9800 GHz	1.200 MHz	1.937100000 GHz	-79.91 dBm	-29.91 dBm

3.11.2.4 Gate

Turning on Gate View shows the Gate Window, which allows you to see your Gating signal at the same time as the measured data. See the description under Gate View in the Trigger, Gate Settings section.

Views in which the Gate window appears:

View	Size	Position
Gate View	One third, full width	Top

3.11.3 Amplitude

The **Amplitude** front-panel key activates the Amplitude menu and selects Reference Level or Reference Value (depending on the measurement) as the active function.

Some features in the Amplitude menu apply to multiple measurements. Some other features apply only to specific measurements and their controls are blanked or grayed out in measurements that are not supported.

3.11.3.1 Y Scale

The Y Scale Tab contains controls that pertain to the Y axis parameters of the measurement. These parameters control how data on the vertical (Y) axis is displayed and control instrument settings that affect the vertical axis.

Ref Value

Sets the value for the absolute power reference. The reference line is at the top, center, or bottom of the graticule, depending on the value of the Ref Position function.

Remote Command	`:DISPlay:SPURious:WINDow[1]:TRACe:Y[:SCALe]:RLEVel <real>` `:DISPlay:SPURious:WINDow[1]:TRACe:Y[:SCALe]:RLEVel?`
Example	`:DISP:SPUR:WIND:TRAC:Y:RLEV 10 dBm` `:DISP:SPUR:WIND:TRAC:Y:RLEV?`

Couplings	When Auto Scaling is ON (default), this value is automatically determined by the measurement result. When you set a value manually, Auto Scaling changes to OFF Attenuation is not coupled to Ref Value
Preset	10.00 dBm
State Saved	Saved in instrument state
Min/Max	-250.00 dBm / 250.00 dBm
Annotation	Ref <value> top left of graph
Backwards Compatibility SCPI	[:SENSe]:SPURious:POWer[:RF]:LEVel :DISPlay:SPURious:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:RLEVel

Scale/Div

For measurements that support a logarithmic Y-Axis, Scale/Div sets the height of one division of the graticule in the current Y-Axis unit.

Scale/Div also determines the displayed amplitude range in the log plot graph. Since there are usually 10 vertical graticule division on the display, the total amplitude range of the graph is typically 10x this amount. For example, if Scale/Div is 10 dB, then the total range of the graph is 100 dB.

Remote Command	:DISPlay:SPURious:WINDow[1]:TRACe:Y[:SCALe]:PDIVision <rel_ampl> :DISPlay:SPURious:WINDow[1]:TRACe:Y[:SCALe]:PDIVision?
Example	:DISP:SPUR:WIND:TRAC:Y:PDIV 10 dB :DISP:SPUR:WIND:TRAC:Y:PDIV?
Couplings	When the Auto Scaling is ON, this value is automatically determined by the measurement result. When you set a value manually, Auto Scaling automatically changes to OFF
Preset	10.00 dB / Div
State Saved	Saved in instrument state
Min	0.10 dB
Max	20 dB
Annotation	<value> dB/ left upper of graph
Backwards Compatibility SCPI	:DISPlay:SPURious:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:PDIVision

Ref Position

Positions the reference level at the top, center, or bottom of the Y Scale display. Changing the reference position does not change the reference level value.

Preset	TOP

State Saved	Saved in instrument state
Range	Top|Center|Bottom
Annotation	The greater than (>) and less than (<) symbols are displayed on both sides of the graph to indicate the Reference Position

Auto Scaling

Toggles the Auto Scaling function between On and Off.

Remote Command	`:DISPlay:SPURious:WINDow[1]:TRACe:Y[:SCALe]:COUPle 0 | 1 | OFF | ON` `:DISPlay:SPURious:WINDow[1]:TRACe:Y[:SCALe]:COUPle?`
Example	`:DISP:SPUR:WIND:TRAC:Y:COUP OFF` `:DISP:SPUR:WIND:TRAC:Y:COUP?`
Couplings	When Auto Scaling is ON, and the **Restart** front-panel key is pressed, this function automatically sets the scale per division to 10 dB and determines the reference values based on the measurement results When you set a value to either Scale/Div or Ref Value manually, Auto Scaling automatically changes to OFF When Y Auto Scaling is OFF, the measurement uses the current reference level settings When Y Auto Scaling is ON, the instrument automatically sets the reference level such that the absolute limit is positioned two divisions down from the top of the display. This is the most useful setting when searching for spurs. The algorithm used for determining the ref level is Ref Level = Absolute Limit + (2 * Scale/Div). All other reference level settings are left as the current base instrument settings
Preset	1
State Saved	Saved in instrument state
Range	OFF|ON
Backwards Compatibility SCPI	`[:SENSe]:SPURious:POWer[:RF]:RANGe:AUTO` `:DISPlay:SPURious:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:COUPle`

3.11.3.2 Attenuation

Controls the attenuator functions and interactions between the attenuation system components.

There are two attenuator configurations in the X-Series. One is a Dual-Attenuator configuration consisting of a mechanical attenuator and an optional electronic attenuator. The other configuration uses a single attenuator with combined mechanical and electronic sections thatcontrols all the attenuation functions. Different models in the X-Series come with different configurations.

– See "Dual-Attenuator Configurations" on page 1442

– See "Single-Attenuator Configuration" on page 1443

Most attenuation settings are the same for all measurements – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset.

This tab is only available when the hardware set includes an input attenuator, which is typically only the case when using Keysight’s box instruments. For example, this tab does not appear in:

– VXT models M9420A/21A/10A/11A

– E7760

– M9391A

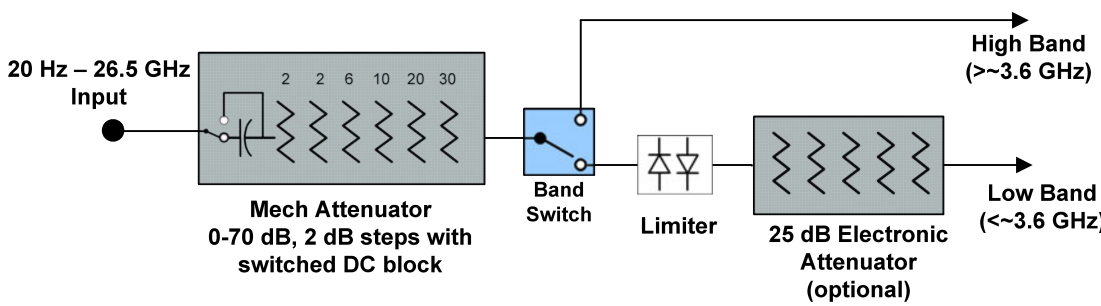
– M9393A

This tab also does not appear in UXM. In UXM all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

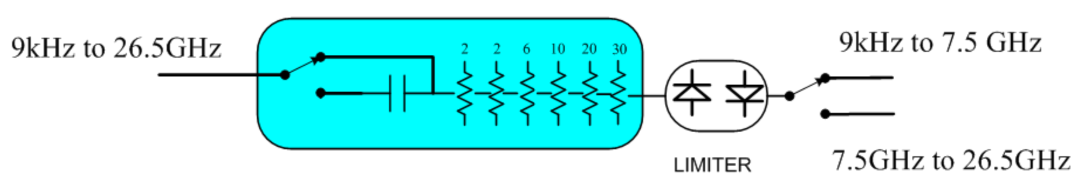
Dependencies	In measurements that support the I/Q inputs, this tab is unavailable when I/Q is the selected input, and is replaced by the Range tab in that case

Dual-Attenuator Configurations

Configuration 1: Mechanical attenuator + optional electronic attenuator

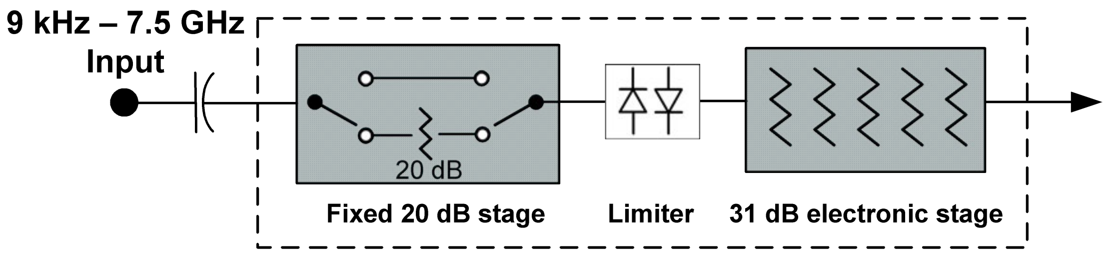


Configuration 2: Mechanical attenuator, no optional electronic attenuator



(note that Configuration 2 is not strictly speaking a dual-section attenuator, since there is no electronic section available. However, it behaves exactly like Configuration 1 without the Electronic Attenuator option EA3, therefore for the sake of this document it is grouped into the “Dual-Attenuator” configuration)

Single-Attenuator Configuration



You can tell which attenuator configuration you have by pressing the Attenuation tab, which (in most Modes) opensthe Attenuation menu. If the first control in the Attenuation menu says **Mech Atten** you have the Dual-Attenuator configuration. If the first control says **Atten** you have the Single-Attenuator configuration.

Dual Attenuator **Single Attenuator**

(Note that depending on the measurement, there may be no Auto/Man functionality on the Mech Atten control).

In the Single-Attenuator configuration, youcontrol the attenuation with a single control, as the fixed stage has only two states. In the Dual-Attenuator configuration, both stages have significant range so you are given separate control of the mechanical and electronic attenuator stages.

When you have the Dual-Attenuator configuration, you may still have only a Single-Attenuator, because unless option EA3 (the Electronic Attenuator option) is available, and you purchase it, you will have only the mechanical attenuator.

Full Range Atten

The **Full Range Atten** control and **Attenuator Summary** only appear in N9041B, when the RF input is selected and the RF Input Port is set to RF Input 2, and the Full Range Attenuator is installed. The Full Range Attenuator adds a second input attenuator at the beginning of the RF Input 2, which enhances the protection and optimizes the performance of the extra internal mixers used by RF Input 2.

Remote Command	`[:SENSe]:POWer[:RF]:FRATten <rel_ampl>` `[:SENSe]:POWer[:RF]:FRATten?`
Example	`:POW:FRAT 14` `:POW:FRAT?`
Notes	When you enter an amplitude value that falls between valid values, the value will be incremented to the

	next smallest valid value
Dependencies	Only appears if input RF is selected, and RF Input Port 2 is selected, and the Full Range Attenuator exists
Couplings	This value is never changed by any coupling, however other couplings use this value. See the **Reference Level** and "Mech Atten" on page 1750 command descriptions
Preset	20 dB
State Saved	Saved in instrument state
Min	0 dB
Max	Only valid values are 0, 6, 14, 20 dB
Annotation	When the Input is RF, and the Input Port is RF Input 2, and the Full Range Attenuator is installed: On the Meas Bar, the field “Atten” displays as follows: – If the sweep is entirely < 50 GHz, the value shown after “Atten:” is equal to Mech Atten + Elec Atten + Full Range Atten – If the sweep is entirely > 50 GHz, the value shown after “Atten:” is equal to Full Range Atten – If the sweep straddles 50 GHz, the value shown after “Atten:” is preceded by the symbol “>=” and is equal to Full Range Atten In the **Amplitude**, "Attenuation" on page 1747 menu, and the Atten Meas Bar dropdown menu panel, a summary is displayed as follows: “Total Atten below 50 GHz” followed by the value of Full Range Atten + Mech Atten + Elec Atten “Total Atten above 50 GHz” followed by the value of Full Range Atten For example, if Mech Atten = 6 dB, Elec Atten = 4 dB, and Full Range Atten = 20 dB, the summary below is shown: – Attenuator summary: – Total Atten below 50 GHz: 30 dB – Total Atten above 50 GHz: 20 dB

Mech Atten

This control is labeled **Mech Atten** in Dual-Attenuator models and **Atten** in Single-Attenuator models. In the Dual-Attenuator configuration, this control only affects the mechanical attenuator.

This control lets you modify the attenuation applied to the RF input signal path. This value is normally auto coupled to the Ref Level, the Internal Preamp Gain, any External Gain that is entered, and the Max Mixer Level, as described in the table below.

See "Attenuator Configurations and Auto/Man" on page 1446

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation <rel_ampl>` `[:SENSe]:POWer[:RF]:ATTenuation?`

	`[:SENSe]:POWer[:RF]:ATTenuation:AUTO OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:ATTenuation:AUTO?`

Example	`:POW:ATT 20`
	Dual-Attenuator configuration: sets the mechanical attenuator to 20 dB
	Single-Attenuator mode: sets the main attenuation to 20 dB (see below for definition of “main” attenuation)
	In either case, if the attenuator was in Auto, it is set to Manual
	`:POW:ATT:AUTO ON`
	Turn Auto Mech Atten ON

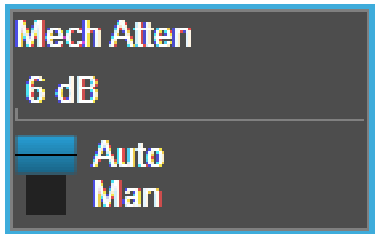
Dependencies	Some measurements do not support the Auto setting of "Mech Atten" on page 1444. In these measurements, the Auto/Man selection is not available, and the Auto/Man toggle function is not available In Dual-Attenuator configurations, when the electronic attenuator is enabled, the mechanical attenuator has no auto setting and the Auto/Man toggle function is not available. The state of Auto/Man is remembered and restored when the electronic attenuator is once again disabled. This is described in more detail in "Elec Atten" on page 1753 See "Attenuator Configurations and Auto/Man" on page 1446 for more information on the Auto/Man functionality `:POW:ATT:AUTO` is only available in measurements that support Mech Atten Auto, such as Swept SA
Couplings	If the RF Input Port is the RF Input: – If the USB Preamp is connected to USB, use 0 dB for Mech Atten – Otherwise compute the auto-selected value of Mech Atten based on **Reference Level**, Int Preamp, External Gain, Ref Level Offset, Max Mixer Level, µW Path Control and IF Gain settings. Limit this value to be no less than 6 dB (total attenuation below 6 dB can never be chosen by Auto) – In the N9041B, if the RF Input Port is RF Input 2, use the formula above and subtract the Full Range Atten value from the result to determine the Mech Atten. Limit the value so that it is never lower than 0 dB and so that total attenuation, including Full Range Atten, is never less than 6 dB (total attenuation, including Full Range Atten below 6 dB, can never be chosen by Auto) In External Mixingand BBIQ, where the Attenuator is not in the signal path, the Attenuator setting changes as described above when "Mech Atten" on page 1444 is in Auto, but no changes are made to the actual attenuator hardware setting until the input is changed back to the RF Input For CXA-m with option FSA (Fine-Step Attenuator or 2 dB steps), the FSA-like behavior is only available when the frequency setting is <= 7.5GHz. So, when the frequency is changed from below 7.5GHz to above 7.5GHz, the attenuation setting will be changed to a multiple of 10dB which will be no smaller than the previous setting. For example, 4dB attenuation will be changed to 10dB
Preset	The preset for Mech Attenuation is “Auto” The Auto value of attenuation is 10 dB ON
State Saved	Saved in instrument state
Min	0 dB The attenuation set by this control cannot be decreased below 6 dB with the knob or step keys. Values below 6 dB must be directly entered from the keypad or via SCPI. This protects against setting a

	dangerously small attenuation value, which can put the instrument at risk of damage to input circuitry. If the current mechanical attenuation is below 6 dB, it can be increased with the knob and step keys, but not decreased
Max	CXA Option 503 or 507: 50 dB EXA: 60 dB All other models: 70 dB Note that in the Single-Attenuator configuration, the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB.
Annotation	The current value for Total Atten is displayed in the Measurement Bar at the top of the display. A value appears for Electronic Attenuation only if the Electronic Attenuator is enabled. The annotation appears as Atten: <total> dB (e<elec>) The e letter is in amber in Single-Attenuator configurations For example: Dual-Attenuator configuration: Atten: 24 dB (e14) Indicating the total attenuation is at 24 dB and the electronic attenuation is at 14 dB Single-Attenuator configuration: A: 24 dB (e14) Indicating the total attenuation is at 24 dB and the “soft” attenuation is at 14 dB (see below for definition of “soft” attenuation) When in Manual, a # sign appears in front of Atten in the annotation

Attenuator Configurations and Auto/Man

As described in "Attenuation" on page 1747 , there are two distinct attenuator configurations available in the X-Series, the single attenuator and Dual-Attenuator configurations. In Dual-Attenuator configurations, we have the mechanical attenuation and the electronic attenuation, and the current total attenuation is the sum of the electronic + mechanical attenuation. In Single-Attenuator configurations, we refer to the attenuation set using "Mech Atten" on page 1444 (or `:POW:ATT`) as the “main” attenuation; and the attenuation that is set by `:POW:EATT` as the “soft” attenuation (`:POW:EATT` is honored even in the Single-Attenuator configuration, for compatibility purposes). Then the current total attenuation is the sum of the main + soft attenuation. See "Elec Atten" on page 1753 for more on “soft” attenuation.

NOTE	In some measurements, the **Mech Atten** control has an Auto/Man function. In these measurements, an Auto/Man switch is shown on the **Mech Atten** control:



Note that in configurations that include an Electronic Attenuator, this switch is only shown when the Electronic Attenuator is disabled.

In other measurements, **Mech Atten** has no Auto/Man function. In these measurements, no switch is shown on the **Mech Atten** control:

Mech Atten also appears with no switch, as above, in configurations that include an Electronic Attenuator but when the Electronic Attenuator is enabled.

Elec Atten

Controls the Electronic Attenuator in Dual-Attenuator configurations. This control does not appear in Single-Attenuator configurations, as the control of both the mechanical and electronic stages of the Single-Attenuator is integrated into the single **Atten** control.

This control includes an Enable/Disable toggle switch; it is only possible to enter a value for the Electronic Attenuator when this switch is in the “Enable” position.

See "More Information" on page 1448

Remote Command	`[:SENSe]:POWer[:RF]:EATTenuation <rel_ampl>`
	`[:SENSe]:POWer[:RF]:EATTenuation?`
	`[:SENSe]:POWer[:RF]:EATTenuation:STATe OFF | ON | 0 | 1`
	`[:SENSe]:POWer[:RF]:EATTenuation:STATe?`

Example	`:POW:EATT 10`
	`:POW:EATT?`
	`:POW:EATT:STAT ON`
	`:POW:EATT:STAT?`

Notes	Electronic Attenuation’s specification is defined only when Mechanical Attenuation is 6 dB
Dependencies	This control only appears in Dual-Attenuator models with an Electronic Attenuator installed and licensed. It does not appear in models with the Single-Attenuator configuration, as in the Single-Attenuator configuration there is no “electronic attenuator” there is only a single integrated attenuator

	(which has both a mechanical and electronic stage). However, in the Single-Attenuator configuration, EATT SCPI commands are accepted for compatibility with other X-series instruments and set a “soft” attenuation as described in . The “soft” attenuation is treated as an addition to the “main” attenuation value set by the Atten control or the POW:ATT SCPI command and affects the total attenuation displayed on the Atten control and the Meas Bar The electronic attenuator (and the “soft” attenuation function provided in Single-Attenuator configurations) is unavailable above the low band (0-3.6 GHz, 0-3.4 GHz 0-3GHz, depending on the model). If the low band ranges from 0-3.6GHz, and Stop Frequency of the instrument is > 3.6 GHz, then the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed out If the Internal Preamp is on, meaning it is set to Low Band or Full, the electronic attenuator (and the “soft” attenuation function provided in Single-Attenuator configurations) is unavailable. In this case the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed out If either of the above is true, if the SCPI command is sent, an error indicating that the electronic attenuator is unavailable will be sent If both of the above are true, pressing the control will generate error message -221, in other words, the frequency range lockout takes precedence If the electronic/soft Attenuator is enabled, then the Stop Freq of the instrument is limited to 3.6 GHz and the Internal Preamp is unavailable The SCPI-only “soft” electronic attenuation for the single-attenuator configuration is not available in all measurements; in particular, it is not available in the Swept SA measurement
Couplings	Enabling and disabling the Electronic Attenuator affects the setting of the Mechanical Attenuator (in Dual-Attenuator configurations). This is described in more detail below and in the section "Attenuator Configurations and Auto/Man" on page 1752
Preset	`OFF` (Disabled) for Swept SA measurement `ON` (Enabled) for all other measurements that support the electronic attenuator
State Saved	Saved in instrument state
Min	0 dB
Max	Dual-Attenuator configuration: 24 dB Single-Attenuator configuration: the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB
Annotation	See Annotation under the **Mech Atten** control description

More Information

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear. These advantages primarily aid in remote operation and are negligible for front panel use. See "Using the Electronic Attenuator: Pros and Cons" on page 1449 for a detailed discussion of the pros and cons of using the electronic attenuator.

For the Single-Attenuator configuration, for SCPI backwards compatibility, the “soft” attenuation feature replaces the Dual-Attenuator configuration’s electronic attenuator. All the same couplings and limitations apply. See "Attenuator Configurations and Auto/Man" on page 1752

Mechanical Attenuator Transition Rules

When the Electronic Attenuator is enabled, the Mechanical Attenuator transitions to a state that has no Auto function. Below are the rules for transitioning the Mechanical Attenuator. Note that the information below ONLY applies to the Dual-Attenuator configurations, and ONLY when the Electronic Attenuator is installed:

When the Electronic Attenuation is enabled from a disabled state:

The Mechanical Attenuator is initialized to 10 dB (this is its optimal performance setting). You can then set it as desired with SCPI, numeric keypad, step keys, or knob, and it behaves as it normally would in manual mode

The Auto/Man state of (Mech) Atten is saved

The Auto/Man toggle on the (Mech) Atten control disappears and the auto rules are disabled

The Electronic Attenuator is set to 10 dB less than the previous value of the Mechanical Attenuator, within the limitation that it must stay within the range of 0 to 24 dB of attenuation

Examples in the Dual-Attenuator configuration:

Mech Atten at 20 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 10 dB. New total attenuation equals the value before Elec Atten enabled

Mech Atten at 0 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 0 dB. New total attenuation does not equal the value before Elec Atten enabled

Mech Atten at 40 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 24 dB. New total attenuation does not equal the value before Elec Atten enabled

When the Electronic Attenuation is disabled from an enabled state:

The Elec Atten control is grayed out

- The Auto/Man state of (Mech) Atten is restored

If now in Auto, (Mech) Atten recouples

If now in Man, (Mech) Atten is set to the value of total attenuation that existed before the Elec Atten was disabled. The resulting value is rounded up to the smallest value possible given the (Mech) Atten Step setting - (That is, 57 dB changes to 58 dB when (Mech) Atten Step is 2 dB)

Using the Electronic Attenuator: Pros and Cons

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear.

The “finer steps” advantage of the electronic attenuator is beneficial in optimizing the alignment of the instrument dynamic range to the signal power in the front panel as well as remote use. Thus, you can achieve improved relative signal measurement accuracy. Compared to a mechanical attenuator with 2 dB steps, the 1 dB resolution

of the electronic attenuator only gives better resolution when the odd-decibel steps are used. Those odd-decibel steps are less accurately calibrated than the even-decibel steps, so one tradeoff for this superior relative accuracy is reduced absolute amplitude accuracy.

Another disadvantage of the electronic attenuator is that the spectrum analyzer loses its “Auto” setting, making operation less convenient.

Also, the relationship between the dynamic range specifications (TOI, SHI, compression, and noise) and instrument performance are less well-known with the electrical attenuator. With the mechanical attenuator, TOI, SHI, and compression threshold levels increase dB-for-dB with increasing attenuation, and the noise floor does as well. With the electronic attenuator, there is an excess attenuation of about 1 to 3 dB between 0 and 3.6 GHz, making the effective TOI, SHI, and so forth, less well known. Excess attenuation is the actual attenuation relative to stated attenuation. Excess attenuation is accounted for in the instrument calibration

Adjust Atten for Min Clipping

Sets the combination of mechanical and electronic attenuation and gain based on the current measured signal level so that clipping will be at a minimum.

This is an "immediate action" function, that is, it executes once, when the control is pressed.

The algorithms that are used for the adjustment are documented under "Pre-Adjust for Min Clipping" on page 1757.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate`
Example	`:POW:RANG:OPT IMM`
Notes	Executing Adjust Atten for Min Clipping initiates the measurement.
Dependencies	Does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum measurements For the Waveform measurement, this control is available only in 5G NR Mode

Adjust Atten

Allows you to select;

- Electric attenuator only
- Combination of Electric attenuator and Mechanical attenuator

when the command `[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate` is executed.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize:TYPE EONLy | COMBined` `[:SENSe]:POWer[:RF]:RANGe:OPTimize:TYPE?`

Example	:POW:RANG:OPT:TYPE EONL :POW:RANG:OPT:TYPE?
Dependencies	Does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum measurements For the Waveform measurement, this control is available only in 5G NR Mode
Preset	COMBined
State Saved	Saved in instrument state

Pre-Adjust for Min Clipping

If this function is ON, it applies the adjustment described under "Adjust Atten for Min Clipping" on page 1756 each time a measurement restarts. Therefore, in Continuous measurement mode, it only executes before the first measurement.

In Dual-Attenuator models, you can set **Elec+Mech Atten**, in which case both attenuators participate in the autoranging, or **Elec Atten Only**, in which case the mechanical attenuator does not participate in the autoranging. This latter case results in less wear on the mechanical attenuator and is usually faster.

See "Adjustment Algorithm" on page 1452

Selection	Example	Note
Off	:POW:RANGe:OPT:ATT OFF	This is the default setting
Elec Atten Only	:POW:RANGe:OPT:ATT ELEC	Selects only the electric attenuator to participate in auto ranging. This offers less wear on the mechanical attenuator and is usually faster
Mech + Elec Atten	:POW:RANGe:OPT:ATT COMB	In Dual-Attenuator models, this selects both attenuators to participate in the autoranging

Remote Command	[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation OFF | ON | ELECtrical | COMBined [:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation?
Example	:POW:RANG:OPT:ATT OFF :POW:RANG:OPT:ATT?
Notes	The parameter option ELECtrical sets this function to ON in Single-Attenuator models The parameter option COMBined is mapped to ELECtrical in Single-Attenuator models. If you send COMBined, it sets the function to ON and returns ELEC to a query For SCPI compatibility with models that do not have an input attenuator, the ON parameter is honored and mapped to COMBined
Dependencies	This control only appears in Dual-Attenuator models with an Electronic Attenuator installed In instruments with Dual-Attenuator model, when **Enable** "Elec Atten" on page 1753 is OFF or grayed-out, "Pre-Adjust for Min Clipping" on page 1451 is grayed-out This control does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum

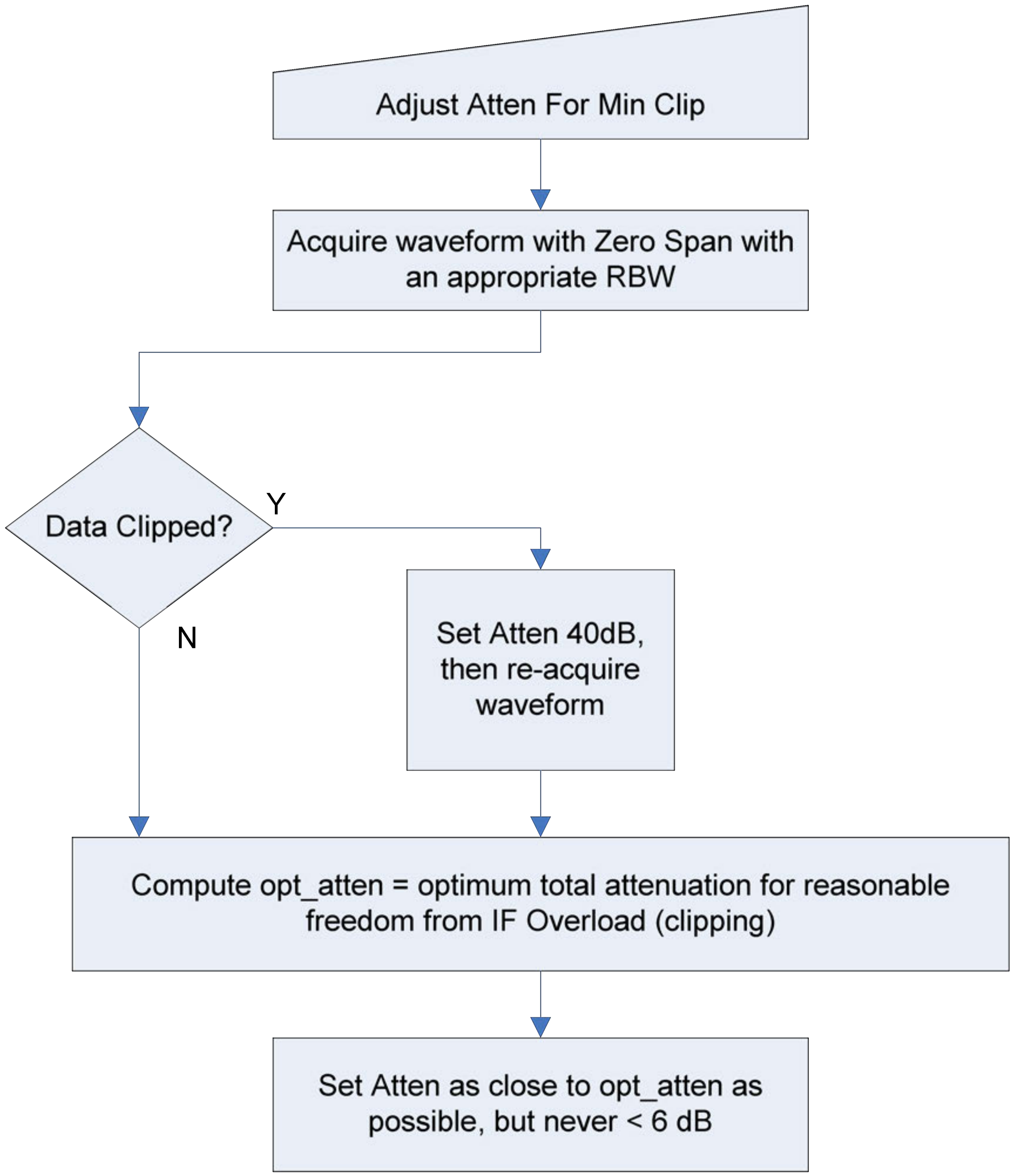
	measurements For the Waveform measurement, this control is available only in 5G NR Mode
Preset	`OFF` when Elec Atten is Disabled at preset, otherwise `ELEC`
State Saved	Saved in instrument state
Range	Dual-Attenuator models: Off | Elec Atten Only | Mech + Elec Atten Single-Attenuator models: Off | On

Notes	`ON` aliases to "Elec Atten Only" (`:POW:RANG:OPT:ATT ELEC`) `OFF` aliases to "Off" (`:POW:RANG:OPT:ATT OFF`) `:POW:RANG:AUTO?` returns true if `:POW:RANG:OPT:ATT` is not `OFF`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:RANGe:AUTO ON | OFF | 1 | 0` `[:SENSe]:POWer[:RF]:RANGe:AUTO?`

Adjustment Algorithm

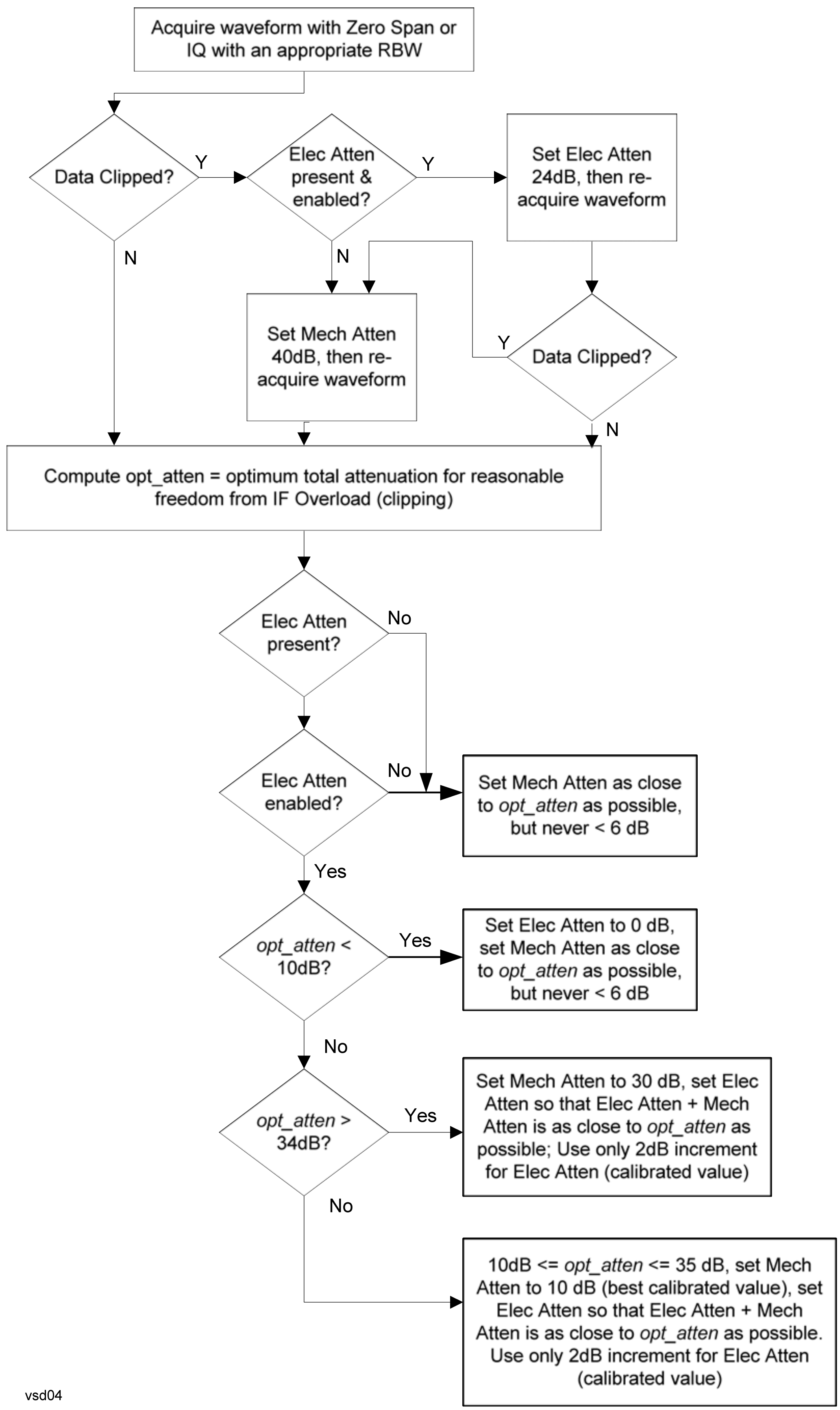
The algorithms for the adjustment are documented below:

Single-Attenuator Models

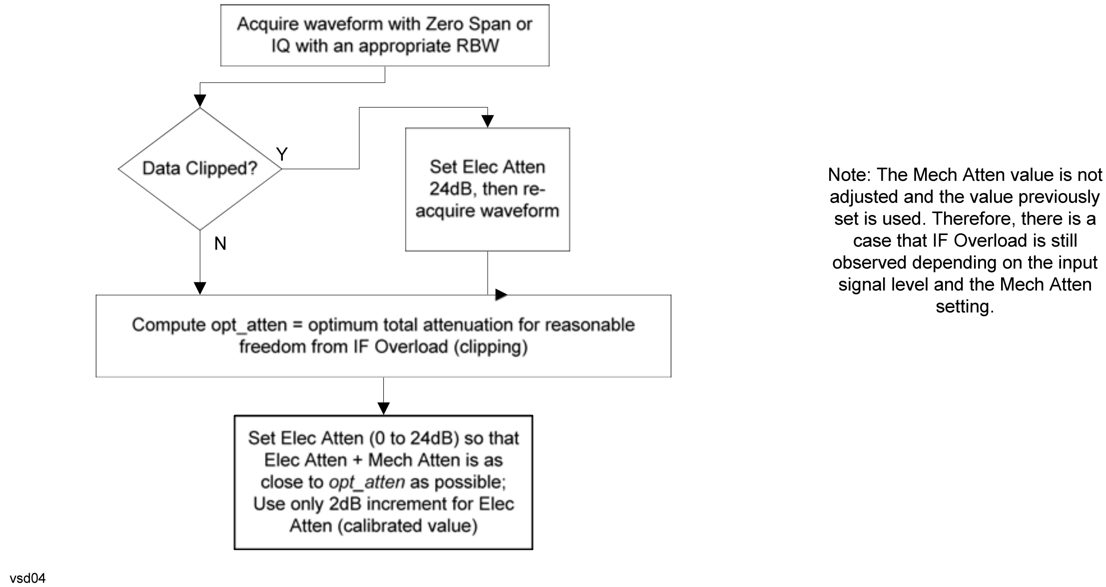


Dual-Attenuator models

"Adjust Atten for Min Clipping" on page 1756 or "Pre-Adjust for Min Clipping" on page 1451 selection is Mech + Elec Atten:


Acquire waveform with Zero Span or IQ with an appropriate RBW
Data Clipped?
Y
N
Elec Atten present & enabled?
Y
N
Set Elec Atten 24dB, then re-acquire waveform
Set Mech Atten 40dB, then re-acquire waveform
Data Clipped?
Y
N
Compute opt_atten = optimum total attenuation for reasonable freedom from IF Overload (clipping)
Elec Atten present?
No
Elec Atten enabled?
No
Set Mech Atten as close to opt_atten as possible, but never < 6 dB
Yes
opt_atten < 10dB?
Yes
Set Elec Atten to 0 dB, set Mech Atten as close to opt_atten as possible, but never < 6 dB
No
opt_atten > 34dB?
Yes
Set Mech Atten to 30 dB, set Elec Atten so that Elec Atten + Mech Atten is as close to opt_atten as possible; Use only 2dB increment for Elec Atten (calibrated value)
No
10dB <= opt_atten <= 35 dB, set Mech Atten to 10 dB (best calibrated value), set Elec Atten so that Elec Atten + Mech Atten is as close to opt_atten as possible. Use only 2dB increment for Elec Atten (calibrated value)
vsd04

"Pre-Adjust for Min Clipping" on page 1451 selection is Elec Only:



Mech Atten Step

Controls thestep size used when making adjustments to the input attenuation.

This control is labeled **Mech Atten Step** in Dual-Attenuator models and **Atten Step** in Single-Attenuator models. In the Dual-Attenuator configuration, this control only affects the step size of the mechanical attenuator.

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement] 10 dB | 2 dB` `[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement]?`
Example	`:POW:ATT:STEP 2` `:POW:ATT:STEP?`
Notes	This feature has a toggle choice from the front panel, but it takes a specific value (in dB) when used remotely. The only valid values are 2 and 10
Dependencies	Blanked in EXA, CXA and CXA-m if option FSA (2 dB steps) is not present. If blanked, attempts to set it via SCPI yield an error
Couplings	When the attenuation step size changes, the current mechanical attenuation value is adjusted (if necessary) to be quantized to the new step size. That is, if step is set to 10 dB, mech atten is increased if necessary so it is a multiple of 10 dB
Preset	EXA, CXA and CXA-m: 10 dB (2 dB with option FSA) All other models: 2 dB
State Saved	Saved in instrument state

3.11.3.3 Range (Non-attenuator models)

This tab is only available for Keysight's modular signal analyzers and certain other Keysight products. Examples include:

- VXT
- E7760
- M9391A
- M9393A

This tab also does not appear in UXM. In UXM, all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

State Saved	No

Range

Represents the amplitude of the largest sinusoidal signal that could be present within the IF without being clipped by the ADC. For signals with high peak-to-average ratios, the range may need to exceed the rms signal power by a significant amount to avoid clipping.

This is a measurement global setting.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe <real>` `[:SENSe]:POWer[:RF]:RANGe?`
Example	`:POW:RANG 10 dBm` `:POW:RANG?`
Notes	The MIN and MAX values are affected by the External Gain parameters, and by the **Center Frequency** The hardware compensates for frequency response and alters the Range setting
Preset	0 dBm
State Saved	Yes
Min	-100
Max	100
Annotation	Meas Bar

Adjust Range for Min Clipping

Sets the combination of attenuation and gain based on the current measured signal level so that clipping will be at a minimum.

This is an "immediate action" function, that is, it executes once, when the key is pressed.

This key does not appear in measurements that do not support this functionality.

Remote Command	[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate
Notes	Executing Adjust Range for Min Clipping initiates the measurement
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760

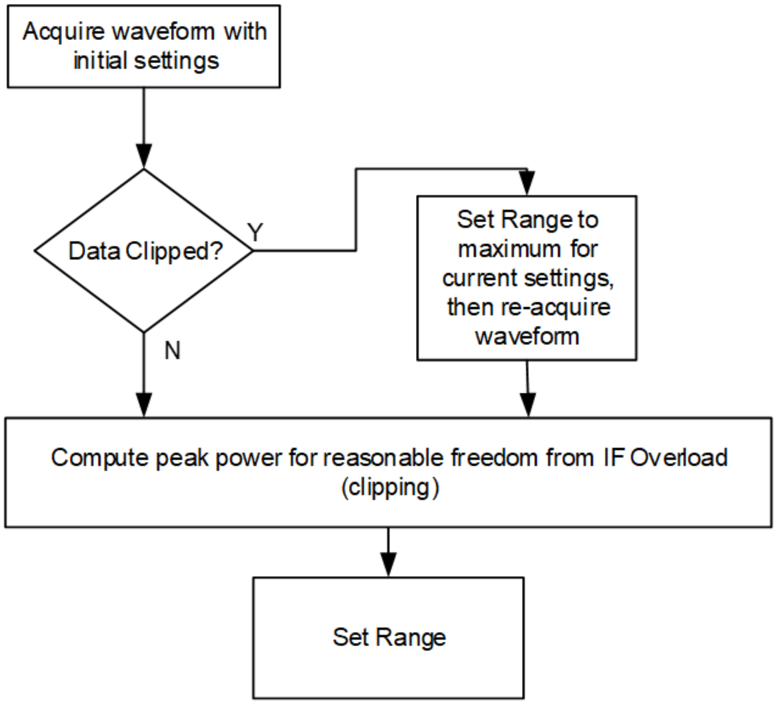
Pre-Adjust for Min Clipping

If this function is ON, it applies the adjustment described under Adjust Range For Min Clipping each time a measurement restarts. Therefore, in Continuous measurement mode, it only executes before the first measurement.

Remote Command	[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation OFF | ON | ELECtrical | COMBined [:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation?
Notes	Because there is no attenuator control available in these models, the control displays only ON and OFF choices. However, for SCPI compatibility with other platforms, all three parameters (ELECtrical, COMBined, and ON) are honored and all are mapped to ELECtrical, so if any of these three parameters is sent, a subsequent query will return ELEC
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760
Preset	OFF for Swept SA measurement; ON for all other measurements that support **Pre-Adjust for Min Clipping**
State Saved	Saved in instrument state

Adjustment Algorithm

The algorithm for the adjustment is documented below:



Peak-to-Average Ratio

Used with "Range (Non-attenuator models)" on page 1864 to optimize the level control in the instrument. The value is the ratio, in dB, of the peak power to the average power of the signal to be measured. A ratio of 0 should be used for sinusoidal signals; for 802.11g OFDM signals use 9 dB.

All Applications (Modes) show the current value of Peak-to-Average ratio on the control. However, some applications do not permit changing the value. In these situations, the control is grayed-out.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:PARatio <real>` `[:SENSe]:POWer[:RF]:RANGe:PARatio?`
Example	`:POW:RANG:PAR 12 dB`
Notes	In some Applications (Modes) this parameter is read-only; meaning the value will appear on the control and query via SCPI, but is not changeable. In such applications the control is grayed-out. Attempting to change the value via SCPI will be ignored but no error message will be generated
Dependencies	This control does not appear in Spectrum Analyzer Mode
Preset	10 dB VXT Models M9410A/11A: 0 dB
State Saved	Saved in instrument state
Min	0 dB
Max	20 dB

	VXT Models M9410A/11A: 50 dB

Mixer Lvl Offset

This is an advanced setting to adjust target Range at the input mixer, which in turn affects the signal level in the instrument's IF. This setting can be used when additional optimization is needed after setting "Peak-to-Average Ratio" on page 1866. Positive values of offset optimize noise performance over distortion, negative values optimize distortion performance over noise.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet <real>` `[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet?`
Example	`:POW:RANG:MIX:OFFS -5 dB`
Preset	0 dB
State Saved	Saved in instrument state
Min	-35 dB VXT Models M9410A/11A: -34 dB
Max	30 dB

3.11.3.4 Signal Path

Contains controls that pertain to the routing of the signal through the frontend of the instrument.

In general, this tab only appears in instruments whose hardware supports this signal routing. For example, this tab does not appear in many of the modular instrument products, including VXT Models M9420/21A. It also does not appear in UXM.

This tab *does* appear in VXT Models M9410A/11A because the Software Preselection control is in this tab, and VXT Models M9410A/11A implement a version of Software Preselection.

Presel Center

Pressing this control adjusts the centering of the preselector filter to optimize the amplitude accuracy at the frequency of the selected marker. If the selected marker is not on when **Presel Center** is pressed, the instrument turns on the selected marker, performs a peak search, and then performs centering on the marker's center frequency. If the selected marker is already on and between the start and stop frequencies of the instrument, the instrument performs the preselector calibration on that marker's frequency. If the selected marker is already on, but outside the frequency range between Start Freq and Stop Freq, the instrument first performs a peak search, and then performs centering on the marker's center frequency.

The value displayed on "Preselector Adjust" on page 1869 will change to reflect the new preselector tuning.

A number of considerations should be observed to ensure proper operation. See "Proper Preselector Operation" on page 1460.

Remote Command	`[:SENSe]:POWer[:RF]:PCENter`
Example	`:POW:PCEN`
Notes	Note that the rules outlined above under the control description apply for the remote command as well as the key. The result of the command is dependent on marker position, etc. Any message shown by the control press is also shown in response to the remote command
Dependencies	Does not appear in CXA-m Does not appear in VXT Models M9410A/11A Grayed-out if the microwave preselector is off – If the selected marker's frequency is below Band 1, an advisory message is generated "Preselector not used in this frequency range" and no action is taken – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz – Blank in models that do not include a preselector, such as option 503. If the remote command is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View
Couplings	The active marker position determines where the centering will be attempted If the instrument is in a measurement such as averaging when centering is initiated, the act of centering the preselector restarts averaging, but the first average trace will not be taken until the centering is completed The offset applied to do the centering reads out on the "Preselector Adjust" on page 1869 control
Status Bits/OPC dependencies	When centering the preselector, `*OPC` will not return true until the process is complete and a subsequent measurement has completed, nor will results be returned to `:READ` or `:MEASure` queries The Measuring bit should remain set while this command is operating and should not go false until the subsequent sweep/measurement has completed

Proper Preselector Operation

A number of considerations should be observed to ensure proper operation:

1 If the selected marker is off, the instrument turns on a marker, performs a peak search, and adjusts the preselector using the selected marker's frequency. It uses the "highest peak" peak search method unqualified by threshold or excursion, so that there is no chance of a 'no peak found' error. It continues with that peak, even if it is the peak of just noise. Therefore, for this operation to work properly, there should be a signal on screen in a preselected range for the peak search to find

2 If the selected marker is already on, the instrument attempts the centering at that marker's frequency. There is no preselector for signals below about 3.6 GHz, so if the marker is on a signal below 3.6 GHz, no centering will be attempted and an advisory message generated

3 In some models, the preselector can be bypassed. If it is bypassed, no centering will be attempted in that range and a message will be generated

Preselector Adjust

Allows you to manually adjust the preselector filter frequency to optimize its response to the signal of interest. This function is only available when "Presel Center" on page 1868is available.

For general purpose signal analysis, using **Presel Center** is recommended. Centering the filter minimizes the impact of long-term preselector drift. **Preselector Adjust** can be used instead to manually optimize the preselector. One application of manual optimization would be to peak the preselector response, which both optimizes the signal-to-noise ratio and minimizes amplitude variations due to small (short-term) preselector drifting.

When **Presel Center** is performed, the offset applied to do the centering becomes the new value of **Preselector Adjust**.

Remote Command	`[:SENSe]:POWer[:RF]:PADJust <freq>` `[:SENSe]:POWer[:RF]:PADJust?`
Example	`:POW:PADJ 100KHz` `:POW:PADJ?`
Notes	The value on the control reads out to 0.1 MHz resolution
Dependencies	– Does not appear in CXA-m – Does not appear in VXT Models M9410A/11A – Grayed-out if microwave preselector is off – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz – Blank in models that do not include a preselector, such as option 503. If the SCPI is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View
Preset	0 MHz
State Saved	The **Preselector Adjust** value set by "Presel Center" on page 1868, or by manually adjusting **Preselector Adjust** It is not saved in instrument state, and does not survive a Preset or power cycle
Min	-500 MHz
Max	500 MHz
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PADJust` `[:SENSe]:POWer[:RF]:MMW:PADJust`

Notes	PSA had multiple preselectors, and you could select which preselector to adjust. Since the X-Series has only one mm/uW preselector, the preselector selection control is no longer available. However, to provide backward compatibility, we accept the legacy remote commands The command form has no effect, the query always returns `MWAVe`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:PADJust:PRESelector MWAVe | MMWave | EXTernal` `[:SENSe]:POWer[:RF]:PADJust:PRESelector?`

Internal Preamp

Accesses a menu of controls for the internal preamps. Turning on the preamp gives a better noise figure, but a poorer inter-modulation distortion (TOI) to noise floor dynamic range. You can optimize this setting for your particular measurement.

The instrument takes the preamp gain into account as it sweeps. If you sweep outside of the range of the preamp, the instrument will also account for that. The displayed result always reflects the correct gain.

For some measurements, when the preamp is on and any part of the displayed frequency range is below the lowest frequency for which the preamp has specifications, a warning condition message appears in the status line. For example, for a preamp with a 9 kHz lowest specified frequency: "Preamp: Accy unspec'd below 9 kHz".

Selection	Example	Note
Off	`:POW:GAIN OFF`	
Low Band	`:POW:GAIN ON` `:POW:GAIN:BAND LOW`	Sets the internal preamp to use only the low band. The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Low Band selection in the dropdown
Full Range	`:POW:GAIN ON` `:POW:GAIN:BAND FULL`	Sets the internal preamp to use its full range. The low band (0-3.6 GHz, 0-3.4 GHz, 0-3GHz, depending on the model) is supplied by the low band preamp and the frequencies above low band are supplied by the high band preamp The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Full Range selection in the dropdown. If the high band option is not installed the Full Range selection does not appear

Remote Command	`[:SENSe]:POWer[:RF]:GAIN:BAND LOW | FULL` `[:SENSe]:POWer[:RF]:GAIN:BAND?`

	`[:SENSe]:POWer[:RF]:GAIN[:STATe] OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:GAIN[:STATe]?`

Example	`:POW:GAIN:BAND LOW`
	`:POW:GAIN:BAND?`
	`:POW:GAIN OFF`
	`:POW:GAIN?`

Dependencies	Preamp is not available on all hardware platforms. If the preamp is not present or is unlicensed, the control is not shown Does not appear in VXT Models M9410A/11A/15A If `:POW:GAIN:BAND FULL` is sent when a low band preamp is available, the preamp band parameter is set to `LOW` instead of `FULL`, and an "Option not installed" message is generated The preamp is not available when the electronic/soft attenuator is enabled
Preset	`LOW` `OFF`
State Saved	Saved in instrument state
Annotation	When the USB Preamp is not connected to USB, the Preamp annotation in the Meas Bar says “Off” if the preamp is off and displays the frequency range of the low band or full range preamp depending on the setting. For example, if the Preamp is set to Low Band and the Low Band is 3.6 GHz the annotation says “3.6 GHz”. If it is a 13.6 GHz preamp and it is set to Full Range the annotation says “13.6 GHz” When the USB Preamp is connected to USB, the Preamp annotation says “Preamp: USB” if the internal preamp is off or “Preamp: USB, Int” if the internal preamp is on (only for measurements that support the USB preamp)

LNA

Lets you turn the Low Noise Amplifier (**LNA**) on or off.

The LNA is an additional preamplifier that provides superior DANL and frequency range compared to the Internal Preamp. The LNA provides lower system noise figure, especially at frequencies above 100 MHz, and can be operated up to the full range of 50 GHz instruments.

For best possible sensitivity, the LNA can be turned on together with the "Internal Preamp" on page 1870, although if you operate both preamps together, note that the TOI (distortion) specifications are impacted. The sensitivity improvement of this combination is substantial when operating in high band (frequencies above 3.6 GHz).

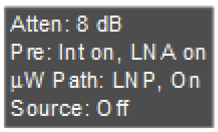
See "More Information" on page 1464

Remote Command	`[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe] OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe]?`
Example	`:POW:GAIN:LNA ON`
Dependencies	Requires option LNA

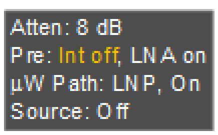
	Option LNA is not required by VXT model M9415A Does not appear in VXT models M9420A/21A/10A/11A May not appear in some measurements
Preset	OFF
State Saved	Saved in State

More Information

When the LNA is installed, the preamp annotation changes to show the state of both the LNA and the Internal Preamp. Below is an example:



Note that when operating entirely in the low band (below about 3.6 GHz), if the LNA is on, the Internal Preamp is switched off (even if you have its switch set to ON). This is because the noise performance is actually degraded in low band if both preamps are on. In this case, the annotation reflects the actual state of the two preamps, but the Internal Preamp annotation displays in amber, to warn you that the actual state of the Internal Preamp does not match the **Internal Preamp** switch control display:



µW Path Control

Options for this control include **µW Preselector Bypass** (Option MPB), **Low Noise Path** (Option LNP) and **Full Bypass Enable** in the High Band path circuits.

When the µW Preselector is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. When **Low Noise Path Enable** is selected, the instrument automatically bypasses certain circuitry in the high frequency bands that can contribute to noise, when it is appropriate based on other instrument settings.

For most applications, the preset state is **Standard Path**, which provides the best remote-control throughput, minimizes acoustic noise from switching and minimizes the risk of wear in the hardware switches, particularly in remote test scenarios where both low band and high band setups will follow in rapid succession. In this path, the bypass of the low band/high band switch and microwave preamp is never activated, which can cause some noise degradation but preserves the life of the bypass switch.

For applications that utilize the wideband IF paths, the preset state is **µW Preselector Bypass**, if option MPB is present. This is because, when using a wideband IF such as

the 140 MHz IF, the µW Preselector's bandwidth can be narrower than the available IF bandwidth, causing degraded amplitude flatness and phase linearity, so it is desirable to bypass the preselector in the default case.

You may choose **Low Noise Path Enable** for a lower noise floor, especially in the 21-26.5 GHz region, though without improving many measures of dynamic range, and without giving the best possible noise floor. The preamp, if purchased and used, gives better noise floor than does **Low Noise Path Enable**, but the preamp's compression threshold and third-order intercept are much poorer than that of **Low Noise Path Enable**.

A fourth choice is **Full Bypass Enable**, which combines **µW Preselector Bypass** and **Low Noise Path Enable**. Because this can bypass most of the circuitry between the input and the first mixer, care should be taken when using this setting to avoid damaging the mixer. **Full Bypass Enable** is only available if both options LNP and MPB are present, as well as option FBP.

Path	Example	Note
Standard Path	`:POW:MW:PATH STD`	Normal setting for most measurements. µW Preselector in circuit, Low Noise Path disabled
Low Noise Path Enable	`:POW:MW:PATH LNP`	See "Low Noise Path Enable" on page 1469
µW Preselector Bypass	`:POW:MW:PATH MPB`	See "µW Preselector Bypass" on page 1470
Full Bypass Enable	`:POW:MW:PATH FULL`	See "Full Bypass Enable" on page 1471

Remote Command	`[:SENSe]:POWer[:RF]:MW:PATH STD | LNPath | MPBypass | FULL` `[:SENSe]:POWer[:RF]:MW:PATH?`

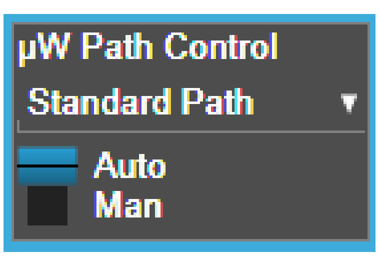
Example	`:POW:MW:PATH LNP`
	Enables the Low Noise path
	`:POW:MW:PATH?`

Notes	If "Presel Center" on page 1868 is performed, the instrument will momentarily switch to the Standard Path, regardless of the setting of **µW Path Control** The DC Block will always be switched in when the low noise path is switched in, to protect succeeding circuitry from DC. Note that this does not mean "when the low noise path is enabled" but when, based on the Low Noise Path rules, the path is actually switched in. This can happen when the selection is **Low Noise Path Enable** or **Full Bypass Enable.** In the case where the DC Block is switched in the instrument is now AC coupled. However, if you selected DC coupling, the UI would still behave as though it were DC coupled, including all annunciation, warnings, status bits, and responses to SCPI queries. This is because, based on other settings, the instrument could switch out the low noise path at any time and hence go back to being DC coupled Alignment switching ignores the settings in this menu, and restores them when finished
Dependencies	Does not appear in CXA-m Does not appear in VXT Models M9410A/11A Does not appear in BBIQ and External Mixing

	The **Low Noise Path Enable** selection does not appear unless Option LNP is present and licensed The **µW Preselector Bypass** selection does not appear unless Option MPB is present and licensed The **Full Bypass Enable** selection does not appear unless options LNP and MPB are both present as well as option FBP In any of these cases, if the required options are not present and the SCPI command is sent, error -241, "Hardware missing; Option not installed" is generated **Low Noise Path Enable** and **Full Bypass Enable** are grayed-out if the current measurement does not support them **Low Noise Path Enable** and **Full Bypass Enable** are not supported in Avionics and MMR Modes. In any of these cases (that is, the feature is not supported in either measurement or mode), if the SCPI command is sent, the following error is generated: -221, “Setting Conflict; Feature not supported for this measurement”
Preset	All except modes specified below: `STD` IQ Analyzer, VXA, Pulse and Avionics mode: – MPB option present and licensed: `MPB` – MPB option not present and licensed: `STD`
State Saved	Save in instrument state
Range	Standard Path|Low Noise Path Enable|µW Presel Bypass|Full Bypass Enable
Annotation	In the Meas Bar, if the Standard path is chosen, it says: µW Path: Standard If Low Noise Path is enabled but the LNP switch is not thrown, it shows: µW Path: LNP,Off If the Low Noise Path is enabled and the LNP switch IS thrown, it shows: µW Path: LNP,On If the preselctor is bypassed, it says: µW Path: Bypass If Full Bypass Enable is selected but the LNP switch is not thrown, it shows: µW Path: FByp,Off If Full Bypass Enable is selected and the LNP switch IS thrown, it shows: µW Path: FByp,On

µW Path Control Auto [Mode: VMA, WLAN, NR5G, CQM]

In VMA, WLAN, 5G NR, CQM modes, an Auto/Man switch is added to **µW Path Control**:



This allows the function to automatically switch based on certain Auto Rules as shown below:

VMA Mode

Measurement	When µW Path Control is in Auto:
Digital Demod	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Custom OFDM	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Presel Bypass
SEM	Always Presel Bypass
Spurious Emissions	Always Standard Path

WLAN Mode

Measurement	When µW Path Control is in Auto:
Modulation Analysis	Always Presel Bypass
Spectral Flatness	Always Presel Bypasss
Power vs Time	Always Presel Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Always Presel Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Always Presel Bypass
SEM	1. For 11be 320M, when 'Enabled Wideband IF for FFT' is OFF or 'Sweep Type Rule' is Best Dynamic Range, auto µW path is standard. 2. For other cases, auto µW path is presel bypass if presel bypass is enabled, auto µW path is standard if presel bypass is not enabled.
Spurious Emissions	Always Standard Path

5G NR Mode

Measurement	When µW Path Control is in Auto:
Modulation	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in

Measurement	When µW Path Control is in Auto:
Analysis	which case choose Full Bypass if conditions warrant(FBP Option is available and “Allow Full Bypass in Auto” is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and “Allow Full Bypass in Auto” is On), otherwise choose Preselector Bypass
Channel Power	Always Standard Path
Occupied BW	Always Standard Path
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Standard Path
SEM	Always Standard Path
Spurious Emissions	Always Standard Path
Transmit On|Off Power	Use Standard Path unless tuned frequency > 3.6 GHz and Info BW > 15 MHz, in which case choose Preselector Bypass

Channel Quality Mode

Measurement	When µW Path Control is in Auto:
Group Delay	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and “Allow Full Bypass in Auto” is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass

Remote Command	`[:SENSe]:POWer[:RF]:MW:PATH:AUTO ON | OFF | 1 | 0` `[:SENSe]:POWer[:RF]:MW:PATH:AUTO?`
Example	`:POW:MW:PATH:AUTO ON` `:POW:MW:PATH:AUTO?`
Dependencies	Only appears in VMA, WLAN, 5G NR and CQM modes
Couplings	See the tables above
Preset	ON
Range	ON|OFF

Low Noise Path Enable

You may select Low Noise Path Enable, which gives a lower noise floor under some circumstances, particularly when operating in the 21-26.5 GHz region. With the Low Noise Path enabled, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

- The instrument is not in the Low Band, meaning:
- the start frequency is above 3.5 GHz and
- the stop frequency is above 3.6 GHz
- the internal preamp is not installed or (if installed) is set to Off or Low Band

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the Low Noise Path Enable is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the Low Noise Path Enable is selected in the user interface. The only time the Low Noise Path is used is when Low Noise Path Enable is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

For measurements that use IQ acquisition, the low noise path is used when Center Frequency is in High Band (> 3.6 GHz) and no preamp is in use. In other words, the rules above are modified to use only the center frequency to qualify which path to switch in. This is not the case for FFTs in the Swept SA measurement; they use the same rules as swept measurements.

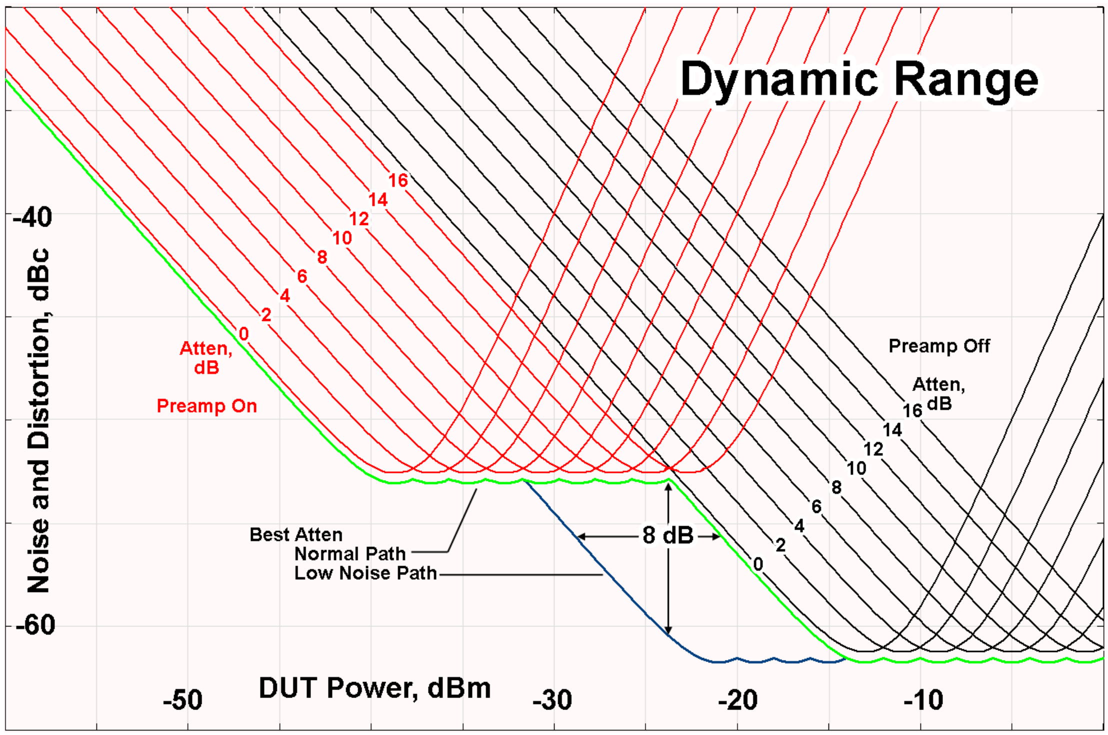
Note that the Low Noise Path, while giving improved DANL, has the disadvantage of decreased TOI performance and decreased gain compression performance relative to the standard path.

Note also that the bypass switch is a mechanical switch and has finite life, so if the Low Noise Path Enable is selected, it is possible to cause frequent cycling of this switch by frequently changing instrument settings such that the above conditions hold true only some of the time. A user making tests of this nature should consider opting for the Standard Path, which will never throw the bypass switch, at the expense of some degraded noise performance.

The low noise path is useful for situations where the signal level is so low that the instrument performance is dominated by noise even with 0 dB attenuation, but still high enough that the preamp option would have excessive third-order intermodulation or compression. The preamp, if purchased and used, gives better noise floor than does the “Low Noise Path.” However, its compression threshold and third-order intercept are much poorer than that of the non-preamp path.

There are some applications, typically for signals around –30 dBm, for which the third-order dynamic range of the standard path is good enough, but the noise floor is not low enough even with 0 dB input attenuation. When the third-order dynamic range of the preamp path is too little and the noise floor of the standard path is too high, the Low Noise Path can provide the best dynamic range

The graph below illustrates the concept. It shows, in red, the performance of an instrument at different attenuation settings, both with the preamp on and off, in a measurement that is affected by both instrument noise and instrument TOI. The green shows the best available dynamic range, offset by 0.5 dB for clarity. The blue shows how the best available dynamic range improves for moderate signal levels with the low noise path switched in. In this illustration, the preamp improves the noise floor by 15 dB while degrading the third-order intercept by 30 dB, and the low noise path reduces loss by 8 dB. The attenuator step size is 2 dB.



There are other times where selecting the low noise path improves performance, too. Compression-limited measurements such as finding the nulls in a pulsed-RF spectrum can profit from the low noise path in a way similar to the TOI-limited measurement illustrated. Accuracy can be improved when the low noise path allows the optimum attenuation to increase from a small amount like 0, 2 or 4 dB to a larger amount, giving better return loss at the instrument input. Harmonic measurements, such as second and third harmonic levels, are much improved using the low noise path because of the superiority of that path for harmonic (though not intermodulation) distortion performance.

µW Preselector Bypass

Toggles the preselector bypass switch for band 1 and higher. When the microwave presel is on, the signal path is preselected. When the microwave preselector is off, the signal path is not preselected. The preselected path is the normal path for the instrument.

The preselector is a tunable bandpass filter which prevents signals away from the frequency of interest from combining in the mixer to generate in-band spurious signals (images). The consequences of using a preselector filter are its limited bandwidth, the amplitude and phase ripple in its passband, and any amplitude and phase instability due to center frequency drift.

Option MPB or pre-selector bypass provides an unpreselected input mixer path for certain X-Series signal analyzers with frequency ranges above 3.6 GHz. This signal path allows a wider bandwidth and less amplitude variability, which is an advantage when doing modulation analysis and broadband signal analysis. The disadvantage is that, without the preselector, image signals will be displayed. Another disadvantage of bypassing the preselector is increased LO emission levels at the front panel input port.

Image responses are separated from the real signal by twice the 1st IF. For IF Paths of 10 MHz and 25 MHz, the 1st IF is 322.5 MHz, so the image response and the real signal will be separated by 645 MHz. The 1st IF will be different for other IF Path settings. When viewing a real signal and its corresponding image response in internal mixing, the image response will be to the left of the real signal.

Also, the image response and the real signal typically have the same amplitude and exhibit the same shape factor.

However, if Option FS1, Fast Sweep Capability, is enabled, the image response in the Swept SA measurement appears lower in amplitude and has a much wider shape factor compared to the real signal.

Full Bypass Enable

With **Full Bypass Enable** selected, the microwave preselector is bypassed. In addition, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

- The instrument is not in the Low Band, meaning:
- the start frequency is above 3.5 GHz and
- the stop frequency is above 3.6 GHz.
- the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. The only time the Low Noise Path is used is when **Full Bypass Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

CAUTION When **Full Bypass Enable** is selected, and "Attenuation" on page 1747 is set to 0 dB, there will be a direct AC connection between the input and the first converter

when the Low Noise Path switches in (when Start Freq >3.6 GHz and the Preamp is either not licensed, set to Low Band, or Off). This puts the first converter at high risk to be damaged by high AC power. Consequently, whenever **Full Bypass Enable** is selected, a warning message appears in the status bar:

Full Bypass Enabled, maximum safe input power reduced

Microwave Preselector Bypass Backwards Compatibility

Example	`:POW:MW:PRES OFF` Bypasses the microwave preselector
Notes	Included for Microwave Preselector Bypass backwards compatibility The `ON` parameter sets the `STD` path (`:POW:MW:PATH STD`) The `OFF` parameter sets path `MPB` (`:POW:MW:PATH MPB`)
Preset	`ON`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe] ON | OFF | 0 | 1` `[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe]?`

Frequency Extender Preselection Bypass

Frequency Extender Preselection Bypass only applies to the high frequency path of the Frequency Extender and only if the Frequency Extender allows it. For example, the V3050A high frequency path is 50 – 110 GHz and does allow control of the preselector bypass.

When the Frequency Extender's preselection is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. For bandwidths greater than 2.5 [GHz], it is recommended that the signal bypass the Frequency Extender Preselector since the max bandwidth of the Preselector can be as narrow as 2.5 [GHz].

For most applications, the preset state is `OFF`, which gives the best remote-control throughput, minimizes acoustic noise from switching, minimizes out of band spurs, and minimizes the risk of wear in the hardware switches.

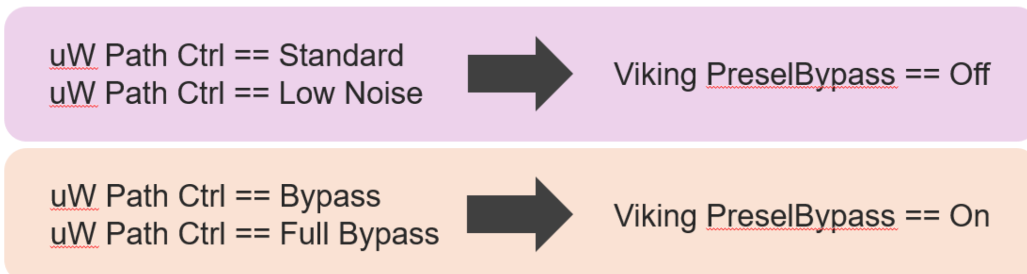
Coupling with Microwave Preselector Control

The control of whether to apply or bypass the Frequency Extender's preselection is dependent on the Microwave Path Control setting.

The coupling between the Microwave Path Control and Frequency Extender Preselector Bypass is described below.

UW PATH CTRL	UW PRESELECTOR	VIKING PRESELECTOR
Standard Path	On	**On**
Low Noise Path Enable	On	**On**
uW Presel Bypass	Off	**Off**
Full Bypass Enable	Off	**Off**

In other words…



For the Frequency Extender Preselector Bypass to take effect, it requires a Frequency Extender device (such as V3050A) be connected and External RF (ERFIN) selected as the input.

The Frequency Extender Preselector is applied or bypassed depending on the Microwave Path Control setting only when the acquisition is above 50 [GHz]. Hence, it will be bypassed only when the acquisition is above 50 [GHz].

Preselector and Bandwidth Conflict

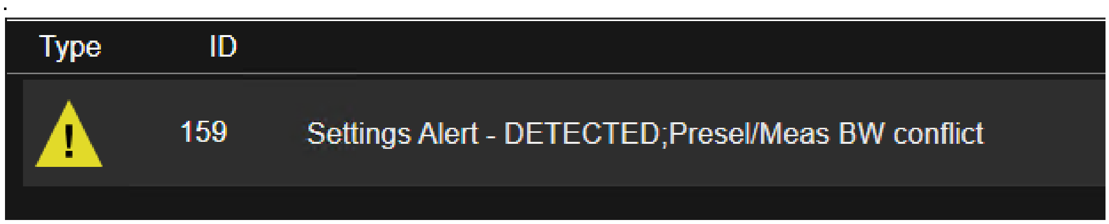
When the Frequency Extender Preselector is applied and the signal bandwidth is greater than 2.5 [GHz], then a settings alert message will show to warn the user that the signal may be distorted due to the limitation of the Frequency Extender Preselector bandwidth.

An example of the settings alert message is shown below.

Settings Alert message in the Status Bar at the bottom of the display.

Settings Alert message in the error queue

.



Software Preselection

Software Preselection is provided in some instruments, either to compensate for issues with provided hardware preselection or to provide the preselection function when there is no hardware preselector.

N9041B

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 50 GHz, software preselection must be used to suppress and separate images above 50 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

In the N9041B, Software Preselection only applies for frequencies above 50 GHz, therefore it is only used for RF Input 2. Even if it is turned on, it will not be used for other inputs and never for frequencies below 50 GHz. This is why the label of this control contains the parenthetical note “(>~50 GHz)”.

Note that in the N9041B, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

N9042B+V3050A

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 88 GHz, software preselection must be used to suppress and separate images above 88 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

For N9042B+V3050A, Software Preselection only applies for frequencies above 88 GHz, therefore it is only used for External RF. Even if it is turned on, it will not be used for other inputs and never for frequencies below 88 GHz. This is why the label of this control contains the parenthetical note “(>~88 GHz)”.

Note that for N9042B+V3050A, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

VXT models M9410A/11A

Software Preselection is used to provide the preselection function, as there is no hardware preselector in these models. Two background traces are taken and compared point by point, and the point with the lowest amplitude from the two traces is used. This provides a method to reduce spurs that are internally generated within the VXT, but the user should note the following when using Software

Preselection:

- There is some speed cost due to the need to take multiple captures
- Taking the point with the lowest amplitude in each trace will make the average noise level lower at all points that do not have a spur. This can reduce the accuracy of the measurement of noise and noise-like signals.

Because of the difficulty in identifying spurs manually, you are encouraged to leave Software Preselection ON at all times in VXT models M9410A/11A. If you turn it off in order to speed up your measurement or improve noise accuracy, be aware of unwanted onscreen spurs.

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel:STATe 0 | 1 | ON | OFF` `[:SENSe]:POWer[:RF]:SWPresel:STAT?`
Example	`:POW:SWPR:STAT 1` `:POW:SWPR:STAT?`
Dependencies	Only appears in N9041B, N9042B+V2050A, and VXT models M9410A/11A. Does not appear in all measurements
Couplings	Sweep Time is affected by SW Preselection. Also Auto Tune supports SW Preselection, so set SW Preselection state and then do Auto Tune
Preset	N9041B: OFF N9042B+V3050A: ON M9410A/11A: ON
State Saved	Saved in instrument state

SW Preselection Type

Specifies the algorithm used for software preselection.

Two hidden sweeps are taken in succession. The second sweep is offset in LO frequency by 2*IF/N. For each point in each trace, the smaller amplitude from the two traces is taken and placed in that point in the selected trace. The Peak detector is auto-selected to improve the image suppression effectiveness. Responses of each trace that lie on top of one another will remain and are valid signals. Other signals are images and are suppressed. The action of taking the smaller of the two traces will make the average noise level lower in all points that do not have an image, thus reducing the accuracy of the measurement of noise and noise-like signals.

- NORMal - mathematically removes all image and multiple responses of signals present at the input
- ADVanced - any trace processing (such as “max hold” or trace averaging) is performed on the points of both candidate traces before the “select minimum” operation occurs. This form of processing works better for non-stationary signals, such as pulsed-RF signals

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel NORMal | ADVanced` `[:SENSe]:POWer[:RF]:SWPResel?`
Example	`:POW:SWPR NORM` `:POW:SWPR?`
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed-out. Its grayout message is "Unavailable unless SW Presel enabled"
Preset	N9041B: `ADVanced` N9042B+V3050A: `NORMal`
State Saved	Saved in instrument state

SW Preselection BW

Specifies the effective bandwidth to be used for Software Preselection.

The choices are:

- `NORMal` – when making Swept measurements, a software preselection algorithm is used which takes up to 4 background acquisitions, then post-processes the result. This algorithm can remove images from signals with an occupied bandwidth up to around 3 GHz. (Default/Preset setting). When making FFT measurements, this algorithm is not used, instead the same algorithm is used as for `NARRow` (below)
- `NARRow`– a software preselection algorithm is used which takes two background acquisitions, then post-processes the result to detect and remove images from wideband signals with occupied bandwidths up to 2 GHz. This increases the risk of images failing to be rejected, but improves the measurement speed

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel:BW NORMal | NARRow` `[:SENSe]:POWer[:RF]:SWPResel:BW?`
Example	`:POW:SWPR:BW NARR`
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed out. Its grayout message is "Unavailable unless SW Presel enabled" For N9042B+V3050A the parameter is SCPI only and always set to `NARRow` when Software Preselection is enabled
Preset	N9041B: `NORMal` N9042B+V3050A: `NARRow`
State Saved	Saved in instrument state

High Freq Prefilter

Lets you set the state of Prefilter for Center Frequencies above 1310 MHz.

In VXT Models M9410A/11A, the Receiver RF path has a bank of filters that come after the RF Attenuator in the signal path. Since this bank of filters precedes the mixer they are known as the “Prefilter” bank. Their purpose is to eliminate unwanted in-band mixing products by filtering out all but the desired frequencies before the signals get to the mixer. There are 13 prefilter bands to cover the frequencies between 9 kHz and 6000 MHz. The Prefilter provides the necessary rejection of the unwanted signal.

Remote Command	`[:SENSe]:<measurement>:PFILter[:STATe] ON | OFF | 1 | 0` `[:SENSe]:<measurement>:PFILter[:STATe]?`

Example	For example, to enable High Freq Prefilter in IQ Analyzer Mode:
	For the Complex Spectrum Measurement:
	`:SPEC:PFIL ON`
	For the IQ Waveform Measurement:
	`:WAV:PFIL ON`
	`:`

Dependencies	This control only appears in VXT models M9410A/11A with center frequency above 1310 MHz
Preset	See “Prefilter Presets” below
State Saved	Saved in instrument state

Prefilter Presets

Meas	Mode	Preset
SPEC	BASIC	OFF
WAV	BASIC, WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
MON	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
RHO	WCDMA	OFF
CDP	WCDMA	OFF
PCON	WCDMA	OFF
EVMQ	WCDMA	OFF
CHP	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
OBW	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
ACP	WCDMA, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
SEM	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PST	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PVT	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF
EVM	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF

Meas	Mode	Preset
FLAT	WLAN	OFF
EVMM	WLAN	OFF
CEVM	LTEAFDD, LTEATDD	OFF
PAVT	5GNR, VMA	OFF
DDEM	VMA	OFF
OFDM	VMA	OFF
SAN	SA	ON
HARM	SA	ON

3.11.4 BW

There is no BW functionality in the Spurious Emissions Measurement.

3.11.5 Display

The **Display** key opens the Display Menu, which lets you configure display items for the current Mode, Measurement View or Window.

3.11.5.1 View

Contains controls for selecting the current **View**, and for editing User Views.

Views

The Spurious Emissions measurement has two Predefined views: Graph + Metrics (`RESult`) and `ALL` Ranges.

These Views are multiple-window Views. When in a multiple window View, you select a window by touching it. The menu controls may sometimes change depending on which window is selected.

If you have modified the current View, using the "View Editor" on page 128, an asterisk appears next to that View in the radio button panel. You can save the modified View as a User View (see "Save Layout as New View" on page 1890).

Remote Command	`:DISPlay:SPURious:VIEW[:SELect] RESult | ALL` `:DISPlay:SPURious:VIEW[:SELect]?`
Example	`:DISP:SPUR:VIEW RANG` `:DISP:SPUR:VIEW?`
Preset	`RESult`

State Saved	No
Range	Graph + Metrics | All Ranges

Graph + Metrics

Windows: "Graph" on page 1436,"Table" on page 1437

Select Graph + Metrics to view measurement results.

The upper window displays a trace of the range that contains the currently selected spur

The lower window displays a list of spurs detected in a measurement cycle. The currently selected spur, which is highlighted, can be changed by the Spur control in the Meas Setup menu

Example	`:DISP:SPUR:VIEW RES`

All Ranges

Windows: "Graph" on page 1436,"All Range Table" on page 1438

Select All Ranges to view measurement results for all the ranges.

The upper window displays a merged trace of all the ranges

The lower window displays a list of spurs detected in a measurement cycle. The currently selected spur, which is highlighted, can be changed by the Spur control in the Meas Setup menu

Example	`:DISP:SPUR:VIEW ALL`

User View

Lets you choose a View from the saved User Views for the current measurement. This panel only appears if a User View exists for the current measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:SELect <alphanumeric>` `:DISPlay:VIEW:ADVanced:SELect?`
Example	Select Baseband as the current View `:DISP:VIEW:ADV:SEL “Baseband”`
Notes	You must be in the measurement whose View you are trying to set to send the command. You can only set Views for the current measurement using this command For predefined views, the parameter is derived from the view name that is shown in the View list in the user interface. For example, if you are trying to select the Trace Zoom view in the Swept SA measurement, you send: `:DISP:VIEW:ADV:SEL "Trace Zoom"`

	because “Trace Zoom” is the name of the View as seen in the Mode/Meas dialog or in the Display, View menu
	You *cannot* use the legacy View parameter (which in this case would be `TZOom`) with `:DISP:VIEW:ADV:SEL`
	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case. Thus, both of the following forms work:
	`:DISP:VIEW:ADV:SEL "Trace Zoom"`
	`:DISP:VIEW:ADV:SEL "TRACE ZOOM"`
	If the specified view is not a valid View, the query returns the error message “-224, Illegal parameter value; View with the name <alphanumeric> does not exist”
	If the display is disabled (via `:DISP:ENAB OFF`) then the error message “-221, Settings conflict; View SCPI cannot be used while Display is disabled” is generated

Backwards Compatibility SCPI	The legacy node `:DISPlay:VIEW[:SELect]` is retained for backwards compatibility, but it only supports predefined views

Restore Layout to Default

Restores the Layout to the default for Basic.

Modified Views are very temporary; if you exit the current measurement they are discarded, and they are not saved in State. To retain this View for later use, and to be able to return easily to your original Basic View, you can save your edited View as a “User View”.

Save Layout as New View

Saves your new View as a User View. An alpha keyboard appears, which lets you name your new View; the default is the old View name plus a number.

Remote Command	`:DISPlay:VIEW:ADVanced:NAME <alphanumeric>`
Example	`:DISP:VIEW:ADV:NAME “Baseband”` Creates a new View named `Baseband` from the current View, and selects it as the current View
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If `<alphanumeric>` name already exists as a View, the error message “-224, Illegal parameter value; View <alphanumeric> already exists” is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message “-221, Settings conflict; User View SCPI cannot be used while Display is disabled” is generated

Re-Save User View

You can re-edit a User View; if you make changes, then an asterisk will appear next to the User View's name. You can then tap **Re-Save User View** to save it back to its existing name, or **Save Layout as New View** to add another, new User View.

This is a front panel function only, there is no remote command available to perform this function. To do this remotely, you must first perform **Save Layout as New View**, then delete the old User View and rename the new one with the name of the View you just deleted.

Rename User View

You can rename the current View by giving it a new unique name. Only User Views can be renamed, if the current View is a Predefined View, an error occurs.

Remote Command	`:DISPlay:VIEW:ADVanced:REName <alphanumeric>`
Example	`:DISP:VIEW:ADV:REN "Baseband"`
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the `<alphanumeric>` specifying the new name is already present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot rename a Predefined View" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete User View

You can delete the current View if it is a User View. The default view becomes the current view for the Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:DELete`
Example	`:DISP:VIEW:ADV:DEL`
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the `<alphanumeric>` is not present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> does not exist" is generated If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot delete a Predefined View" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete All User Views

Deletes all previously saved User Views. The default view becomes the current view for the Measurement if a User View was the current view when this command was executed.

Remote Command	`:DISPlay:VIEW:ADVanced:DELete:ALL`
Example	`:DISP:VIEW:ADV:DEL:ALL`
Notes	Disabled if there are no User Views

View Editor Remote Commands

The following remote commands help you manage Views and User Views. Note that the SCPI node for User Views handles both Predefined and User Views. The legacy nodes, `:DISPlay:VIEW[:SELect]` and `:DISPlay:VIEW:NSEL`, are retained for backwards compatibility, but they only support predefined views.

View Listing Query

Returns a string containing a comma-separated list of names for *all* the Views, including User Views, available for the current Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:CATalog?`
Example	`:DISP:VIEW:ADV:CAT?`
Notes	Returns a quoted string of the available Views for the current measurement, separated by commas. The list includes names for *all* the Views, including User Views, available for the current Measurement Example: `"Normal,Trace Zoom,Spectrogram,Baseband,myView1,yourView1"` No distinction is made between Predefined and User Views If you switch measurements with the display disabled (via `:DISP:ENAB OFF`), then query the list of available Views, the result is undefined

User View Listing Query

Returns a string containing a comma-separated list of names for *only* the User Views available for the current Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:USER:CATalog?`
Example	`:DISP:VIEW:ADV:USER:CAT?`

Notes	Returns a quoted string of the available User Views for the current measurement, separated by commas. Example: `"Baseband,myView1,yourView1"` If you switch measurements with the display disabled (see "Display Enable (Remote Command Only)" on page 1894), then query the list of available Views, the result is undefined

3.11.5.2 Annotation

Contains controls for setting up the annotation for the current Mode or Measurement.

Graticule

Turns the display graticule On or Off for all windows with graticules in all measurements in the current Mode. Also turns the graticule Y-Axis annotation on and off.

Remote Command	`:DISPlay:GRATicule[:STATe] OFF | ON | 0 | 1` `:DISPlay:GRATicule[:STATe]?`
Example	`:DISP:GRAT OFF`
Notes	The graticule is the set of horizontal and vertical lines that make up the grid/divisions for the X-Axis and Y-Axis
Preset	`ON`
State Saved	Saved in instrument state

Backwards Compatibility SCPI	`:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe] OFF | ON | 0 | 1`
	`:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe]?`
	This command is accepted for backwards compatibility with older instruments, but the `WINDow`, `TRACe` and `GRID` parameters are ignored

Screen Annotation

Controls the display of the annunciation and annotation around the graticule, including any annotation on lines (such as the display line, the threshold line, etc.) and the Y-Axis annotation, for all windows with screen annotation in all measurements in the current Mode.

This does *not* include marker annotation (or the N dB result). When `OFF`, the graticule expands to fill the entire graticule area, leaving only the 1.5% gap above the graticule, as described in the **Trace** section.

Remote Command	`:DISPlay:ANNotation:SCReen[:STATe] OFF | ON | 0 | 1` `:DISPlay:ANNotation:SCReen[:STATe]?`

Example	:DISP:ANN:SCR OFF
Dependencies	Grayed-out and forced to OFF when **System Display Settings**, **Annotation** is OFF
Preset	ON This remains OFF through a Preset when **System Display Settings**, **Annotation** is set to OFF
State Saved	Saved in instrument state

Trace Annotation

Turns on and off the labels on the traces, showing their detector (or their Math Mode) as described in the **Trace** section, for all windows in all measurements in the current Mode for which Trace Annotation on/off is supported.

If Trace Math is being performed on a trace, then the Trace Math annotation replaces the detector annotation.

For measurements that support limit lines, this key also turns on and off the labels on the Limit Lines. The label is the Limit number annotation and Limit Comment displayed on the graph. If the length of the comment is greater than 20 characters, the first 8 characters and the last 8 characters are displayed, joined with ….

Remote Command	:DISPlay:ANNotation:TRACe[:STATe] ON | OFF | 1 | 0 :DISPlay:ANNotation:TRACe[:STATe]?
Example	:DISP:ANN:TRAC OFF
Preset	OFF
State Saved	Saved in instrument state

Control Annotation

Turns on and off the display of values on the Active Function controls for all measurements in the current Mode. This is a security feature.

Remote Command	:DISPlay:ACTivefunc[:STATe] ON | OFF | 1 | 0 :DISPlay:ACTivefunc[:STATe]?
Example	:DISP:ACT OFF
Dependencies	Grayed out and forced to OFF when **System Display Settings**, **Annotation** is OFF
Preset	ON This remains OFF through a Preset when **System Display Settings**, **Annotation** is set to OFF
State Saved	Saved in instrument state

Meas Bar

Turns the Measurement Bar at the top of the screen on and off for all measurements in the current Mode. When `OFF`, the graticule area expands to fill the area formerly occupied by the Measurement Bar.

Remote Command	`:DISPlay:ANNotation:MBAR[:STATe] OFF | ON | 0 | 1` `:DISPlay:ANNotation:MBAR[:STATe]?`
Example	`:DISP:ANN:MBAR OFF`
Dependencies	Grayed out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Display Enable (Remote Command Only)

Turns the display on/off, including the display drive circuitry. The backlight stays lit to confirm that the instrument is on. The display enable setting is mode global. Theare three reasons for turning the display off:

1. To increase speed as much as possible by freeing the instrument from having to update the display
2. To reduce emissions from the display, drive circuitry
3. For security purposes

If you have turned off the display:

- and you are in local operation, the display can be turned back on by pressing any key or by sending `:SYSTem:DEFaults MISC` or `:DISPlay:ENABle ON` (neither `*RST` nor :SYSTem:PRESet enable the display)
- and you are in remote operation, the display can be turned back on by pressing the **Local** or **Esc** keys, or by sending `:SYSTem:DEFaults MISC` or `:DISPlay:ENABle ON` (neither `*RST` nor `:SYSTem:PRESet` enable the display)
- and you are using either the `:SYSTem:KLOCk` command or GPIB local lockout, then *no* front-panel key press will turn the display back on. You must turn it back on remotely.

If the display is `OFF`, many SCPI commands related to User Views and Multiscreen functionality do not work, and return the error messages “-221, Settings conflict; Screen SCPI cannot be used when Display is disabled” or “221, Settings conflict; View SCPI cannot be used while Display is disabled”. These commands include:

Name	Command
Select User View	:DISPlay:VIEW:ADVanced:SELect
Rename User View	:DISPlay:VIEW:ADVanced:REName
Delete User View	:DISPlay:VIEW:ADVanced:DELete
Create User View	:DISPlay:VIEW:ADVanced:NAME
Select Screen	:INSTrument:SCReen:SELect
Delete Screen	:INSTrument:SCReen:DELete
Delete All But This Screen	:INSTrument:SCReen:DELete:ALL
Add Screen	:INSTrument:SCReen:CREate
Rename Screen	:INSTrument:SCReen:REName
Sequencer On/Off	:SYSTem:SEQuencer

Remote Command	:DISPlay:ENABle OFF | ON | 0 | 1 :DISPlay:ENABle?
Example	:DISP:ENAB OFF
Couplings	:DISP:ENAB OFF turns Backlight OFF and :DISP:ENAB ON turns Backlight ON, but changing Backlight settings does *not* change the state of :DISP:ENAB
Preset	ON Set by :SYST:DEF MISC, but not affected by *RST or :SYSTem:PRESet
State Saved	Not saved in instrument state
Backwards Compatibility Notes	:SYST:PRES no longer turns on :DISPlay:ENABle as it did in legacy analyzers

3.11.6 Freq

The **Freq** key opens the Frequency menu, which contains controls that allow you to control the Frequency and Channel parameters of the instrument.

Some features in the Frequency menu are the same for all measurements in the current Mode – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset. For example, the Center Freq setting is the same for all measurements - it does not change as you change measurements.

3.11.6.1 Settings

The Settings Tab contains controls that pertain to the X axis parameters of the measurement. These parameters control how data on the vertical (X) axis is displayed and control instrument settings that affect the horizontal axis.

Center Frequency

Sets the frequency that corresponds to the horizontal center of the graticule. While adjusting the Center Frequency the Span is held constant.

The center frequency setting is the same for all measurements within a mode, that is, it is Meas Global. Some modes are also able to share a Mode Global center frequency value. If this is the case, then a **Global** tab appears in the **Meas Setup** menu.

The **Center Freq** function sets (and queries) the Center Frequency for the currently selected input. If your instrument has multiple inputs, and you select another input, the Center Freq changes to the value for that input. SCPI commands are available to directly set the Center Freq for a specific input.

Center Freq is remembered as you go from input to input. Thus you can set a Center Freq of 10 GHz with the RF Input selected, change to BBIQ and set a Center Freq of 20 MHz, then switch to External Mixing and set a Center Freq of 60 GHz, and when you go back to the RF Input the Center Freq will go back to 10 GHz; back to BBIQ and it is 20 MHz; back to External Mixing and it is 60 GHz.

See:

"RF Center Freq" on page 1490

"Ext Mix Center Freq" on page 1490

"I/Q Center Freq" on page 1491

"Center Frequency Presets" on page 1488

"VXT Models with Radio Heads/CIU Frequency Range" on page 1490

Remote Command	`[:SENSe]:FREQuency:CENTer <freq>` `[:SENSe]:FREQuency:CENTer?`

Example	`:FREQ:CENT 50 MHz`
	sets Center Frequency to 50 MHz
	`:FREQ:CENT UP`
	increments the Center Frequency by the value of CF Step
	`:FREQ:CENT?`
	returns the current value of Center Frequency

Notes	This command sets the RF, External Mixing or I/Q Center Frequency depending on the selected input For RF input it is equivalent to `:FREQ:RF:CENT` For I/Q input it is equivalent to `:FREQ:IQ:CENT` For External Mixer it is equivalent to `:FREQ:EMIX:CENT` Preset and Max values are dependent on Hardware Options (5xx) If no terminator (e.g., MHz) is sent the terminator Hz is used. If a terminator with unit other than Frequency is used, an invalid suffix error message is generated
Dependencies	Not available in the MSR, LTE-Advanced FDD/TDD and 5G NR modes.

Preset	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 1488, "RF Center Freq" on page 1490, "Ext Mix Center Freq" on page 1490, "I/Q Center Freq" on page 1491 and "VXT Models with Radio Heads/CIU Frequency Range" on page 1490
State Saved	Saved in instrument state
Min/Max	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 1488, "RF Center Freq" on page 1490, "I/Q Center Freq" on page 1491 and "VXT Models with Radio Heads/CIU Frequency Range" on page 1490
Annotation	Center <value> appears in the lower left corner of the display
Status Bits/OPC dependencies	Non-overlapped

Center Frequency Presets

The following table provides the Center Frequency Presets for the Spectrum Analyzer mode, and the Max Freq, for the various frequency options:

Freq Option	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
503 (all but CXA)	1.805 GHz	3.6 GHz	3.7 GHz
503 (CXA)	1.505 GHz	3.0 GHz	3.08 GHz
507 (all but CXA)	3.505 GHz	7.0 GHz	7.1 GHz
507 (CXA)	3.755 GHz	7.5 GHz	7.58 GHz
508 (all but MXE)	1.805 GHz	3.6 GHz	8.5 GHz
508 (MXE)	4.205 GHz	8.4 GHz	8.5 GHz
513	6.805 GHz	13.6 GHz	13.8 GHz
526 (except CXA and MXE)	13.255 GHz	26.5 GHz	27.0 GHz*
526 (CXA)	13.255 GHz	26.5 GHz	26.55 GHz
526 (MXE)	1.805 GHz	3.6 GHz	27.0 GHz
532	16.005 GHz	32.0 GHz	32.5 GHz
540	20.005 GHz	40.0 GHz	40.5 GHz
543	21.505 GHz	43.0 GHz	43.0 GHz
544	22.005 GHz	44.0 GHz	45.0 GHz
550	25.005 GHz	50.0 GHz	52 GHz
F03 (CXA-m)	1.505 GHz	3.0 GHz	3.08 GHz
F07 (CXA-m)	3.755 GHz	7.5 GHz	7.575 GHz
F13 (CXA-m)	6.805 GHz	13.6 GHz	13.8 GHz
F26 (CXA-m)	13.255 GHz	26.5 GHz	26.55 GHz
504 (M9420A/21A, M8920A)	2.145 GHz	3.88GHz	3.88 GHz
506 (M9420A/21A,	3.245 GHz	6.08GHz	6.08 GHz

Freq Option	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
M8920A)			
F06 (M9410A/11A)	1.0 GHz	6.08 GHz	6.08 GHz
F06 (M9415A)	1 GHz	1.08 GHz	6.6 GHz
F08 (M9415A)	1 GHz	1.08 GHz	8.6 GHz
F12 (M9415A)	1 GHz	1.08 GHz	12.9 GHz

*For option 526, the Max CF in RTSA is 26.999999995 GHz.

N9041B Center Freq Presets

Input	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
Input 1, all models	25.005 GHz	50.0 GHz	52 GHz
Input 2, opt 585	42.505 GHz	85.0 GHz	86 GHz
Input 2, opt 590	45.005 GHz	90.0 GHz	92 GHz
Input 2, opt 5CX	55.005 GHz	110.0 GHz	110 GHz

Input 2, CXA and MXE

Model	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
CXA opt C75	0.7505 GHz	1.5 GHz	1.58 GHz
MXE	505 MHz	1 GHz	1.000025 GHz

Tracking Generator Frequency Limits (CXA only)

Tracking Generator Option	Min Freq (clips to this freq when turn TG on and can't tune below while TG on)	If above this Freq, Stop Freq clipped to this Freq when TG turned on	Max Freq (can't tune above) while TG on
T03	9 kHz	3.0 GHz	3.08 GHz
T06	9 kHz	6.0 GHz	6.05 GHz

Tracking Generator Frequency Limits(CXA-m only)

Tracking Generator Option	Min Freq (clips to this freq when turn TG on and can't tune below while TG on)	If above this Freq, Stop Freq clipped to this Freq when TG turned on	Max Freq (can't tune above) while TG on
T03	2 MHz	3.08 GHz	3.08 GHz
T07	2 MHz	7.575 GHz	7.575 GHz
T13	2 MHz	13.8 GHz	13.8 GHz
T26	2 MHz	26.55 GHz	26.55 GHz

VXT Models with Radio Heads/CIU Frequency Range

The following table shows the Center Frequency Presets and Range for VXT modes with Radio Heads/CIU.

Products with Radio Heads/CIU	Preset	Start frequency	Stop frequency
M9421A + CIU	6 GHz	5.9 GHz	12 GHz
M9410A + CIU	6 GHz	5.9 GHz	12 GHz
M9410A + CIU + RRH	25 GHz	24.25 GHz	43.5 GHz

RF Center Freq

SCPI command for specifying the RF Center Frequency. This command will set the Center Frequency to be used when the RF input is selected, even if the RF input is not the input that is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:RF:CENTer <freq>` `[:SENSe]:FREQuency:RF:CENTer?`
Example	`:FREQ:RF:CENT 30 MHz` `:FREQ:RF:CENT?`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode
Dependencies	If the electronic/soft attenuator is enabled, any attempt to set Center Frequency such that the Stop Frequency would be >3.6 GHz fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning
Preset	See table above
State Saved	Saved in instrument state
Min	-79.999995 MHz
Max	See table above. Basically instrument maximum frequency - 5 Hz If the knob or step keys are being used, also depends on Span

Ext Mix Center Freq

SCPI command for specifying the External Mixer Center Frequency. This command will set the Center Frequency to be used when the External Mixer is selected, even if the External Mixer input is not the input which is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:EMIXer:CENTer <freq>` `[:SENSe]:FREQuency:EMIXer:CENTer?`
Example	`:FREQ:EMIX:CENT 60 GHz`

	`:FREQ:EMIX:CENT?`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode
Couplings	When returning to External Mixing after having been switched to one of the other inputs (for example, RF), you will return to the settings that you had when you left External Mixing. So you will return to the band you were in with the Center Frequency that you had. However, Span is not an input-dependent parameter, therefore you will bring the span over from the other input. Therefore, the instrument returns to the span from the previous input, limited as necessary by the current mixer setup
Preset	When a Mode Preset is performed while in External Mixing, the Start frequency of the current Mode is set to the nominal Min Freq of the lowest harmonic range in the Harmonic Table for the current mixer setup. Similarly, the Stop frequency of the current Mode is set to the nominal Max Freq of the highest harmonic range in the Harmonic Table. The Center Freq thus presets to the point arithmetically equidistant from these two frequencies Note that, if the current measurement has a limited Span available to it, and cannot achieve the Span shown in the table (Span=Stop Freq – Start Freq), the instrument uses the maximum Span the measurement allows, and still sets the Center Freq to the midpoint of the Start and Stop Freq values in the Harmonic Table When Restore Input/Output Defaults is performed, the mixer presets to the 11970A, whose Start and Stop frequencies are 26.5 and 40 GHz respectively. The center of these two frequencies is 33.25 GHz Therefore, after a Restore Input/Output Defaults, if you go into External Mixing and do a Mode Preset while in the Spectrum Analyzer Mode, the resulting Center Freq is 33.25 GHz
State Saved	Yes
Min	The minimum frequency in the currently selected mixer band + 5 Hz If the knob or step keys are being used, also depends on Span
Max	The maximum frequency in the currently selected mixer band - 5 Hz If the knob or step keys are being used, also depends on Span

I/Q Center Freq

Command for specifying the I/Q Center Frequency. This sets the Center Frequency to be used when the I/Q input is selected, even if the I/Q input is not the input that is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:IQ:CENTer <freq>` `[:SENSe]:FREQuency:IQ:CENTer?`
Example	`:FREQ:IQ:CENT 30 MHz`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode
Preset	0 Hz
State Saved	Saved in instrument state
Min	-40.049995 MHz
Max	40.049995 MHz

CF Step

Changes the step size for the center frequency and start and stop frequency functions. Once a step size has been selected and the center frequency function is active, the step keys (and the UP|DOWN parameters for Center Frequency from remote commands) change the center frequency by the step-size value. The step size function is useful for finding harmonics and sidebands beyond the current frequency span of the instrument.

Note that the start and stop frequencies also step by the CF Step value.

Remote Command	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement] <freq>`
	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement]?`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO?`

Example	`:FREQ:CENT:STEP 500 MHz`
	`:FREQ:CENT UP`
	increases the current center frequency value by 500 MHz
	`:FREQ:CENT:STEP?`
	`:FREQ:CENT:STEP:AUTO ON`
	`:FREQ:CENT:STEP:AUTO?`

Notes	Preset and Max values are depending on Hardware Options
Dependencies	Not available in the MSR, LTE-A FDD/TDD and 5G NR modes If the electronic/soft attenuator is enabled, any attempt to change the value of the center frequency >3.6 GHz by pressing the Up-arrow key, fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning
Couplings	When auto-coupled, the center frequency step size is set to 10% of the span
Preset	Auto `ON`
State Saved	Saved in instrument state
Min	– (the maximum frequency of the instrument). That is, 27 GHz max freq instrument has a CF step range of +/- 27 GHz. Note that this is the maximum frequency given the current settings of the instrument, so in External Mixing, for example, it is the maximum frequency of the current mixer band
Max	The maximum frequency of the instrument. That is, 27 GHz max freq instrument has a CF step range of +/- 27 GHz. Note that this is the maximum frequency given the current settings of the instrument, so in External Mixing, for example, it is the maximum frequency of the current mixer band
Status Bits/OPC dependencies	non-overlapped

3.11.7 Marker

Accesses a menu that enables you to select, set up and control the markers for the current measurement. If there are no active markers, **Marker** selects marker 1, sets it to Normal and places it at the center of the display. If the selected marker is Off, it is set to Normal and placed it at the center of the screen on the trace determined by the **Marker Trace** rules.

For more detailed information on the types of Markers and the interaction between Markers, see the Marker section of the Swept SA measurement.

3.11.7.1 Select Marker

Specifies the selected marker. The term "selected marker" is used throughout this document to specify which marker will be affected when you change marker settings, perform a Peak Search, etc.

The **Select Marker** control appears above the menu panel, indicating that it applies to all controls in the Marker menu panels. Select Marker is blanked if you select a tab whose controls do *not* depend on the selected marker (e.g., Counter).

On any menu tab that displays **Select Marker**, the first control is always **Marker Frequency|Time**.

Notes	The selected marker is remembered even when not in the Marker menu and is used if a Search is done or a Band Function is turned on or for Signal Track or Continuous Peak
Preset	Marker 1
State Saved	The number of the selected marker is saved in instrument state
Annunciation	Appears in the marker results block label for **Normal** and **Delta** markers

3.11.7.2 Settings

The controls on the Settings tab include the Marker active function and a radio button selection of the marker control mode (Normal, Delta, or Off) for the selected marker, as well as additional functions that help you use markers.

Marker Frequency

Sets the marker X Axis value in the current marker X Axis Scale unit. It has no effect if the control mode is **Off,** but is the SCPI equivalent of entering an X value if the control mode is **Normal** or **Delta**.

Remote Command	`:CALCulate:SPURious:MARKer[1]|2|...|12:X <freq>` `:CALCulate:SPURious:MARKer[1]|2|...|12:X?`
Example	`:CALC:SPUR:MARK2:X 25 kHz`

	:CALC:SPUR:MARK3:X?
Notes	If no suffix is sent, uses the fundamental units for the current marker X Axis Scale. If a suffix is sent that does not match the current marker X Axis Scale unit, an error “Invalid suffix” is generated The query returns the marker’s absolute X Axis value if the control mode is **Normal**, or the offset from the marker’s reference marker if the control mode is **Delta**. The query is returned in the fundamental units for the current marker X Axis scale: Hz for **Frequency** and Inverse Time, seconds for Period and Time
Preset	After a preset, all markers are turned OFF, so Marker X Axis Value query returns a Not A Number (NAN) After Mode Preset, change **Sweep/Measure** to **Single**
State Saved	Saved in instrument state
Min	-9.9E+37
Max	9.9E+37
Annotation	Mkr # <X value> and <Marker value> upper right on graph

Marker X Axis Position (Remote Command Only)

Sets the marker X-Axis Scale position in trace points. This setting has no effect if the control mode is **Off,** but is the SCPI equivalent of entering a value if the control mode is **Normal** or **Delta** - except in trace points rather than X-Axis Scale units. The entered value is immediately translated into the current X-Axis Scale units for setting the value of the marker.

Remote Command	:CALCulate:SPURious:MARKer[1]|2|...|12:X:POSition <real> :CALCulate:SPURious:MARKer[1]|2|...|12:X:POSition?
Example	:CALC:SPUR:MARK10:X:POS 300 :CALC:SPUR:MARK10:X:POS?
Notes	The query returns the marker’s absolute X-Axis value in trace points if the control mode is **Normal**, or the offset from the marker’s reference marker in trace points if the control mode is **Delta**. The value is returned as a real number, not an integer, corresponding to the translation from X-Axis Scale units to trace points . When a Marker is turned on, it is placed center of the screen on the trace. Therefore the default value depends on instrument condition. If the marker is OFF, the response is Not A Number
Preset	After a preset, all markers are turned OFF, so Marker X-Axis Value query returns a Not A Number (NAN)
State Saved	Saved in instrument state
Min	-9.9E+37
Max	9.9E+37

Marker Y Axis Value (Remote Command only)

Returns the marker Y Axis value in the current marker Y Axis unit.

Remote Command	:CALCulate:SPURious:MARKer[1]|2|...|12:Y?
Example	:CALC:SPUR:MARK11:Y?
Notes	The query returns the marker Y-axis result, if the control mode is **Normal** or **Delta**. If the marker is OFF,

	the response is Not A Number In the Complex Spectrum measurement, when the marker is on and Marker Trace is set to IQ, it returns I and Q values Case #1 - MarkerTrace SPEC, I or Q: returns a single double value – >:CALC:SPEC:MARK1:Y? – -2.402406506109E+001 Case #2 - MarkerTrace IQ: returns a double array of two values, the first is I, and the second is Q – >:CALC: SPEC:MARK1:Y? – -3.006944493834E-003,+9.9870666467354E-004 The IQ selection is for backward compatibility purposes. It is recommended that the users use the I and/or Q selection instead
Preset	Result dependent on Marker setup and signal source
State Saved	No
Backwards Compatibility SCPI	`:CALCulate:SPURious:MARKer[1]|2|...|12:FUNCtion:RESult?`

Marker Mode

Sets the marker control mode to `POSition` (Normal), `DELTa`, or `OFF`. All interactions and dependencies detailed under the control description are enforced when the remote command is sent. If the selected marker is `OFF`, pressing **Marker** sets it to `POSition` and places it at the center of the screen on the trace determined by the **Marker Trace** rules. At the same time, **Marker X Axis Value** appears on the Active Function area.

The default active function is the active function for the currently selected marker control mode. If the current control mode is `OFF`, there is no active function and the active function is turned off.

Remote Command	`:CALCulate:SPURious:MARKer[1]|2|...|12:MODE POSition | DELTa | OFF` `:CALCulate:SPURious:MARKer[1]|2|...|12:MODE?`
Example	`:CALC:SPUR:MARK:MODE POS` `:CALC:SPUR:MARK:MODE?`
Preset	`OFF`
State Saved	Saved in instrument state
Range	`POSition|DELTa|OFF`
Annotation	Mkr # <X value> and <Marker value> upper right on graph When Marker Trace is Polar in WCDMA mode: Mkr # <Chip Value (RHO & QPSKEVM)/Symbol Value (CDP)>, <X value> and <Y value> upper right on graph

Backward Compatibility SCPI Commands

Sets or queries the state of a marker. Setting a marker that is OFF to ON (1) puts it in POSition mode and places it at the center of the screen.

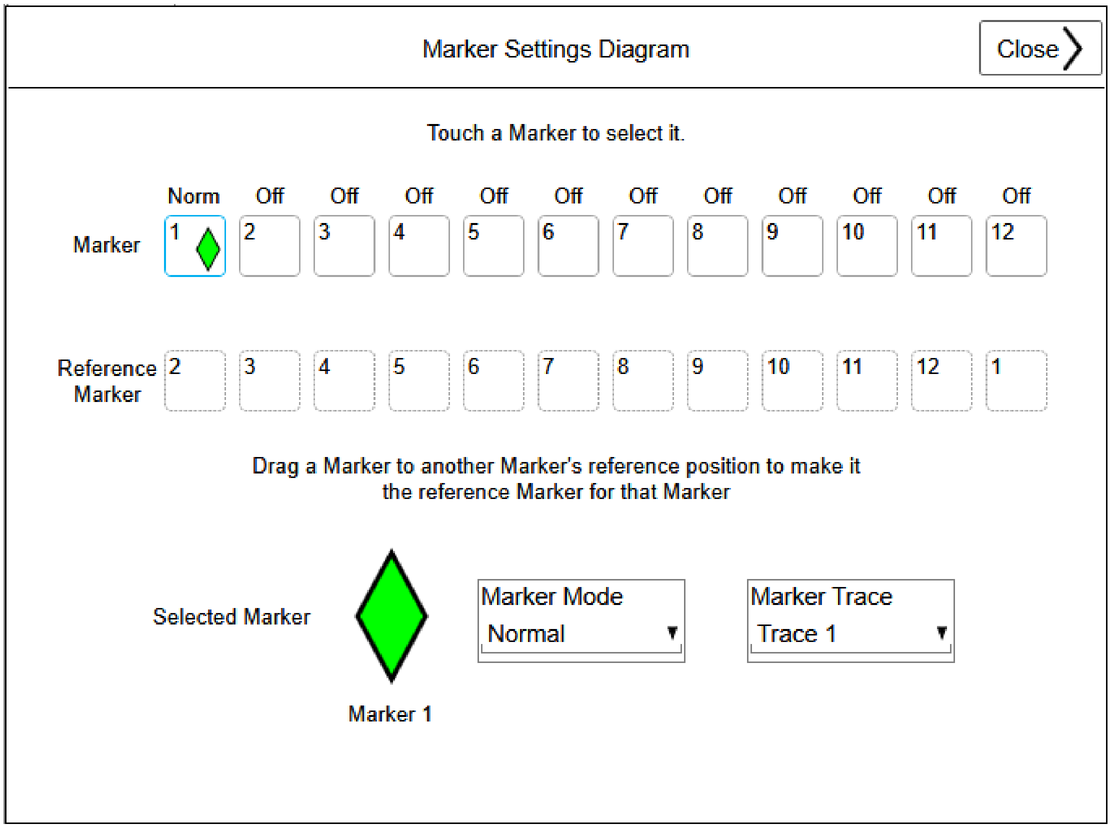
Remote Command	:CALCulate:SPURious:MARKer[1]|2|...|12:STATe OFF | ON | 0 | 1 :CALCulate:SPURious:MARKer[1]|2|...|12:STATe?
Example	:CALC:SPUR:MARK3:STAT 1 :CALC:SPUR:MARK3:STAT?
Preset	OFF
State Saved	Saved in instrument state
Range	OFF|ON

Delta Marker (Reset Delta)

Pressing this control has exactly the same effect as pressing the "Delta" selection on the **Marker Mode** radio button. The selected marker becomes a Delta Marker. If the selected marker is already a Delta marker, the reference marker is moved to the current position of the selected marker, thus resetting the Delta to zero.

Marker Settings Diagram

The Marker Settings Diagram lets you configure the Marker system using a visual utility.



All Markers Off

Turns off all markers.

Remote Command	`:CALCulate:SPURious:MARKer:AOFF`
Example	`:CALC:SPUR:MARK:AOFF`

Couple Markers

When this function is On, moving any marker causes an equal X-Axis movement of every other marker that is not `OFF`. By "equal X-Axis movement" we mean that we preserve the difference between each marker's X-Axis value (in the fundamental x-axis units of the trace that marker is on) and the X-Axis value of the marker being moved (in the same fundamental X-Axis units).

This may result in markers going off screen.

Remote Command	`:CALCulate:SPURious:MARKer:COUPle[:STATe] ON | OFF | 1 | 0` `:CALCulate:SPURious:MARKer:COUPle[:STATe]?`
Example	`:CALC:SPUR:MARK:COUP ON` `:CALC:SPUR:MARK:COUP?`

Preset	OFF Presets on **Mode Preset** and **All Markers Off**
State Saved	Saved in instrument state

3.11.7.3 Peak Search

The controls on the **Peak Search** tab allow you to move the marker to selected peaks of the signal, giving you enormous analysis capabilities, particularly when combined with the Delta Marker function.

NOTE Pressing the **Peak Search** hardkey automatically moves you to the **Peak Search** page of the **Marker** menu *and* performs a Peak Search.

Pressing the **Peak Search** tab once you are already *in* the **Marker** menu does *not* perform a Peak Search.

Marker Frequency

The **Marker Frequency** control is the fundamental control that you use to move a marker around on the trace. This is the same as the Marker Frequency control on the **Settings** tab.

Peak Search

Pressing the **Peak Search** control moves the selected marker to the trace point which has the maximum y-axis value for that marker's trace.

NOTE Pressing the **Peak Search** hardkey automatically moves you to the Peak Search page of the Marker menu *and* performs a Peak Search.

Remote Command	:CALCulate:SPURious:MARKer[1]|2|...|12:MAXimum
Example	:CALC:SPUR:MARK2:MAX :SYST:ERR? can be used to query the errors to determine if a peak is found. The message “No peak found” will be returned after an unsuccessful search
Notes	Sending this command selects the subopcoded marker In the WCDMA mode, this command does not work when the selected marker is located on the polar trace. In this case, the command is ignored

Next Peak

Pressing **Next Peak** moves the selected marker to the peak that is next lower in amplitude than the current marker value.

If the selected marker was `OFF`, then it is turned on as a `POSition` marker and a peak search is performed.

Remote Command	`:CALCulate:SPURious:MARKer[1]|2|...|12:MAXimum:NEXT`
Example	`:CALC:SPUR:MARK2:MAX:NEXT`
Notes	Sending this command selects the subopcoded marker
State Saved	Not part of saved state

Next Pk Right

Pressing **Next Pk Right** moves the selected marker to the nearest peak right of the current marker.

If the selected marker was `OFF`, then it is turned on as a `POSition` marker and a peak search is performed.

Remote Command	`:CALCulate:SPURious:MARKer[1]|2|...|12:MAXimum:RIGHt`
Example	`:CALC:SPUR:MARK2:MAX:RIGH`
Notes	Sending this command selects the subopcoded marker
State Saved	Not part of saved state

Next Pk Left

Pressing **Next Pk Left** moves the selected marker to the nearest peak left of the current marker.

If the selected marker was `OFF`, then it is turned on as a `POSition` marker and a peak search is performed.

Remote Command	`:CALCulate:SPURious:MARKer[1]|2|...|12:MAXimum:LEFT`
Example	`:CALC:SPUR:MARK2:MAX:LEFT`
State Saved	Not part of saved state

Minimum Peak

Moves the selected marker to the minimum Y-Axis value on the current trace.

If the selected marker is `OFF`, it is turned `ON` before the minimum search is performed.

Remote Command	`:CALCulate:SPURious:MARKer[1]|2|...|12:MINimum`
Example	`:CALC:SPUR:MARK:MIN`
Notes	Sending this command selects the subopcoded marker
State Saved	Not part of saved state

Pk-Pk Search

Finds and displays the amplitude and frequency (or time, if in zero span) differences between the highest and lowest y-axis value. It places the selected marker on the minimum value on its selected trace, and places that marker's reference marker on the peak of its selected trace.

This function turns on the reference marker and sets its mode to **Fixed** or **Normal** if it is not already on. (These markers may be on two different traces.)

If the selected marker is off, a delta type marker is turned on and the peak-to-peak search is done. If the selected marker is on, but it is not a delta marker, then it is changed to delta which turns on the reference marker if needed, and then it performs the peak-to-peak function.

Remote Command	`:CALCulate:SPURious:MARKer[1]|2|...|12:PTPeak`
Example	`:CALC:SPUR:MARK:PTP`
Notes	Turns on the Marker D active function Sending this command selects the subopcoded marker
Dependencies	Pk-Pk Search is not available when **Coupled Markers** is on
Couplings	The selected marker becomes a delta marker if not already in delta mode
State Saved	Not part of saved state

Marker Delta

Pressing this button has exactly the same effect as pressing the **Delta** selection on the **Marker Mode** radio button on the **Settings** tab. The selected marker becomes a Delta Marker. If the selected marker is already a Delta marker, the reference marker is moved to the current position of the selected marker, thus resetting the Delta to zero.

The control is duplicated here in the **Peak Search** Menu to allow you to conveniently perform a peak search, and change the marker's control mode to Delta without having to access two separate menus.

3.11.7.4 Properties

The controls on the **Properties** tab are used to set certain properties of the selected marker.

Marker Frequency

The **Marker Frequency** control is the fundamental control that you use to move a marker around on the trace. This is the same as the Marker Frequency control on the **Settings** tab.

Relative To

Selects the marker to which the selected marker is relative (its reference marker).

Every marker has another marker to which it is relative. This marker is referred to as the "reference marker" for that marker. This attribute is set by the **Marker, Properties, Relative To** control. The marker must be a **Delta** marker to make this attribute relevant. If it is a **Delta** marker, the reference marker determines how the marker is controlled and how its value is displayed. A marker cannot be relative to itself.

Remote Command	`:CALCulate:SPURious:MARKer[1]|2|...|12:REFerence <integer>` `:CALCulate:SPURious:MARKer[1]|2|...|12:REFerence?`
Example	`:CALC:SPUR:MARK3:REF 5` `:CALC:SPUR:MARK:REF?`
Notes	This command causes the marker specified with the subopcode to become selected Range (for SCPI command): 1 to 12. If the range is exceeded the value is clipped A marker cannot be relative to itself, so that choice is not available, and if sent from SCPI generates error -221: "Settings conflict; marker cannot be relative to itself" When queried a single value is returned (the specified marker numbers relative marker)
Couplings	The act of specifying the selected marker's reference marker makes the selected marker a Delta marker If the reference marker is off it is turned on in **Normal** mode at the delta marker location
Preset	The preset default "Relative To" marker (reference marker) is the next higher numbered marker (current marker +1). For example, if marker 2 is selected, then it's default reference marker is marker 3. The exception is marker 12, which has a default reference of marker 1 Set to the defaults by using **Restore Mode Defaults.** This is not reset by **Marker Off**, **All Markers Off**, or **Preset**
State Saved	Saved in instrument state. Not affected by Marker Off and hence not affected by Preset or power cycle
Min	1
Max	12
Annunciation	Appears in the marker label of a **Delta** marker

Marker Trace

Selects the trace on which you want your marker placed. A marker is associated with one and only one trace.

This trace is used to determine the placement, result, and X-Axis Scale of the marker.

All markers have an associated trace; it is from that trace that they determine their attributes and behaviors, and it is to that trace that they go when they become Normal markers.

Specifying a Marker Trace manually or with this command associates the marker with the specified trace. If the marker is not OFF, it moves the marker from the trace it was on to the new trace. If the marker is OFF, it stays off but is now associated with the specified trace.

The query returns the trace name on which the marker is currently placed.

Remote Command	`:CALCulate:SPURious:MARKer[1]|2|...|12:TRACe:ATTached TRACe1 | TRACe2 | TRACe3` `:CALCulate:SPURious:MARKer[1]|2|...|12:TRACe:ATTached?`
Example	`:CALC:SPUR:MARK2:TRAC:ATT TRAC2` `:CALC:SPUR:MARK2:TRAC:ATT?`
Notes	A marker may be placed on a blanked and/or inactive trace, even though the trace is not visible and/or updating. An application may register a trace name to be displayed on the control instead of a trace number.
Couplings	The state of Marker Trace is not affected by the "Auto Couple" on page 1718 key If a Marker Trace is chosen manually, Auto Initialize goes to `OFF` for that marker Sending the remote command causes the addressed marker to become selected
Preset	`TRACe1`
State Saved	Saved in instrument state
Range	`TRACe1|TRACe2|TRACe3`

Marker Settings Diagram

The Marker Settings Diagram lets you configure the Marker system using a visual utility. This is the same as the "Marker Settings Diagram" on page 1496 control on the **Settings** tab.

3.11.8 Meas Setup

The **Meas Setup** menu panel contains functions for setting up the measurement parameters and also contains functions for setting up parameters global to all measurements in the mode.

3.11.8.1 Settings

The Settings tab contains frequently-used Meas Setup functions, to which you will want the fastest access.

Avg/Hold Num

Specifies the number of measurement averages used to calculate the measurement result. The average is displayed at the end of each sweep.

Remote Command	`[:SENSe]:SPURious:AVERage:COUNt <integer>` `[:SENSe]:SPURious:AVERage:COUNt?`
Example	`:SPUR:AVER:COUN 2500` `:SPUR:AVER:COUN?`
Preset	10
State Saved	Saved in instrument state
Min/Max	1/10000

Averaging On/Off

Turns Averaging on or off.

NOTE: In this measurement, the **Average Type** is preset to the `Log-Pwr Avg (Video)` method. Other averaging methods are not available.

Remote Command	`[:SENSe]:SPURious:AVERage[:STATe] ON | OFF | 1 | 0` `[:SENSe]:SPURious:AVERage[:STATe]?`
Example	`:SPUR:AVER ON` `:SPUR:AVER?`
Preset	`OFF`
State Saved	Saved in instrument state
Range	`ON|OFF`

Average Mode

Enables you to set the Averaging Mode. Options are:

- `EXPonential`: The measurement averaging continues using the specified number of averages to compute each averaged value. The average will be displayed at the end of each sweep
- `REPeat`: The measurement resets the average counter each time the specified number of averages is reached

Remote Command	`[:SENSe]:SPURious:AVERage:TCONtrol EXPonential | REPeat` `[:SENSe]:SPURious:AVERage:TCONtrol?`

Example	`:SPUR:AVER:TCON REP` `:SPUR:AVER:TCON?`
Preset	`EXPonential`
State Saved	Saved in instrument state
Range	`EXPonential|REPeat`

Meas Type

Selects either `EXAMine` or `FULL` measurement type. This parameter is coupled to "Average Mode" on page 1503. Therefore, if the `EXAMine` measurement type is selected, the measurement sets the Average Mode to exponential. If the `FULL` measurement type is selected, the measurement sets the Average Mode to repeat. The behavior of each measurement type is described in the table below. When averaging is on, trace averaging is used as each active range is measured. Averaging is not used at any other time.

Type	Single		Continuous	
	No Spurs Found	Spurs Found	No Spurs Found	Spurs Found
`EXAMine`	All active ranges are measured. On completion the measurement is set to the idle state and the 'No Spurs' happening is displayed	All active ranges are measured and the spurs found reported. On completion the measurement is set to the idle state and the trace containing the worst spur restored. The spur control is enabled. A marker is also added which is set to the frequency of the worst spur	All active ranges are measured. On completion the SA remains set to last range checked with an active trace and the 'No Spurs' happening is displayed	All active ranges are measured and the spurs found reported. On completion the SA is set to the range containing the worst spur found and continually sweeps this range. Note that the trace is continually updated but the metrics results aren't updated until restart to keep the initial results as references. Use marker readouts to refer the latest results. The spur control is enabled. A marker is also added which is set to the

Type	Single		Continuous	
	No Spurs Found	Spurs Found	No Spurs Found	Spurs Found
				frequency of the worst spur
FULL	All active ranges are measured. On completion measurement is set to idle state and the 'No Spurs' happening is displayed	All active ranges are measured and spurs found reported. On completion the measurement is set to the idle state, displaying the trace of the last active range	Measurement continually cycles through all active ranges	All active ranges are measured and spurs found reported. On each cycle of the active ranges the spurs found are reset. This ensures any remote queries retrieve the trace data that matches the currently displayed results

Remote Command	`[:SENSe]:SPURious:TYPE EXAMine | FULL` `[:SENSe]:SPURious:TYPE?`
Example	`:SPUR:TYPE FULL` `:SPUR:TYPE?`
Preset	`EXAMine`
State Saved	Saved in instrument state
Range	`EXAMine|FULL`

Spur

Displays any spurs found. Only enabled when the measurement type is set to `EXAMine`, and will turn on upon completion of a measurement. Once the **Spur** control has been enabled, you can view any spur. The measurement sets the instrument to the range in which the currently selected spur was found. The range settings only change if the spur selected is in a range that is different from the current range settings. A marker is used to identify the currently selected spur on the trace.

Remote Command	`[:SENSe]:SPURious:SPUR <integer>` `[:SENSe]:SPURious:SPUR?`
Example	`:SPUR:SPUR 55` `:SPUR:SPUR?`
Preset	1
State Saved	No

Min/Max	1/200

Range

Selects the sweep range to show the trace in the display. Marker operation such as peak search is performed in the selected range.

Preset	1
State Saved	No
Min/Max	1/20

Spur Report Mode

Selects the spurious report mode. Options are:

Limit Line Test	`LIMTest`	Report only spurs above the limit line. Any spurs reported will cause the measurement to fail. See Abs Start Limit for more information
All Spurs	`ALL`	Report all spurs detected by Peak Threshold and Peak Excursion
Minimum Margin	`MMARgin`	Report only the spur with the minimum margin from the limit line. For the spur above the limit, its margin is defined as the negative margin. If there are more than one spurs above the limit, only one spur with the largest negative margin is reported

Remote Command	`[:SENSe]:SPURious:REPT:MODE ALL | LIMTest | MMARgin` `[:SENSe]:SPURious:REPT:MODE?`
Example	`:SPUR:REPT:MODE LIMT` `:SPUR:REPT:MODE?`
Dependencies	`MMARgin` is available only when option N9060A-7FP is installed
Preset	`ALL`
State Saved	Saved in instrument state
Range	All Spurs|Limit Test|Minimum Margin

Range Settings

The **Range Settings** dialog enables you to set range parameters. As you change values, the instrument settings are updated with the new parameter values.

In Spectrum Analyzer Mode, and most other Modes, each Range is defined by its Start Freq and Stop Freq. The index tabs which appear on the left side of the dialog let you change different sets of Range parameters; the Ranges themselves (Start Freq and Stop Freq) are the same in each of these tabs. In some tabs, Center Freq and Span are also shown, but these are dependent on the Start Freq and Stop Freq parameters for each Range.

In MSR Mode, each Range is defined by the parameters under the **Frequency** Index tab. The parameters for each Range are defined using the other index tabs, tied to the **Frequency** tab by the Range number, which appears in the leftmost column of each table.

Each Range has an **Enabled** checkbox, which lets you decide whether to use the Range or not. The checkbox state is the same for all tabs.

Bandwidth

The **Bandwidth** index tab lets you set RBW and VBW parameters for each range, as well as Filter Type. The **Bandwidth** tab appears in all Modes but MSR.

Frequency Range

Allows you to switch the displayed Frequency Range columns. When `ALL` is selected, Start Frequency, Stop Frequency, Center Frequency, and Span are displayed.

This control appears only in 4U size front panel.

Remote Command	`:DISPlay:SPURious:VIEW:RANGe:TABLe:FMODe ALL | SSTop | CSPan` `:DISPlay:SPURious:VIEW:RANGe:TABLe:FMODe?`
Example	`:DISP:SPUR:VIEW:RANG:TABL:FMOD ALL` `:DISP:SPUR:VIEW:RANG:TABL:FMOD?`
Preset	`SSTop`
State Saved	Saved in instrument state
Range	All|Start/Stop Frequency|Center Frequency/Span

Enabled

Turns on/off each Range. If Range is turned on, it will be used as part of the measurement. If it is off, it will be excluded. This parameter can send up to 20 values. The location in the list sent corresponds to the range number. When sending the remote command, missing values are not permitted; that is, if you want to change values 2 and 6 you must send all values up to 6. Subsequent values will remain as they were. The query for this parameter always returns 20 values.

Remote Command	`[:SENSe]:SPURious[:RANGe][:LIST]:STATe ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0, ON | OFF | 1 | 0`

	[:SENSe]:SPURious[:RANGe][:LIST]:STATe?
Example	:SPUR:STAT ON :SPUR:STAT?
Preset	SA: ON, ON, ON, ON, ON, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF WCDMA: ON, ON, ON, ON, ON, ON, ON, ON, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF LTETDD, LTEATDD, 5G NR: OFF, OFF, ON, ON, ON, ON, ON, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF LTE, LTEAFDD: ON, ON, ON, ON, ON, ON, ON, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF MSR: ON, ON, ON, ON, ON, ON, ON, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF
State Saved	Yes
Range	ON|OFF

Start Freq

Sets the start frequency of the instrument. This parameter can send up to 20 values. The location where the start frequency occurs in the list sent to the measurement corresponds to the range the value is associated with.

When sending the remote command, missing values are not permitted. If you want to change values 2 and 6 you must send all values up to 6. Subsequent values will remain as they were. The query for this parameter always returns 20 values.

Remote Command	[:SENSe]:SPURious[:RANGe][:LIST]:FREQuency:STARt <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq> [:SENSe]:SPURious[:RANGe][:LIST]:FREQuency:STARt?
Example	:SPUR:FREQ:STAR 9 kHz, 150 kHz, 30 MHz, 1GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz :SPUR:FREQ:STAR?
Preset	SA: +1.92000000E+009, +1.89350000E+009, +2.10000000E+009, +2.17500000E+009, +8.00000000E+008, +1.50000000E+009, +1.50000000E+009, +1.50000000E+009,

	+1.50000000E+009, +1.50000000E+009, +1.50000000E+009, +1.50000000E+009, +1.50000000E+009, +1.50000000E+009, +1.50000000E+009, +1.50000000E+009, +1.50000000E+009, +1.50000000E+009, +1.50000000E+009, +1.50000000E+009 WCDMA: 9kHz, 150kHz, 30MHz, 1GHz, 2.1GHz, 2.1GHz, 2.1774GHz, 2.18GHz, 1.5GHz, 1.5GHz, 1.5GHz, 1.5GHz, 1.5GHz, 1.5GHz, 1.5GHz, 1.5GHz, 1.5GHz, 1.5GHz, 1.5GHz, 1.5GHz LTETDD, LTEATDD, 5G NR: 9 kHz, 150 kHz, 30 MHz, 1 GHz, 1.90GHz, 2.01 GHz, 2.025 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz LTE, LTEAFDD: 9 kHz, 150 kHz, 30 MHz, 1 GHz, 1.92GHz, 1.98 GHz, 2.18 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz WLAN: 9 kHz, 150 kHz, 30 MHz, 1GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz MSR: 9 kHz, 150 kHz, 30 MHz, 1 GHz, 1.92GHz, 1.98 GHz, 2.18 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz
State Saved	Saved in instrument state
Min/Max	-80 MHz/Hardware Dependent: – Option 503: 3699999990 – Option 508: 8499999990 – Option 513: 13799999990 – Option 526: 26999999990

Stop Freq

Sets the stop frequency of the instrument. This parameter can send up to 20 values.

When sending the remote command, missing values are not permitted. If you want to change values 2 and 6, then you must send all values up to 6. Subsequent values will remain as they were. The query for this parameter always returns 20 values.

Remote Command	`[:SENSe]:SPURious[:RANGe][:LIST]:FREQuency:STOP <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>` `[:SENSe]:SPURious[:RANGe][:LIST]:FREQuency:STOP?`
Example	`:SPUR:FREQ:STOP 150kHz, 30MHz, 1GHz, 2.1GHz, 2.1GHz, 2.1774GHz, 2.18GHz, 12.75GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz` `:SPUR:FREQ:STOP?`
Preset	SA: +1.98000000E+009, +1.91960000E+009, +2.10150000E+009, +2.18000000E+009, +1.00000000E+009, +2.50000000E+009, +2.50000000E+009, +2.50000000E+009, +2.50000000E+009, +2.50000000E+009, +2.50000000E+009, +2.50000000E+009, +2.50000000E+009, +2.50000000E+009, +2.50000000E+009, +2.50000000E+009,

	+2.50000000E+009, +2.50000000E+009, +2.50000000E+009, +2.50000000E+009 WCDMA: 150kHz, 30MHz, 1GHz, 2.1GHz, 2.1GHz, 2.1774GHz, 2.18GHz, 12.75GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz LTETDD, LTEATDD, 5G NR: 150kHz, 30MHz, 1GHz, 1.90GHz, 2.01GHz, 2.025GHz, 12.75GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz LTE, LTEAFDD: 150kHz, 30MHz, 1GHz, 1.92GHz, 1.98GHz, 2.1GHz, 12.75GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz WLAN: 150kHz, 30 MHz, 1GHz, 12.75GHz, 2.5 GHz, 2.5 GHz, 2.5 GHz , 2.5 GHz, 2.5 GHz, 2.5 GHz, 2.5 GHz, 2.5 GHz, 2.5 GHz, 2.5 GHz, 2.5 GHz, 2.5 GHz, 2.5 GHz, 2.5 GHz, 2.5 GHz, 2.5 GHz MSR: 150kHz, 30MHz, 1GHz, 1.92GHz, 1.98GHz, 2.1GHz, 12.75GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz, 2.5GHz
State Saved	Yes
Min/Max	-79999990/Hardware Dependent: – Option 503: 3.7 GHz – Option 508: 8.5 GHz – Option 513: 13.8 GHz – Option 526: 27.0 GHz

Center Frequency

Sets the center frequency of the instrument. This parameter can send up to 20 values. The location where the center frequency occurs in the list sent to the measurement corresponds to the range the value is associated with.

When sending the remote command, missing values are not permitted. If you want to change values 2 and 6 you must send all values up to 6. Subsequent values will remain as they were. The query for this parameter always returns 20 values.

Remote Command	`[:SENSe]:SPURious[:RANGe][:LIST]:FREQuency:CENTer <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>` `[:SENSe]:SPURious[:RANGe][:LIST]:FREQuency:CENTer?`
Example	`:SPUR:FREQ:CENT 9 kHz, 150 kHz, 30 MHz, 1GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz` `:SPUR:FREQ:CENT?`
Preset	(Preset of Start Freq + Preset of Stop Freq)/2
State Saved	No
Min/Max	-79.999995 MHz/ Instrument maximum frequency - 5 Hz

Span

Sets the span of the instrument. This parameter can send up to 20 values. The location where the span occurs in the list sent to the measurement corresponds to the range the value is associated with.

When sending the remote command, missing values are not permitted. If you want to change values 2 and 6, then you must send all values up to 6. Subsequent values will remain as they were. The query for this parameter always returns 20 values.

Remote Command	`[:SENSe]:SPURious[:RANGe][:LIST]:FREQuency:SPAN <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>, <freq>`
	
	`[:SENSe]:SPURious[:RANGe][:LIST]:FREQuency:SPAN?`

Example	`:SPUR:FREQ:SPAN 9 kHz, 150 kHz, 30 MHz, 1GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz, 1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz,1.5 GHz`
	
	`:SPUR:FREQ:SPAN?`

Preset	(Preset of Stop Freq) - (Preset of Start Freq)
State Saved	No
Min/Max	0Hz/Instrument maximum frequency + 80MHz

Res BW

Sets the resolution bandwidth of the instrument. This parameter can send up to 20 values.

The location of where the resolution bandwidth occurs in the list sent to the measurement corresponds to the range the value is associated with.

When sending the remote command, missing values are not permitted. In other words, if you want to change values 2 and 6, then you must send all values up to 6. Subsequent values will remain as they were. The query for this parameter always returns 20 values.

Remote Command	`[:SENSe]:SPURious[:RANGe][:LIST]:BANDwidth[:RESolution]:AUTO OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1`  `[:SENSe]:SPURious[:RANGe][:LIST]:BANDwidth[:RESolution]:AUTO?`
Example	`:SPUR:BAND 1kHz, 10kHz, 100kHz, 1MHz, 1MHz, 1MHz, 1MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz`

	`:SPUR:BAND?`
	`:SPUR:BWID:AUTO ON, ON, ON, OFF, OFF, OFF, OFF, OFF, ON, ON, ON, ON, OFF, OFF, OFF, OFF, OFF, OFF, ON, ON`
	`:SPUR:BWID:AUTO?`

Preset	SA: 1.2MHz, 0.51MHz, 0.1MHz, 0.1MHz, 4MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz WCDMA:1kHz, 10kHz, 100kHz, 1MHz, 1MHz, 1MHz, 1MHz, 1MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz LTETDD, LTEATDD, 5G NR: 1kHz, 10kHz, 100kHz, 1MHz, 1MHz, 1MHz, 1MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz LTE, LTEAFDD: 1kHz, 10kHz, 100kHz, 1MHz, 100kHz, 1MHz, 1MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz WLAN: 1kHz, 10kHz, 100kHz, 1MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz MSR: 1kHz, 10kHz, 100kHz, 1MHz, 100kHz, 1MHz, 1MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz SA: OFF, OFF, OFF, OFF, OFF, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON WCDMA: OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON LTE, LTEAFDD, LTETDD, LTEATDD, 5G NR: OFF, OFF, OFF, OFF, OFF, OFF, OFF, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON WLAN: OFF, OFF, OFF, OFF, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON MSR: OFF, OFF, OFF, OFF, OFF, OFF, OFF, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON
State Saved	Saved in instrument state Saved in instrument state
Min/Max	1 Hz/8 MHz
Backwards Compatibility SCPI	`[:SENSe]:SPURious[:RANGe][:LIST]:BWIDth[:RESolution]` `[:SENSe]:SPURious[:RANGe][:LIST]:BWIDth[:RESolution]:AUTO`

Meas BW

Allows you to specify a multiplier of Res BW for the measurement integration bandwidth.

Meas BW is multiplier integer number. It shows a ratio between Integration BW and Resolution BW of the measurement result:

Integ BW = Meas BW * Resolution BW

Integration BW is desired resolution bandwidth and Resolution BW is actual bandwidth for sweep. Measurement sweeps with Resolution BW and Meas BW compensates sweep resolution bandwidth to Integration BW.

When sending the remote command, missing values are not permitted; that is, if you want to change values 2 and 6, you must send all values up to 6. Subsequent values will remain as they were. The query always returns 20 values.

Remote Command	`[:SENSe]:SPURious[:RANGe][:LIST]:BANDwidth:IMULti <integer>, …` `[:SENSe]:SPURious[:RANGe][:LIST]:BANDwidth:IMULti?`
Example	`:SPUR:BAND:IMUL 1,1,1,1,1,1` `:SPUR:BAND:IMUL?`
Notes	Comma separated list of values
Preset	`1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1`
State Saved	Yes
Max	1000
Min/Max	1
Backwards Compatibility SCPI	`[:SENSe]:SPURious[:RANGe][:LIST]:BWIDth:IMULti`

Video BW

Sets the Video BW mode of the instrument. This can be Auto, where the instrument determines the optimum setting, or Manual, where you determine the setting. This parameter can send up to 20 values. The location in the list sent corresponds to the range the value is associated with. When sending the remote command, missing values are not permitted; that is, if you want to change values 2 and 6, then you must send all values up to 6. Subsequent values will remain as they were. The query always returns 20 values.

Remote Command	`[:SENSe]:SPURious[:RANGe][:LIST]:BANDwidth:VIDeo:AUTO OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1` `[:SENSe]:SPURious[:RANGe][:LIST]:BANDwidth:VIDeo:AUTO?`

Example	`:SPUR:BAND:VID 1kHz, 10kHz, 100kHz, 1MHz, 1MHz, 1MHz, 1MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz, 3MHz`
	`:SPUR:BAND:VID?`
	`:SPUR:BAND:VID:AUTO ON, ON, OFF, OFF, OFF, ON, ON, ON, OFF, OFF, OFF, OFF, OFF, OFF, OFF, ON, ON, ON, ON, ON`
	`:SPUR:BAND:VID:AUTO?`

Preset	SA, WCDMA, WLAN: Automatically calculated LTE, LTEAFDD, MSR: 4.7kHz, 47kHz, 470kHz, 5MHz, 470kHz, 5MHz, 5MHz, 300kHz, 300kHz, 300kHz, 300kHz, 300kHz, 300kHz, 300kHz, 300kHz, 300kHz, 300kHz, 300kHz, 300kHz, 300kHz

	LTETDD, LTEATDD 4.7kHz, 47kHz, 470kHz, 5MHz, 5MHz, 5MHz, 5MHz, 300kHz, 300kHz, 300kHz, 300kHz, 300kHz, 300kHz, 300kHz, 300kHz, 300kHz, 300kHz, 300kHz, 300kHz, 300kHz 5G NR 100 Hz, 1 kHz, 10 kHz, 100 kHz, 100 kHz, 100 kHz, 100 kHz, 300 kHz, 300 kHz, 300 kHz, 300 kHz, 300 kHz, 300 kHz, 300 kHz, 300 kHz, 300 kHz, 300 kHz, 300 kHz, 300 kHz, 300 kHz ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON unless noted below LTE, LTEAFDD, LTETDD, LTEATDD, MSR: OFF, OFF, OFF, OFF, OFF, OFF, OFF, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON
State Saved	Saved in instrument state Saved in instrument state
Min/Max	1 Hz/50 MHz
Backwards Compatibility SCPI	[:SENSe]:SPURious[:RANGe][:LIST]:BWIDth:VIDeo [:SENSe]:SPURious[:RANGe][:LIST]:BWIDth:VIDeo:AUTO

Filter Type

In addition to the Gaussian filter shape, there are certain special filter types, such as Flat Top, that are desirable under certain conditions. The **Filter Type** menu gives you control over these parameters.

Remote Command	[:SENSe]:SPURious[:RANGe][:LIST]:BANDwidth:SHAPe GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop, GAUSsian | FLATtop [:SENSe]:SPURious[:RANGe][:LIST]:BANDwidth:SHAPe?
Example	:SPUR:BAND:SHAP GAUS, GAUS, GAUS, GAUS, GAUS, GAUS, FLAT, FLAT, FLAT, FLAT, FLAT, GAUS, GAUS, GAUS, GAUS, GAUS, FLAT, FLAT, GAUS, GAUS :SPUR:BAND:SHAP?
Preset	GAUS, GAUS, GAUS, GAUS, GAUS, GAUS, GAUS, GAUS, GAUS, GAUS, GAUS, GAUS, GAUS, GAUS, GAUS, GAUS, GAUS, GAUS, GAUS, GAUS
State Saved	Saved in instrument state
Range	Gaussian (Normal)|Flattop
Backwards Compatibility SCPI	[:SENSe]:SPURious[:RANGe][:LIST]:BWIDth:SHAPe

Filter/Atten

This tab lets you set Attenuation and IF Gain values for each Range. The Atten tab appears in all Modes but MSR.

Frequency Range

Same as Frequency Range under the **Bandwidth** index tab. See "Frequency Range" on page 1507.

Enabled

Same as Enabled under the **Bandwidth** index tab. See"Enabled" on page 1507.

Start Freq

Same as the Start Freq column under the **Bandwidth** index tab. See"Start Freq" on page 1508.

Stop Freq

Same as the Stop Freq column under the **Bandwidth** index tab. See"Stop Freq" on page 1509.

Center Frequency

Same as the Center column under the **Bandwidth** index tab. See"Center Frequency" on page 1510.

Span

Same as the Span column under the **Bandwidth** index tab. See "Span" on page 1511.

Attenuation

Defines attenuation value for each range:

`ON`	The Attenuation value under AMPTD Y Scale is used
`OFF`	This value is used as mechanical attenuation value without electric attenuation

Remote	`[:SENSe]:SPURious[:RANGe][:LIST]:ATTenuation:AUTO OFF | ON | 0 | 1,`

Command	`OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1` `[:SENSe]:SPURious[:RANGe][:LIST]:ATTenuation:AUTO?`

Example	`:SPUR:ATT 10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB`
	`:SPUR:ATT?`
	`:SPUR:ATT:AUTO 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0`
	`:SPUR:ATT:AUTO?`

Couplings	"---" is displayed as value when Auto state is ON, to indicate attenuation value under AMPTD Y Scale is being used
Preset	10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB, 10dB `ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON`
State Saved	Saved in instrument state Saved in instrument state
Range	Auto|Man
Min/Max	0 dB/70 dB

IF Gain

Sets the IF Gain function to Auto, On (the extra 10 dB) or Off. These settings affect sensitivity and IF overloads. A switched IF amplifier with approximately 10 dB of gain is available. This amplifier takes full advantage of the RF dynamic range of the instrument. When it can be turned on without an overload, the dynamic range is always better with the amplifier on than off.

Dependencies	The IF Gain controls (FFT IF Gain and Swept IF Gain) have no effect when the U7227A USB Preamplifier is connected. This is not annotated or reflected on any control; there are no controls grayed out nor any SCPI locked out. The instrument simply behaves as though both FFT IF Gain and Swept IF Gain are set to Low regardless of the setting on the controls

IF Gain Auto

Activates the rules for auto IF Gain.

Remote Command	`[:SENSe]:SPURious:IF:GAIN:AUTO[:STATe] OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1`

	`[:SENSe]:SPURious:IF:GAIN:AUTO[:STATe]?`
Example	`:SPUR:IF:GAIN:AUTO ON,ON` `:SPUR:IF:GAIN:AUTO?`
Couplings	When the sweep type is Swept, 'Auto' sets IF Gain to High Gain under any of the following conditions: the input attenuator is set to 0 dB, the preamp is turned on, or the Max Mixer Level is –20 dBm or lower. For other settings using the swept sweep type, auto sets IF Gain to Low Gain
Preset	`OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF`
State Saved	Saved in instrument state

IF Gain State

Selects the range of IF Gain.

Remote Command	`[:SENSe]:SPURious:IF:GAIN[:STATe] OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1` `[:SENSe]:SPURious:IF:GAIN[:STATe]?`
Example	`:SPUR:IF:GAIN ON,ON` `:SPUR:IF:GAIN?`
Preset	`OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF`
State Saved	Saved in instrument state
Range	Low|High

Meas BW

Same as the Meas BW column under the **Bandwidth** index tab. See"Meas BW" on page 1512.

Detector/Sweep

The **Detector/Sweep** tab lets you set Sweep, IF Gain and Detector parameters for each Range.

Frequency Range

Same as **Frequency Range** under the **Bandwidth** index tab. See "Frequency Range" on page 1507. This control does not appear in MSR mode.

Enabled

Same as the **Enabled** checkbox under the **Bandwidth** index tab. See"Enabled" on page 1507.

Start Freq

Same as the Start Freq column under the **Bandwidth** index tab. See"Start Freq" on page 1508. This column does not appear in MSR mode.

Stop Freq

Same as the Stop Freq column under the **Bandwidth** index tab. See"Stop Freq" on page 1509. This column does not appear in MSR mode.

Center Frequency

Same as the Center column under the **Bandwidth** index tab. See"Center Frequency" on page 1510. This column does not appear in MSR mode.

Span

Same as the Span column under the **Bandwidth** index tab. See "Span" on page 1511. This column does not appear in MSR mode.

Sweep Time

Sets the sweep time mode of the instrument. This can be Auto, where the instrument determines the optimum setting, or Manual, where you determine the setting.

This parameter can send up to 20 values. The location in the list sent corresponds to the range of the associated value. When sending the remote command, missing values are not permitted. If you want to change values 2 and 6, then you must send all values up to 6. Subsequent values will remain as they were. The query always returns 20 values.

Remote Command	`[:SENSe]:SPURious[:RANGe][:LIST]:SWEep:TIME:AUTO OFF | ON | 0 | 1,OFF | ON | 0 | 1,OFF | ON | 0 | 1,OFF | ON | 0 | 1,OFF | ON | 0 | 1,OFF | ON | 0 | 1,OFF | ON | 0 | 1,OFF | ON | 0 | 1,OFF | ON | 0 | 1,OFF | ON | 0 | 1,OFF | ON | 0 | 1,OFF | ON | 0 | 1,OFF | ON | 0 | 1,OFF | ON | 0 | 1,OFF | ON | 0 | 1,OFF | ON | 0 | 1,OFF | ON | 0 | 1,OFF | ON | 0 | 1,OFF | ON | 0 | 1,OFF | ON | 0 | 1`   `[:SENSe]:SPURious[:RANGe][:LIST]:SWEep:TIME:AUTO?`

Example	`:SPUR:SWE:TIME 10,10,10,10,10,10,10,10,10,10,10,10,10,10,10,10,10,10,10,10`
	`:SPUR:SWE:TIME?`
	`:SPUR:SWE:TIME:AUTO ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON`
	`:SPUR:SWE:TIME:AUTO?`

Preset	Automatically calculated `ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON`
State Saved	Saved in instrument state Saved in instrument state
Range	`OFF|ON`
Min/Max	1.0E-3/2.0E+3

Points

Sets the number of points per sweep for the measurement. This parameter can send up to 20 values. The location in the list sent corresponds to the range of the associated value. When sending the remote command, missing values are not permitted. If you want to change values 2 and 6, then you must send all values up to 6. Subsequent values will remain as they were. The query always returns 20 values.

The Points mode can be manual, where you determine the setting or auto, where the instrument determines the number of trace points to ensure the sweep points resolution equals RBW/2. This is calculated using the following algorithm:

Points = (Stop Freq – Start Freq) / (ResBW / 2)

with the computed values being clipped to a minimum of 601 and a maximum of 20001.

Remote Command	`[:SENSe]:SPURious[:RANGe][:LIST]:SWEep:POINts:AUTO OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1` `[:SENSe]:SPURious[:RANGe][:LIST]:SWEep:POINts:AUTO?`

Example	`:SPUR:SWE:POIN 1001,1001,1001`
	`:SPUR:SWE:POIN?`
	`:SPUR:SWE:POIN:AUTO ON,ON,ON`
	`:SPUR:SWE:POIN:AUTO?`

Preset	SA, 5G NR: +601, +601, +601, +601, +601, +601, +601, +601, +601, +601, +601, +601, +601, +601, +601, +601, +601, +601, +601, +601 WCDMA: 601, 2985, 9700, 1100, 601, 601, 601, 10570, 601, 601, 601, 601, 601, 601, 601, 601, 601,

	601, 601, 601
	LTE, LTETDD, LTEAFDD, LTEATDD, WLAN, MSR: Automatically calculated
	`OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF`
	unless noted below
	LTE, LTETDD, LTEAFDD, LTEATDD, MSR:
	`ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON`

State Saved	Saved in instrument state Saved in instrument state
Range	`OFF|ON`
Min/Max	101/20001

IF Gain

Same as the IF Gain column under the **Atten** index tab. See"IF Gain" on page 1516.

Detector 1

Sets the detector to be used by the trace for spur detection and limit line testing.

Remote Command	`[:SENSe]:SPURious[:RANGe][:LIST]:DETector[1][:FUNCtion] AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, AVERage | NEGative | NORMal | POSitive | SAMPle | RMS` `[:SENSe]:SPURious[:RANGe][:LIST]:DETector[1][:FUNCtion]?`
Example	`:SPUR:DET NORM, NORM, NORM, NORM, NORM, NORM, NORM, NORM, NORM, NORM, NORM, NORM, NORM, NORM, NORM, NORM, NORM, NORM, NORM, NORM` `:SPUR:DET?`
Notes	For backwards compatibility, `NORMal` is available as a SCPI command parameter. However, this is treated the same as `RMS` internally, so the query never returns `NORMal` as its results

Preset	POS, POS, POS, POS, POS, POS, POS, POS, POS, POS, POS, POS, POS, POS, POS, POS, POS, POS, POS, POS
State Saved	Saved in instrument state
Range	Normal|Average|Peak|Sample|Negative Peak

Detector 2

Sets the detector to be used by the trace for display purposes only.

Remote Command	[:SENSe]:SPURious[:RANGe][:LIST]:DETector2[:FUNCtion] OFF | AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, OFF | AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, OFF | AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, OFF | AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, OFF | AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, OFF | AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, OFF | AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, OFF | AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, OFF | AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, OFF | AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, OFF | AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, OFF | AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, OFF | AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, OFF | AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, OFF | AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, OFF | AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, OFF | AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, OFF | AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, OFF | AVERage | NEGative | NORMal | POSitive | SAMPle | RMS, OFF | AVERage | NEGative | NORMal | POSitive | SAMPle | RMS [:SENSe]:SPURious[:RANGe][:LIST]:DETector2[:FUNCtion]?
Example	:SPUR:DET2 AVER, AVER, AVER, AVER, AVER, AVER, AVER, AVER, AVER, AVER, AVER, AVER, AVER, AVER, AVER, AVER, AVER, AVER, AVER, AVER :SPUR:DET2?
Notes	For backward compatibility, "NORMal" is available as a SCPI command parameter. However, this is treated same as "RMS" internally, so the query never returns "NORMal" as its results.
Preset	OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF, OFF
State Saved	Saved in instrument state
Range	Off| Normal|Average|Peak|Sample|Negative Peak

Limits

The **Limits** tab lets you set Start and Stop Limits and Threshold values for each Range.

Frequency Range

Same as **Frequency Range** under the **Bandwidth** index tab. See "Frequency Range" on page 1507.

Enabled

Same as the **Enabled** checkbox under the **Bandwidth** index tab. See"Enabled" on page 1507.

Start Freq

Same as the Start Freq column under the **Bandwidth** index tab. See"Start Freq" on page 1508. This column does not appear in MSR.

Stop Freq

Same as the Stop Freq column under the **Bandwidth** index tab. See"Stop Freq" on page 1509. This column does not appear in MSR.

Center Frequency

Same as the Center column under the **Bandwidth** index tab. See"Center Frequency" on page 1510. This column does not appear in MSR mode.

Span

Same as the Span column under the **Bandwidth** index tab. See "Span" on page 1511. This column does not appear in MSR mode.

Abs Start Limit

Determines the limit above which spurs will report a failing. If Abs Stop Limit Mode is set to **Auto**, this is coupled to Abs Stop Limit to make a flat limit line. If set to **Man**, Abs Start Limit and Abs Stop Limit can take different values to make a sloped limit line.

If the Limit Line Test parameter is off, then any spurs that are found to be above the current ‘Peak Excursion’ are added to the results table. From these spurs, the amplitude is checked using the abs limit start and abs limit stop parameters, then the limit is calculated. An ‘F’ is appended to the amplitude value of the spur if the measured amplitude is above the limit. If the Limit Line Test is on, only the spurs whose amplitudes exceed the limit are reported.

This parameter can send up to 20 values. The location in the list sent corresponds to the range of the associated value. When sending the remote command, missing values are not permitted. If you want to change values 2 and 6, then you must send all values up to 6. Subsequent values will remain as they were. The query always returns 20 values.

Remote Command	`:CALCulate:SPURious[:RANGe][:LIST]:LIMit:ABSolute[:UPPer]:DATA[:STARt] <ampl>, <ampl>, <ampl>, <ampl>, <ampl>, <ampl>, <ampl>, <ampl>, <ampl>, <ampl>, <ampl>, <ampl>, <ampl>, <ampl>, <ampl>, <ampl>, <ampl>, <ampl>, <ampl>, <ampl>` `:CALCulate:SPURious[:RANGe][:LIST]:LIMit:ABSolute[:UPPer]:DATA[:STARt]?`
Example	`:CALC:SPUR:LIM:ABS:DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0` `:CALC:SPUR:LIM:ABS:DATA?`
Preset	SA: -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001 WCDMA: -36dBm, -36dBm, -36dBm, -30dBm, -25dBm, -15dBm, -25dBm, -30dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm LTE, LTEAFDD, MSR: -36dBm, -36dBm, -36dBm, -30dBm, -96dBm, -30dBm, -30dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm LTETDD, LTEATDD, 5G NR: -36dBm, -36dBm, -36dBm, -30dBm, -30dBm, -30dBm, -30dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm WLAN: -36dBm, -36dBm, -36dBm, -30dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm
State Saved	Saved in instrument state
Min/Max	-200.0 dBm/50.0 dBm

Abs Stop Limit

Abs Stop Limit is used to determine the limit above which spurs will report a failing. If Abs Stop Limit Mode is set to **Auto**, this is coupled to Abs Start Limit to make a flat limit line. If set to **Man**, Abs Start Limit and Abs Stop Limit can take different values to make a sloped limit line.

Abs Stop Limit Mode, when set to Couple, couples Abs Start Limit and Abs Stop Limit to make a flat limit line. If set to Man, Abs Start and Abs Stop can take different values to make a sloped limit line.

This parameter can send up to 20 values. The location in the list sent corresponds to the range of the associated value. When sending the remote command, missing values are not permitted; that is, if you want to change values 2 and 6, then you must send all values up to 6. Subsequent values will remain as they were. The query for this parameter always returns 20 values.

Remote Command	`:CALCulate:SPURious[:RANGe][:LIST]:LIMit:ABSolute[:UPPer-]:DATA:STOP:AUTO OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1, OFF | ON | 0 | 1` `:CALCulate:SPURious[:RANGe][:LIST]:LIMit:ABSolute[:UPPer-]:DATA:STOP:AUTO?`

Example	`:CALC:SPUR:LIM:ABS:DATA:STOP -25, -25, -25, -25, -25, -25, -25, -25, -25, -25, -25, -25, -25, -25, -25, -25, -25, -25, -25, -25`
	`:CALC:SPUR:LIM:ABS:DATA:STOP?`
	`:CALC:SPUR:LIM:ABS:DATA:STOP:AUTO ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON, ON`
	`:CALC:SPUR:LIM:ABS:DATA:STOP:AUTO?`

Preset	SA: -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001, -5.00000000E+001 WCDMA: -36dBm, -36dBm, -36dBm, -30dBm, -25dBm, -15dBm, -25dBm, -30dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm LTETDD, LTEATDD, 5G NR: -36dBm, -36dBm, -36dBm, -30dBm, -30dBm, -30dBm, -30dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm LTE, LTEAFDD, MSR: -36dBm, -36dBm, -36dBm, -30dBm, -96dBm, -30dBm, -30dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm WLAN: -36dBm, -36dBm, -36dBm, -30dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm, -50dBm `ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON,ON`
State Saved	Saved in instrument state Saved in instrument state
Min/Max	-200.0 dBm/50.0 dBm

Peak Excursion

Sets the minimum amplitude variation of signals that can be identified as peaks. If a value of 6 dB is selected, peaks that rise and fall more than 6 dB above the peak threshold value are identified.

This parameter can send up to 20 values. The location in the list sent corresponds to the range of the associated value. When sending the remote command, missing values are not permitted. If you want to change values 2 and 6 you must send all values up to 6. Subsequent values will remain as they were. The query for this parameter always returns 20 values.

Remote Command	[:SENSe]:SPURious[:RANGe][:LIST]:PEAK:EXCursion <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl>, <rel_ampl> [:SENSe]:SPURious[:RANGe][:LIST]:PEAK:EXCursion?
Example	:SPUR:PEAK:EXC 20,20, 20, 20, 20, 20, 20, 20, 20, 20, 20, 20, 20, 20, 20, 20, 20, 20, 20, 20 :SPUR:PEAK:EXC?
Preset	+6.00000000E+000, +6.00000000E+000, +6.00000000E+000, +6.00000000E+000, +6.00000000E+000, +6.00000000E+000, +6.00000000E+000, +6.00000000E+000, +6.00000000E+000, +6.00000000E+000, +6.00000000E+000, +6.00000000E+000, +6.00000000E+000, +6.00000000E+000, +6.00000000E+000, +6.00000000E+000, +6.00000000E+000, +6.00000000E+000, +6.00000000E+000, +6.00000000E+000
State Saved	Saved in instrument state
Min/Max	0.0 dB/100.0 dB

Pk Threshold

Sets the minimum amplitude of signals that can be identified as peaks. For example, if a value of -90 dBm is selected, only peaks that rise and fall more than the peak excursion value which are above –90 dBm are identified.

This parameter can send up to 20 values. The location in the list sent corresponds to the range of the associated value. When sending the remote command, missing values are not permitted. If you want to change values 2 and 6, then you must send all values up to 6. Subsequent values will remain as they were. The query for this parameter always returns 20 values.

Remote Command	[:SENSe]:SPURious[:RANGe][:LIST]:PEAK:THReshold <real>, <real>, <real>, <real>, <real>, <real>, <real>, <real>, <real>, <real>, <real>, <real>, <real>, <real>, <real>, <real>, <real>, <real>, <real>, <real> [:SENSe]:SPURious[:RANGe][:LIST]:PEAK:THReshold?
Example	:SPUR:PEAK:THR 0,0,0 :SPUR:PEAK:THR?
Preset	-9.00000000E+001, -9.00000000E+001, -9.00000000E+001, -9.00000000E+001, -9.00000000E+001, -9.00000000E+001, -9.00000000E+001, -9.00000000E+001, -9.00000000E+001, -9.00000000E+001, -9.00000000E+001, -9.00000000E+001, -9.00000000E+001, -9.00000000E+001, -9.00000000E+001, -9.00000000E+001, -9.00000000E+001, -9.00000000E+001, -9.00000000E+001, -9.00000000E+001

State Saved	Saved in instrument state
Min/Max	-200/0

Meas Setup Summary Table

The Meas Setup Summary Table lets you view and access many of the parameters in the Meas Setup menus on one screen.

Auto Couple

Immediately puts all Auto/Man functions into Auto. The **Auto Couple** action is confined to the current measurement only. It does not affect other measurements in the mode.

In the Auto state, Auto/Man functions are said to be “coupled”, meaning their values change as you make changes to other values in the measurement. This helps ensure accurate measurements and optimum dynamic range. Auto Couple is an immediate action function, and when it is executed, all the Auto/Man controls for the current measurement are set to Auto, and all measurement settings coupled to the Auto/Man parameters are automatically set to their optimal value.

For further details of measurement-specific settings (if any), see "Measurement-Specific Details" on page 1527 below.

Remote Command	`:COUPle ALL`
Example	`:COUP ALL`
Backwards Compatibility SCPI	`:COUPLE ALL | NONE`
Backwards Compatibility Notes	`:COUP:NONE` puts all Auto/Man parameters in manual mode, decoupling all the coupled instrument parameters. It is retained for backwards compatibility and is *not* recommended for making measurements or new designs

All Auto/Man parameter couplings in the measurement are set to Auto. This includes couplings that may be unavailable or grayed-out due to the current state. For example, in the Swept SA measurement, there is no Auto/Man coupling for RBW while in Zero Span. Nonetheless, if **Auto Couple** were executed while in Zero Span it would set RBW to Auto "behind the scenes" so that, on exit from Zero Span, it would be in Auto.

Any Auto/Man selection specific (local) to the other measurements in the current Mode will not be affected by **Auto Couple**. Any functions that are *not* coupled with other instrument parameters, such as ranging or leveling variables, such as "AutoRange" or "AutoScale", will not be affected.

Executing the **Auto Couple** command generates the informational message, "All Auto/Man functions have been set to Auto".

Each parameter, upon being set to Auto, selects and sets the appropriate auto-coupled value based on that parameter's coupling rules. The Dependency Resolver orchestrates the couplings for parameters that are dependent on one or more other parameters. The coupling and dependency rules for each parameter are defined in the chapter describing that parameter.

Executing the **Auto Couple** command *does not* affect markers, marker functions, trace or display attributes, or any other instrument setting other than those specifically mentioned above.

Measurement-Specific Details

TOI

Parameters affected by Auto Couple are:

- Center Frequency Step
- Resolution Bandwidth
- Span/RBW Ratio
- Sweep Time
- Video BandwidthVBW/RBW ratio
- Upper and Lower Tone (set to Sense
-)Zero span measurement Resolution Bandwidth
- Zero span measurement Dwell Time

Harmonics

For Harmonics, these parameters are:

- Resolution Bandwidth
- Fundamental Frequency
- Dwell Time
- Range Table Resolution Bandwidths
- Range Table Dwell Times

Meas Preset

Restores all measurement parameters to their default values.

Remote Command	:CONFigure:SPURious
Example	:CONF:SPUR

Fast Spurious Meas (Remote Command only)

This command is provided as the backward compatibility SCPI command of the Fast Spurious Measurement. Since this command is another representation of Spurious Report Mode, this command is coupled with the command.

- When set to ON, only spurs above the limit line are reported. This is the same as Spurious Report Mode LIMTest.
- When set to OFF, all detected spurs are reported. This is the same as Spurious Report Mode ALL.

Remote Command	[:SENSe]:SPURious:FSMeas ON | OFF | 1 | 0 [:SENSe]:SPURious:FSMeas?
Example	:SPUR:FSM ON :SPUR:FSM?
Couplings	If :SPUR:REPT:MODE is ALL, this parameter is OFF If :SPUR:REPT:MODE is LIMTest, this parameter is ON
Preset	OFF
State Saved	Saved in instrument state

3.11.8.2 Radio

The Radio tab contains controls to select the Radio Device, and enable or disable HSPA/HSPA+ options.

Radio Device

Allows you to specify the device to be used.

Remote Command	[:SENSe]:RADio:STANdard:DEVice BTS | MS [:SENSe]:RADio:STANdard:DEVice?
Example	:RAD:STAN:DEV MS :RAD:STAN:DEV?
Preset	BTS
State Saved	Saved in instrument state.
Range	BTS | MS
Backwards Compatibility SCPI	[:SENSe]:RADio:DEVice

HSPA Enable

Allows you to turn on or off the HSDPA/HSUPA option enable. This selection is necessary because some of the auto detection functions that expect an HSPA signal are less tolerant when the signal is noisy or distorted. When the HSPA signal is not expected, turn HSPA Enable off.

Remote Command	`[:SENSe]:RADio:CONFigure:HSDPa[:STATe] 0 | 1 | OFF | ON` `[:SENSe]:RADio:CONFigure:HSDPa[:STATe]?`
Example	`:RAD:CONF:HSDP 0` `:RAD:CONF:HSDP?`
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

HSPA+ Enable

Allows you to turn on or off the HSPA+ option enable. This selection is necessary because some of the auto detection functions that expect an HSPA+ signal are less tolerant when the signal is noisy or distorted. When the HSPA+ signal is not expected, turn HSPA+ Enable off.

Remote Command	`[:SENSe]:RADio:CONFigure:EHSPa[:STATe] OFF | ON | 0 | 1` `[:SENSe]:RADio:CONFigure:EHSPa[:STATe]?`
Example	`:RAD:CONF:EHSP 0` `:RAD:CONF:EHSP?`
Notes	When HSPA enable is OFF, HSPA+ function is disabled too.
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

3.11.8.3 Advanced

The **Advanced** tab contains controls for setting advanced functions of the instrument.

This tab does not appear in VXT.

This tab does not appear in the M9393A or M9391A.

Noise Floor Extension

Allows you to turn on/configure the Noise Floor Extension (NFE) function. Some Modes (such as Spectrum Analyzer Mode), support two states of NFE, Full and Adaptive. The ON state (in Modes which do not support Adaptive NFE) matches the FULL state (in Modes which DO support Adaptive NFE).

In ON or FULL NFE, the expected noise power of the instrument (derived from a factory calibration) is subtracted from the trace data. This will usually reduce the apparent noise level by about 10 dB in low band, and 8 dB in high band (>~3.6 GHz).

In Adaptive NFE, there is not the same dramatic visual impact on the noise floor as there is in Full NFE. Adaptive NFE controls the amount of correction that is applied based on other instrument settings like RBW, averaging and sweep time. Adaptive NFE controls the degree of potential improvement in the noise floor to give more improvement for those instrument settings that can make good use of the potential improvement, such as settings that provide more averaging. The result is that when not much averaging is being performed, the signal displays more like the NFE-off case; and when lots of averaging is being performed, the signal displays more like the full-NFE case.

Adaptive NFE (in Modes which support it) is recommended for general-purpose use. For fully ATE (automatic test equipment) applications, where the distraction of a person using the instrument is not a risk, Full NFE is recommended.

NFE works with any RBW, VBW, detector, any setting of Average Type, any amount of trace averaging, and any signal type. It is ineffective when the trace is not smoothed (smoothing processes include narrow VBWs, trace averaging, and long sweep times with the detector set to Average or Peak). It works best with extreme amounts of smoothing, and with the average detector, with the Average Type set to Power.

In those cases where the cancellation is ineffective, it nonetheless has no undesirable side-effects. There is no significant speed impact to having Noise Floor Extension on.

The best accuracy is achieved when substantial smoothing occurs in each point before trace averaging. Thus, when using the average detector, results are better with long sweep times and fewer trace averages. When using the sample detector, the VBW filter should be set narrow with less trace averaging, instead of a wide VBW filter with more trace averaging.

NOTE

Noise Floor Extension has no effect unless the RF Input is selected, therefore it does nothing when External Mixing is selected.

In Modes that support Adaptive NFE, the default state of NFE is Adaptive. In Modes that do not support Adaptive NFE, the default state of NFE is OFF. Prior to the introduction of Adaptive NFE (firmware version A.18.00), the default state of NFE was OFF for all Modes.

With the introduction of Adaptive NFE, the menu control is changed from On|Off to Full|Adaptive|Off. For SCPI Backwards Compatibility, the existing SCPI command to turn NFE on and off was retained, and a new command was added to set the state to turn Adaptive On and Off

`[:SENSe]:CORRection:NOISe:FLOor ON|OFF|1|0` is retained, default changed to On for modes which support Adaptive NFE

`[:SENSe]:CORRection:NOISe:FLOor:ADAPtive ON|OFF|1|0` is added (for certain Modes), default=On

FULL = `:CORRection:NOISe:FLOor ON` plus `:CORRection:NOISe:FLOor:ADAPtive ON`

Remote Command	`[:SENSe]:CORRection:NOISe:FLOor ON | OFF | 1 | 0` `[:SENSe]:CORRection:NOISe:FLOor?`
Example	`:CORR:NOIS:FLO ON`
Dependencies	This control only appears in instruments with the NFE or NF2 license installed. In all others, the control does not appear, however the SCPI command will be accepted without error (but will have no effect)
Couplings	When NFE is enabled in any mode manually, a prompt will be displayed reminding you to perform the Characterize Noise Floor operation if it is needed. If NFE is enabled through SCPI and a Characterize Noise Floor operation is needed, an error will be entered in the system error queue
Preset	Unaffected by Mode Preset. Turned ON at startup and by Restore Mode Defaults in Modes which support Adaptive. Turned OFF at startup and by Restore Mode Defaults in Modes which do not support Adaptive
State Saved	No

Remote Command	`[:SENSe]:CORRection:NOISe:FLOor:ADAptive ON | OFF | 1 | 0` `[:SENSe]:CORRection:NOISe:FLOor:ADAptive?`

Example	First turn NFE on, this is Full mode
	`:CORR:NOIS:FLO ON`
	Then set it to Adaptive
	`:CORR:NOIS:FLO:ADAP ON`

Dependencies	Only available in Modes which support Adaptive NFE Only appears in instruments with the NFE or NF2 license installed. In all others, the control does not appear, however the SCPI command will be accepted without error (but will have no effect)
Couplings	Sending `:CORR:NOIS:FLO ON` turns NFE Adaptive `OFF` for backwards compatibility. So to turn Adaptive on, you must issue the commands in the proper order, as shown in the example above
Preset	Not affected by Mode Preset, but set to `ON` at startup and by Restore Mode Defaults
State Saved	No

More Information

The instrument is characterized in the factory (or during a field calibration) with a model of the noise, referred to the input mixer, versus frequency in each band and path combination. Bands are 0 (low band) and 1 through 4 (high band) in a 26.5 GHz instrument, for example. Paths include normal paths, preamp paths, the electronic attenuator, etc.

In most band/path combinations, the noise can be well characterized based on just two parameters and the instrument frequency response before compensation for frequency-dependent losses.

After the noise density at the input mixer is estimated, the effects of the input attenuator, RBW, detector, etc. are computed to get the estimated input-port-referred noise level.

In the simplest case, the measured power (signal plus analyzer noise) in each display point (bucket) is compensated by subtracting the estimated noise power, leaving just the signal power. This is the operation when the detector is Average and the Average Type is set to Power.

In other cases, operation is often not quite as good but still highly effective. With peak detection, the noise floor is estimated based on the RBW and the duration of the bucket using the same equations used in the noise marker function. The voltage of the noise is subtracted from the voltage of the observed signal-plus-noise measurement to compute the estimated signal voltage. The peak detector is one example of processing that varies with detector to give good estimates of the signal level without the analyzer noise.

For best operation, the average detector and the power scale are recommended, as already stated. Peak detection for pulsed-RF can still give excellent effectiveness. FFT analysis does not work well, and does not do NFE well, with pulsed-RF signals, so this combination is not recommended. Negative peak detection is not very useful, either. Sample detection works well, but is never better than the average detector because it doesn’t smooth as well. The Normal detector is a combination of peak and negative peak behaviors, and works about as well as these.

For best operation, extreme smoothing is desirable, as already stated. Using narrow VBWs works well, but using very long bucket durations and the average detector works best. Reducing the number of trace points will make the buckets longer.

For best operation, the power scale (Average Type = Power) is optimum. When making CW measurements in the presence of noise without NFE, averaging on the decibel scale has the advantage of reducing the effect of noise. When using NFE, the NFE does an even better job than using the log scale ever could. Using NFE with the log scale is not synergistic, though; NFE with the power scale works a little better than NFE with log averaging type.

The results from NFE with internal preamp can often be lower than the theoretical noise in a signal source at room temperature, a noise density of -174 dBm/Hz. This is expected and useful behavior, because NFE is designed to report the amount of input signal that is in excess of the thermal noise, not the amount that includes the thermal noise. This can be a useful behavior because thermal noise often interferes with what you want to measure, instead of being part of what you want to measure. Note that NFE is not adequately accurate to always be able to read below kTB.

Adaptive NFE provides an alternative to fully-on and -off NFE. Fully-on NFE can, notably in cases with little or no averaging of the spectrum, result in a display that is distractingly unfamiliar in the variability in response to low level signals. Fully-off NFE fails to achieve the potential improvement in dynamic range and associated accuracy of measurement of low level signals. Adaptive NFE controls the degree of potential improvement in the noise floor to give more improvement for those instrument settings that can make good use of the potential improvement—those settings with high degrees of variance reduction through some variant of averaging. When the potential improvement is small, the display acts like the NFE-off case, and when it is high, it acts like the fully-on case, and in-between, application is a compromise between attractiveness and effectiveness.

On instruments with the NF2 license installed, the calibrated Noise Floor used by Noise Floor Extensions should be refreshed periodically. Keysight recommends that the **Characterize Noise Floor** operation be performed after the first 500 hours of operation, and once every calendar year. The control to perform this is located in the **System, Alignments, Advanced** menu. If you have not done this yourself at the recommended interval, then when you turn on Noise Floor Extensions, the instrument will prompt you to do so with a dialog that says:

“This action will take several minutes to perform. Please disconnect all cables from the RF input and press Enter to proceed. Press ESC to cancel, or Postpone to postpone for a week”

If you Cancel, you will be prompted again the next time you turn NFE on. If you postpone, you will be prompted again after a week passes and you then turn NFE on.

3.11.8.4 Global

The controls in this menu apply to all Modes in the instrument.

Some controls (for example, **Global Center Freq**) allow you to switch certain Meas Global parameters to a Mode Global state. These switches apply to all Modes that support global settings. For example, no matter what Mode you are in when you set **Global Center Freq** to `ON`, it applies to all Modes that support Global Settings.

Other controls (for example, **Extend Low Band**) are actually set in this menu, but apply to all Modes.

Global Center Freq

The software maintains a Mode Global value called **Global Center Freq**.

When **Global Center Freq** is switched `ON`, the current Mode’s center frequency is copied into the **Global Center Frequency**, and from then on all Modes that support global settings use the **Global Center Frequency**, so you can switch between any of these Modes and the Center Freq will remain unchanged.

Adjusting the Center Freq of any Mode that supports Global Settings, while **Global Center Freq** is `ON`, modifies the Global Center Frequency.

When **Global Center Freq** is switched OFF, the Center Freq of the current Mode is unchanged, but now the Center Freq of each Mode is once again independent.

When **Mode Preset** is pressed while **Global Center Freq** is ON, the Global Center Freq is preset to the preset Center Freq of the current Mode.

This function is reset to OFF when "Restore Defaults" on page 1737 (in this tab) is pressed, or when **System**, **Restore Defaults**, **All Modes** is pressed.

Remote Command	:INSTrument:COUPle:FREQuency:CENTer ALL | NONE :INSTrument:COUPle:FREQuency:CENTer?
Example	:INST:COUP:FREQ:CENT ALL :INST:COUP:FREQ:CENT?
Preset	Set to OFF on **Global** Settings, **Restore Defaults** and **System, Restore Defaults, All Modes**
Range	ALL|NONE

Preset	OFF
Backwards Compatibility SCPI	:GLOBal:FREQuency:CENTer[:STATe] 1 | 0 | ON | OFF :GLOBal:FREQuency:CENTer[:STATe]?

Global EMC Std

When this control is switched ON, the current Mode's EMC Std is copied into the **Global EMC Std**, and from then on all Modes that support global settings use the Global EMC Std, so you can switch between any of these Modes and the EMC Std will remain unchanged.

Adjusting the EMC Std of any Mode that supports Global Settings, while Global EMC Std is ON, will modify the **Global EMC Std**.

When **Global EMC Std** is switched OFF, the EMC Std of the current Mode is unchanged, but now the EMC Std of each Mode is once again independent. When **Mode Preset** is pressed while **Global EMC Std** is ON, the Global EMC Std is preset to the preset EMC Std of the current Mode.

This function is reset to OFF when "Restore Defaults" on page 1737 (in this tab) is pressed, or when **System, Restore Defaults, All Modes** is pressed.

Remote Command	:INSTrument:COUPle:EMC:STANdard ALL | NONE :INSTrument:COUPle:EMC:STANdard?
Example	:INST:COUP:EMC:STAN ALL :INST:COUP:EMC:STAN?
Dependencies	Only available if option EMC is installed
Preset	Set to OFF on **Global** Settings, **Restore Defaults** and **System, Restore Defaults, All Modes**

Range	ALL|NONE

Extend Low Band

The software maintains a Mode Global value called **Extend Low Band**.

Under the current sweep configuration crossing over two bands, when **Extend Low Band** is turned ON, the instrument checks whether one band can cover the whole sweep frequency range or not. If it can, then the instrument locks the band; otherwise, it does nothing (the band crossover occurs).

This function does *not* work when **Band Lock** under **System** > **Service** > **Lock Functions** is not -1 (no Band Lock). In that case, **Band Lock** takes priority over **Extend Low Band**.

This function is reset to OFF when "Restore Defaults" on page 1737 (in this tab) is pressed, or when **System**, **Restore Defaults**, **All Modes** is pressed.

This parameter is available for SA, RTSA, WCDMA, WIMAX OFDMA, LTEAFDD, LTEATDD Modes.

Remote Command	:INSTrument:COUPle:FREQuency:BAND:EXTend 0 | 1 | ON | OFF :INSTrument:COUPle:FREQuency:BAND:EXTend?
Example	:INST:COUP:FREQ:BAND:EXT 1 :INST:COUP:FREQ:BAND:EXT?
Dependencies	Only applies to UXA, PXA, MXA and EXA
Preset	Set to OFF by **Global** Settings > **Restore Defaults** and **System** > **Restore Defaults** > **All Modes**
Range	ON|OFF

Restore Defaults

Resets all of the functions in the **Global** Settings menu to OFF. This also occurs when **System**, **Restore Defaults**, **All Modes** is pressed.

Remote Command	:INSTrument:COUPle:DEFault
Example	:INST:COUP:DEF
Backwards Compatibility SCPI	:GLOBal:DEFault

3.11.9 Sweep

The **Sweep** key accesses controls that enable you to configure and control the acquisition of data and the X-axis parameters of the instrument. These controls might include Sweep Time, Continuous/Single, Pause/Resume, X Scale and number of Points.

3.11.9.1 Sweep/Control

Contains controls for the Sweep and Control functions of the instrument, such as Sweep Time and Continuous/Single.

Sweep/Measure

Allows you to toggle between Continuous and Single sweep or measurement operation. The Single/Continuous state is Meas Global, so the setting affects *all* measurements.

The front-panel key **Single/Cont** performs exactly the same function

NOTE **In the `WAVeform` measurement, this control only appears in the Meas Bar, and not in the Sweep/Control tab.**

See "More Information" on page 1536

Remote Command	`:INITiate:CONTinuous OFF | ON | 0 | 1` `:INITiate:CONTinuous?`

Example	`:INIT:CONT 0`
	`:INIT:CONT OFF`
	puts instrument into Single measurement operation
	`:INIT:CONT 1`
	`:INIT:CONT ON`
	puts instrument into Continuous measurement operation

Preset	ON Note that `:SYST:PRES` sets `:INIT:CONT` to `ON` but `*RST` sets `:INIT:CONT` to `OFF`
State Saved	Saved in instrument state
Annunciation	The **Single/Continuous** icon in the Meas Bar changes depending on the setting: – A line with an arrow is Single – A loop with an arrow is Continuous

More Information

With **Avg/Hold Num** (in the **Meas Setup** menu) set to **Off** or set to **On** with a value of 1, a sweep is taken after the trigger condition is met; and the instrument continues to take new sweeps after the current sweep has completed and the trigger condition is again met. However, with **Avg/Hold Num** set to On with a value >1, multiple sweeps (data acquisitions) are taken for the measurement. The trigger condition must be met prior to each sweep. The sweep is not stopped when the average count k equals the number N set for Avg/Hold Num is reached, but the number k stops incrementing. A measurement average usually applies to all traces, marker results, and numeric results, but sometimes only applies to the numeric results.

If the instrument is in Single measurement, pressing the **Cont/Single** toggle control does not change k and does not cause the sweep to be reset; the only action is to put the instrument into Continuous measurement operation.

If it is already in Continuous sweep:

- the `:INIT:CONT 1` command has no effect
- the `:INIT:CONT 0` command will place the instrument in Single Sweep but will have no effect on the current sequence until k = N, at which point the current sequence will stop and the instrument will go to the idle state.

See "Restart" on page 1738 control description for details on the `:INIT:IMM` (Restart) function.

If you are already in Single sweep, the `:INIT:CONT OFF` command has no effect.

If you are already in Single Sweep, then pressing the **Cont/Single** toggle control in the middle of a sweep does not restart the sweep or sequence. Similarly, pressing the **Cont/Single** toggle control does not restart the sweep or sequence if the sweep is not in the idle state (for example, if you are taking a very slow sweep, or the instrument is waiting for a trigger). Even though pressing the **Cont/Single** toggle control in the middle of a sweep does *not* restart the sweep, sending `:INIT:IMM` *does* reset it.

Restart

The **Restart** function restarts the current sweep, or measurement, or set of averaged/held sweeps or measurements. In measurements that support pausing, if you are Paused, pressing **Restart** performs a **Resume**.

The Restart function is accessed in several ways:

- Pressing the **Restart** key
- Sending the remote command `:INIT:IMM`
- Sending the remote command `:INIT:REST`

See "More Information" on page 1538

Remote Command	`:INITiate[:IMMediate]` `:INITiate:RESTart`
Example	`:INIT:IMM` `:INIT:REST`
Notes	`:INIT:REST` and `:INIT:IMM` and the front-panel **Restart** key perform exactly the same function

Couplings	Resets average/hold count k For the first sweep, overwrites all active (update=on) traces with new current data For application modes, resets other parameters as required by the measurement
Status Bits/OPC dependencies	This is an Overlapped command The `:STATus:OPERation` register bits 0 through 8 are cleared The `:STATus:QUEStionable` register bit 9 (INTegrity sum) is cleared The `SWEEPING` bit is set The `MEASURING` bit is set
Backwards Compatibility Notes	For Spectrum Analysis mode in ESA and PSA, the **Restart** hardkey and the `:INIT:REST` command restart trace averages (displayed average count reset to 1) for a trace in **Clear Write**, but did not restart **Max Hold** and **Min Hold** In the X-Series, the **Restart** hardkey and the `:INIT:REST` command restart not only **Trace Average**, but **Max Hold** and **Min Hold** traces as well For wireless comms modes in ESA and PSA, the **Restart** hardkey and the `:INIT:REST` command restarted every measurement, including all traces and numeric results. There is no change to this operation

More Information

The **Restart** function first aborts the current sweep or measurement as quickly as possible. It then resets the sweep and trigger systems, sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is in the process of aligning when a Restart is executed, the alignment finishes before the restart function is performed.

Even when set for Single operation, multiple sweeps may be taken when **Restart** is pressed (for example, when averaging/holding is on). Thus when we say that Restart "restarts a measurement," depending on the current settings, we may mean:

– It restarts the current sweep

– It restarts the current measurement

– It restarts the current set of sweeps if any trace is in Trace Average, Max Hold or Min Hold

– It restarts the current set of measurements if Averaging, or Max Hold, or Min Hold is on for the measurement

With Average/Hold Number (in Meas Setup menu) set to 1, or Averaging off, or no trace in Trace Average or Hold, a single sweep is equivalent to a single measurement. A single sweep is taken after the trigger condition is met; and the instrument stops sweeping once that sweep has completed. However, with Average/Hold Number >1 and at least one trace set to Trace Average, Max Hold, or Min Hold (SA Measurement) or Averaging on (most other measurements), multiple sweeps/data acquisitions are taken for a single measurement. The trigger condition must be met prior to each sweep. The sweep is stopped when the average count k equals the number N set for Average/Hold Number. A measurement average usually applies to all traces, marker results, and numeric results, but sometimes only applies to the numeric results.

Once the full set of sweeps has been taken, the instrument will go to the idle state. To take one more sweep without resetting the average count, increment the average count by 1, by pressing the step up key while Average/Hold Number is the active function, or by sending the remote command `:CALC:AVER:TCON UP`.

Pause/Resume

Pauses a measurement after the current data acquisition is complete.

When a measurement is paused:

- The label on this control changes to **Resume**. Pressing **Resume** un-pauses the measurement.
- Pressing **Restart** also performs a **Resume**.

Remote Command	`:INITiate:PAUSe` `:INITiate:RESume`
Example	`:INIT:PAUS` `:INIT:RES`
Dependencies	Not displayed in Modes that do not support pausing
Couplings	When Averaging is On, if the measurement is paused no more updates will occur until either a Resume or Restart occurs If the measurement is resumed, the averaging continues to use the traces from before the Pause occurred and continues to use the traces from the point where the Resume occurred. This still provides real-time traces, but they will no longer be gap free In a view with a Waterfall window, when the measurement is paused, the Waterfall stops updating. When Resume is selected, the Waterfall will retain the existing traces and continue updating using traces from the point at which Resume was selected. The time stamp of the individual Waterfall traces will show the time from the beginning of the measurement the trace relates to, showing there was a gap in the Waterfall capture In Density view, when the measurement is paused, the Density Display stops updating. When the measurement is resumed, if Persistence is `ON`, the persistence fading will continue from the point when the measurement was paused If a Restart occurs, the average counter is reset and all results are discarded. The measurement begins again, using traces after the Restart occurred

Abort (Remote Command Only)

This command stops the current measurement. It aborts the current measurement as quickly as possible, resets the sweep and trigger systems, and puts the measurement into an "idle" state. If the instrument is in the process of aligning when :ABORt is sent, the alignment finishes before the abort function is performed, so :ABORt does *not* abort an alignment.

If the instrument is set for Continuous measurement, it sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is set for Single measurement, it remains in the "idle" state until an :INIT:IMM command is received.

Remote Command	:ABORt
Example	:ABOR
Notes	If :INIT:CONT is ON, then a new continuous measurement will start immediately, with sweep (data acquisition) occurring once the trigger condition has been met If :INIT:CONT is OFF, then :INIT:IMM is used to start a single measurement, with sweep (data acquisition) occurring once the trigger condition has been met
Dependencies	For continuous measurement, :ABORt is equivalent to the **Restart** key Not all measurements support the abort command
Status Bits/OPC dependencies	The :STATus:OPERation register bits 0 through 8 are cleared The :STATus:QUEStionable register bit 9 (INTegrity sum) is cleared Since all the bits that feed into OPC are cleared by :ABORt, the :ABORt will cause the *OPC query to return true

3.11.9.2 Sweep Config

This tab accesses controls that enable you to configure the Sweep and Control functions of the instrument, such as Sweep Rules.

Sweep Type

Sets the sweep type of the spurious measurement to either Auto or Swept. When in Auto, the selections of swept type of ranges are governed by the Best Speed Sweep Type Rule, and FFT analysis might be chosen for some ranges if it speeds up the measurement.

Remote Command	[:SENSe]:SPURious[:RANGe]:ALL:SWEep:TYPE:AUTO OFF | ON | 0 | 1 [:SENSe]:SPURious[:RANGe]:ALL:SWEep:TYPE:AUTO?
Example	:SPUR:ALL:SWE:TYPE:AUTO 1 :SPUR:ALL:SWE:TYPE:AUTO?
Dependencies	This parameter is available only when option N9060A-7FP is installed
Preset	ON
State Saved	Saved in instrument state
Range	Auto|Swept

Annotation	When in Auto and the instrument is in FFT analysis, an indicator, “FFT” is displayed at the right bottom of range spectrum trace window

Sweep Time Rules

Switches the instrument between normal and accuracy sweep states.

Setting **Auto Sweep Time** to **Accy** results in slower sweep times, usually about three times as long, but yields better amplitude accuracy for CW signals. The instrument amplitude accuracy specifications only apply when **Auto Sweep Time** is set to **Accy**.

Additional amplitude errors which occur when **Auto Sweep Time** is set to **Norm** are usually well under 0.1 dB, though this is not guaranteed. Because of the faster sweep times and still low errors, **Norm** is the preferred setting of **Auto Sweep Time**. **Auto Sweep Time** is set to **Norm** on a **Preset** or **Auto Couple**. This means that in the Preset or Auto Coupled state, instrument amplitude accuracy specifications do not apply.

Remote Command	`[:SENSe]:SPURious:SWEep:TIME:AUTO:RULes NORMal | ACCuracy` `[:SENSe]:SPURious:SWEep:TIME:AUTO:RULes?`
Example	`:SPUR:SWE:TIME:AUTO:RUL ACC` `:SPUR:SWE:TIME:AUTO:RUL?`
Notes	This command is implemented as `[:SENSe]:SPURious[:RANGe][:LIST]:SWEep:TIME:AUTO:RULes` to avoid illegal SCPI node definition. So, this command should be used as `[:SENSe]:SPURious:SWEep:TIME:AUTO:RULes`
Dependencies	This control does not appear in Spectrum Analyzer Mode in VXT This control is not available in E7760
Couplings	Set to `NORMal` when **Auto Couple** is pressed or sent remotely
Preset	`NORMal`
State Saved	Saved in instrument state
Range	`NORMal|ACCuracy`

IF Dithering

Lets you turn IF Dithering on and off. IF Dithering is a technique used in unpreselected instruments (such as Keysight’s modular instruments) to enhance the rejection of images and internally-generated spurious signals.

Remote Command	`[:SENSe]:SWEep:IF:DITHer OFF | ON | 0 | 1` `[:SENSe]:SWEep:IF:DITHer?`
Dependencies	This control only appears in Spectrum Analyzer Mode in VXT
Preset	`OFF`
State Saved	Saved in instrument state

Image Protection

Lets you turn IF Protection on and off. IF Protection is a technique used in unpreselected instruments (such as Keysight's modular instruments) to detect and suppress images and spurs that may be present in non-preselected hardware.

IF Protection takes two sweeps and by correlating the data between them, provides a single, correct power-versus-frequency trace.

Remote Command	`[:SENSe]:SWEep:IMAGeprot OFF | ON | 0 | 1` `[:SENSe]:SWEep:IMAGeprot?`
Dependencies	This control only appears in Spectrum Analyzer Mode in VXT
Preset	ON
State Saved	Saved in instrument state

3.11.10 Trace

The **Trace** menu lets you control the acquisition, display, storage, detection and manipulation of trace data for the available traces. The Trace Control tab of this menu contains radio-button selections for the trace type (Trace Average, Max Hold, Min Hold) and View/Blank setting for the selected trace.

3.11.10.1 Select Trace

Specifies the *selected trace*, which is the trace that will be affected when you change trace settings.

The **Select Trace** control appears above the menu panel, indicating that it applies to *all* controls in the menu panel. **Select Trace** is blanked if you select a tab whose controls do *not* depend on the selected trace (for example, **Trace Function**).

Notes	The selected trace is remembered even when not in the **Trace** menu
Preset	Trace 1
State Saved	Yes

3.11.10.2 Trace Control

The controls on the **Trace Control** tab allow you to set the type of the Trace and its update mode.

There are four Trace Types: **Clear/Write, Trace Average, Max Hold** and **Min Hold.** Each type handles data in a different way (see "Trace Type" on page 1543).

Each trace also has two values that determine whether it is being written or not and whether it is being displayed or not. These values, **Update** and **Display,** are described more fully in the "View/Blank" on page 1544 control description; when **Update** is `ON` a trace is updating and when **Update** is `OFF` it is not; and when **Display** is `ON` it is visible and when **Display** is `OFF` it is not. These terms are used throughout the descriptions below.

When Trace Annotation (see **Display** menu) is `ON`, each non-blanked trace is labeled on the trace with the detector used to take it.

For slower sweeps a visual indicator exists on the trace where the new data is being written, a green "caret" or ^ symbol, which moves across the bottom of the graticule showing the current trace point.

Trace Type

Allows you to select the type of trace you want to you use for the current measurement. There are four Trace Types:

Type	Option	Description
Clear Write	`WRITe`	Each trace update replaces the old data in the trace with new data
Trace Average	`AVERage`	The instrument maintains and displays an average trace, which represents the cumulative average on a point-by-point basis of the new trace data and previous averaged trace data
Max Hold	`MAXHold`	The instrument maintains and displays a max hold trace, which represents the maximum data value on a point-by-point basis of the new trace data and previous trace data
Min Hold	`MINHold`	The instrument maintains and displays a min hold trace, which represents the minimum data value on a point-point basis of the new trace data and previous trace data

Besides the **Trace Type**, the state of "View/Blank" on page 1544 must be set to **Active** (**Update**ON, **Display**ON) for a trace to be updating and visible. Selecting any **Trace Type** automatically makes the trace **Active**.

Remote Command	`:TRACe[1]|2|3:SPURious:TYPE WRITe | AVERage | MAXHold | MINHold` `:TRACe[1]|2|3:SPURious:TYPE?`
Example	`:TRAC:SPUR:TYPE MINH` `:TRAC:SPUR:TYPE?`
Preset	`AVERage`
State Saved	Saved in instrument state
Range	ClearWrite|Average|MaxHold|MinHold

Clear and Write | Restart Averaging | Restart Max/Min Hold

Starts the trace writing as though the trace type had just been selected. Pressing this button is has exactly the same effect as selecting the current trace type again – it is provided because it may not be obvious that re-selecting the current selection from a radio button menu will take an action.

This button takes on different labels, depending on the "Trace Type" on page 1543:

- **Clear/Write**: Clear and Write
- **Trace Average**: Restart Averaging
- **Max Hold**: Restart Max Hold
- **Min Hold**: Restart Min Hold

View/Blank

Lets you set the state of the two trace values, **Update** and **Display**. The four choices available are:

Active	Update and Display both ON
View	Update OFF, Display ON
Blank	Update OFF, Display OFF
Background	Update ON, Display OFF This allows a trace to be blanked and continue to update "in the background", which was not possible in the past

See the tables below for details onthe SCPI remote commands to control these two variables.

Preset	Trace On
State Saved	Saved in instrument state
Range	Trace On|Blank

Trace Update State On/Off

Toggles a trace Update state between On and Off. The `OFF` selection makes the trace inactive. This does not affect whether the trace is visible or not. To change the trace visibility, see "Trace Display State On/Off" on page 1545

Remote Command	`:TRACe[1]|2|3:SPURious:UPDate[:STATe] ON | OFF | 0 | 1` `:TRACe[1]|2|3:SPURious:UPDate[:STATe]?`
Example	`:TRAC:SPUR:UPD ON` `:TRAC:SPUR:UPD?`
Couplings	Whenever you set **Update** to ON for any trace, the **Display** is set to ON for that trace
Preset	1|0|0 (ON for Trace 1; OFF for 2 &3)
State Saved	Saved in instrument state

Trace Display State On/Off

Toggles a trace Display state between On and Off. The OFF selection makes the trace not visible. This does not affect whether the trace is updating or not.

Even when not visible, traces may be queried, and markers may be placed on them.

Remote Command	:TRACe[1]|2|3:SPURious:DISPlay[:STATe] ON | OFF | 0 | 1 :TRACe[1]|2|3:SPURious:DISPlay[:STATe]?
Example	:TRAC:SPUR:DISP ON :TRAC:SPUR:DISP?
Couplings	Whenever you set **Update** to **On** for any trace, the **Display** is set to **On** for that trace
Preset	1|0|0 (ON for Trace 1; OFF for 2 &3)
State Saved	Saved in instrument state

3.11.10.3 Math

The Math tab lets you turn on and configure trace math functions.

Math Function

Trace math functions perform mathematical operations between traces and, in some cases, user-specified offsets. When in a trace math function, the indicated function is performed during the sweep with the math function used in place of a detector.

The trace operands for the math function are set using the **Trace Operands** control.

See also "More Information" on page 1547 and "How trace math is processed" on page 1549.

Remote Command	:CALCulate:SPURious:MATH TRACe1 | TRACe2 | TRACe3, PDIFference | PSUM | LOFFset | LDIFference | OFF, TRACe1 | TRACe2 | TRACe3,TRACe1 | TRACe2 | TRACe3, <real>,<real> :CALCulate:SPURious:MATH? TRACe1 | TRACe2 | TRACe3
Example	:CALC:SPUR:MATH TRAC1,PDIF,TRAC2,TRAC3,0,0 Sets Trace 1 to Power Diff trace math function, and sets the First Trace operand (for Trace 1) to Trace 2 and the Second Trace operand (for Trace 1) to Trace 3 :CALC:SPUR:MATH TRAC1,PSUM,TRAC2,TRAC3,0,0 Sets Trace 1 to Power Sum trace math function and sets the First Trace operand (for Trace 1) to Trace 2 and the Second Trace operand (for Trace 1) to Trace 3 :CALC:SPUR:MATH TRAC1,LOFF,TRAC3,TRAC2,-6.00,0 Sets Trace 1 to Log Offset trace math function, sets the First Trace operand (for Trace 1) to Trace 3, leaves the Second Trace operand (for Trace 1) unchanged (it is irrelevant for this function) and sets the Log Offset (for Trace 1) to -6 dB :CALC:SPUR:MATH TRAC1,LDIF,TRAC2,TRAC3,0,-6.00

	Sets Trace 1 to Log Diff trace math function, sets the First Trace operand (for Trace 1) to Trace 2, sets the Second Trace operand (for Trace 1) to Trace 3, and sets the Log Difference reference for Trace 1 to -6 dBm `:CALC:SPUR:MATH TRAC1,OFF,TRAC2,TRAC3,0,0` Turns off trace math for trace 1
Notes	**Math Function** has 6 main sets of parameters:

Set	Defines the "result trace"	`TRACe1|TRACe2|TRACe3`
Set 2	Defines the "function"	`PDIFference|PSUM|LOFFset|LDIFference|OFF`
Set 3	A "trace operand" (1)	`TRACe1|TRACe2|TRACe3`
Set 4	A "trace operand" (2)	`TRACe1|TRACe2|TRACe3`
Set 5	Defines the "Log Offset" (in dB)	
Set 6	Defines the "Log Difference Reference" (in dBm)	

Note that the Trace Math mode is an enumeration; that is, when a math function is set for a trace, it turns off any math function that is on for that trace and sets the new math function.

The parameters sent in the command are reflected in the values in the control menu. There is no default for any parameter; all 6 parameters must be sent to satisfy the parser. Failure to specify a parameter results in a missing parameter message

Note that, for some of the math modes, some of the parameters are not relevant. For those modes, the parameters are ignored, and sending ",," is sufficient for those parameters

The query returns the Math Mode, the operand traces, the offset and the reference for the specified trace, all separated by commas. The return value of irrelevant parameters is undefined

Remote command examples are included in each section below

Dependencies	None of the trace operands can be the destination trace. If any of the three trace math commands is sent with a destination trace number matching one of the operands, a warning is generated and the function does not turn on
Couplings	Whenever a math function other than `OFF` is selected for a trace, that trace is set to Display=`ON` and Update=`ON`
Preset	`OFF,TRACe2,TRACEe,0,0 | OFF,TRACe3,TRACe1,0,0 | OFF,TRACe1,TRACe2,0,0`
State Saved	The trace math function for each trace is saved in instrument state
Range	Power Difference|Power Sum|Log Offset|Log Difference|Off
Annunciation	The function is annotated on the trace if Trace Annotation is `ON`
Status Bits/OPC dependencies	`*OPC` can be used to detect the completion of a sweep, which will also correspond to the completion of the math operation, since all math takes place during the sweep

More Information

IMPORTANT

To generate a trace math result, *you must take a sweep*. The trace math engine, described below, operates in concert with the sweep engine in the instrument. Until a sweep has been taken, even if the constituent traces are not in Update mode, no result is generated.

Note that certain events can affect the trace in ways that affects all points at once. This can happen in any number of ways, including:

- A trace clear taking place
- A trace being loaded from the file system
- Trace data being sent in from the remote interface
- A copy or exchange of trace data

You should try to avoid these occurrences during a sweep, as they will tend to invalidate the math result being accumulated.

The Trace Math functions are:

Power Diff (Op1 - Op2)

Calculates a power difference between the `First Trace` operand and the `Second Trace` operand and puts the result in the destination trace.

During the sweep, the following formula is executed for each point in the trace operands, and the corresponding point is generated for the destination trace:

```
DestinationTrace = 10 log(10(1/10)(FirstTrace) – 10(1/10)(SecondTrace))
```

The values of the trace points are assumed to be in a decibel scale, as they are internally stored.

If a point in `FirstTrace` is equal to `maxtracevalue`, the resultant point is also `maxtracevalue`.

Otherwise, if the result of the subtraction is less than or equal to 0, the resultant point is `mintracevalue`.

Power Sum (Op1 + Op2)

Calculates a power sum between the `First Trace` operand and the `Second Trace` operand and puts the result in the destination trace.

During the sweep, the following formula is executed for each point in the trace operands, and the corresponding point is generated for the destination trace.

```
DestinationTrace = 10 log(10(1/10)(FirstTrace) + 10(1/10)(SecondTrace))
```

The values of the trace points are assumed to be in a decibel scale, as they are internally stored.

If a point in either trace operand is equal to `maxtracevalue`, the resultant point is also `maxtracevalue`.

Log Offset (Op1 + Offset)

Calculates a log offset from the `First Trace` operand and puts the result in the destination trace. This is like the B-DL function in some older instruments. The offset is entered on the `Offset` control, which only appears when this math function is in force for the selected trace. Each destination trace has its own offset.

During the sweep, the following formula is executed for each point in the trace operand, and the corresponding point is generated for the destination trace.

```
DestinationTrace = FirstTrace + Offset
```

The values of the trace points are assumed to be in dBm (as they are internally stored) and the offset is in dB.

If a point in the trace operand is equal to `maxtracevalue`, the resultant point is also `maxtracevalue`.

If a point in the trace operand is equal to `mintracevalue`, the resultant point is also `mintracevalue`.

Example: If offset is 25 dB, then our destination trace will be higher than the operand trace by 25 dB.

Note that the `Second Trace` operand is not used for this function.

Log Diff (Op1 - Op2 + Ref)

Offsets the difference between the `First Trace` operand and the `Second Trace` operand by a reference and puts the result in the destination trace. This is like the A-B+DL function in some older instruments. The Reference is entered on the **Reference** control, which only appears when this math function is in force for the selected trace. Each destination trace has its own reference.

Offsets the difference between the `First Trace` operand and the `Second Trace` operand by a reference and puts the result in the destination trace. This is like the A-B+DL function in some older instruments. The Reference is entered on the **Reference** control, which only appears when this math function is in force for the selected trace. Each destination trace has its own reference.

During the sweep, the following formula is executed for each point in the trace operands, and the corresponding point is generated for the destination trace.

```
DestinationTrace = (FirstTrace - SecondTrace) + Reference
```

The values of the operand trace points are assumed to be in decibel units (as they are internally stored) and the reference is in dBm so the result is in dBm.

Example: If the first operand trace 1 is at 5 dBm, the second operand trace 2 is at –5 dBm, and the reference is –25 dBm, then the destination trace will be –15 dBm.

Example: If the first operand trace1 is at 60 dBuV, the second operand trace 2 is at 50 dBuV, and the reference is 35 dBuV, then the destination trace will be 45 dBuV.

If a point in `FirstTrace` is equal to `maxtracevalue`, the resultant point is also `maxtracevalue`.

If a point in `FirstTrace` is equal to `mintracevalue`, the resultant point is also `mintracevalue`.

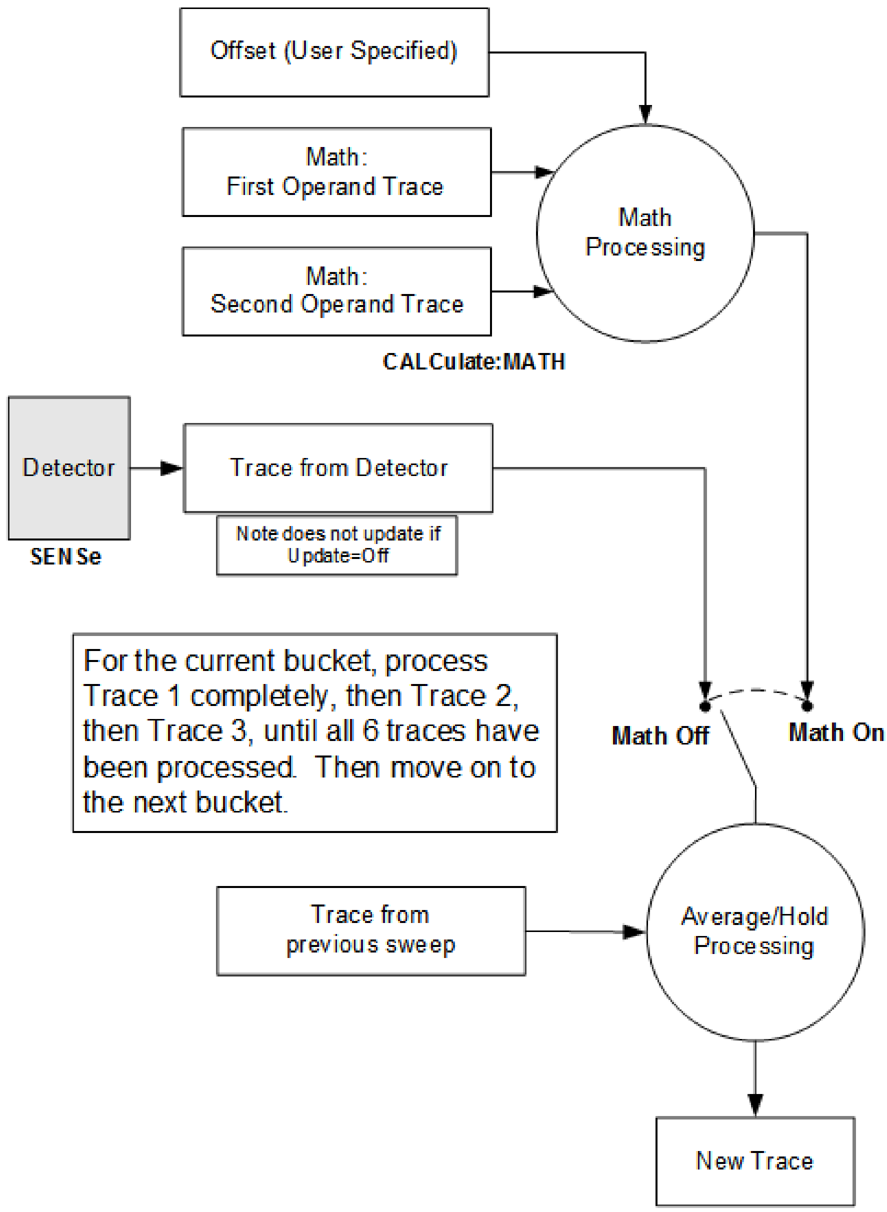
If neither of the above is true for a given point, then:

- If that point in `SecondTrace` is equal to `maxtracevalue`, the resultant point is `mintracevalue`.
- If that point in `SecondTrace` is equal to `mintracevalue`, the resultant point is `maxtracevalue`.

How trace math is processed

Whenever a trace math function is turned on, or the parameters and/or operands of an existing trace math function are changed, the destination trace is cleared. After the trace is cleared, all x-axis values in the trace, and the domain of the trace, are set to match the X-Axis settings of the first trace operand. When this is complete, a new sweep is initiated.

The process of acquiring data, processing it using the math and Average/Hold functions, and presenting it as trace data, consists of several functional blocks, as shown below:



NOTE ABOUT OFFSETS: When either External Gain or Ref Level Offset is on, an offset is applied to the trace operands, and when Trace Math is on this offset is applied before any math processing is performed. Since the operands have already been offset the result trace should NOT be offset. Therefore when any Trace Math operation is performed, the sum of (External Gain - Ref Level Offset) is added to the result before it is stored in the result trace.

For each active trace, the current trace point is processed for `Trace 1`, then `Trace 2`, then `Trace 3`, etc. Trace data is taken from either the detector for that trace, or from the mathematical result of up to two other traces and an offset, depending on whether trace math is on or not. The resultant data is then fed to the Average/Hold

processing block, where (if the trace type is **Average**, **Max Hold**, or **Min Hold**) it is processed with previous trace data. The new trace data resulting from this process is then available for display, storage or remote output.

When the processing is complete for `Trace 1`, `Trace 2` is processed, and so on until all six traces have been processed. This allows a downstream trace to use as one of its math components a fully processed upstream trace. In other words, if math is `ON` for `Trace 4`, and its operand traces are `Trace 2` and `Trace 3`, then all detector, math, average and hold processing for Traces 2 and 3 is completed before the math is performed for `Trace 4`. When the current trace point is completed for all traces, the instrument moves on to the next trace point.

This allows very flexible and powerful math functions to be configured. For example, `Trace 1` can be an average trace, which can be fed with an offset to `Trace 2`, which can also be in **Max Hold**, allowing you to obtain the **Max Hold** of an Average trace.

Note that none of this processing is performed on inactive traces.

Note also that for any active trace with math `ON`, the Operand traces should have *lower* numbers than the trace (for example, using `Trace 4` as an operand for `Trace 1` will cause the data coming from `Trace 4` to be delayed by one sweep).

Operand 1/2

Selects the first and second trace operands, respectively, to be used for the trace math functions for the destination trace.

The operands are common to all math functions for a given trace. The most recently sent `:CALCulate:MATH` command for a given trace sets the operands for that trace, and will be reflected on the trace operand controls for that trace.

Example	The following examples are for the Swept SA measurement.
	1) Set Trace 3 to Power Diff trace math function. Set the First Trace operand (for Trace 3) to Trace 1 and the Second Trace operand (for Trace 3) to Trace 2
	`:CALC:MATH TRACE3,PDIF,TRACE1,TRACE2,0,0`
	
	2) Set Trace 3 to Log Offset trace math function. Set the First Trace operand (for Trace 3) to Trace 1, leave the Second Trace operand (for Trace 3) unchanged (it is irrelevant for this function) and set the Log Offset (for Trace 3) to -6 dB
	`:CALC:MATH TRACE3,LOFF,TRACE1,TRACE2,-6.00,0`

Notes	See the Math Function section for how to specify Operand 1 and Operand 2 using the `:CALCulate:MATH` SCPI command
Dependencies	The destination trace cannot be an operand. The destination trace number is gray on the dropdown
Preset	**Operand 1**: Trace number minus 2 (wraps at 1) For example, for Trace 1, Operand 1 presets to Trace 5; for Trace 6, it presets to Trace 4 **Operand 2**: Trace number minus 1 (wraps at 1) For example, for Trace 1, Operand 2 presets to Trace 6; for Trace 6, it presets to Trace 5
State Saved	Operand 1 and Operand 2 for each trace are stored in instrument state

Offset

The Offset value is used by the Log Offset math function.

Example	The following example is for the Swept SA measurement. `:CALC:MATH TRACE3,LOFF,TRACE1,TRACE2,-6.00,0` Sets Trace 3 to Log Offset trace math function, sets the First Trace operand (for Trace 3) to Trace 1, leaves the Second Trace operand (for Trace 3) unchanged (it is irrelevant for this function) and sets the Log Offset (for Trace 3) to -6 dB
State Saved	The Log Offset value for each trace is saved in Instrument State
Min	–100 dB
Max	100 dB

Reference

The Reference value is used by the Log Diff math function.

Example	The following example is for the Swept SA measurement. `:CALC:MATH TRACE3,LDIF,TRACE1,TRACE2,0,-6.00` Sets Trace 3 to Log Diff trace math function, sets the First Trace operand (for Trace 3) to Trace 1, sets the Second Trace operand (for Trace 3) to Trace 2, and sets the Log Difference reference (for Trace 3) to -6 dBm
State Saved	The Log Difference reference value for each trace is saved in instrument state
Min/Max	Same as reference level

3.11.10.4 Trace Function

The Trace Function includes controls to:

– Copy and Exchange traces

– Preset or Clear all traces

From Trace

Selects the trace to be copied to or exchanged with the **To Trace** when a "Copy" on page 1553 or "Exchange" on page 1553 is performed

Preset	1

To Trace

Selects the trace to be copied from or exchanged with the **From Trace** when a "Copy" on page 1553 or "Exchange" on page 1553 is performed

Preset	2

Copy

This button executes a Trace Copy based on the From Trace and To Trace parameters. The Copy is done from the From Trace to the To Trace. The action is performed once.

The X-Axis settings and domain of a trace go with it when it is copied.

Remote Command	For Swept SA Measurement (in SA Mode):
	`:TRACe:COPY TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6, TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6`
	
	For all other measurements:
	`:TRACe:<meas>:COPY TRACe1 | TRACe2 | TRACe3, TRACe1 | TRACe2 | TRACe3`
	where:
	<meas> is the identifier for the current measurement.
	Note that the format of the TRACe<n> parameter differs from that for the Swept SA Measurement.

Example	`:TRAC:COPY TRACE1,TRACE3` Copies Trace 1 to Trace 3 and puts Trace 3 in Update=Off, Display=On
Notes	The `:TRACe:COPY` command is of the form: `:TRACe:COPY <source_trace>,<dest_trace>`
Dependencies	When Signal ID is on, this key is grayed out
Couplings	The destination trace is put in View (Update=Off, Display=On) after the copy

Preset	For Swept SA Measurement (in SA Mode):
	`TRACE1, TRACE2`
	For all other measurements:
	`TRACe1, TRACe2`

Exchange

This button executes a Trace Exchange based on the From Trace and To Trace parameters. The From Trace and To Trace are exchanged with each other. The action is performed once.

The X-Axis settings and domain of a trace go with it when it is exchanged with another trace.

Remote Command	For Swept SA Measurement (in SA Mode):
	`:TRACe:EXCHange TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6, TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6`
	
	For all other measurements:
	`:TRACe:<meas>:EXCHange TRACe1 | TRACe2 | TRACe3, TRACe1 | TRACe2 | TRACe3`
	where:
	<meas> is the identifier for the current measurement.
	Note that the format of the TRACe<n> parameter differs from that for the Swept SA Measurement.

Example	`:TRAC:EXCH TRACE1,TRACE2` Exchanges Trace 1 and Trace 2 and puts both traces in Update=Off, Display=On
Notes	The `TRACe[:<meas>]:EXCHange` command is of the form: `:TRACe[:<meas>]:EXCHange <trace_1>,<trace_2>`
Couplings	Both traces are put in View (Update=Off, Display=On) after the exchange
Backwards Compatibility Notes	The copy and exchange operations menu in ESA and PSA is replaced with the more general purpose Trace Function menu. The remote commands are unaffected, as they were already general

Preset All Traces

Turns on Trace 1 and blanks all other traces. Useful when you have many traces on and you want to go back to having only Trace 1 on the display. Does not affect the trace type, detector or any other aspect of the trace system.

Remote Command	`:TRACe[:<meas>]:PRESet:ALL`
Example	`:TRAC:PRES:ALL`
Dependencies	When Signal ID is on, this key is grayed out

Clear All Traces

Clears all traces. Does not affect the state of any function or variable in the instrument. Loads `mintracevalue` into all of the points all traces, except traces in Min Hold in which case it loads `maxtracevalue`. Does so even if Update=Off.

Remote Command	`:TRACe[:<meas>]:CLEar:ALL`
Example	`:TRAC:CLE:ALL` Clears all traces
Dependencies	When Signal ID is on, this key is grayed out

3.11.10.5 Advanced

The **Advanced** tab contains controls for setting advanced functions of the instrument.

Measure Trace

Specifies which trace's scalar results are displayed in the Metrics window and retrieved by sending a `:READ` or `:FETCh` command:

- Trace 1
- Trace 2
- Trace 3

Remote Command	`:CALCulate:SPURious:MTRace TRACe1 | TRACe2 | TRACe3` `:CALCulate:SPURious:MTRace?`
Example	`:CALC:SPUR:MTR TRACe1` `:CALC:SPUR:MTR?`
Preset	`TRACe1`
State Saved	No
Range	`TRACe1|TRACe2|TRACe3`

3.12 Power Stat CCDF Measurement

Many modern digitally modulated signals look noise-like in the time and frequency domain, requiring statistical measurement of these signals for meaningful characterization and differentiation. The Power Complementary Cumulative Distribution Function (CCDF) measurement displays curves to characterize the higher level power statistics of digitally modulated signals. The curves can be useful in determining design parameters for digital communications systems.

The Power Statistics CCDF measurement displays probability on the Y-Axis and amplitude on the X-axis, for a display of the statistical amplitude distribution of a signal. This distribution can be affected by many factors. For example, modulation filtering, modulation format, combining the multiple signals at different frequencies, number of active codes, and correlation between symbols on different codes with spread spectrum systems will all affect measurement results. These factors are all related to modulation and signal parameters. External factors such as signal compression and expansion by nonlinear components, group delay distortion from filtering, and power control within the observation interval also affect the measurement.

The power measured in power statistics CCDF curves is actually instantaneous envelope power defined by the equation:

$P = (I^2 + Q^2) / Zo$

where I & Q are the quadrature voltage components of the waveform, and Zo is the characteristic impedance.

A CCDF curve is defined by how much time the waveform spends at or above a given power level. The percent of time the signal spends at or above the level defines the probability for that particular power level. For capturing a lower probability down to 0.0001%, this measurement is made in the single mode by pressing Single. To make the power statistics CCDF measurement, the instrument uses digital signal processing (DSP) to sample the input signal in the channel bandwidth. The Gaussian distribution line as the band-limited Gaussian noise CCDF reference line, the user-definable reference trace, and the currently measured trace can be displayed on a semi-log graph. If the currently measured trace is above the user reference trace, it means that the higher peak power levels against the average power are included in the input signal.

Power Stat CCDF Measurement Commands

The following commands and queries can be used to retrieve the measurement results:

```
:CONFigure:PSTatistic
:CONFigure:PSTatistic:NDEFault
:INITiate:PSTatistic
:FETCh:PSTatistic[n]?
```

`:READ:PSTatistic[n]?`

`:MEASure:PSTatistic[n]?`

Measurement Results for Power Stat CCDF

The following table describes the results returned by the FETCh, MEASure, and READ queries listed above, according to the index value n.

n	Results Returned
0	Returns unprocessed I/Q trace data, as a series of trace point values, in volts. The I values are listed first in each pair, using the 0 through even-indexed values. The Q values are the odd-indexed values
1, or not specified	Returns 10 scalar results: 1. Average input power (in dBm) 2. Probability at the average input power level (in %) 3. Power level that has 10% of the power 4. Power level that has 1% of the power 5. Power level that has 0.1% of the power 6. Power level that has 0.01% of the power 7. Power level that has 0.001% of the power 8. Power level that has 0.0001% of the power 9. Peak power (in dB) 10. Count
2	Returns a series of 5001 floating point numbers (in percent) that represent the current measured power stat trace. This is the probability at particular power levels (average power), in the following order: 1. Probability at 0.0 dB power 2. Probability at 0.01 dB power 3. Probability at 0.02 dB power ... 5000. Probability at 49.9 dB power 5001. Probability at 50.0 dB power
3	Returns a series of 5001 floating point numbers (in percent) that represent the Gaussian trace. This is the probability at particular power levels (average power), in the following order: 1. Probability at 0.0 dB power 2. Probability at 0.01 dB power 3. Probability at 0.02 dB power ... 5000. Probability at 49.9 dB power

n	Results Returned
	5001. Probability at 50.0 dB power
4	Returns a series of 5001 floating point numbers (in percent) that represent the user-definable reference trace. This is the probability at particular power levels (average power), in the following order: 1. Probability at 0.0 dB power 2. Probability at 0.01 dB power 3. Probability at 0.02 dB power ... 5000. Probability at 49.9 dB power 5001. Probability at 50.0 dB power

3.12.1 Views

The General Power Stat CCDF measurement provides a single view. The LTE/LTE-A TDD and 5G NR Power Stat CCDF measurement has two views: the Normal View and the Slot View.

These Views are multiple-window Views. When in a multiple window View, you select a window by touching it. The menu controls may sometimes change depending on which window is selected.

Remote Command	`[:SENSe]:PSTatistic:SLTView[:STATe] OFF | ON | 0 | 1` `[:SENSe]:PSTatistic: SLTView[:STATe]?`

Example	Select Slot View
	`:PST:SLTV ON`
	Select Normal View
	`:PST:SLTV OFF`
	`:PST:SLTV?`

Dependencies	Only available in LTE/LTEATDD and 5GNR Modes
Preset	`OFF`
State Saved	Yes
Range	`OFF|ON`

3.12.1.1 Normal

Windows: "Metrics" on page 1560, "Graph" on page 1559

The Power Stat CCDF measurement provides CCDF curves and power statistics metrics. This is common for both Uplink (MS) and Downlink (BTS).

Example	`:PST:SLTV OFF`

3.12.2 Windows

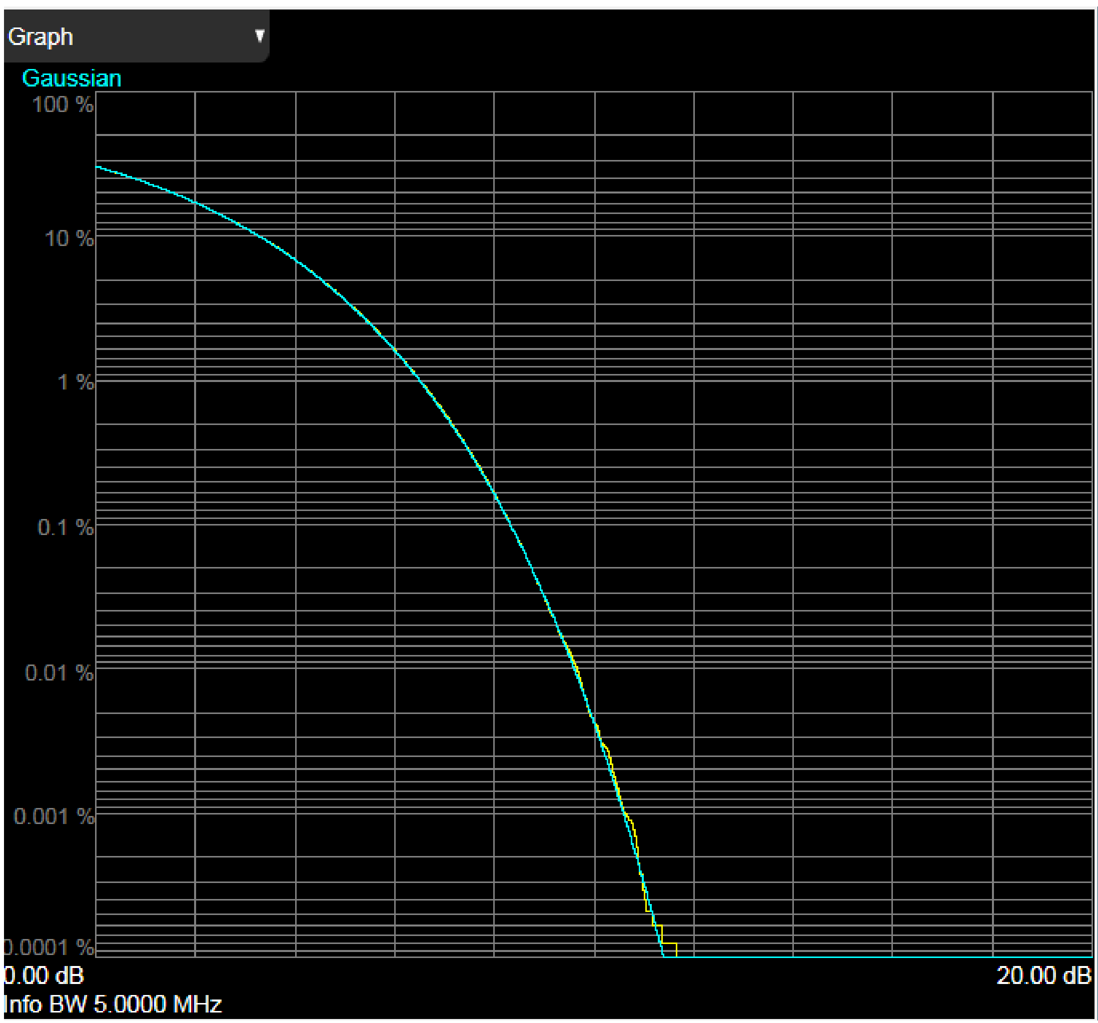
There are three windows in the CCDF measurement:

1. Graph
2. Slot View
3. Metrics

The Slot View window only appears in the LTE/LTEATDD and 5GNR modes.

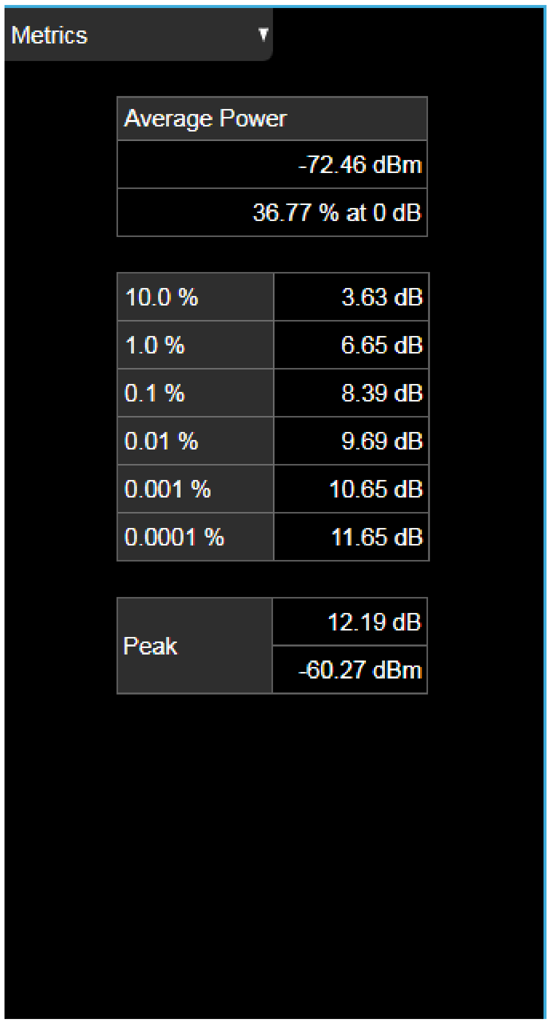
3.12.2.1 Graph

The Graph window displays Amplitude versus probability



3.12.2.2 Metrics

The Metrics window displays the textual results of the Power Stat CCDF measurement.



Name	Corresponding Results	Explanation
Average Power [dBm]	n=1 1st Average input power	99.99 dBm
Average Power [%]	n=1 2nd Probability at the average input power level	99.99 %
10.0% [dB]	n=1 3rd Power level that has 10% of the power	99.99 dB
1.0% [dB]	n=1 4th Power level that has 1% of the power	99.99 dB
0.1% [dB]	n=1 5th	99.99 dB

Name	Corresponding Results	Explanation
	Power level that has 0.1% of the power	
0.01% [dB]	n=1 6th	99.99 dB
	Power level that has 0.01% of the power	
0.001% [dB]	n=1 7th	99.99 dB
	Power level that has 0.001% of the power	
0.0001% [dB]	n=1 8th	99.99 dB
	Power level that has 0.0001% of the power	
Peak [dB]	n=1 9th	99.99 dB
	Peak power	
Peak [dBm]	This is not available from SCPI using remote commands	99.99 dBm

3.12.3 Amplitude

Activates the **Amplitude** menu and selects **Reference Level Offset** as the active function.

3.12.3.1 Y Scale

Contains controls that pertain to the Y-Axis parameters of the measurement. These parameters control how data on the vertical (Y) axis is displayed and control instrument settings that affect the vertical axis.

3.12.3.2 Attenuation

Controls the attenuator functions and interactions between the attenuation system components.

There are two attenuator configurations in the X-Series. One is a Dual-Attenuator configuration consisting of a mechanical attenuator and an optional electronic attenuator. The other configuration uses a single attenuator with combined mechanical and electronic sections thatcontrols all the attenuation functions. Different models in the X-Series come with different configurations.

– See "Dual-Attenuator Configurations" on page 1562

– See "Single-Attenuator Configuration" on page 1563

Most attenuation settings are the same for all measurements – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset.

This tab is only available when the hardware set includes an input attenuator, which is typically only the case when using Keysight’s box instruments. For example, this tab does not appear in:

– VXT models M9420A/21A/10A/11A

– E7760

– M9391A

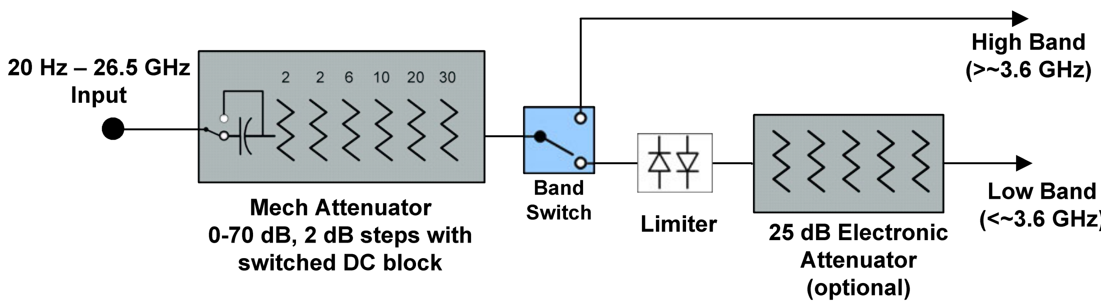
– M9393A

This tab also does not appear in UXM. In UXM all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

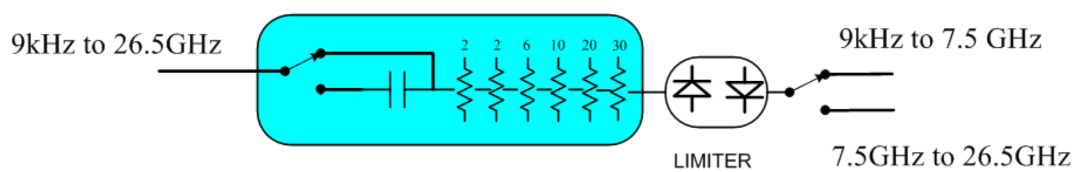
Dependencies	In measurements that support the I/Q inputs, this tab is unavailable when I/Q is the selected input, and is replaced by the Range tab in that case

Dual-Attenuator Configurations

Configuration 1: Mechanical attenuator + optional electronic attenuator

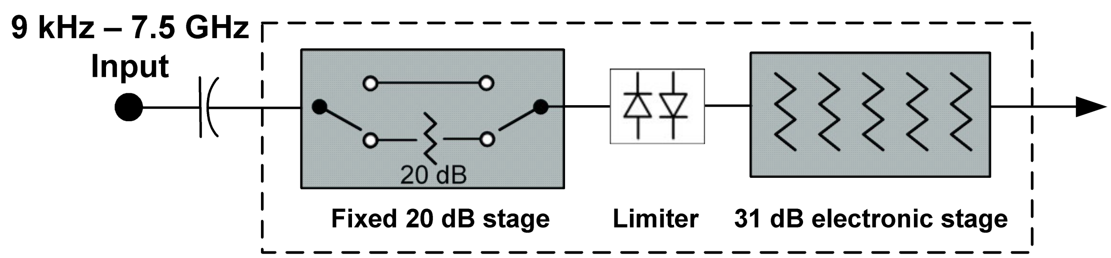


Configuration 2: Mechanical attenuator, no optional electronic attenuator



(note that Configuration 2 is not strictly speaking a dual-section attenuator, since there is no electronic section available. However, it behaves exactly like Configuration 1 without the Electronic Attenuator option EA3, therefore for the sake of this document it is grouped into the “Dual-Attenuator” configuration)

Single-Attenuator Configuration



You can tell which attenuator configuration you have by pressing the Attenuation tab, which (in most Modes) opensthe Attenuation menu. If the first control in the Attenuation menu says **Mech Atten** you have the Dual-Attenuator configuration. If the first control says **Atten** you have the Single-Attenuator configuration.

(Note that depending on the measurement, there may be no Auto/Man functionality on the Mech Atten control).

In the Single-Attenuator configuration, youcontrol the attenuation with a single control, as the fixed stage has only two states. In the Dual-Attenuator configuration, both stages have significant range so you are given separate control of the mechanical and electronic attenuator stages.

When you have the Dual-Attenuator configuration, you may still have only a Single-Attenuator, because unless option EA3 (the Electronic Attenuator option) is available, and you purchase it, you will have only the mechanical attenuator.

Full Range Atten

The **Full Range Atten** control and **Attenuator Summary** only appear in N9041B, when the RF input is selected and the RF Input Port is set to RF Input 2, and the Full Range Attenuator is installed. The Full Range Attenuator adds a second input attenuator at the beginning of the RF Input 2, which enhances the protection and optimizes the performance of the extra internal mixers used by RF Input 2.

Remote Command	`[:SENSe]:POWer[:RF]:FRATten <rel_ampl>` `[:SENSe]:POWer[:RF]:FRATten?`
Example	`:POW:FRAT 14` `:POW:FRAT?`
Notes	When you enter an amplitude value that falls between valid values, the value will be incremented to the

	next smallest valid value
Dependencies	Only appears if input RF is selected, and RF Input Port 2 is selected, and the Full Range Attenuator exists
Couplings	This value is never changed by any coupling, however other couplings use this value. See the **Reference Level** and "Mech Atten" on page 1750 command descriptions
Preset	20 dB
State Saved	Saved in instrument state
Min	0 dB
Max	Only valid values are 0, 6, 14, 20 dB
Annotation	When the Input is RF, and the Input Port is RF Input 2, and the Full Range Attenuator is installed: On the Meas Bar, the field "Atten" displays as follows: – If the sweep is entirely < 50 GHz, the value shown after "Atten:" is equal to Mech Atten + Elec Atten + Full Range Atten – If the sweep is entirely > 50 GHz, the value shown after "Atten:" is equal to Full Range Atten – If the sweep straddles 50 GHz, the value shown after "Atten:" is preceded by the symbol ">=" and is equal to Full Range Atten In the **Amplitude**, "Attenuation" on page 1747 menu, and the Atten Meas Bar dropdown menu panel, a summary is displayed as follows: "Total Atten below 50 GHz" followed by the value of Full Range Atten + Mech Atten + Elec Atten "Total Atten above 50 GHz" followed by the value of Full Range Atten For example, if Mech Atten = 6 dB, Elec Atten = 4 dB, and Full Range Atten = 20 dB, the summary below is shown: – Attenuator summary: – Total Atten below 50 GHz: 30 dB – Total Atten above 50 GHz: 20 dB

Mech Atten

This control is labeled **Mech Atten** in Dual-Attenuator models and **Atten** in Single-Attenuator models. In the Dual-Attenuator configuration, this control only affects the mechanical attenuator.

This control lets you modify the attenuation applied to the RF input signal path. This value is normally auto coupled to the Ref Level, the Internal Preamp Gain, any External Gain that is entered, and the Max Mixer Level, as described in the table below.

See "Attenuator Configurations and Auto/Man" on page 1566

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation <rel_ampl>` `[:SENSe]:POWer[:RF]:ATTenuation?`

	`[:SENSe]:POWer[:RF]:ATTenuation:AUTO OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:ATTenuation:AUTO?`

Example	`:POW:ATT 20`
	Dual-Attenuator configuration: sets the mechanical attenuator to 20 dB
	Single-Attenuator mode: sets the main attenuation to 20 dB (see below for definition of "main" attenuation)
	In either case, if the attenuator was in Auto, it is set to Manual
	`:POW:ATT:AUTO ON`
	Turn Auto Mech Atten ON

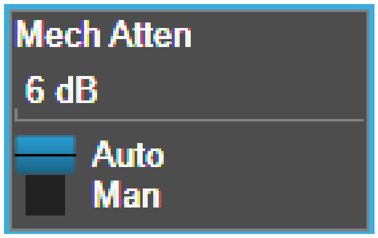
Dependencies	Some measurements do not support the Auto setting of "Mech Atten" on page 1564. In these measurements, the Auto/Man selection is not available, and the Auto/Man toggle function is not available In Dual-Attenuator configurations, when the electronic attenuator is enabled, the mechanical attenuator has no auto setting and the Auto/Man toggle function is not available. The state of Auto/Man is remembered and restored when the electronic attenuator is once again disabled. This is described in more detail in "Elec Atten" on page 1753 See "Attenuator Configurations and Auto/Man" on page 1566 for more information on the Auto/Man functionality `:POW:ATT:AUTO` is only available in measurements that support Mech Atten Auto, such as Swept SA
Couplings	If the RF Input Port is the RF Input: – If the USB Preamp is connected to USB, use 0 dB for Mech Atten – Otherwise compute the auto-selected value of Mech Atten based on **Reference Level**, Int Preamp, External Gain, Ref Level Offset, Max Mixer Level, µW Path Control and IF Gain settings. Limit this value to be no less than 6 dB (total attenuation below 6 dB can never be chosen by Auto) – In the N9041B, if the RF Input Port is RF Input 2, use the formula above and subtract the Full Range Atten value from the result to determine the Mech Atten. Limit the value so that it is never lower than 0 dB and so that total attenuation, including Full Range Atten, is never less than 6 dB (total attenuation, including Full Range Atten below 6 dB, can never be chosen by Auto) In External Mixingand BBIQ, where the Attenuator is not in the signal path, the Attenuator setting changes as described above when "Mech Atten" on page 1564 is in Auto, but no changes are made to the actual attenuator hardware setting until the input is changed back to the RF Input For CXA-m with option FSA (Fine-Step Attenuator or 2 dB steps), the FSA-like behavior is only available when the frequency setting is <= 7.5GHz. So, when the frequency is changed from below 7.5GHz to above 7.5GHz, the attenuation setting will be changed to a multiple of 10dB which will be no smaller than the previous setting. For example, 4dB attenuation will be changed to 10dB
Preset	The preset for Mech Attenuation is "Auto" The Auto value of attenuation is 10 dB ON
State Saved	Saved in instrument state
Min	0 dB The attenuation set by this control cannot be decreased below 6 dB with the knob or step keys. Values below 6 dB must be directly entered from the keypad or via SCPI. This protects against setting a

	dangerously small attenuation value, which can put the instrument at risk of damage to input circuitry. If the current mechanical attenuation is below 6 dB, it can be increased with the knob and step keys, but not decreased
Max	CXA Option 503 or 507: 50 dB EXA: 60 dB All other models: 70 dB Note that in the Single-Attenuator configuration, the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB.
Annotation	The current value for Total Atten is displayed in the Measurement Bar at the top of the display. A value appears for Electronic Attenuation only if the Electronic Attenuator is enabled. The annotation appears as Atten: <total> dB (e<elec>) The e letter is in amber in Single-Attenuator configurations For example: Dual-Attenuator configuration: Atten: 24 dB (e14) Indicating the total attenuation is at 24 dB and the electronic attenuation is at 14 dB Single-Attenuator configuration: A: 24 dB (e14) Indicating the total attenuation is at 24 dB and the “soft” attenuation is at 14 dB (see below for definition of “soft” attenuation) When in Manual, a # sign appears in front of Atten in the annotation

Attenuator Configurations and Auto/Man

As described in "Attenuation" on page 1747 , there are two distinct attenuator configurations available in the X-Series, the single attenuator and Dual-Attenuator configurations. In Dual-Attenuator configurations, we have the mechanical attenuation and the electronic attenuation, and the current total attenuation is the sum of the electronic + mechanical attenuation. In Single-Attenuator configurations, we refer to the attenuation set using "Mech Atten" on page 1564 (or `:POW:ATT`) as the “main” attenuation; and the attenuation that is set by `:POW:EATT` as the “soft” attenuation (`:POW:EATT` is honored even in the Single-Attenuator configuration, for compatibility purposes). Then the current total attenuation is the sum of the main + soft attenuation. See "Elec Atten" on page 1753 for more on “soft” attenuation.

NOTE	In some measurements, the **Mech Atten** control has an Auto/Man function. In these measurements, an Auto/Man switch is shown on the **Mech Atten** control:



Note that in configurations that include an Electronic Attenuator, this switch is only shown when the Electronic Attenuator is disabled.

In other measurements, **Mech Atten** has no Auto/Man function. In these measurements, no switch is shown on the **Mech Atten** control:

Mech Atten also appears with no switch, as above, in configurations that include an Electronic Attenuator but when the Electronic Attenuator is enabled.

Elec Atten

Controls the Electronic Attenuator in Dual-Attenuator configurations. This control does not appear in Single-Attenuator configurations, as the control of both the mechanical and electronic stages of the Single-Attenuator is integrated into the single **Atten** control.

This control includes an Enable/Disable toggle switch; it is only possible to enter a value for the Electronic Attenuator when this switch is in the “Enable” position.

See "More Information" on page 1568

Remote Command	`[:SENSe]:POWer[:RF]:EATTenuation <rel_ampl>`
	`[:SENSe]:POWer[:RF]:EATTenuation?`
	`[:SENSe]:POWer[:RF]:EATTenuation:STATe OFF | ON | 0 | 1`
	`[:SENSe]:POWer[:RF]:EATTenuation:STATe?`

Example	`:POW:EATT 10`
	`:POW:EATT?`
	`:POW:EATT:STAT ON`
	`:POW:EATT:STAT?`

Notes	Electronic Attenuation’s specification is defined only when Mechanical Attenuation is 6 dB
Dependencies	This control only appears in Dual-Attenuator models with an Electronic Attenuator installed and licensed. It does not appear in models with the Single-Attenuator configuration, as in the Single-Attenuator configuration there is no “electronic attenuator” there is only a single integrated attenuator

	(which has both a mechanical and electronic stage). However, in the Single-Attenuator configuration, EATT SCPI commands are accepted for compatibility with other X-series instruments and set a "soft" attenuation as described in . The "soft" attenuation is treated as an addition to the "main" attenuation value set by the Atten control or the POW:ATT SCPI command and affects the total attenuation displayed on the Atten control and the Meas Bar The electronic attenuator (and the "soft" attenuation function provided in Single-Attenuator configurations) is unavailable above the low band (0-3.6 GHz, 0-3.4 GHz 0-3GHz, depending on the model). If the low band ranges from 0-3.6GHz, and Stop Frequency of the instrument is > 3.6 GHz, then the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed out If the Internal Preamp is on, meaning it is set to Low Band or Full, the electronic attenuator (and the "soft" attenuation function provided in Single-Attenuator configurations) is unavailable. In this case the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed out If either of the above is true, if the SCPI command is sent, an error indicating that the electronic attenuator is unavailable will be sent If both of the above are true, pressing the control will generate error message -221, in other words, the frequency range lockout takes precedence If the electronic/soft Attenuator is enabled, then the Stop Freq of the instrument is limited to 3.6 GHz and the Internal Preamp is unavailable The SCPI-only "soft" electronic attenuation for the single-attenuator configuration is not available in all measurements; in particular, it is not available in the Swept SA measurement
Couplings	Enabling and disabling the Electronic Attenuator affects the setting of the Mechanical Attenuator (in Dual-Attenuator configurations). This is described in more detail below and in the section "Attenuator Configurations and Auto/Man" on page 1752
Preset	`OFF` (Disabled) for Swept SA measurement `ON` (Enabled) for all other measurements that support the electronic attenuator
State Saved	Saved in instrument state
Min	0 dB
Max	Dual-Attenuator configuration: 24 dB Single-Attenuator configuration: the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB
Annotation	See Annotation under the **Mech Atten** control description

More Information

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear. These advantages primarily aid in remote operation and are negligible for front panel use. See "Using the Electronic Attenuator: Pros and Cons" on page 1569 for a detailed discussion of the pros and cons of using the electronic attenuator.

For the Single-Attenuator configuration, for SCPI backwards compatibility, the "soft" attenuation feature replaces the Dual-Attenuator configuration's electronic attenuator. All the same couplings and limitations apply. See "Attenuator Configurations and Auto/Man" on page 1752

Mechanical Attenuator Transition Rules

When the Electronic Attenuator is enabled, the Mechanical Attenuator transitions to a state that has no Auto function. Below are the rules for transitioning the Mechanical Attenuator. Note that the information below ONLY applies to the Dual-Attenuator configurations, and ONLY when the Electronic Attenuator is installed:

When the Electronic Attenuation is enabled from a disabled state:

The Mechanical Attenuator is initialized to 10 dB (this is its optimal performance setting). You can then set it as desired with SCPI, numeric keypad, step keys, or knob, and it behaves as it normally would in manual mode

The Auto/Man state of (Mech) Atten is saved

The Auto/Man toggle on the (Mech) Atten control disappears and the auto rules are disabled

The Electronic Attenuator is set to 10 dB less than the previous value of the Mechanical Attenuator, within the limitation that it must stay within the range of 0 to 24 dB of attenuation

Examples in the Dual-Attenuator configuration:

Mech Atten at 20 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 10 dB. New total attenuation equals the value before Elec Atten enabled

Mech Atten at 0 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 0 dB. New total attenuation does not equal the value before Elec Atten enabled

Mech Atten at 40 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 24 dB. New total attenuation does not equal the value before Elec Atten enabled

When the Electronic Attenuation is disabled from an enabled state:

The Elec Atten control is grayed out

- The Auto/Man state of (Mech) Atten is restored

If now in Auto, (Mech) Atten recouples

If now in Man, (Mech) Atten is set to the value of total attenuation that existed before the Elec Atten was disabled. The resulting value is rounded up to the smallest value possible given the (Mech) Atten Step setting - (That is, 57 dB changes to 58 dB when (Mech) Atten Step is 2 dB)

Using the Electronic Attenuator: Pros and Cons

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear.

The “finer steps” advantage of the electronic attenuator is beneficial in optimizing the alignment of the instrument dynamic range to the signal power in the front panel as well as remote use. Thus, you can achieve improved relative signal measurement accuracy. Compared to a mechanical attenuator with 2 dB steps, the 1 dB resolution

of the electronic attenuator only gives better resolution when the odd-decibel steps are used. Those odd-decibel steps are less accurately calibrated than the even-decibel steps, so one tradeoff for this superior relative accuracy is reduced absolute amplitude accuracy.

Another disadvantage of the electronic attenuator is that the spectrum analyzer loses its “Auto” setting, making operation less convenient.

Also, the relationship between the dynamic range specifications (TOI, SHI, compression, and noise) and instrument performance are less well-known with the electrical attenuator. With the mechanical attenuator, TOI, SHI, and compression threshold levels increase dB-for-dB with increasing attenuation, and the noise floor does as well. With the electronic attenuator, there is an excess attenuation of about 1 to 3 dB between 0 and 3.6 GHz, making the effective TOI, SHI, and so forth, less well known. Excess attenuation is the actual attenuation relative to stated attenuation. Excess attenuation is accounted for in the instrument calibration

Adjust Atten for Min Clipping

Sets the combination of mechanical and electronic attenuation and gain based on the current measured signal level so that clipping will be at a minimum.

This is an "immediate action" function, that is, it executes once, when the control is pressed.

The algorithms that are used for the adjustment are documented under "Pre-Adjust for Min Clipping" on page 1757.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate`
Example	`:POW:RANG:OPT IMM`
Notes	Executing Adjust Atten for Min Clipping initiates the measurement.
Dependencies	Does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum measurements For the Waveform measurement, this control is available only in 5G NR Mode

Adjust Atten

Allows you to select;

– Electric attenuator only

– Combination of Electric attenuator and Mechanical attenuator

when the command `[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate` is executed.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize:TYPE EONLy | COMBined` `[:SENSe]:POWer[:RF]:RANGe:OPTimize:TYPE?`

Example	:POW:RANG:OPT:TYPE EONL :POW:RANG:OPT:TYPE?
Dependencies	Does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum measurements For the Waveform measurement, this control is available only in 5G NR Mode
Preset	COMBined
State Saved	Saved in instrument state

Pre-Adjust for Min Clipping

If this function is ON, it applies the adjustment described under "Adjust Atten for Min Clipping" on page 1756 each time a measurement restarts. Therefore, in Continuous measurement mode, it only executes before the first measurement.

In Dual-Attenuator models, you can set **Elec+Mech Atten**, in which case both attenuators participate in the autoranging, or **Elec Atten Only**, in which case the mechanical attenuator does not participate in the autoranging. This latter case results in less wear on the mechanical attenuator and is usually faster.

See "Adjustment Algorithm" on page 1572

Selection	Example	Note
Off	:POW:RANGe:OPT:ATT OFF	This is the default setting
Elec Atten Only	:POW:RANGe:OPT:ATT ELEC	Selects only the electric attenuator to participate in auto ranging. This offers less wear on the mechanical attenuator and is usually faster
Mech + Elec Atten	:POW:RANGe:OPT:ATT COMB	In Dual-Attenuator models, this selects both attenuators to participate in the autoranging

Remote Command	[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation OFF | ON | ELECtrical | COMBined [:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation?
Example	:POW:RANG:OPT:ATT OFF :POW:RANG:OPT:ATT?
Notes	The parameter option ELECtrical sets this function to ON in Single-Attenuator models The parameter option COMBined is mapped to ELECtrical in Single-Attenuator models. If you send COMBined, it sets the function to ON and returns ELEC to a query For SCPI compatibility with models that do not have an input attenuator, the ON parameter is honored and mapped to COMBined
Dependencies	This control only appears in Dual-Attenuator models with an Electronic Attenuator installed In instruments with Dual-Attenuator model, when **Enable** "Elec Atten" on page 1753 is OFF or grayed-out, "Pre-Adjust for Min Clipping" on page 1571 is grayed-out This control does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum

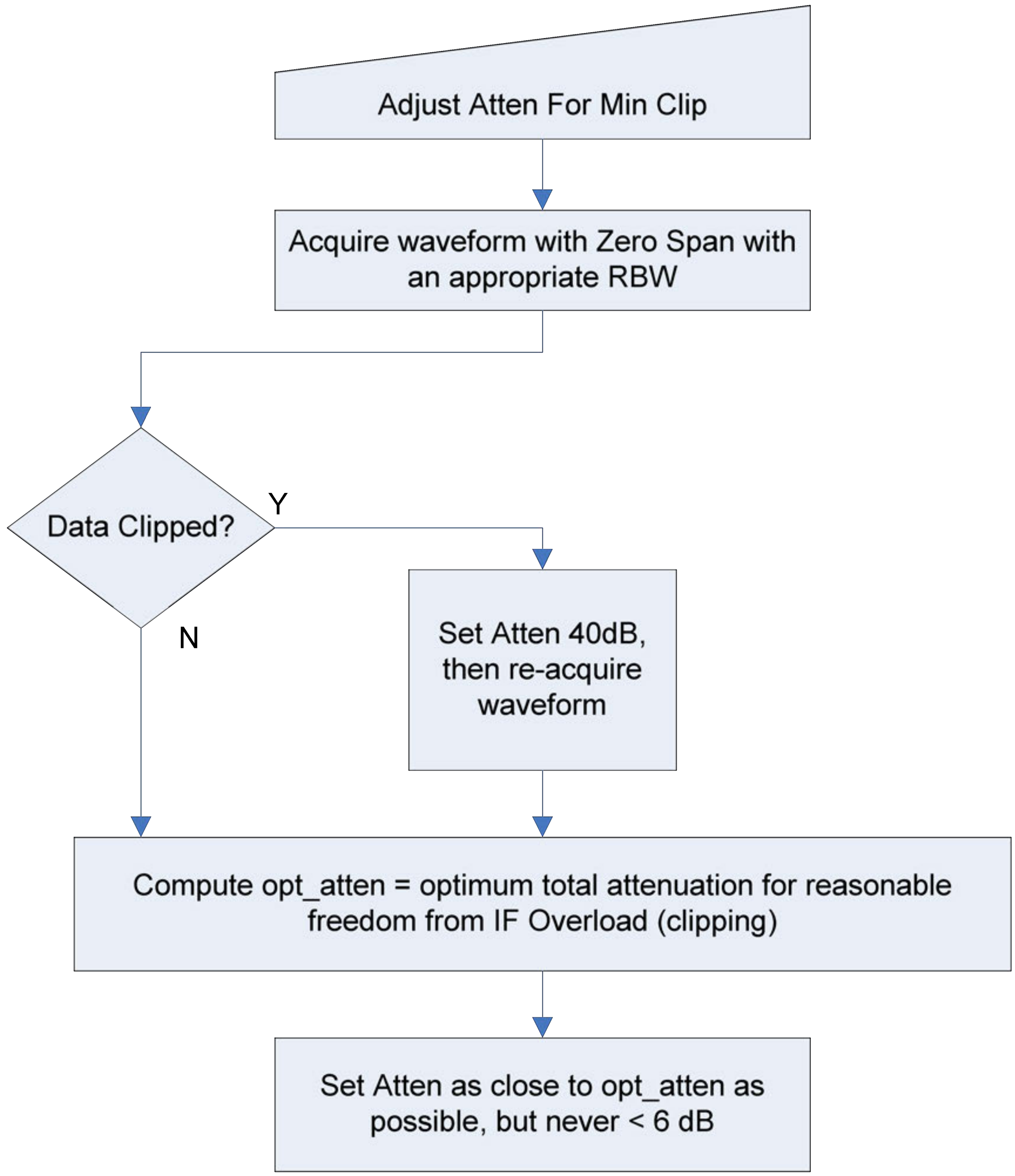
	measurements For the Waveform measurement, this control is available only in 5G NR Mode
Preset	`OFF` when Elec Atten is Disabled at preset, otherwise `ELEC`
State Saved	Saved in instrument state
Range	Dual-Attenuator models: Off | Elec Atten Only | Mech + Elec Atten Single-Attenuator models: Off | On

Notes	`ON` aliases to "Elec Atten Only" (`:POW:RANG:OPT:ATT ELEC`) `OFF` aliases to "Off" (`:POW:RANG:OPT:ATT OFF`) `:POW:RANG:AUTO?` returns true if `:POW:RANG:OPT:ATT` is not `OFF`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:RANGe:AUTO ON | OFF | 1 | 0` `[:SENSe]:POWer[:RF]:RANGe:AUTO?`

Adjustment Algorithm

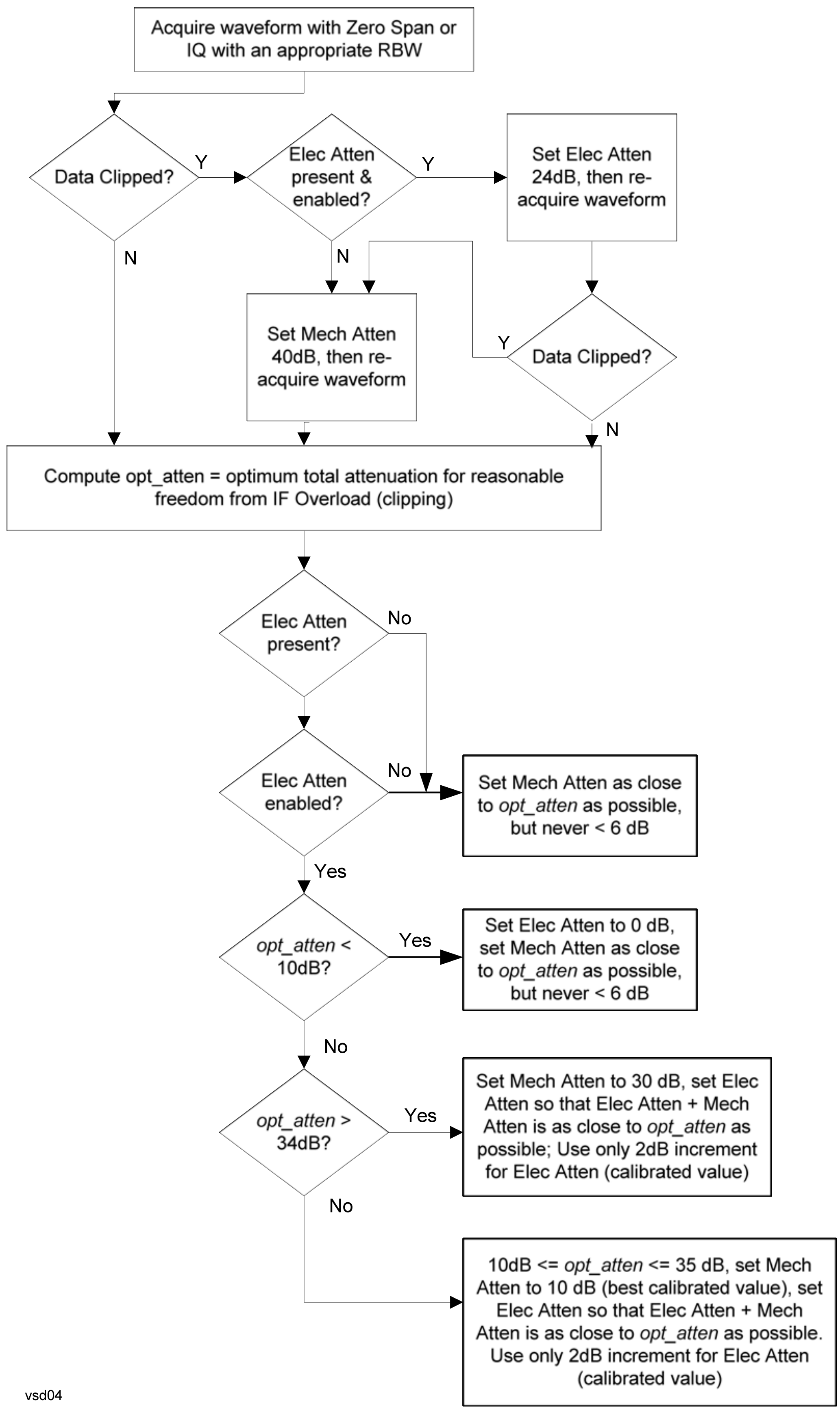
The algorithms for the adjustment are documented below:

Single-Attenuator Models

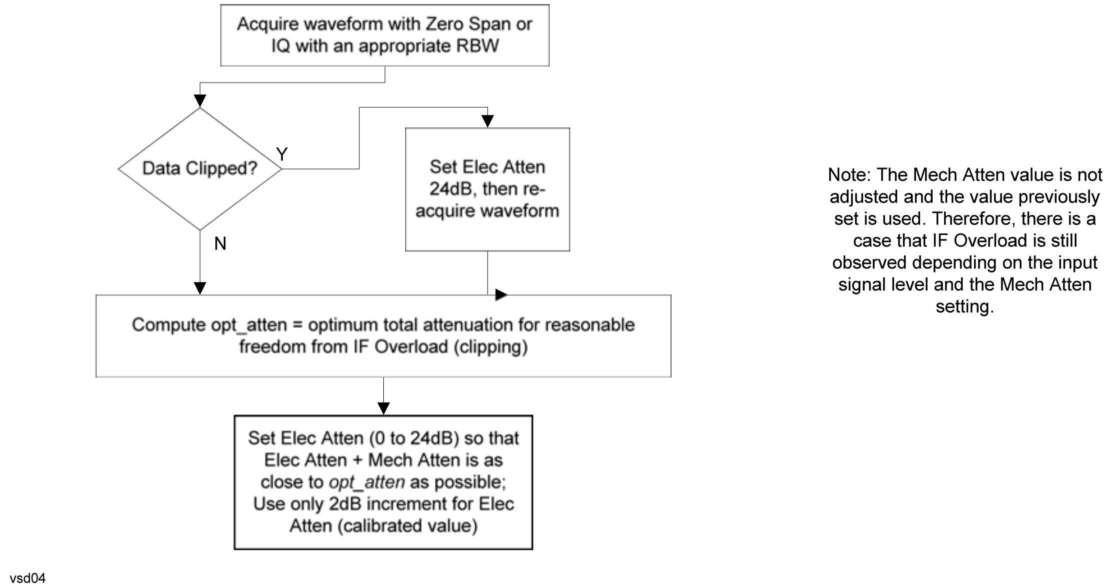


Dual-Attenuator models

"Adjust Atten for Min Clipping" on page 1756 or "Pre-Adjust for Min Clipping" on page 1571 selection is Mech + Elec Atten:


Acquire waveform with Zero Span or IQ with an appropriate RBW
Data Clipped?
Y
N
Elec Atten present & enabled?
Y
N
Set Elec Atten 24dB, then re-acquire waveform
Set Mech Atten 40dB, then re-acquire waveform
Y
Data Clipped?
N
Compute opt_atten = optimum total attenuation for reasonable freedom from IF Overload (clipping)
Elec Atten present?
No
Elec Atten enabled?
No
Set Mech Atten as close to opt_atten as possible, but never < 6 dB
Yes
opt_atten < 10dB?
Yes
Set Elec Atten to 0 dB, set Mech Atten as close to opt_atten as possible, but never < 6 dB
No
opt_atten > 34dB?
Yes
Set Mech Atten to 30 dB, set Elec Atten so that Elec Atten + Mech Atten is as close to opt_atten as possible; Use only 2dB increment for Elec Atten (calibrated value)
No
10dB <= opt_atten <= 35 dB, set Mech Atten to 10 dB (best calibrated value), set Elec Atten so that Elec Atten + Mech Atten is as close to opt_atten as possible. Use only 2dB increment for Elec Atten (calibrated value)
vsd04

"Pre-Adjust for Min Clipping" on page 1571 selection is Elec Only:



Mech Atten Step

Controls thestep size used when making adjustments to the input attenuation.

This control is labeled **Mech Atten Step** in Dual-Attenuator models and **Atten Step** in Single-Attenuator models. In the Dual-Attenuator configuration, this control only affects the step size of the mechanical attenuator.

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement] 10 dB | 2 dB` `[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement]?`
Example	`:POW:ATT:STEP 2` `:POW:ATT:STEP?`
Notes	This feature has a toggle choice from the front panel, but it takes a specific value (in dB) when used remotely. The only valid values are 2 and 10
Dependencies	Blanked in EXA, CXA and CXA-m if option FSA (2 dB steps) is not present. If blanked, attempts to set it via SCPI yield an error
Couplings	When the attenuation step size changes, the current mechanical attenuation value is adjusted (if necessary) to be quantized to the new step size. That is, if step is set to 10 dB, mech atten is increased if necessary so it is a multiple of 10 dB
Preset	EXA, CXA and CXA-m: 10 dB (2 dB with option FSA) All other models: 2 dB
State Saved	Saved in instrument state

3.12.3.3 Range (Baseband Input models)

This tab is only available when Option BBA is present (I/Q Baseband Inputs), the current measurement supports option BBA, and I/Q is the selected input. It replaces the Attenuation tab in that case.

Each input channel (I and Q) has four internal gain ranges. The maximum allowed voltage in each gain range is slightly more than the nominal value, so the break point between ranges is a few millivolts higher than the nominal (setting a peak voltage of 0.502 mV will still map to the 0.5 V Peak range).

Gain Setting	Volts RMS	Volts Peak	Volts Peak - Peak	dBm (50Ω)	Break Point
0 dB	0.7071	1.0	2.0	10	n/a
6 dB	0.3536	0.5	1.0	4	0.502 V Peak
12 dB	0.1768	0.25	0.5	-2	0.252 V Peak
18 dB	0.0884	0.125	0.25	-8	0.127 V Peak

Dependencies	Available only when the selected input is I/Q. If the current measurement does not support baseband inputs, an error will be displayed: “No result; Meas invalid with I/Q inputs”
State Saved	No

Range Auto/Man

The Auto setting for Range causes the range to be set based on the Y Scale settings. When Range is “Auto”, the I & Q Range are set based on the top of the Y Scale when the Y scale is in dB units (for example, power), or to the max(abs(top), abs(bottom)) when the Y scale reference is not at the top of the screen.

Not all measurements support **Range Auto/Man**. If Auto is not supported in the current measurement, this control is grayed-out displaying “Man”, and `MAN` is returned to a SCPI query, but this does *not* change the Auto/Man setting for Range. When you switch to a measurement that supports Auto, it goes back to Auto if it was previously in Auto mode.

Remote Command	`[:SENSe]:VOLTage:IQ:RANGe:AUTO OFF | ON | 0 | 1` `[:SENSe]:VOLTage:IQ:RANGe:AUTO?`

Example	Put the I Range and Q Range in manual.
	`:VOLT:IQ:RANG:AUTO OFF`
	`:VOLT:IQ:RANG:AUTO?`

Dependencies	If Auto is not supported, sending the SCPI command generates an error
Couplings	When in Auto, both I Range and Q Range are set to the same value, computed as follows:

	Maximum absolute value is computed for the Y Scale. The top and bottom of the graph are computed based on Ref Value, Scale/Div, and Ref Position. Formula: Y_{Max} = max(abs(top), abs(bottom)) The I Range and Q Range are then set to Y_{Max}
Preset	ON
State Saved	Saved in instrument state
Annotation	When in Man, the Range annotation is preceded by "#"

This is an alternate form of the command to match the POWer form of the I Range and Q Range SCPI.

Remote Command	[:SENSe]:POWer:IQ:RANGe:AUTO OFF | ON | 0 | 1 [:SENSe]:POWer:IQ:RANGe:AUTO?
Example	Put the I Range and Q Range in manual :POW:IQ:RANG:AUTO OFF :POW:IQ:RANG:AUTO?
Notes	:POW:IQ:RANG:AUTO is an alternate form of :VOLT:IQ:RANG:AUTO, to maintain consistency with I Range and Q Range, which support both the POWer and VOLTage forms of the command
Preset	ON
Range	Auto | Man

I Range

The internal gain range for the I channel when the Input Path is I Only or I and I/Q. Used for both the I and Q channels when the Input Path is I+jQ.

Remote Command	[:SENSe]:VOLTage:IQ[:I]:RANGe[:UPPer] <voltage> [:SENSe]:VOLTage:IQ[:I]:RANGe[:UPPer]?
Example	Set the I Range to 0.5 V Peak :VOLT:IQ:RANG 0.5 V :VOLT:IQ:RANG?
Notes	The numeric entries are mapped to the smallest gain range whose break point is greater than or equal to the value, or 1 V Peak if the value is greater than 1 V
Couplings	When "Q Same as I" on page 1580 is On, the **I Range** value will be copied to "Q Range" on page 1578 Changing the value also sets Range = Man
Preset	1 V Peak
State Saved	Saved in instrument state
Range	1 V Peak (10 dBm @ 50 Ω) | 0.5 V Peak (4 dBm @ 50Ω) | 0.25 V Peak (-2 dBm @ 50Ω) | 0.125 V Peak (-8 dBm @ 50Ω)
Min	0.125 V
Max	1 V
Annotation	The Range annotation replaces the RF Input context's "Atten" annotation

	"Rng: <I Range>". When Range = Man the annotation is preceded by "#" The I Range is not annotated in Input Path Q Only. When I Range and Q Range are the same, the annotation is "Rng: <Range>". When I Range and Q Range are different and the Input Path is Ind I/Q, the annotation is "Rng: <I Range>, <Q Range>" and "Peak" is removed from the text. Examples: "Rng: 1 V Peak" the I Range is 1 V Peak "Rng: 1 V, 0.5 V " the I Range is 1 V Peak and the Q Range is 0.5 V Peak

This is an alternate form of the command to allow entry as a power.

Remote Command	`[:SENSe]:POWer:IQ[:I]:RANGe[:UPPer] <ampl>` `[:SENSe]:POWer:IQ[:I]:RANGe[:UPPer]?`

Example	Set the I Range to 0.5 V Peak when Reference Z is 50 Ω, and to 1.0 V Peak when Reference Z is 75 Ω
	`:POW:IQ:RANG 4 dBm`
	`:POW:IQ:RANG?`

Notes	The `POWer` form of the command is provided for convenience. It maps to the same underlying gain range parameter as the `VOLTage` form of the command The Reference Z (not the I channel Input Z) is used to convert the power to peak voltage, which is then used to set the I Range as with the `VOLTage` form of the command. The power values of the 4 range states (1V Peak, 0.5V Peak, 0.25V Peak, and 0.125V Peak) will vary with Reference Z. Here are some examples: 50 Ω: 10, 4, -2, -8 75 Ω: 8.2, 2.2, -3.8, -9.8 600 Ω: -0.8, -6.8, -12.8, -18.9
Preset	10.0 dBm
Range	-20 dBm to 10 dBm
Min	-20 dBm
Max	10 dBm

Q Range

The internal gain range for the Q channel.**Q Range** only applies to Input Path Q Only and Ind I/Q. For input I+jQ "I Range" on page 1577 determines both I and Q channel range settings.

Remote Command	`[:SENSe]:VOLTage:IQ:Q:RANGe[:UPPer] <voltage>` `[:SENSe]:VOLTage:IQ:Q:RANGe[:UPPer]?`

Example	Set the Q Range to 0.5 V Peak:
	`:VOLT:IQ:Q:RANG 0.5 V`
	`:VOLT:IQ:Q:RANG?`

Notes	The numeric entries are mapped to the smallest gain range whose break point is greater than or equal to the value, or 1 V Peak if the value is greater than 1 V **Q Range** is only used for Input Path Q Only and Ind I/Q. For input I+jQ, "I Range" on page 1577

	determines both I and Q channel range settings
Couplings	When "Q Same as I" on page 1580 is On, the "I Range" on page 1577 value is copied to **Q Range** and the range value keys are disabled Changing the value also sets Range = Man
Preset	1 V Peak
State Saved	Saved in instrument state
Range	1 V Peak (10 dBm @ 50Ω) | 0.5 V Peak (4 dBm @ 50Ω) | 0.25 V Peak (-2 dBm @ 50Ω) | 0.125 V Peak (-8 dBm @ 50Ω)
Min	0.125 V
Max	1 V
Annotation	The Range annotation replaces the RF Input context's "Atten" annotation "Rng: <Q Range>". When Range = Man the annotation is preceded by "#" The Q Range is not annotated in Input Path I Only or I+jQ. When I Range and Q Range are the same, the annotation is "Rng: <Range>". When I Range and Q Range are different and the Input Path is Ind I/Q, the annotation is "Rng: <I Range>, <Q Range>" and "Peak" is removed from the text. Examples: "Rng: 1 V Peak" the Q Range is 1 V Peak "Rng: 1 V, 0.5 V " the I Range is 1 V Peak and the Q Range is 0.5 V Peak

This is an alternate form of the command to allow entry as a power.

Remote Command	`[:SENSe]:POWer:IQ:Q:RANGe[:UPPer] <ampl>` `[:SENSe]:POWer:IQ:Q:RANGe[:UPPer]?`

Example	Sets the Q Range to 0.5 V Peak when Reference Z is 50 **Ω**, and to 1.0 V Peak when Reference Z is 75 **Ω**:
	`:POW:IQ:Q:RANG 4 dBm`
	`:POW:IQ:Q:RANG?`

Notes	The `POWer` form of the command is provided for convenience. It maps to the same underlying gain range parameter as the `VOLTage` form of the command The Reference Z (not the Q channel Input Z) is used to convert the power to peak voltage, which is then used to set the Q Range as with the `VOLTage` form of the command. The power values of the 4 range states (1V Peak, 0.5V Peak, 0.25V Peak, and 0.125V Peak) will vary with Reference Z. Here are some examples: 50 Ω: 10, 4, -2, -8 75 Ω: 8.2, 2.2, -3.8, -9.8 600 Ω: -0.8, -6.8, -12.8, -18.9
Preset	10.0 dBm
Range	-20 dBm to 10 dBm
Min	-20 dBm
Max	10 dBm

Q Same as I

Many, but not all, usages require the I and Q channels to have an identical setup. To simplify channel setup, **Q Same as I** causes the Q channel range to be mirrored from the I channel. That way you only need to set up one channel (the I channel). The I channel values are copied to the Q channel, so at the time **Q Same as I** is Off, the I and Q channel setups will be identical.

Remote Command	`[:SENSe]:VOLTage|POWer:IQ:MIRRored OFF | ON | 0 | 1` `[:SENSe]:VOLTage|POWer:IQ:MIRRored?`

Example	Turn off the mirroring of I Range to Q Range.
	`:VOLT:IQ:MIRR OFF`
	`:POW:IQ:MIRR OFF`

Couplings	When ON, the "I Range" on page 1577 value is mirrored (copied) to the "Q Range" on page 1578
Preset	ON
State Saved	Saved in instrument state
Range	OFF|ON

3.12.3.4 Range (Non-attenuator models)

This tab is only available for Keysight's modular signal analyzers and certain other Keysight products. Examples include:

- VXT
- E7760
- M9391A
- M9393A

This tab also does not appear in UXM. In UXM, all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

State Saved	No

Range

Represents the amplitude of the largest sinusoidal signal that could be present within the IF without being clipped by the ADC. For signals with high peak-to-average ratios, the range may need to exceed the rms signal power by a significant amount to avoid clipping.

This is a measurement global setting.

Remote Command	[:SENSe]:POWer[:RF]:RANGe <real> [:SENSe]:POWer[:RF]:RANGe?
Example	:POW:RANG 10 dBm :POW:RANG?
Notes	The MIN and MAX values are affected by the External Gain parameters, and by the **Center Frequency** The hardware compensates for frequency response and alters the Range setting
Preset	0 dBm
State Saved	Yes
Min	-100
Max	100
Annotation	Meas Bar

Adjust Range for Min Clipping

Sets the combination of attenuation and gain based on the current measured signal level so that clipping will be at a minimum.

This is an "immediate action" function, that is, it executes once, when the key is pressed.

This key does not appear in measurements that do not support this functionality.

Remote Command	[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate
Notes	Executing Adjust Range for Min Clipping initiates the measurement
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760

Pre-Adjust for Min Clipping

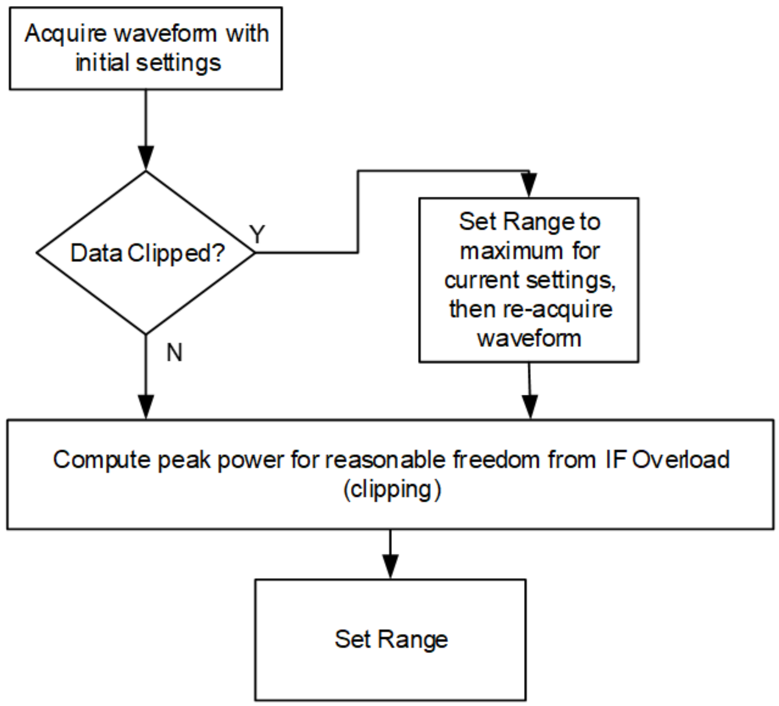
If this function is ON, it applies the adjustment described under Adjust Range For Min Clipping each time a measurement restarts. Therefore, in Continuous measurement mode, it only executes before the first measurement.

Remote Command	[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation OFF | ON | ELECtrical | COMBined [:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation?
Notes	Because there is no attenuator control available in these models, the control displays only ON and OFF choices. However, for SCPI compatibility with other platforms, all three parameters (ELECtrical, COMBined, and ON) are honored and all are mapped to ELECtrical, so if any of these three parameters is sent, a subsequent query will return ELEC
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760
Preset	OFF for Swept SA measurement; ON for all other measurements that support **Pre-Adjust for Min**

	Clipping
State Saved	Saved in instrument state

Adjustment Algorithm

The algorithm for the adjustment is documented below:



Peak-to-Average Ratio

Used with "Range (Non-attenuator models)" on page 1864 to optimize the level control in the instrument. The value is the ratio, in dB, of the peak power to the average power of the signal to be measured. A ratio of 0 should be used for sinusoidal signals; for 802.11g OFDM signals use 9 dB.

All Applications (Modes) show the current value of Peak-to-Average ratio on the control. However, some applications do not permit changing the value. In these situations, the control is grayed-out.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:PARatio <real>` `[:SENSe]:POWer[:RF]:RANGe:PARatio?`
Example	`:POW:RANG:PAR 12 dB`
Notes	In some Applications (Modes) this parameter is read-only; meaning the value will appear on the control and query via SCPI, but is not changeable. In such applications the control is grayed-out. Attempting to change the value via SCPI will be ignored but no error message will be generated

Dependencies	This control does not appear in Spectrum Analyzer Mode
Preset	10 dB VXT Models M9410A/11A: 0 dB
State Saved	Saved in instrument state
Min	0 dB
Max	20 dB VXT Models M9410A/11A: 50 dB

Mixer Lvl Offset

This is an advanced setting to adjust target Range at the input mixer, which in turn affects the signal level in the instrument’s IF. This setting can be used when additional optimization is needed after setting "Peak-to-Average Ratio" on page 1866. Positive values of offset optimize noise performance over distortion, negative values optimize distortion performance over noise.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet <real>` `[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet?`
Example	`:POW:RANG:MIX:OFFS -5 dB`
Preset	0 dB
State Saved	Saved in instrument state
Min	-35 dB VXT Models M9410A/11A: -34 dB
Max	30 dB

3.12.3.5 Signal Path

Contains controls that pertain to the routing of the signal through the frontend of the instrument.

In general, this tab only appears in instruments whose hardware supports this signal routing. For example, this tab does not appear in many of the modular instrument products, including VXT Models M9420/21A. It also does not appear in UXM.

This tab *does* appear in VXT Models M9410A/11A because the Software Preselection control is in this tab, and VXT Models M9410A/11A implement a version of Software Preselection.

Presel Center

Pressing this control adjusts the centering of the preselector filter to optimize the amplitude accuracy at the frequency of the selected marker. If the selected marker is not on when **Presel Center** is pressed, the instrument turns on the selected marker, performs a peak search, and then performs centering on the marker’s center frequency. If the selected marker is already on and between the start and stop frequencies of the instrument, the instrument performs the preselector calibration on that marker's frequency. If the selected marker is already on, but outside the frequency range between Start Freq and Stop Freq, the instrument first performs a peak search, and then performs centering on the marker's center frequency.

The value displayed on "Preselector Adjust" on page 1869 will change to reflect the new preselector tuning.

A number of considerations should be observed to ensure proper operation. See "Proper Preselector Operation" on page 1584.

Remote Command	`[:SENSe]:POWer[:RF]:PCENter`
Example	`:POW:PCEN`
Notes	Note that the rules outlined above under the control description apply for the remote command as well as the key. The result of the command is dependent on marker position, etc. Any message shown by the control press is also shown in response to the remote command
Dependencies	Does not appear in CXA-m Does not appear in VXT Models M9410A/11A Grayed-out if the microwave preselector is off – If the selected marker's frequency is below Band 1, an advisory message is generated "Preselector not used in this frequency range" and no action is taken – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz – Blank in models that do not include a preselector, such as option 503. If the remote command is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View
Couplings	The active marker position determines where the centering will be attempted If the instrument is in a measurement such as averaging when centering is initiated, the act of centering the preselector restarts averaging, but the first average trace will not be taken until the centering is completed The offset applied to do the centering reads out on the "Preselector Adjust" on page 1869 control
Status Bits/OPC dependencies	When centering the preselector, `*OPC` will not return true until the process is complete and a subsequent measurement has completed, nor will results be returned to `:READ` or `:MEASure` queries The Measuring bit should remain set while this command is operating and should not go false until the subsequent sweep/measurement has completed

Proper Preselector Operation

A number of considerations should be observed to ensure proper operation:

1 If the selected marker is off, the instrument turns on a marker, performs a peak search, and adjusts the preselector using the selected marker's frequency. It uses the

"highest peak" peak search method unqualified by threshold or excursion, so that there is no chance of a 'no peak found' error. It continues with that peak, even if it is the peak of just noise. Therefore, for this operation to work properly, there should be a signal on screen in a preselected range for the peak search to find

2 If the selected marker is already on, the instrument attempts the centering at that marker's frequency. There is no preselector for signals below about 3.6 GHz, so if the marker is on a signal below 3.6 GHz, no centering will be attempted and an advisory message generated

3 In some models, the preselector can be bypassed. If it is bypassed, no centering will be attempted in that range and a message will be generated

Preselector Adjust

Allows you to manually adjust the preselector filter frequency to optimize its response to the signal of interest. This function is only available when "Presel Center" on page 1868is available.

For general purpose signal analysis, using **Presel Center** is recommended. Centering the filter minimizes the impact of long-term preselector drift. **Preselector Adjust** can be used instead to manually optimize the preselector. One application of manual optimization would be to peak the preselector response, which both optimizes the signal-to-noise ratio and minimizes amplitude variations due to small (short-term) preselector drifting.

When **Presel Center** is performed, the offset applied to do the centering becomes the new value of **Preselector Adjust**.

Remote Command	`[:SENSe]:POWer[:RF]:PADJust <freq>` `[:SENSe]:POWer[:RF]:PADJust?`
Example	`:POW:PADJ 100KHz` `:POW:PADJ?`
Notes	The value on the control reads out to 0.1 MHz resolution
Dependencies	– Does not appear in CXA-m – Does not appear in VXT Models M9410A/11A – Grayed-out if microwave preselector is off – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz – Blank in models that do not include a preselector, such as option 503. If the SCPI is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View

Preset	0 MHz
State Saved	The **Preselector Adjust** value set by "Presel Center" on page 1868, or by manually adjusting **Preselector Adjust** It is not saved in instrument state, and does not survive a Preset or power cycle
Min	-500 MHz
Max	500 MHz
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PADJust` `[:SENSe]:POWer[:RF]:MMW:PADJust`

Notes	PSA had multiple preselectors, and you could select which preselector to adjust. Since the X-Series has only one mm/uW preselector, the preselector selection control is no longer available. However, to provide backward compatibility, we accept the legacy remote commands The command form has no effect, the query always returns `MWAVe`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:PADJust:PRESelector MWAVe | MMWave | EXTernal` `[:SENSe]:POWer[:RF]:PADJust:PRESelector?`

Internal Preamp

Accesses a menu of controls for the internal preamps. Turning on the preamp gives a better noise figure, but a poorer inter-modulation distortion (TOI) to noise floor dynamic range. You can optimize this setting for your particular measurement.

The instrument takes the preamp gain into account as it sweeps. If you sweep outside of the range of the preamp, the instrument will also account for that. The displayed result always reflects the correct gain.

For some measurements, when the preamp is on and any part of the displayed frequency range is below the lowest frequency for which the preamp has specifications, a warning condition message appears in the status line. For example, for a preamp with a 9 kHz lowest specified frequency: "Preamp: Accy unspec'd below 9 kHz".

Selection	Example	Note
Off	`:POW:GAIN OFF`	
Low Band	`:POW:GAIN ON` `:POW:GAIN:BAND LOW`	Sets the internal preamp to use only the low band. The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Low Band selection in the dropdown
Full Range	`:POW:GAIN ON` `:POW:GAIN:BAND FULL`	Sets the internal preamp to use its full range. The low band (0-3.6 GHz, 0-3.4 GHz, 0-3GHz, depending on the model) is supplied by the low band preamp and the frequencies above low band are supplied by the high

Selection	Example	Note
		band preamp The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Full Range selection in the dropdown. If the high band option is not installed the Full Range selection does not appear

Remote Command	`[:SENSe]:POWer[:RF]:GAIN:BAND LOW | FULL`
	`[:SENSe]:POWer[:RF]:GAIN:BAND?`
	`[:SENSe]:POWer[:RF]:GAIN[:STATe] OFF | ON | 0 | 1`
	`[:SENSe]:POWer[:RF]:GAIN[:STATe]?`

Example	`:POW:GAIN:BAND LOW`
	`:POW:GAIN:BAND?`
	`:POW:GAIN OFF`
	`:POW:GAIN?`

Dependencies	Preamp is not available on all hardware platforms. If the preamp is not present or is unlicensed, the control is not shown Does not appear in VXT Models M9410A/11A/15A If `:POW:GAIN:BAND FULL` is sent when a low band preamp is available, the preamp band parameter is set to `LOW` instead of `FULL`, and an "Option not installed" message is generated The preamp is not available when the electronic/soft attenuator is enabled
Preset	`LOW` `OFF`
State Saved	Saved in instrument state
Annotation	When the USB Preamp is not connected to USB, the Preamp annotation in the Meas Bar says “Off” if the preamp is off and displays the frequency range of the low band or full range preamp depending on the setting. For example, if the Preamp is set to Low Band and the Low Band is 3.6 GHz the annotation says “3.6 GHz”. If it is a 13.6 GHz preamp and it is set to Full Range the annotation says “13.6 GHz” When the USB Preamp is connected to USB, the Preamp annotation says “Preamp: USB” if the internal preamp is off or “Preamp: USB, Int” if the internal preamp is on (only for measurements that support the USB preamp)

LNA

Lets you turn the Low Noise Amplifier (LNA) on or off.

The LNA is an additional preamplifier that provides superior DANL and frequency range compared to the Internal Preamp. The LNA provides lower system noise figure, especially at frequencies above 100 MHz, and can be operated up to the full range of 50 GHz instruments.

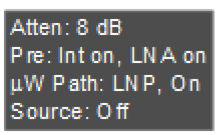
For best possible sensitivity, the LNA can be turned on together with the "Internal Preamp" on page 1870, although if you operate both preamps together, note that the TOI (distortion) specifications are impacted. The sensitivity improvement of this combination is substantial when operating in high band (frequencies above 3.6 GHz).

See "More Information" on page 1588

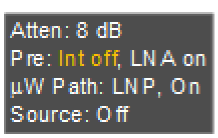
Remote Command	`[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe] OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe]?`
Example	`:POW:GAIN:LNA ON`
Dependencies	Requires option LNA Option LNA is not required by VXT model M9415A Does not appear in VXT models M9420A/21A/10A/11A May not appear in some measurements
Preset	`OFF`
State Saved	Saved in State

More Information

When the LNA is installed, the preamp annotation changes to show the state of both the LNA and the Internal Preamp. Below is an example:



Note that when operating entirely in the low band (below about 3.6 GHz), if the LNA is on, the Internal Preamp is switched off (even if you have its switch set to ON). This is because the noise performance is actually degraded in low band if both preamps are on. In this case, the annotation reflects the actual state of the two preamps, but the Internal Preamp annotation displays in amber, to warn you that the actual state of the Internal Preamp does not match the **Internal Preamp** switch control display:



µW Path Control

Options for this control include **µW Preselector Bypass** (Option MPB), **Low Noise Path** (Option LNP) and **Full Bypass Enable** in the High Band path circuits.

When the µW Preselector is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. When **Low Noise Path Enable** is selected, the instrument automatically bypasses certain circuitry in the high frequency bands that can contribute to noise, when it is appropriate based on other instrument settings.

For most applications, the preset state is **Standard Path**, which provides the best remote-control throughput, minimizes acoustic noise from switching and minimizes the risk of wear in the hardware switches, particularly in remote test scenarios where both low band and high band setups will follow in rapid succession. In this path, the bypass of the low band/high band switch and microwave preamp is never activated, which can cause some noise degradation but preserves the life of the bypass switch.

For applications that utilize the wideband IF paths, the preset state is **µW Preselector Bypas**s, if option MPB is present. This is because, when using a wideband IF such as the 140 MHz IF, the µW Preselector's bandwidth can be narrower than the available IF bandwidth, causing degraded amplitude flatness and phase linearity, so it is desirable to bypass the preselector in the default case.

You may choose **Low Noise Path Enable** for a lower noise floor, especially in the 21–26.5 GHz region, though without improving many measures of dynamic range, and without giving the best possible noise floor. The preamp, if purchased and used, gives better noise floor than does **Low Noise Path Enable**, but the preamp's compression threshold and third-order intercept are much poorer than that of **Low Noise Path Enable**.

A fourth choice is **Full Bypass Enable**, which combines **µW Preselector Bypass** and **Low Noise Path Enable**. Because this can bypass most of the circuitry between the input and the first mixer, care should be taken when using this setting to avoid damaging the mixer. **Full Bypass Enable** is only available if both options LNP and MPB are present, as well as option FBP.

Path	Example	Note
Standard Path	`:POW:MW:PATH STD`	Normal setting for most measurements. µW Preselector in circuit, Low Noise Path disabled
Low Noise Path Enable	`:POW:MW:PATH LNP`	See "Low Noise Path Enable" on page 1593
µW Preselector Bypass	`:POW:MW:PATH MPB`	See "µW Preselector Bypass" on page 1595
Full Bypass Enable	`:POW:MW:PATH FULL`	See "Full Bypass Enable" on page 1595

Remote Command	`[:SENSe]:POWer[:RF]:MW:PATH STD | LNPath | MPBypass | FULL` `[:SENSe]:POWer[:RF]:MW:PATH?`

Example	`:POW:MW:PATH LNP`
	Enables the Low Noise path
	`:POW:MW:PATH?`

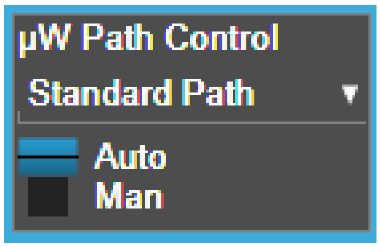
Notes	If "Presel Center" on page 1868 is performed, the instrument will momentarily switch to the Standard Path, regardless of the setting of **µW Path Control** The DC Block will always be switched in when the low noise path is switched in, to protect succeeding circuitry from DC. Note that this does not mean "when the low noise path is enabled" but when, based on the Low Noise Path rules, the path is actually switched in. This can happen when the selection is **Low Noise Path Enable** or **Full Bypass Enable.** In the case where the DC Block is switched in the instrument is now AC coupled. However, if you selected DC coupling, the UI would still behave as though it were DC coupled, including all annunciation, warnings, status bits, and responses to SCPI queries. This is because, based on other settings, the instrument could switch out the low noise path at any time and hence go back to being DC coupled Alignment switching ignores the settings in this menu, and restores them when finished
Dependencies	Does not appear in CXA-m Does not appear in VXT Models M9410A/11A Does not appear in BBIQ and External Mixing The **Low Noise Path Enable** selection does not appear unless Option LNP is present and licensed The **µW Preselector Bypass** selection does not appear unless Option MPB is present and licensed The **Full Bypass Enable** selection does not appear unless options LNP and MPB are both present as well as option FBP In any of these cases, if the required options are not present and the SCPI command is sent, error -241, "Hardware missing; Option not installed" is generated **Low Noise Path Enable** and **Full Bypass Enable** are grayed-out if the current measurement does not support them **Low Noise Path Enable** and **Full Bypass Enable** are not supported in Avionics and MMR Modes. In any of these cases (that is, the feature is not supported in either measurement or mode), if the SCPI command is sent, the following error is generated: -221, "Setting Conflict; Feature not supported for this measurement"
Preset	All except modes specified below: `STD` IQ Analyzer, VXA, Pulse and Avionics mode: – MPB option present and licensed: `MPB` – MPB option not present and licensed: `STD`
State Saved	Save in instrument state
Range	Standard Path|Low Noise Path Enable|µW Presel Bypass|Full Bypass Enable
Annotation	In the Meas Bar, if the Standard path is chosen, it says: µW Path: Standard If Low Noise Path is enabled but the LNP switch is not thrown, it shows: µW Path: LNP,Off If the Low Noise Path is enabled and the LNP switch IS thrown, it shows: µW Path: LNP,On If the preselctor is bypassed, it says: µW Path: Bypass If Full Bypass Enable is selected but the LNP switch is not thrown, it shows: µW Path: FByp,Off

If Full Bypass Enable is selected and the LNP switch IS thrown, it shows:

µW Path: FByp,On

µW Path Control Auto [Mode: VMA, WLAN, NR5G, CQM]

In VMA, WLAN, 5G NR, CQM modes, an Auto/Man switch is added to **µW Path Control**:



This allows the function to automatically switch based on certain Auto Rules as shown below:

VMA Mode

Measurement	When µW Path Control is in Auto:
Digital Demod	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Custom OFDM	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Presel Bypass
SEM	Always Presel Bypass
Spurious Emissions	Always Standard Path

WLAN Mode

Measurement	When µW Path Control is in Auto:
Modulation Analysis	Always Presel Bypass
Spectral Flatness	Always Presel Bypasss
Power vs Time	Always Presel Bypass
Monitor Spectrum	Always Presel Bypass

Measurement	When µW Path Control is in Auto:
IQ Waveform	Always Presel Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Always Presel Bypass
SEM	1. For 11be 320M, when 'Enabled Wideband IF for FFT' is OFF or 'Sweep Type Rule' is Best Dynamic Range, auto µW path is standard. 2. For other cases, auto µW path is presel bypass if presel bypass is enabled, auto µW path is standard if presel bypass is not enabled.
Spurious Emissions	Always Standard Path

5G NR Mode

Measurement	When µW Path Control is in Auto:
Modulation Analysis	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and "Allow Full Bypass in Auto" is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and "Allow Full Bypass in Auto" is On), otherwise choose Preselector Bypass
Channel Power	Always Standard Path
Occupied BW	Always Standard Path
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Standard Path
SEM	Always Standard Path
Spurious Emissions	Always Standard Path
Transmit On|Off Power	Use Standard Path unless tuned frequency > 3.6 GHz and Info BW > 15 MHz, in which case choose Preselector Bypass

Channel Quality Mode

Measurement	When µW Path Control is in Auto:
Group Delay	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and "Allow Full Bypass in Auto" is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass

Remote Command	`[:SENSe]:POWer[:RF]:MW:PATH:AUTO ON | OFF | 1 | 0` `[:SENSe]:POWer[:RF]:MW:PATH:AUTO?`
Example	`:POW:MW:PATH:AUTO ON` `:POW:MW:PATH:AUTO?`
Dependencies	Only appears in VMA, WLAN, 5G NR and CQM modes
Couplings	See the tables above
Preset	ON
Range	ON|OFF

Low Noise Path Enable

You may select **Low Noise Path Enable**, which gives a lower noise floor under some circumstances, particularly when operating in the 21-26.5 GHz region. With the Low Noise Path enabled, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

- The instrument is not in the Low Band, meaning:
- the start frequency is above 3.5 GHz and
- the stop frequency is above 3.6 GHz
- the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Low Noise Path Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Low Noise Path Enable** is selected in the user interface. The only time the Low Noise Path is used is when **Low Noise Path Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

For measurements that use IQ acquisition, the low noise path is used when **Center Frequency** is in High Band (> 3.6 GHz) and no preamp is in use. In other words, the rules above are modified to use only the center frequency to qualify which path to switch in. This is not the case for FFTs in the Swept SA measurement; they use the same rules as swept measurements.

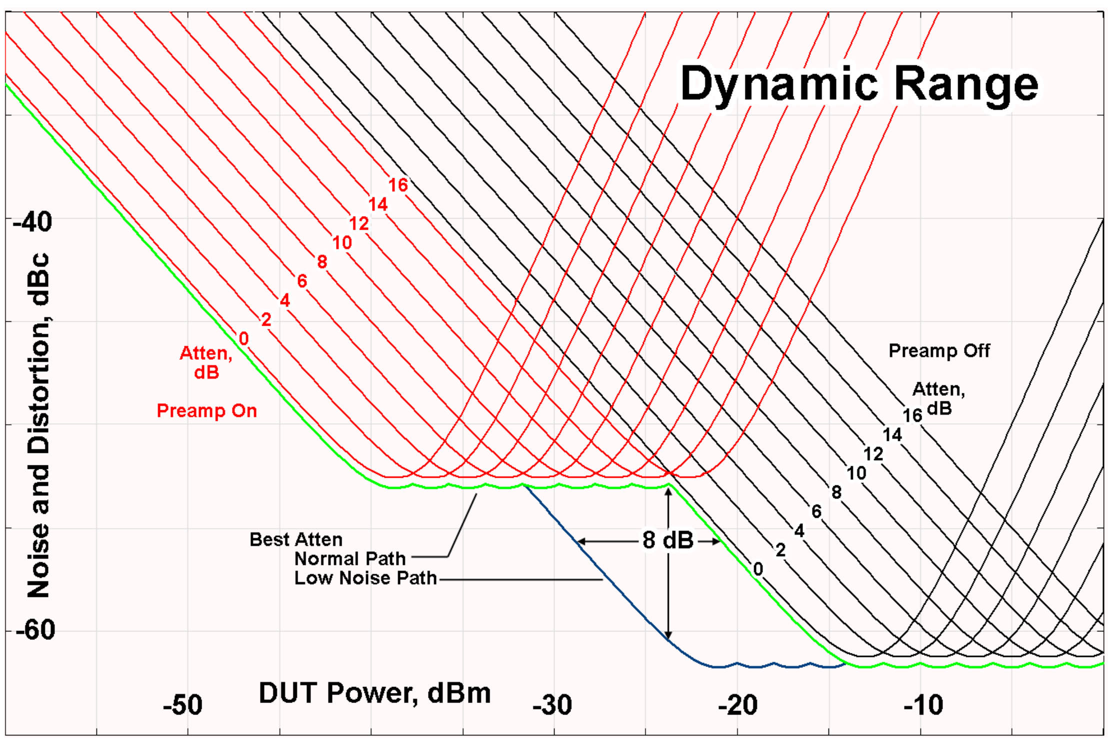
Note that the Low Noise Path, while giving improved DANL, has the disadvantage of decreased TOI performance and decreased gain compression performance relative to the standard path.

Note also that the bypass switch is a mechanical switch and has finite life, so if the **Low Noise Path Enable** is selected, it is possible to cause frequent cycling of this switch by frequently changing instrument settings such that the above conditions hold true only some of the time. A user making tests of this nature should consider opting for the **Standard Path**, which will never throw the bypass switch, at the expense of some degraded noise performance.

The low noise path is useful for situations where the signal level is so low that the instrument performance is dominated by noise even with 0 dB attenuation, but still high enough that the preamp option would have excessive third-order intermodulation or compression. The preamp, if purchased and used, gives better noise floor than does the “Low Noise Path.” However, its compression threshold and third-order intercept are much poorer than that of the non-preamp path.

There are some applications, typically for signals around –30 dBm, for which the third-order dynamic range of the standard path is good enough, but the noise floor is not low enough even with 0 dB input attenuation. When the third-order dynamic range of the preamp path is too little and the noise floor of the standard path is too high, the Low Noise Path can provide the best dynamic range

The graph below illustrates the concept. It shows, in red, the performance of an instrument at different attenuation settings, both with the preamp on and off, in a measurement that is affected by both instrument noise and instrument TOI. The green shows the best available dynamic range, offset by 0.5 dB for clarity. The blue shows how the best available dynamic range improves for moderate signal levels with the low noise path switched in. In this illustration, the preamp improves the noise floor by 15 dB while degrading the third-order intercept by 30 dB, and the low noise path reduces loss by 8 dB. The attenuator step size is 2 dB.



There are other times where selecting the low noise path improves performance, too. Compression-limited measurements such as finding the nulls in a pulsed-RF spectrum can profit from the low noise path in a way similar to the TOI-limited measurement illustrated. Accuracy can be improved when the low noise path allows the optimum attenuation to increase from a small amount like 0, 2 or 4 dB to a larger amount, giving better return loss at the instrument input. Harmonic measurements, such as second and third harmonic levels, are much improved using the low noise path because of the superiority of that path for harmonic (though not intermodulation) distortion performance.

µW Preselector Bypass

Toggles the preselector bypass switch for band 1 and higher. When the microwave presel is on, the signal path is preselected. When the microwave preselector is off, the signal path is not preselected. The preselected path is the normal path for the instrument.

The preselector is a tunable bandpass filter which prevents signals away from the frequency of interest from combining in the mixer to generate in-band spurious signals (images). The consequences of using a preselector filter are its limited bandwidth, the amplitude and phase ripple in its passband, and any amplitude and phase instability due to center frequency drift.

Option MPB or pre-selector bypass provides an unpreselected input mixer path for certain X-Series signal analyzers with frequency ranges above 3.6 GHz. This signal path allows a wider bandwidth and less amplitude variability, which is an advantage when doing modulation analysis and broadband signal analysis. The disadvantage is that, without the preselector, image signals will be displayed. Another disadvantage of bypassing the preselector is increased LO emission levels at the front panel input port.

Image responses are separated from the real signal by twice the 1st IF. For IF Paths of 10 MHz and 25 MHz, the 1st IF is 322.5 MHz, so the image response and the real signal will be separated by 645 MHz. The 1st IF will be different for other IF Path settings. When viewing a real signal and its corresponding image response in internal mixing, the image response will be to the left of the real signal.

Also, the image response and the real signal typically have the same amplitude and exhibit the same shape factor.

However, if Option FS1, Fast Sweep Capability, is enabled, the image response in the Swept SA measurement appears lower in amplitude and has a much wider shape factor compared to the real signal.

Full Bypass Enable

With **Full Bypass Enable** selected, the microwave preselector is bypassed. In addition, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

– The instrument is not in the Low Band, meaning:

– the start frequency is above 3.5 GHz and

– the stop frequency is above 3.6 GHz.

– the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. The only time the Low Noise Path is used is when **Full Bypass Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

CAUTION When **Full Bypass Enable** is selected, and "Attenuation" on page 1747 is set to 0 dB, there will be a direct AC connection between the input and the first converter when the Low Noise Path switches in (when Start Freq >3.6 GHz and the Preamp is either not licensed, set to Low Band, or Off). This puts the first converter at high risk to be damaged by high AC power. Consequently, whenever **Full Bypass Enable** is selected, a warning message appears in the status bar:

Full Bypass Enabled, maximum safe input power reduced

Microwave Preselector Bypass Backwards Compatibility

Example	`:POW:MW:PRES OFF` Bypasses the microwave preselector
Notes	Included for Microwave Preselector Bypass backwards compatibility The `ON` parameter sets the `STD` path (`:POW:MW:PATH STD`) The `OFF` parameter sets path `MPB` (`:POW:MW:PATH MPB`)
Preset	`ON`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe] ON | OFF | 0 | 1` `[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe]?`

Frequency Extender Preselection Bypass

Frequency Extender Preselection Bypass only applies to the high frequency path of the Frequency Extender and only if the Frequency Extender allows it. For example, the V3050A high frequency path is 50 – 110 GHz and does allow control of the preselector bypass.

When the Frequency Extender’s preselection is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. For bandwidths greater than 2.5 [GHz], it is recommended that the signal bypass the Frequency Extender

Preselector since the max bandwidth of the Preselector can be as narrow as 2.5 [GHz].

For most applications, the preset state is `OFF`, which gives the best remote-control throughput, minimizes acoustic noise from switching, minimizes out of band spurs, and minimizes the risk of wear in the hardware switches.

Coupling with Microwave Preselector Control

The control of whether to apply or bypass the Frequency Extender's preselection is dependent on the Microwave Path Control setting.

The coupling between the Microwave Path Control and Frequency Extender Preselector Bypass is described below.

UW PATH CTRL	UW PRESELECTOR	VIKING PRESELECTOR
Standard Path	On	**On**
Low Noise Path Enable	On	**On**
uW Presel Bypass	Off	**Off**
Full Bypass Enable	Off	**Off**

In other words…

uW Path Ctrl == Standard
uW Path Ctrl == Low Noise
Viking PreselBypass == Off

uW Path Ctrl == Bypass
uW Path Ctrl == Full Bypass
Viking PreselBypass == On

For the Frequency Extender Preselector Bypass to take effect, it requires a Frequency Extender device (such as V3050A) be connected and External RF (ERFIN) selected as the input.

The Frequency Extender Preselector is applied or bypassed depending on the Microwave Path Control setting only when the acquisition is above 50 [GHz]. Hence, it will be bypassed only when the acquisition is above 50 [GHz].

Preselector and Bandwidth Conflict

When the Frequency Extender Preselector is applied and the signal bandwidth is greater than 2.5 [GHz], then a settings alert message will show to warn the user that the signal may be distorted due to the limitation of the Frequency Extender Preselector bandwidth.

An example of the settings alert message is shown below.

Settings Alert message in the Status Bar at the bottom of the display.

Settings Alert message in the error queue

.

Software Preselection

Software Preselection is provided in some instruments, either to compensate for issues with provided hardware preselection or to provide the preselection function when there is no hardware preselector.

N9041B

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 50 GHz, software preselection must be used to suppress and separate images above 50 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

In the N9041B, Software Preselection only applies for frequencies above 50 GHz, therefore it is only used for RF Input 2. Even if it is turned on, it will not be used for other inputs and never for frequencies below 50 GHz. This is why the label of this control contains the parenthetical note “(>~50 GHz)”.

Note that in the N9041B, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

N9042B+V3050A

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 88 GHz, software preselection must be used to suppress and separate images above 88 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

For N9042B+V3050A, Software Preselection only applies for frequencies above 88 GHz, therefore it is only used for External RF. Even if it is turned on, it will not be used for other inputs and never for frequencies below 88 GHz. This is why the label of this control contains the parenthetical note “(>~88 GHz)”.

Note that for N9042B+V3050A, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

VXT models M9410A/11A

Software Preselection is used to provide the preselection function, as there is no hardware preselector in these models. Two background traces are taken and compared point by point, and the point with the lowest amplitude from the two traces is used. This provides a method to reduce spurs that are internally generated within the VXT, but the user should note the following when using Software Preselection:

- There is some speed cost due to the need to take multiple captures
- Taking the point with the lowest amplitude in each trace will make the average noise level lower at all points that do not have a spur. This can reduce the accuracy of the measurement of noise and noise-like signals.

Because of the difficulty in identifying spurs manually, you are encouraged to leave Software Preselection ON at all times in VXT models M9410A/11A. If you turn it off in order to speed up your measurement or improve noise accuracy, be aware of unwanted onscreen spurs.

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel:STATe 0 | 1 | ON | OFF` `[:SENSe]:POWer[:RF]:SWPresel:STAT?`
Example	`:POW:SWPR:STAT 1` `:POW:SWPR:STAT?`
Dependencies	Only appears in N9041B, N9042B+V2050A, and VXT models M9410A/11A. Does not appear in all measurements
Couplings	Sweep Time is affected by SW Preselection. Also Auto Tune supports SW Preselection, so set SW Preselection state and then do Auto Tune
Preset	N9041B: OFF N9042B+V3050A: ON M9410A/11A: ON
State Saved	Saved in instrument state

SW Preselection Type

Specifies the algorithm used for software preselection.

Two hidden sweeps are taken in succession. The second sweep is offset in LO frequency by 2*IF/N. For each point in each trace, the smaller amplitude from the two traces is taken and placed in that point in the selected trace. The Peak detector is auto-selected to improve the image suppression effectiveness. Responses of each trace that lie on top of one another will remain and are valid signals. Other signals are images and are suppressed. The action of taking the smaller of the two traces will make the average noise level lower in all points that do not have an image, thus reducing the accuracy of the measurement of noise and noise-like signals.

- `NORMal` - mathematically removes all image and multiple responses of signals present at the input
- `ADVanced` - any trace processing (such as "max hold" or trace averaging) is performed on the points of both candidate traces before the "select minimum" operation occurs. This form of processing works better for non-stationary signals, such as pulsed-RF signals

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel NORMal | ADVanced` `[:SENSe]:POWer[:RF]:SWPResel?`
Example	`:POW:SWPR NORM` `:POW:SWPR?`
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed-out. Its grayout message is "Unavailable unless SW Presel enabled"
Preset	N9041B: `ADVanced` N9042B+V3050A: `NORMal`
State Saved	Saved in instrument state

SW Preselection BW

Specifies the effective bandwidth to be used for Software Preselection.

The choices are:

- `NORMal` – when making Swept measurements, a software preselection algorithm is used which takes up to 4 background acquisitions, then post-processes the result. This algorithm can remove images from signals with an occupied bandwidth up to around 3 GHz. (Default/Preset setting). When making FFT measurements, this algorithm is not used, instead the same algorithm is used as for `NARRow` (below)
- `NARRow`– a software preselection algorithm is used which takes two background acquisitions, then post-processes the result to detect and remove images from wideband signals with occupied bandwidths up to 2 GHz. This increases the risk of images failing to be rejected, but improves the measurement speed

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel:BW NORMal | NARRow` `[:SENSe]:POWer[:RF]:SWPResel:BW?`
Example	`:POW:SWPR:BW NARR`
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed out. Its grayout message is "Unavailable unless SW Presel enabled" For N9042B+V3050A the parameter is SCPI only and always set to `NARRow` when Software Preselection is enabled
Preset	N9041B: `NORMal` N9042B+V3050A: `NARRow`
State Saved	Saved in instrument state

High Freq Prefilter

Lets you set the state of Prefilter for Center Frequencies above 1310 MHz.

In VXT Models M9410A/11A, the Receiver RF path has a bank of filters that come after the RF Attenuator in the signal path. Since this bank of filters precedes the mixer they are known as the "Prefilter" bank. Their purpose is to eliminate unwanted in-band mixing products by filtering out all but the desired frequencies before the signals get to the mixer. There are 13 prefilter bands to cover the frequencies between 9 kHz and 6000 MHz. The Prefilter provides the necessary rejection of the unwanted signal.

Remote Command	`[:SENSe]:<measurement>:PFILter[:STATe] ON | OFF | 1 | 0` `[:SENSe]:<measurement>:PFILter[:STATe]?`

Example	For example, to enable High Freq Prefilter in IQ Analyzer Mode:
	For the Complex Spectrum Measurement:
	`:SPEC:PFIL ON`
	For the IQ Waveform Measurement:
	`:WAV:PFIL ON`
	`:`

Dependencies	This control only appears in VXT models M9410A/11A with center frequency above 1310 MHz
Preset	See "Prefilter Presets" below
State Saved	Saved in instrument state

Prefilter Presets

Meas	Mode	Preset
SPEC	BASIC	OFF

Meas	Mode	Preset
WAV	BASIC, WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
MON	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
RHO	WCDMA	OFF
CDP	WCDMA	OFF
PCON	WCDMA	OFF
EVMQ	WCDMA	OFF
CHP	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
OBW	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
ACP	WCDMA, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
SEM	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PST	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PVT	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF
EVM	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF
FLAT	WLAN	OFF
EVMM	WLAN	OFF
CEVM	LTEAFDD, LTEATDD	OFF
PAVT	5GNR, VMA	OFF
DDEM	VMA	OFF
OFDM	VMA	OFF
SAN	SA	ON
HARM	SA	ON

3.12.4 BW

Opens the bandwidth (**BW**) menu, which contains the Info BW control.

3.12.4.1 Settings

Contains the basic Bandwidth functions. It is the only tab under Bandwidth.

Info BW

Allows you to enter a frequency value to set the channel bandwidth that will be used for data acquisition. When in Auto, it is set to the value that covers carriers set by carrier configuration.

Remote Command	`[:SENSe]:PSTatistic:BANDwidth <freq>`
	`[:SENSe]:PSTatistic:BANDwidth?`
	`[:SENSe]:PSTatistic:BANDwidth:AUTO ON | OFF | 1 | 0`
	`[:SENSe]:PSTatistic:BANDwidth:AUTO`

Example	`:PST:BAND 8 MHz`
	`:PST:BAND?`
	`:PST:BAND:AUTO 0`
	`:PST:BAND:AUTO?`

Notes	Auto/Man is available only for 5G NR, LTE, LTETDD, LTEAFDD, LTEA TDD

Preset	SA, WCDMA: 5 MHz
	CQM: 10 MHz
	LTE, LTETDD, LTEATDD, LTEAFDD: Automatically calculated
	5G NR: 100 MHz
	The default value depends on the Radio Standard selection
	MSR: same as max value
	WLAN:
	– No option = 10 MHz
	– Option B25 = 25 MHz
	– Option B40:
	  – if Radio Std is 802.11a/b/g/n/ac/ax/be (20 MHz) = 25 MHz
	  – if Radio Std is 802.11n/ac/ax/be (40 MHz) = 40 MHz
	  – if Radio Std is 802.11ac/ax/be (80 MHz) = 80 MHz
	  – if Radio Std is 802.11ac/ax/be (160 MHz) = 160 MHz
	  – if Radio Std is 802.11be (320 MHz) = 320 MHz
	– Option B1X:
	  – if Radio Std is 802.11ac(80 MHz) = 80 MHz
	– Option B1Y:
	  – if Radio Std is 802.11ac(160 MHz) = 160 MHz
	
	ON

State Saved	Saved in instrument state

Min/Max	10 kHz / Max Info BW
	The Max Info BW is hardware dependent:
	– RF Input:
	  – No Option = 10 MHz
	  – WB (25 MHz or wider) = Hardware Option Limit
	– I/Q Input (for I+jQ):
	  – No Option = 20 MHz
	Option B25 = 50 MHz

Backwards Compatibility SCPI	[:SENSe]:PSTatistic:BWIDth

3.12.5 Display

Opens the **Display** menu, which lets you configure display items for the current Mode, Measurement View or Window.

3.12.5.1 View

Contains controls for selecting the current **View**, and for editing User Views.

Views

The General Power Stat CCDF measurement provides a single view. The LTE/LTE-A TDD and 5G NR Power Stat CCDF measurement has two views: the Normal View and the Slot View.

These Views are multiple-window Views. When in a multiple window View, you select a window by touching it. The menu controls may sometimes change depending on which window is selected.

Remote Command	[:SENSe]:PSTatistic:SLTView[:STATe] OFF | ON | 0 | 1 [:SENSe]:PSTatistic: SLTView[:STATe]?
Example	Select Slot View :PST:SLTV ON Select Normal View :PST:SLTV OFF :PST:SLTV?
Dependencies	Only available in LTE/LTEATDD and 5GNR Modes
Preset	OFF
State Saved	Yes
Range	OFF|ON

Normal

Windows: "Metrics" on page 1560, "Graph" on page 1559

The Power Stat CCDF measurement provides CCDF curves and power statistics metrics. This is common for both Uplink (MS) and Downlink (BTS).

Example	:PST:SLTV OFF

User View

Lets you choose a View from the saved User Views for the current measurement. This panel only appears if a User View exists for the current measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:SELect <alphanumeric>` `:DISPlay:VIEW:ADVanced:SELect?`
Example	Select Baseband as the current View `:DISP:VIEW:ADV:SEL “Baseband”`

Notes	You must be in the measurement whose View you are trying to set to send the command. You can only set Views for the current measurement using this command
	For predefined views, the parameter is derived from the view name that is shown in the View list in the user interface. For example, if you are trying to select the Trace Zoom view in the Swept SA measurement, you send:
	`:DISP:VIEW:ADV:SEL "Trace Zoom"`
	because “Trace Zoom” is the name of the View as seen in the Mode/Meas dialog or in the Display, View menu
	You *cannot* use the legacy View parameter (which in this case would be `TZOom`) with `:DISP:VIEW:ADV:SEL`
	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case. Thus, both of the following forms work:
	`:DISP:VIEW:ADV:SEL "Trace Zoom"`
	`:DISP:VIEW:ADV:SEL "TRACE ZOOM"`
	If the specified view is not a valid View, the query returns the error message “-224, Illegal parameter value; View with the name <alphanumeric> does not exist”
	If the display is disabled (via `:DISP:ENAB OFF`) then the error message “-221, Settings conflict; View SCPI cannot be used while Display is disabled” is generated

Backwards Compatibility SCPI	The legacy node `:DISPlay:VIEW[:SELect]` is retained for backwards compatibility, but it only supports predefined views

Restore Layout to Default

Restores the Layout to the default for Basic.

Modified Views are very temporary; if you exit the current measurement they are discarded, and they are not saved in State. To retain this View for later use, and to be able to return easily to your original Basic View, you can save your edited View as a “User View”.

Save Layout as New View

Saves your new View as a User View. An alpha keyboard appears, which lets you name your new View; the default is the old View name plus a number.

Remote Command	`:DISPlay:VIEW:ADVanced:NAME <alphanumeric>`
Example	`:DISP:VIEW:ADV:NAME "Baseband"` Creates a new View named `Baseband` from the current View, and selects it as the current View
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If `<alphanumeric>` name already exists as a View, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; User View SCPI cannot be used while Display is disabled" is generated

Re-Save User View

You can re-edit a User View; if you make changes, then an asterisk will appear next to the User View's name. You can then tap **Re-Save User View** to save it back to its existing name, or **Save Layout as New View** to add another, new User View.

This is a front panel function only, there is no remote command available to perform this function. To do this remotely, you must first perform **Save Layout as New View**, then delete the old User View and rename the new one with the name of the View you just deleted.

Rename User View

You can rename the current View by giving it a new unique name. Only User Views can be renamed, if the current View is a Predefined View, an error occurs.

Remote Command	`:DISPlay:VIEW:ADVanced:REName <alphanumeric>`
Example	`:DISP:VIEW:ADV:REN "Baseband"`
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the `<alphanumeric>` specifying the new name is already present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot rename a Predefined View" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete User View

You can delete the current View if it is a User View. The default view becomes the current view for the Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:DELete`
Example	`:DISP:VIEW:ADV:DEL`
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the `<alphanumeric>` is not present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> does not exist" is generated If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot delete a Predefined View" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete All User Views

Deletes all previously saved User Views. The default view becomes the current view for the Measurement if a User View was the current view when this command was executed.

Remote Command	`:DISPlay:VIEW:ADVanced:DELete:ALL`
Example	`:DISP:VIEW:ADV:DEL:ALL`
Notes	Disabled if there are no User Views

View Editor Remote Commands

The following remote commands help you manage Views and User Views. Note that the SCPI node for User Views handles both Predefined and User Views. The legacy nodes, `:DISPlay:VIEW[:SELect]` and `:DISPlay:VIEW:NSEL`, are retained for backwards compatibility, but they only support predefined views.

View Listing Query

Returns a string containing a comma-separated list of names for *all* the Views, including User Views, available for the current Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:CATalog?`
Example	`:DISP:VIEW:ADV:CAT?`
Notes	Returns a quoted string of the available Views for the current measurement, separated by commas. The

	list includes names for *all* the Views, including User Views, available for the current Measurement Example: `"Normal,Trace Zoom,Spectrogram,Baseband,myView1,yourView1"` No distinction is made between Predefined and User Views If you switch measurements with the display disabled (via `:DISP:ENAB OFF`), then query the list of available Views, the result is undefined

User View Listing Query

Returns a string containing a comma-separated list of names for *only* the User Views available for the current Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:USER:CATalog?`
Example	`:DISP:VIEW:ADV:USER:CAT?`
Notes	Returns a quoted string of the available User Views for the current measurement, separated by commas. Example: `"Baseband,myView1,yourView1"` If you switch measurements with the display disabled (see "Display Enable (Remote Command Only)" on page 1894), then query the list of available Views, the result is undefined

3.12.5.2 Annotation

Contains controls for setting up the annotation for the current Mode or Measurement.

Graticule

Turns the display graticule On or Off for all windows with graticules in all measurements in the current Mode. Also turns the graticule Y-Axis annotation on and off.

Remote Command	`:DISPlay:GRATicule[:STATe] OFF | ON | 0 | 1` `:DISPlay:GRATicule[:STATe]?`
Example	`:DISP:GRAT OFF`
Notes	The graticule is the set of horizontal and vertical lines that make up the grid/divisions for the X-Axis and Y-Axis
Preset	`ON`
State Saved	Saved in instrument state
Backwards Compatibility SCPI	`:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe] OFF | ON | 0 | 1` `:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe]?`

This command is accepted for backwards compatibility with older instruments, but the WINDow, TRACe and GRID parameters are ignored

Screen Annotation

Controls the display of the annunciation and annotation around the graticule, including any annotation on lines (such as the display line, the threshold line, etc.) and the Y-Axis annotation, for all windows with screen annotation in all measurements in the current Mode.

This does *not* include marker annotation (or the N dB result). When OFF, the graticule expands to fill the entire graticule area, leaving only the 1.5% gap above the graticule, as described in the **Trace** section.

Remote Command	`:DISPlay:ANNotation:SCReen[:STATe] OFF | ON | 0 | 1` `:DISPlay:ANNotation:SCReen[:STATe]?`
Example	`:DISP:ANN:SCR OFF`
Dependencies	Grayed-out and forced to OFF when **System Display Settings**, **Annotation** is OFF
Preset	ON This remains OFF through a Preset when **System Display Settings**, **Annotation** is set to OFF
State Saved	Saved in instrument state

Trace Annotation

Turns on and off the labels on the traces, showing their detector (or their Math Mode) as described in the **Trace** section, for all windows in all measurements in the current Mode for which Trace Annotation on/off is supported.

If Trace Math is being performed on a trace, then the Trace Math annotation replaces the detector annotation.

For measurements that support limit lines, this key also turns on and off the labels on the Limit Lines. The label is the Limit number annotation and Limit Comment displayed on the graph. If the length of the comment is greater than 20 characters, the first 8 characters and the last 8 characters are displayed, joined with ….

Remote Command	`:DISPlay:ANNotation:TRACe[:STATe] ON | OFF | 1 | 0` `:DISPlay:ANNotation:TRACe[:STATe]?`
Example	`:DISP:ANN:TRAC OFF`
Preset	OFF
State Saved	Saved in instrument state

Control Annotation

Turns on and off the display of values on the Active Function controls for all measurements in the current Mode. This is a security feature.

Remote Command	`:DISPlay:ACTivefunc[:STATe] ON | OFF | 1 | 0` `:DISPlay:ACTivefunc[:STATe]?`
Example	`:DISP:ACT OFF`
Dependencies	Grayed out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Meas Bar

Turns the Measurement Bar at the top of the screen on and off for all measurements in the current Mode. When `OFF`, the graticule area expands to fill the area formerly occupied by the Measurement Bar.

Remote Command	`:DISPlay:ANNotation:MBAR[:STATe] OFF | ON | 0 | 1` `:DISPlay:ANNotation:MBAR[:STATe]?`
Example	`:DISP:ANN:MBAR OFF`
Dependencies	Grayed out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Display Enable (Remote Command Only)

Turns the display on/off, including the display drive circuitry. The backlight stays lit to confirm that the instrument is on. The display enable setting is mode global. Theare three reasons for turning the display off:

1. To increase speed as much as possible by freeing the instrument from having to update the display
2. To reduce emissions from the display, drive circuitry
3. For security purposes

If you have turned off the display:

- and you are in local operation, the display can be turned back on by pressing any key or by sending `:SYSTem:DEFaults MISC` or `:DISPlay:ENABle ON` (neither `*RST` nor :SYSTem:PRESet enable the display)
- and you are in remote operation, the display can be turned back on by pressing the **Local** or **Esc** keys, or by sending `:SYSTem:DEFaults MISC` or `:DISPlay:ENABle ON` (neither `*RST` nor `:SYSTem:PRESet` enable the display)
- and you are using either the `:SYSTem:KLOCk` command or GPIB local lockout, then *no* front-panel key press will turn the display back on. You must turn it back on remotely.

If the display is `OFF`, many SCPI commands related to User Views and Multiscreen functionality do not work, and return the error messages "-221, Settings conflict; Screen SCPI cannot be used when Display is disabled" or "221, Settings conflict; View SCPI cannot be used while Display is disabled". These commands include:

Name	Command
Select User View	`:DISPlay:VIEW:ADVanced:SELect`
Rename User View	`:DISPlay:VIEW:ADVanced:REName`
Delete User View	`:DISPlay:VIEW:ADVanced:DELete`
Create User View	`:DISPlay:VIEW:ADVanced:NAME`
Select Screen	`:INSTrument:SCReen:SELect`
Delete Screen	`:INSTrument:SCReen:DELete`
Delete All But This Screen	`:INSTrument:SCReen:DELete:ALL`
Add Screen	`:INSTrument:SCReen:CREate`
Rename Screen	`:INSTrument:SCReen:REName`
Sequencer On/Off	`:SYSTem:SEQuencer`

Remote Command	`:DISPlay:ENABle OFF | ON | 0 | 1` `:DISPlay:ENABle?`
Example	`:DISP:ENAB OFF`
Couplings	`:DISP:ENAB OFF` turns Backlight `OFF` and `:DISP:ENAB ON` turns Backlight `ON`, but changing Backlight settings does *not* change the state of `:DISP:ENAB`
Preset	`ON` Set by `:SYST:DEF MISC`, but not affected by `*RST` or `:SYSTem:PRESet`
State Saved	Not saved in instrument state
Backwards Compatibility Notes	`:SYST:PRES` no longer turns on `:DISPlay:ENABle` as it did in legacy analyzers

3.12.6 Freq

Opens the **Frequency** menu, which contains controls that allow you to control the Frequency and Channel parameters of the instrument.

Some features in the Frequency menu are the same for all measurements in the current Mode – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset. For example, the Center Freq setting is the same for all measurements - it does not change as you change measurements.

3.12.6.1 Settings

Contains controls that pertain to the X axis parameters of the measurement. These parameters control how data on the vertical (X) axis is displayed and control instrument settings that affect the horizontal axis.

Center Frequency

Sets the frequency that corresponds to the horizontal center of the graticule. While adjusting the Center Frequency the Span is held constant.

The **Center Frequency** setting is the same for all measurements within a mode, that is, it is Meas Global. Some modes are also able to share a Mode Global center frequency value. If this is the case, the Mode will have a **Global** tab in its **Meas Setup** menu.

The **Center Frequency** function sets (and queries) the Center Frequency for the currently selected input. If your instrument has multiple inputs, and you select another input, the Center Freq changes to the value for that input. SCPI commands are available to directly set the Center Freq for a specific input.

Center Freq is remembered as you go from input to input. Thus you can set a Center Freq of 10 GHz with the RF Input selected, change to BBIQ and set a Center Freq of 20 MHz, then switch to External Mixing and set a Center Freq of 60 GHz, and when you go back to the RF Input the Center Freq will go back to 10 GHz; back to BBIQ and it is 20 MHz; back to External Mixing and it is 60 GHz.

See:

– "Center Frequency Presets" on page 1614

– "VXT Models with Radio Heads/CIU Frequency Range" on page 1615

– "RF Center Freq" on page 1616

– "Ext Mix Center Freq" on page 1616

– "I/Q Center Freq" on page 1617

Remote Command	`[:SENSe]:FREQuency:CENTer <freq>` `[:SENSe]:FREQuency:CENTer?`

Example	Set Center Frequency to 50 MHz:
	`:FREQ:CENT 50 MHz`
	Increment the Center Frequency by the value of CF Step:
	`:FREQ:CENT UP`
	Return the current value of Center Frequency:
	`:FREQ:CENT?`

Notes	This command sets the RF, External Mixing or I/Q Center Frequency depending on the selected input For RF input it is equivalent to `:FREQ:RF:CENT` For I/Q input it is equivalent to `:FREQ:IQ:CENT` For External Mixer it is equivalent to `:FREQ:EMIX:CENT` Preset and Max values are dependent on Hardware Options (5xx) If no terminator (e.g., MHz) is sent the terminator Hz is used. If a terminator with unit other than Frequency is used, an invalid suffix error message is generated
Preset	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 1614, "RF Center Freq" on page 1616, "Ext Mix Center Freq" on page 1616, "I/Q Center Freq" on page 1617, and "VXT Models with Radio Heads/CIU Frequency Range" on page 1615.
State Saved	Saved in instrument state
Min/Max	Depends on instrument maximum frequency, mode, measurement, and selected input. See "Center Frequency Presets" on page 1614, "RF Center Freq" on page 1616, "I/Q Center Freq" on page 1617, and "VXT Models with Radio Heads/CIU Frequency Range" on page 1615.
Status Bits/OPC dependencies	Non-overlapped

Remote Command	`[:SENSe]:FREQuency:CENTer:AUTO ON | OFF | 1 | 0` `[:SENSe]:FREQuency:CENTer:AUTO?`
Example	`:FREQ:CENT:AUTO OFF` `:FREQ:CENT:AUTO?`
Dependencies	This is only available for the Monitor Spectrum, Power Stat CCDF and IQ waveform measurements in MSR, LTE-Advanced FDD/TDD and 5G NR modes
Couplings	When the Center Frequency is changed, the state is automatically changed to Manual **Center Frequency, Center Frequency Offset and Carrier Reference Frequency are coupled.** When Carrier Reference Frequency changes: Center Frequency : Auto Center Frequency = Carrier Reference Frequency + Center Frequency Offset (fixed) Center Frequency : Man Center Frequency (fixed) = Carrier Reference Frequency + Center Frequency Offset

Preset	ON
State Saved	Saved in instrument state
Range	Auto|Man

Center Frequency Presets

The following table provides the Center Frequency Presets for the Spectrum Analyzer mode, and the Max Freq, for the various frequency options:

Freq Option	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
503 (all but CXA)	1.805 GHz	3.6 GHz	3.7 GHz
503 (CXA)	1.505 GHz	3.0 GHz	3.08 GHz
507 (all but CXA)	3.505 GHz	7.0 GHz	7.1 GHz
507 (CXA)	3.755 GHz	7.5 GHz	7.58 GHz
508 (all but MXE)	1.805 GHz	3.6 GHz	8.5 GHz
508 (MXE)	4.205 GHz	8.4 GHz	8.5 GHz
513	6.805 GHz	13.6 GHz	13.8 GHz
526 (except CXA and MXE)	13.255 GHz	26.5 GHz	27.0 GHz*
526 (CXA)	13.255 GHz	26.5 GHz	26.55 GHz
526 (MXE)	1.805 GHz	3.6 GHz	27.0 GHz
532	16.005 GHz	32.0 GHz	32.5 GHz
540	20.005 GHz	40.0 GHz	40.5 GHz
543	21.505 GHz	43.0 GHz	43.0 GHz
544	22.005 GHz	44.0 GHz	45.0 GHz
550	25.005 GHz	50.0 GHz	52 GHz
F03 (CXA-m)	1.505 GHz	3.0 GHz	3.08 GHz
F07 (CXA-m)	3.755 GHz	7.5 GHz	7.575 GHz
F13 (CXA-m)	6.805 GHz	13.6 GHz	13.8 GHz
F26 (CXA-m)	13.255 GHz	26.5 GHz	26.55 GHz
504 (M9420A/21A, M8920A)	2.145 GHz	3.88GHz	3.88 GHz
506 (M9420A/21A, M8920A)	3.245 GHz	6.08GHz	6.08 GHz
F06 (M9410A/11A)	1.0 GHz	6.08 GHz	6.08 GHz
F06 (M9415A)	1 GHz	1.08 GHz	6.6 GHz
F08 (M9415A)	1 GHz	1.08 GHz	8.6 GHz
F12 (M9415A)	1 GHz	1.08 GHz	12.9 GHz

*For option 526, the Max CF in RTSA is 26.999999995 GHz.

N9041B Center Freq Presets

Input	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
Input 1, all models	25.005 GHz	50.0 GHz	52 GHz
Input 2, opt 585	42.505 GHz	85.0 GHz	86 GHz
Input 2, opt 590	45.005 GHz	90.0 GHz	92 GHz
Input 2, opt 5CX	55.005 GHz	110.0 GHz	110 GHz

Input 2, CXA and MXE

Model	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
CXA opt C75	0.7505 GHz	1.5 GHz	1.58 GHz
MXE	505 MHz	1 GHz	1.000025 GHz

Tracking Generator Frequency Limits (CXA only)

Tracking Generator Option	Min Freq (clips to this freq when turn TG on and can't tune below while TG on)	If above this Freq, Stop Freq clipped to this Freq when TG turned on	Max Freq (can't tune above) while TG on
T03	9 kHz	3.0 GHz	3.08 GHz
T06	9 kHz	6.0 GHz	6.05 GHz

Tracking Generator Frequency Limits(CXA-m only)

Tracking Generator Option	Min Freq (clips to this freq when turn TG on and can't tune below while TG on)	If above this Freq, Stop Freq clipped to this Freq when TG turned on	Max Freq (can't tune above) while TG on
T03	2 MHz	3.08 GHz	3.08 GHz
T07	2 MHz	7.575 GHz	7.575 GHz
T13	2 MHz	13.8 GHz	13.8 GHz
T26	2 MHz	26.55 GHz	26.55 GHz

VXT Models with Radio Heads/CIU Frequency Range

The following table shows the Center Frequency Presets and Range for VXT modes with Radio Heads/CIU.

Products with Radio Heads/CIU	Preset	Start frequency	Stop frequency
M9421A + CIU	6 GHz	5.9 GHz	12 GHz
M9410A + CIU	6 GHz	5.9 GHz	12 GHz
M9410A + CIU + RRH	25 GHz	24.25 GHz	43.5 GHz

RF Center Freq

Lets you specify the RF Center Frequency. This command sets the Center Frequency to be used when the RF input is selected, even if the RF input is not selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:RF:CENTer <freq>` `[:SENSe]:FREQuency:RF:CENTer?`
Example	`:FREQ:RF:CENT 30 MHz` `:FREQ:RF:CENT?`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So, the value is independent in each mode and common across all the measurements in the mode
Dependencies	If the electronic/soft attenuator is enabled, any attempt to set Center Frequency such that the Stop Frequency would be >3.6 GHz fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning
Preset	See table above
State Saved	Saved in instrument state
Min	-79.999995 MHz
Max	See table above. Basically, instrument maximum frequency - 5 Hz

Ext Mix Center Freq

Specifies the External Mixer Center Frequency. This command sets the Center Frequency to be used when the External Mixer is selected, even if the External Mixer input is not the input that is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:EMIXer:CENTer <freq>` `[:SENSe]:FREQuency:EMIXer:CENTer?`
Example	`:FREQ:EMIX:CENT 60 GHz` `:FREQ:EMIX:CENT?`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode
Couplings	When returning to External Mixing after having been switched to one of the other inputs (e.g., RF), you will come back into the settings that you had when you left External Mixing. So you will come back to the band you were in with the Center Frequency that you had. However, Span is not an input-dependent parameter, therefore you will bring the span over from the other input. Therefore, the instrument comes back with the span from the previous input, limited as necessary by the current mixer setup
Preset	When a Mode Preset is performed while in External Mixing, the Start frequency of the current Mode is set to the nominal Min Freq of the lowest harmonic range in the Harmonic Table for the current mixer setup. Similarly, the Stop frequency of the current Mode is set to the nominal Max Freq of the highest harmonic range in the Harmonic Table. The Center Freq thus presets to the point arithmetically

	equidistant from these two frequencies Note that, if the current measurement has a limited Span available to it, and cannot achieve the Span shown in the table (Span=Stop Freq – Start Freq), the instrument uses the maximum Span the measurement allows, and still sets the Center Freq to the midpoint of the Start and Stop Freq values in the Harmonic Table When Restore Input/Output Defaults is performed, the mixer presets to the 11970A, whose Start and Stop frequencies are 26.5 and 40 GHz respectively. The center of these two frequencies is 33.25 GHz Therefore, after a Restore Input/Output Defaults, if you go into External Mixing and do a Mode Preset while in the Spectrum Analyzer Mode, the resulting Center Freq is 33.25 GHz
State Saved	Yes
Min	The minimum frequency in the currently selected mixer band + 5 Hz
Max	The maximum frequency in the currently selected mixer band - 5 Hz

I/Q Center Freq

Specifies the I/Q Center Frequency. This command sets the Center Frequency to be used when the I/Q input is selected, even if the I/Q input is not the input that is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:IQ:CENTer <freq>` `[:SENSe]:FREQuency:IQ:CENTer?`
Example	`:FREQ:IQ:CENT 30 MHz`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode
Preset	0 Hz
State Saved	Saved in instrument state
Min	-40.049995 MHz
Max	40.049995 MHz

CF Step

Changes the step size for the center frequency and start and stop frequency functions. Once a step size has been selected and the center frequency function is active, the step keys (and the UP|DOWN parameters for Center Frequency from remote commands) change the center frequency by the step-size value. The step size function is useful for finding harmonics and sidebands beyond the current frequency span of the instrument.

Note that the start and stop frequencies also step by the CF Step value.

Remote Command	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement] <freq>` `[:SENSe]:FREQuency:CENTer:STEP[:INCRement]?`

	`[:SENSe]:FREQuency:CENTer:STEP:AUTO OFF | ON | 0 | 1` `[:SENSe]:FREQuency:CENTer:STEP:AUTO?`

Example	`:FREQ:CENT:STEP 500 MHz`
	`:FREQ:CENT UP`
	increases the current center frequency value by 500 MHz
	`:FREQ:CENT:STEP?`
	`:FREQ:CENT:STEP:AUTO ON`
	`:FREQ:CENT:STEP:AUTO?`

Notes	Preset and Max values are depending on Hardware Options
Dependencies	Not available in the MSR, LTEAFDD/LTEATDD, 5GNR, and Channel Quality modes If the electronic/soft attenuator is enabled, any attempt to change the value of the center frequency >3.6 GHz by pressing the Up-arrow key, fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning
Couplings	When auto-coupled, the center frequency step size is set to 10% of the span
Preset	Auto `ON`
State Saved	Saved in instrument state
Min	– (the maximum frequency of the instrument). That is, 27 GHz max freq instrument has a CF step range of +/- 27 GHz. Note that this is the maximum frequency given the current settings of the instrument, so in External Mixing, for example, it is the maximum frequency of the current mixer band
Max	The maximum frequency of the instrument. That is, 27 GHz max freq instrument has a CF step range of +/- 27 GHz. Note that this is the maximum frequency given the current settings of the instrument, so in External Mixing, for example, it is the maximum frequency of the current mixer band
Status Bits/OPC dependencies	non-overlapped

3.12.7 Marker

Accesses a menu that enables you to select, set up and control the markers for the current measurement. If there are no active markers, **Marker** selects marker 1, sets it to Normal and places it at the center of the display. If the selected marker is Off, it is set to Normal and placed it at the center of the screen on the trace determined by the Marker Trace rules.

For more detailed information on the types of Markers and the interaction between Markers, see the Marker section of the Swept SA measurement.

3.12.7.1 Select Marker

Specifies the selected marker. The term “selected marker” is used throughout this document to specify which marker will be affected when you change marker settings, perform a Peak Search, etc.

The **Select Marker** control appears above the menu panel, indicating that it applies to all controls in the Marker menu panels. **Select Marker** is blanked if you select a tab whose controls do *not* depend on the selected marker (e.g., Counter).

On any menu tab for which **Select Marker** displays, the first control is always **Marker Frequency|Time**.

Notes	The selected marker is remembered even when not in the Marker menu and is used if a Search is done or a Band Function is turned on or for Signal Track or Continuous Peak
Preset	Marker 1
State Saved	The number of the selected marker is saved in instrument state
Annunciation	Appears in the marker results block label for **Normal** and **Delta** markers

3.12.7.2 Settings

The controls on this tab include the Marker active function and a radio button selection of the marker control mode (Position/Normal, Delta or Off) for the selected marker, as well as additional functions that help you use markers.

Marker X-Axis Value

Sets the marker X-Axis value in the current marker X Axis Scale unit. This function has no effect if the control mode is **Off**, but is the remote command equivalent of entering an X value if the control mode is **Normal** or **Delta**.

Remote Command	`:CALCulate:PSTatistic:MARKer[1]|2|...|12:X <rel_ampl>` `:CALCulate:PSTatistic:MARKer[1]|2|...|12:X?`
Example	`:CALC:PST:MARK3:X 0` `:CALC:PST:MARK3:X?`
Notes	If no suffix is sent, it will use the fundamental units for the current marker X Axis Scale. If a suffix is sent that does not match the current marker X Axis Scale unit, an error “Invalid suffix” will be generated The query returns the marker’s absolute X Axis value if the control mode is **Normal**, or the offset from the marker’s reference marker if the control mode is **Delta**. The query is returned in the fundamental units for the current marker X Axis scale: Hz for **Frequency** and **Inverse Time**, seconds for **Period** and **Time**. If the marker is **Off** the response is not a number
Preset	After a preset, all Markers are turned `OFF`, so Marker X Axis Value query will return a Not a Number (`NAN`)
State Saved	No

Min	-9.9E+37
Max	9.9E+37
Annotation	Mkr # <X value> and <Marker value> upper right on graph

Marker Y Axis Value (Remote Command Only)

Queries the marker Y-Axis value in the current marker Y-Axis unit.

Remote Command	`:CALCulate:PSTatistic:MARKer[1]|2|...|12:Y?`
Example	`:CALC:PST:MARK11:Y?`
Notes	The query returns the marker Y-Axis result, if the control mode is **Normal,** or **Delta.** If the marker is **Off** the response is *Not a Number*
Preset	0
State Saved	No
Backwards Compatibility SCPI	`:CALCulate:PSTatistic:MARKer[1]|2|...|12:FUNCtion:RESult?`

Marker Mode

Sets the marker control mode to **Normal** (`POSition`), **Delta**, or **Off**. All interactions and dependencies detailed under the control description are enforced when the remote command is sent. If the selected marker is `OFF`, pressing **Marker** sets it to **Normal** and places it at the center of the screen on the trace determined by the **Marker Trace** rules. At the same time, **Marker X Axis Value** appears on the Active Function area.

The default active function is the active function for the currently selected marker control mode. If the current control mode is Off, there is no active function and the active function is turned off.

Remote Command	`:CALCulate:PSTatistic:MARKer[1]|2|...|12:MODE POSition	DELTa	OFF` `:CALCulate:PSTatistic:MARKer[1]|2|...|12:MODE?`
Example	`:CALC:PST:MARK:MODE POS` `:CALC:PST:MARK:MODE?`
Preset	`OFF`
State Saved	Saved in instrument state
Range	`POSition|DELTa|OFF`
Annotation	Mkr # <X value> and <Marker value> upper right on graph When Marker Trace is Polar in WCDMA mode: Mkr # <Chip Value (RHO & QPSKEVM)/Symbol Value (CDP)>, <X value> and <Y value> upper right on graph

Backwards Compatibility SCPI Commands

Sets or queries the state of a marker. Setting a marker which is OFF to state ON or 1 puts it in Normal mode and places it at the center of the screen.

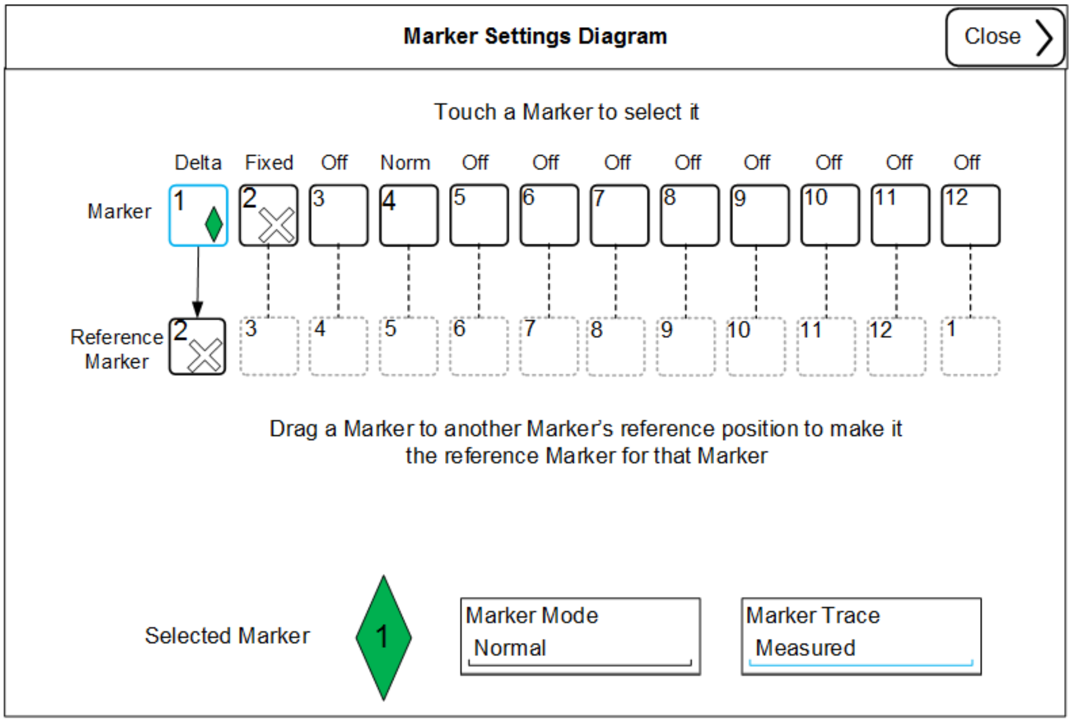
Example	`:CALC:PST:MARK3:STAT 1` `:CALC:PST:MARK3:STAT?`
Preset	`OFF`
State Saved	Saved in instrument state
Range	`OFF|ON`
Backwards Compatibility SCPI	`:CALCulate:PSTatistic:MARKer[1]|2|...|12:STATe OFF | ON | 0 | 1` `:CALCulate:PSTatistic:MARKer[1]|2|...|12:STATe?`

Delta Marker (Reset Delta)

Pressing this button has exactly the same effect as pressing the **Delta** selection on the **Marker Mode** radio button. The selected marker becomes a Delta Marker. If the selected marker is already a Delta marker, the reference marker is moved to the current position of the selected marker, thus resetting the Delta to zero.

Marker Settings Diagram

Lets you configure the Marker system using a visual utility.



All Markers Off

Turns off all markers.

Remote Command	`:CALCulate:PSTatistic:MARKer:AOFF`
Example	`:CALC:PST:MARK:AOFF`

Couple Markers

When this function is ON, moving any marker causes an equal X-Axis movement of every other marker that is not Off. By "equal X-Axis movement" we mean that we preserve the difference between each marker's X-Axis value (in the fundamental x-axis units of the trace that marker is on) and the X-Axis value of the marker being moved (in the same fundamental x-axis units).

This may result in markers going off screen.

Remote Command	`:CALCulate:PSTatistic:MARKer:COUPle[:STATe] ON | OFF | 1 | 0` `:CALCulate:PSTatistic:MARKer:COUPle[:STATe]?`
Example	`:CALC:PST:MARK:COUP ON` `:CALC:PST:MARK:COUP?`
Preset	`OFF`

	Presets on Mode Preset and All Markers Off
State Saved	Saved in instrument state

3.12.7.3 Properties

The controls on this tab are used to set certain properties of the selected marker.

Marker X-Axis Value

This is the fundamental control that you use to move a marker around on the trace. This is the same as the X-Axis Value control on the **Settings** tab.

Relative To

Selects the marker to which the selected marker is relative (its reference marker).

Every marker has another marker to which it is relative. This marker is referred to as the "reference marker" for that marker. This attribute is set by the **Marker, Properties, Relative To** key. The marker must be a **Delta** marker to make this attribute relevant. If it is a **Delta** marker, the reference marker determines how the marker is controlled and how its value is displayed. A marker cannot be relative to itself.

Remote Command	`:CALCulate:PSTatistic:MARKer[1]|2|...|12:REFerence <integer>` `:CALCulate:PSTatistic:MARKer[1]|2|...|12:REFerence?`
Example	`:CALC:PST:MARK:REF 3` `:CALC:PST:MARK:REF?`
Notes	This command causes the marker specified with the subopcode to become selected Range (for SCPI command): 1 to 12. If the range is exceeded the value is clipped A marker cannot be relative to itself so that choice is not available, and if sent from SCPI generates error -221: "Settings conflict; marker cannot be relative to itself" When queried a single value is returned (the specified marker numbers relative marker)
Couplings	The act of specifying the selected marker's reference marker makes the selected marker a Delta marker. If the reference marker is off it is turned on in **Fixed or Normal** mode at the delta marker location
Preset	The preset default "Relative To" marker (reference marker) is the next higher numbered marker (current marker +1). For example, if marker 2 is selected, then it's default reference marker is marker 3. The exception is marker 12, which has a default reference of marker 1. Set to the defaults by using **Restore Mode Defaults.** This is not reset by **Marker Off**, **All Markers Off**, or **Preset**.
State Saved	Saved in instrument state. Not affected by Marker Off and hence not affected by Preset or power cycle.
Min	1
Max	12
Annunciation	Appears in the marker label of a **Delta** marker

Marker Trace

Assigns the specified marker to the designated trace. The trace choices are:

- Measured
- Gaussian
- Reference

Remote Command	`:CALCulate:PSTatistic:MARKer[1]|2|...|12:TRACe MEASured | GAUSsian | REFerence` `:CALCulate:PSTatistic:MARKer[1]|2|...|12:TRACe?`
Example	`:CALC:PST:MARK3:TRAC MEAS` `:CALC:PST:MARK:TRACE?`
Preset	`MEASured`
State Saved	Yes
Range	`MEASured|GAUSsian|REFerence`

Marker Settings Diagram

Lets you configure the Marker system using a visual utility. This is the same as the "Marker Settings Diagram" on page 1621 control on the **Settings** tab.

3.12.8 Meas Setup

Contains functions for setting up the measurement parameters and also contains functions for setting up parameters global to all measurements in the mode.

3.12.8.1 Settings

Contains frequently used Meas Setup functions to which you will want the fastest access.

Counts

Sets the accumulated number of sampling points for data acquisition. The range is 1.000 kpt (k point) to 2.00000 Gpt (G point) with 1 kpt resolution.

Remote Command	`[:SENSe]:PSTatistic:COUNts <integer>` `[:SENSe]:PSTatistic:COUNts?`
Example	`:PST:COUN 5001`

	`:PST:COUN?`
Couplings	This value is coupled to Meas Cycles. When Counts is changed, the MeasCycles value will be (Counts / SamplingFrequency * MeasInterval)
Preset	10000000
State Saved	Saved in instrument state
Min/Max	1000/2000000000

Meas Cycles

Set the number of measurement cycles to calculate power statistic data. This number couples to Counts. The Counts value is (MeasCycles * Sampling Frequency * MeasInterval).

When the counts value cannot be divided by (Sampling Frequency * MeasInterval), this value is displayed as a decimal fraction.

Remote Command	`[:SENSe]:PSTatistic:SWEep:CYCLes <real>` `[:SENSe]:PSTatistic:SWEep:CYCLes?`
Example	`:PST:SWE:CYCL 1001` `:PST:SWE:CYCL?`
Couplings	The Counts value will be (MeasCycles * Sampling Frequency * MeasInterval)
Preset	Depends on the sampling frequency
Min	0.001
Max	Depends on the sampling frequency

Meas Interval

Sets the number of data points to be used as the measurement interval. This value couples to Counts. The Counts value is (MeasCycles * Sampling Frequency * MeasInterval).

Remote Command	`[:SENSe]:PSTatistic:SWEep:TIME <time>` `[:SENSe]:PSTatistic:SWEep:TIME?`
Example	`:PST:SWE:TIME 2 ms` `:PST:SWE:TIME?`
Couplings	The Counts value will be (MeasCycles * Sampling Frequency * MeasInterval)
Preset	1.0 ms !unless noted below LTETDD, LTEATDD, 5G NR: 500 us

Min/Max	50.0 us/10.0 ms !unless noted below LTETDD, LTEATDD, 5G NR: 1 us/10.0 ms

IF Gain

This control can be used to set the IF Gain function to Auto, Low Gain or High Gain. These settings affect sensitivity and IF overloads.

This only applies to the RF input. It does not apply to baseband I/Q input.

Remote Command	`[:SENSe]:PSTatistic:IF:GAIN[:STATe] ON | OFF | 1 | 0`
	`[:SENSe]:PSTatistic:IF:GAIN[:STATe]?`
	`[:SENSe]:PSTatistic:IF:GAIN:AUTO[:STATe] ON | OFF | 1 | 0`
	`[:SENSe]:PSTatistic:IF:GAIN:AUTO[:STATe]?`

Example	`:PST:IF:GAIN ON`
	`:PST:IF:GAIN?`
	`:PST:IF:GAIN:AUTO ON`
	`:PST:IF:GAIN:AUTO?`

Notes	`ON` = high gain `OFF` = low gain
Dependencies	IF Gain is not available when IQ Input is selected The IF Gain control has no effect when the U7227A USB Preamplifier is connected. This is not annotated or reflected on any control; there are no controls grayed out nor any SCPI locked out. The instrument simply behaves as though both IF Gain is set to Low regardless of the setting on the control This control is not available in VXT, EXM, or UXM This control is not available in the E7760, M9393A or M9391A
Couplings	Sending this command forces IF Gain Auto to OFF (Man) Auto sets IF Gain to High Gain under any of the following conditions: – The input attenuator is set to 0 dB, or the preamp is turned on or the Max Mixer Level is –20 dBm or lower For other conditions, Auto sets IF Gain to Low Gain
Preset	`OFF` `OFF`
State Saved	Saved in instrument state
Range	Low Gain|High Gain

Meas Setup Summary Table

Lets you view and access many of the parameters in the Meas Setup menus on one screen.

Auto Couple

Immediately puts all Auto/Man functions into Auto. The **Auto Couple** action is confined to the current measurement only. It does not affect other measurements in the mode.

In the Auto state, Auto/Man functions are said to be "coupled", meaning their values change as you make changes to other values in the measurement. This helps ensure accurate measurements and optimum dynamic range. Auto Couple is an immediate action function, and when it is executed, all the Auto/Man controls for the current measurement are set to Auto, and all measurement settings coupled to the Auto/Man parameters are automatically set to their optimal value.

For further details of measurement-specific settings (if any), see "Measurement-Specific Details" on page 1628 below.

Remote Command	`:COUPle ALL`
Example	`:COUP ALL`
Backwards Compatibility SCPI	`:COUPLE ALL | NONE`
Backwards Compatibility Notes	`:COUP:NONE` puts all Auto/Man parameters in manual mode, decoupling all the coupled instrument parameters. It is retained for backwards compatibility and is *not* recommended for making measurements or new designs

All Auto/Man parameter couplings in the measurement are set to Auto. This includes couplings that may be unavailable or grayed-out due to the current state. For example, in the Swept SA measurement, there is no Auto/Man coupling for RBW while in Zero Span. Nonetheless, if **Auto Couple** were executed while in Zero Span it would set RBW to Auto "behind the scenes" so that, on exit from Zero Span, it would be in Auto.

Any Auto/Man selection specific (local) to the other measurements in the current Mode will not be affected by **Auto Couple**. Any functions that are *not* coupled with other instrument parameters, such as ranging or leveling variables, such as "AutoRange" or "AutoScale", will not be affected.

Executing the **Auto Couple** command generates the informational message, "All Auto/Man functions have been set to Auto".

Each parameter, upon being set to Auto, selects and sets the appropriate auto-coupled value based on that parameter's coupling rules. The Dependency Resolver orchestrates the couplings for parameters that are dependent on one or more other parameters. The coupling and dependency rules for each parameter are defined in the chapter describing that parameter.

Executing the **Auto Couple** command *does not* affect markers, marker functions, trace or display attributes, or any other instrument setting other than those specifically mentioned above.

Measurement-Specific Details

TOI

Parameters affected by Auto Couple are:

- Center Frequency Step
- Resolution Bandwidth
- Span/RBW Ratio
- Sweep Time
- Video BandwidthVBW/RBW ratio
- Upper and Lower Tone (set to Sense
-)Zero span measurement Resolution Bandwidth
- Zero span measurement Dwell Time

Harmonics

For Harmonics, these parameters are:

- Resolution Bandwidth
- Fundamental Frequency
- Dwell Time
- Range Table Resolution Bandwidths
- Range Table Dwell Times

Meas Preset

Restores all the measurement parameters to their default values.

Remote Command	`:CONFigure:PSTatistic`

Example	`:CONF:PST`
Couplings	Selecting Meas Preset will restore all measurement parameters to their default values

3.12.8.2 Radio

The Radio tab contains controls to select the Radio Device, and enable or disable HSPA/HSPA+ options.

Radio Device

Allows you to specify the device to be used.

Remote Command	`[:SENSe]:RADio:STANdard:DEVice BTS | MS` `[:SENSe]:RADio:STANdard:DEVice?`
Example	`:RAD:STAN:DEV MS` `:RAD:STAN:DEV?`
Preset	BTS
State Saved	Saved in instrument state.
Range	BTS | MS
Backwards Compatibility SCPI	`[:SENSe]:RADio:DEVice`

HSPA Enable

Allows you to turn on or off the HSDPA/HSUPA option enable. This selection is necessary because some of the auto detection functions that expect an HSPA signal are less tolerant when the signal is noisy or distorted. When the HSPA signal is not expected, turn HSPA Enable off.

Remote Command	`[:SENSe]:RADio:CONFigure:HSDPa[:STATe] 0 | 1 | OFF | ON` `[:SENSe]:RADio:CONFigure:HSDPa[:STATe]?`
Example	`:RAD:CONF:HSDP 0` `:RAD:CONF:HSDP?`
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

HSPA+ Enable

Allows you to turn on or off the HSPA+ option enable. This selection is necessary because some of the auto detection functions that expect an HSPA+ signal are less tolerant when the signal is noisy or distorted. When the HSPA+ signal is not expected, turn HSPA+ Enable off.

Remote Command	`[:SENSe]:RADio:CONFigure:EHSPa[:STATe] OFF | ON | 0 | 1` `[:SENSe]:RADio:CONFigure:EHSPa[:STATe]?`
Example	`:RAD:CONF:EHSP 0` `:RAD:CONF:EHSP?`
Notes	When HSPA enable is OFF, HSPA+ function is disabled too.
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

3.12.8.3 Global

The controls in this menu apply to all Modes in the instrument.

Some controls (for example, **Global Center Freq**) allow you to switch certain Meas Global parameters to a Mode Global state. These switches apply to all Modes that support global settings. For example, no matter what Mode you are in when you set **Global Center Freq** to `ON`, it applies to all Modes that support Global Settings.

Other controls (for example, **Extend Low Band**) are actually set in this menu, but apply to all Modes.

Global Center Freq

The software maintains a Mode Global value called **Global Center Freq**.

When **Global Center Freq** is switched `ON`, the current Mode's center frequency is copied into the **Global Center Frequency**, and from then on all Modes that support global settings use the **Global Center Frequency**, so you can switch between any of these Modes and the Center Freq will remain unchanged.

Adjusting the Center Freq of any Mode that supports Global Settings, while **Global Center Freq** is `ON`, modifies the Global Center Frequency.

When **Global Center Freq** is switched `OFF`, the Center Freq of the current Mode is unchanged, but now the Center Freq of each Mode is once again independent.

When **Mode Preset** is pressed while **Global Center Freq** is `ON`, the Global Center Freq is preset to the preset Center Freq of the current Mode.

This function is reset to `OFF` when "Restore Defaults" on page 1737 (in this tab) is pressed, or when **System**, **Restore Defaults**, **All Modes** is pressed.

Remote Command	`:INSTrument:COUPle:FREQuency:CENTer ALL | NONE` `:INSTrument:COUPle:FREQuency:CENTer?`
Example	`:INST:COUP:FREQ:CENT ALL` `:INST:COUP:FREQ:CENT?`
Preset	Set to `OFF` on **Global** Settings, **Restore Defaults** and **System, Restore Defaults, All Modes**
Range	`ALL|NONE`

Preset	`OFF`
Backwards Compatibility SCPI	`:GLOBal:FREQuency:CENTer[:STATe] 1 | 0 | ON | OFF` `:GLOBal:FREQuency:CENTer[:STATe]?`

Global EMC Std

When this control is switched `ON`, the current Mode's EMC Std is copied into the **Global EMC Std**, and from then on all Modes that support global settings use the Global EMC Std, so you can switch between any of these Modes and the EMC Std will remain unchanged.

Adjusting the EMC Std of any Mode that supports Global Settings, while Global EMC Std is `ON`, will modify the **Global EMC Std**.

When **Global EMC Std** is switched `OFF`, the EMC Std of the current Mode is unchanged, but now the EMC Std of each Mode is once again independent. When **Mode Preset** is pressed while **Global EMC Std** is `ON`, the Global EMC Std is preset to the preset EMC Std of the current Mode.

This function is reset to `OFF` when "Restore Defaults" on page 1737 (in this tab) is pressed, or when **System, Restore Defaults, All Modes** is pressed.

Remote Command	`:INSTrument:COUPle:EMC:STANdard ALL | NONE` `:INSTrument:COUPle:EMC:STANdard?`
Example	`:INST:COUP:EMC:STAN ALL` `:INST:COUP:EMC:STAN?`
Dependencies	Only available if option EMC is installed
Preset	Set to `OFF` on **Global** Settings, **Restore Defaults** and **System, Restore Defaults, All Modes**
Range	`ALL|NONE`

Extend Low Band

The software maintains a Mode Global value called **Extend Low Band**.

Under the current sweep configuration crossing over two bands, when **Extend Low Band** is turned `ON`, the instrument checks whether one band can cover the whole sweep frequency range or not. If it can, then the instrument locks the band; otherwise, it does nothing (the band crossover occurs).

This function does *not* work when **Band Lock** under **System** > **Service** > **Lock Functions** is not -1 (no Band Lock). In that case, **Band Lock** takes priority over **Extend Low Band**.

This function is reset to `OFF` when "Restore Defaults" on page 1737 (in this tab) is pressed, or when **System**, **Restore Defaults**, **All Modes** is pressed.

This parameter is available for SA, RTSA, WCDMA, WIMAX OFDMA, LTEAFDD, LTEATDD Modes.

Remote Command	`:INSTrument:COUPle:FREQuency:BAND:EXTend 0 | 1 | ON | OFF` `:INSTrument:COUPle:FREQuency:BAND:EXTend?`
Example	`:INST:COUP:FREQ:BAND:EXT 1` `:INST:COUP:FREQ:BAND:EXT?`
Dependencies	Only applies to UXA, PXA, MXA and EXA
Preset	Set to `OFF` by **Global** Settings > **Restore Defaults** and **System** > **Restore Defaults** > **All Modes**
Range	`ON|OFF`

Restore Defaults

Resets all of the functions in the **Global** Settings menu to `OFF`. This also occurs when **System**, **Restore Defaults**, **All Modes** is pressed.

Remote Command	`:INSTrument:COUPle:DEFault`
Example	`:INST:COUP:DEF`
Backwards Compatibility SCPI	`:GLOBal:DEFault`

3.12.9 Sweep

The **Sweep** key accesses controls to configure and control the acquisition of data, and the X-axis parameters of the instrument.

Depending on the selected mode and measurement, these controls might include: Sweep Time, Continuous/Single, Pause/Resume, X Scale and Number of Points.

3.12.9.1 Sweep/Control

Contains controls for the Sweep and Control functions of the instrument, such as Sweep Time and Continuous/Single.

Sweep/Measure

Allows you to toggle between Continuous and Single sweep or measurement operation. The Single/Continuous state is Meas Global, so the setting affects *all* measurements.

The front-panel key **Single/Cont** performs exactly the same function

NOTE	In the `WAVeform` measurement, this control only appears in the Meas Bar, and not in the **Sweep/Control** tab.

See "More Information" on page 1633

Remote Command	`:INITiate:CONTinuous OFF | ON | 0 | 1` `:INITiate:CONTinuous?`

Example	`:INIT:CONT 0`
	`:INIT:CONT OFF`
	puts instrument into Single measurement operation
	`:INIT:CONT 1`
	`:INIT:CONT ON`
	puts instrument into Continuous measurement operation

Preset	ON Note that `:SYST:PRES` sets `:INIT:CONT` to `ON` but `*RST` sets `:INIT:CONT` to `OFF`
State Saved	Saved in instrument state
Annunciation	The **Single/Continuous** icon in the Meas Bar changes depending on the setting: – A line with an arrow is Single – A loop with an arrow is Continuous

More Information

With **Avg/Hold Num** (in the **Meas Setup** menu) set to **Off** or set to **On** with a value of 1, a sweep is taken after the trigger condition is met; and the instrument continues to take new sweeps after the current sweep has completed and the trigger condition is again met. However, with **Avg/Hold Num** set to On with a value >1, multiple sweeps (data acquisitions) are taken for the measurement. The trigger condition must be met prior to each sweep. The sweep is not stopped when the average count k equals the number N set for Avg/Hold Num is reached, but the number k stops incrementing. A measurement average usually applies to all traces, marker results, and numeric results, but sometimes only applies to the numeric results.

If the instrument is in Single measurement, pressing the **Cont/Single** toggle control does not change k and does not cause the sweep to be reset; the only action is to put the instrument into Continuous measurement operation.

If it is already in Continuous sweep:

– the `:INIT:CONT 1` command has no effect

– the `:INIT:CONT 0` command will place the instrument in Single Sweep but will have no effect on the current sequence until k = N, at which point the current sequence will stop and the instrument will go to the idle state.

See "Restart" on page 1738 control description for details on the `:INIT:IMM` (Restart) function.

If you are already in Single sweep, the `:INIT:CONT OFF` command has no effect.

If you are already in Single Sweep, then pressing the **Cont/Single** toggle control in the middle of a sweep does not restart the sweep or sequence. Similarly, pressing the **Cont/Single** toggle control does not restart the sweep or sequence if the sweep is not in the idle state (for example, if you are taking a very slow sweep, or the instrument is waiting for a trigger). Even though pressing the **Cont/Single** toggle control in the middle of a sweep does *not* restart the sweep, sending `:INIT:IMM` *does* reset it.

Restart

The **Restart** function restarts the current sweep, or measurement, or set of averaged/held sweeps or measurements. In measurements that support pausing, if you are Paused, pressing **Restart** performs a **Resume**.

The Restart function is accessed in several ways:

– Pressing the **Restart** key

– Sending the remote command `:INIT:IMM`

– Sending the remote command `:INIT:REST`

See "More Information" on page 1635

Remote Command	`:INITiate[:IMMediate]` `:INITiate:RESTart`
Example	`:INIT:IMM` `:INIT:REST`
Notes	`:INIT:REST` and `:INIT:IMM` and the front-panel **Restart** key perform exactly the same function

Couplings	Resets average/hold count k For the first sweep, overwrites all active (update=on) traces with new current data For application modes, resets other parameters as required by the measurement
Status Bits/OPC dependencies	This is an Overlapped command The `:STATus:OPERation` register bits 0 through 8 are cleared The `:STATus:QUEStionable` register bit 9 (INTegrity sum) is cleared The `SWEEPING` bit is set The `MEASURING` bit is set
Backwards Compatibility Notes	For Spectrum Analysis mode in ESA and PSA, the **Restart** hardkey and the `:INIT:REST` command restart trace averages (displayed average count reset to 1) for a trace in **Clear Write**, but did not restart **Max Hold** and **Min Hold** In the X-Series, the **Restart** hardkey and the `:INIT:REST` command restart not only **Trace Average**, but **Max Hold** and **Min Hold** traces as well For wireless comms modes in ESA and PSA, the **Restart** hardkey and the `:INIT:REST` command restarted every measurement, including all traces and numeric results. There is no change to this operation

More Information

The **Restart** function first aborts the current sweep or measurement as quickly as possible. It then resets the sweep and trigger systems, sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is in the process of aligning when a Restart is executed, the alignment finishes before the restart function is performed.

Even when set for Single operation, multiple sweeps may be taken when **Restart** is pressed (for example, when averaging/holding is on). Thus when we say that Restart "restarts a measurement," depending on the current settings, we may mean:

– It restarts the current sweep

– It restarts the current measurement

– It restarts the current set of sweeps if any trace is in Trace Average, Max Hold or Min Hold

– It restarts the current set of measurements if Averaging, or Max Hold, or Min Hold is on for the measurement

With Average/Hold Number (in Meas Setup menu) set to 1, or Averaging off, or no trace in Trace Average or Hold, a single sweep is equivalent to a single measurement. A single sweep is taken after the trigger condition is met; and the instrument stops sweeping once that sweep has completed. However, with Average/Hold Number >1 and at least one trace set to Trace Average, Max Hold, or Min Hold (SA Measurement) or Averaging on (most other measurements), multiple sweeps/data acquisitions are taken for a single measurement. The trigger condition must be met prior to each sweep. The sweep is stopped when the average count k equals the number N set for Average/Hold Number. A measurement average usually applies to all traces, marker results, and numeric results, but sometimes only applies to the numeric results.

Once the full set of sweeps has been taken, the instrument will go to the idle state. To take one more sweep without resetting the average count, increment the average count by 1, by pressing the step up key while Average/Hold Number is the active function, or by sending the remote command `:CALC:AVER:TCON UP`.

Pause/Resume

Pauses a measurement after the current data acquisition is complete.

When a measurement is paused:

– The label on this control changes to **Resume**. Pressing **Resume** un-pauses the measurement.

– Pressing **Restart** also performs a **Resume**.

Remote Command	`:INITiate:PAUSe` `:INITiate:RESume`
Example	`:INIT:PAUS` `:INIT:RES`
Dependencies	Not displayed in Modes that do not support pausing
Couplings	When Averaging is On, if the measurement is paused no more updates will occur until either a Resume or Restart occurs If the measurement is resumed, the averaging continues to use the traces from before the Pause occurred and continues to use the traces from the point where the Resume occurred. This still provides real-time traces, but they will no longer be gap free In a view with a Waterfall window, when the measurement is paused, the Waterfall stops updating. When Resume is selected, the Waterfall will retain the existing traces and continue updating using traces from the point at which Resume was selected. The time stamp of the individual Waterfall traces will show the time from the beginning of the measurement the trace relates to, showing there was a gap in the Waterfall capture In Density view, when the measurement is paused, the Density Display stops updating. When the measurement is resumed, if Persistence is `ON`, the persistence fading will continue from the point when the measurement was paused If a Restart occurs, the average counter is reset and all results are discarded. The measurement begins again, using traces after the Restart occurred

Abort (Remote Command Only)

This command stops the current measurement. It aborts the current measurement as quickly as possible, resets the sweep and trigger systems, and puts the measurement into an "idle" state. If the instrument is in the process of aligning when

`:ABORt` is sent, the alignment finishes before the abort function is performed, so `:ABORt` does *not* abort an alignment.

If the instrument is set for Continuous measurement, it sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is set for Single measurement, it remains in the "idle" state until an `:INIT:IMM` command is received.

Remote Command	`:ABORt`
Example	`:ABOR`
Notes	If `:INIT:CONT` is `ON`, then a new continuous measurement will start immediately, with sweep (data acquisition) occurring once the trigger condition has been met If `:INIT:CONT` is `OFF`, then `:INIT:IMM` is used to start a single measurement, with sweep (data acquisition) occurring once the trigger condition has been met
Dependencies	For continuous measurement, `:ABORt` is equivalent to the **Restart** key Not all measurements support the abort command
Status Bits/OPC dependencies	The `:STATus:OPERation` register bits 0 through 8 are cleared The `:STATus:QUEStionable` register bit 9 (INTegrity sum) is cleared Since all the bits that feed into OPC are cleared by `:ABORt`, the `:ABORt` will cause the *OPC query to return true

3.12.9.2 X Scale

Accesses controls that enable you to set the horizontal scale parameters.

Scale/Div

Enables you to enter a time value to change the horizontal scale.

Remote Command	`:DISPlay:PSTatistic:VIEW[1]:WINDow2:TRACe:X[:SCALe]:PDIVision <rel_ampl>` `:DISPlay:PSTatistic:VIEW[1]:WINDow2:TRACe:X[:SCALe]:PDIVision?`
Example	`:DISP:PST:VIEW:WIND2:TRAC:X:PDIV 10` `:DISP:PST:VIEW:WIND2:TRAC:X:PDIV?`
Notes	CCDF measurement has the trace display only at Window 2, because values other than “2” are *not* available as the sub-op code
Preset	2.00
State Saved	Saved in instrument state
Min	0.1
Max	20
Backwards Compatibility SCPI	`:DISPlay:PSTatistic:XSCale`

3.12.10 Trace

This menu lets you control the display and storage of trace data for the available traces.

3.12.10.1 Trace Control

The controls on this tab allow you to select display of the Reference Trace and the Gaussian Line, and store the Reference Trace.

Store Ref Trace

Copies the currently measured curve as the user-definable reference trace. The captured data remains until the other mode is chosen. Pressing this key also refreshes the reference trace.

No query is available.

Remote Command	`:CALCulate:PSTatistic:STORe:REFerence`
Example	`:CALC:PST:STOR:REF`
Backwards Compatibility SCPI	`[:SENSe]:PSTatistic:SRTRace`

Ref Trace

Toggles the reference trace display between On and Off.

Remote Command	`:DISPlay:PSTatistic:RTRace[:STATe] OFF | ON | 0 | 1` `:DISPlay:PSTatistic:RTRace[:STATe]?`
Example	`:DISP:PST:RTR OFF` `:DISP:PST:RTR?`
Preset	`OFF`
State Saved	Saved in instrument state
Range	`OFF|ON`
Backwards Compatibility SCPI	`[:SENSe]:PSTatistic:RTRace[:STATe]`

Gaussian Line

Toggles the Gaussian trace display between On and Off.

Remote Command	:DISPlay:PSTatistic:GAUSsian[:STATe] OFF | ON | 0 | 1 :DISPlay:PSTatistic:GAUSsian[:STATe]?
Example	:DISP:PST:GAUS OFF :DISP:PST:GAUS?
Preset	ON
State Saved	Saved in instrument state
Range	OFF|ON
Backwards Compatibility SCPI	[:SENSe]:PSTatistic:GAUSsian[:STATe]

3.13 IQ Waveform Measurement

The IQ Waveform measurement is a time-domain measurement that lets you view the envelope, real and imaginary components of an RF or baseband signal. It is similar in many respects to the zero-span measurement in traditional spectrum analysis, but gives you direct access to the I/Q pairs of the signal, such as those which make up modern communications signals. The IQ Waveform measurement can also be used to perform general purpose power measurements to a high degree of accuracy.

You can look at the RF envelope (magnitude) of the signal, or open up an I/Q Waveform window, which shows the I and Q signal waveform voltage versus time, to disclose the voltages that comprise the complex modulated waveform of a digital signal.

IQ Waveform Measurement Commands

The following measurement commands are described in this section:

`:CONFigure:WAVeform`

`:CONFigure:WAVeform:NDEFault`

`:INITiate:WAVeform`

`:FETCh:WAVeform[n]?`

`:MEASure:WAVeform[n]?`

`:READ:WAVeform[n]?`

Remote Command Results for the Waveform Measurement

For the `:FETCh|MEASure|READ` queries, the results returned depend on the `n` parameter value as follows:

n	Results Returned
0	Returns unprocessed I/Q trace data, as a series of trace point values, in volts. The I values are listed first in each pair, using the 0 through even-indexed values. The Q values are the odd-indexed values
1	Returns the following scalar results: 1. **Sample Time** is a floating point number representing the time between samples when using the trace queries (n=0, 2, and so forth) 2. **Mean Power** is the mean power (in dBm). This is the power across the entire trace. If averaging is on, the power is for the latest acquisition 3. **Mean Power Averaged** is the power (in dBm) for N averages if averaging is on. This is the power across the entire trace. If averaging is on, the power is for the latest acquisition. If averaging is off, the value of the mean power averaged is the same as the value of the mean power

n	Results Returned
	4. **Number of samples** is the number of data points in the captured signal. This number is useful when performing a query on the signal (i.e., when n=0, 2, etc.) 5. **Peak-to-mean ratio** has units of dB. This is the ratio of the maximum signal level to the mean power. Valid values are only obtained with averaging turned off. If averaging is on, the peak-to-mean ratio is calculated using the highest peak value, rather than the displayed average peak value 6. **Maximum value** is the maximum of the most recently acquired data (in dBm) 7. **Minimum value** is the minimum of the most recently acquired data (in dBm)
2	Returns trace point values of the entire captured signal envelope trace data. These data points are floating point numbers representing the power of the signal (in dBm). There are N data points, where N is the number of samples. The period between the samples is defined by the sample time

3.13.1 Views

You can select the measurement view you want to use from the Mode/Measurement/View selector screen.

View Selection by name

You can program the View you want by name:

Remote Command	`:DISPlay:WAVeform:VIEW[:SELect] RFENvelope | IQ` `:DISPlay:WAVeform:VIEW[:SELect]?`
Example	`:DISP:WAV:VIEW RFEN` `:DISP:WAV:VIEW?`
Preset	`RFENvelope`
State Saved	Saved in instrument state
Range	RF Envelope|I/Q Waveform

View Selection by number

You can program the View you want by number:

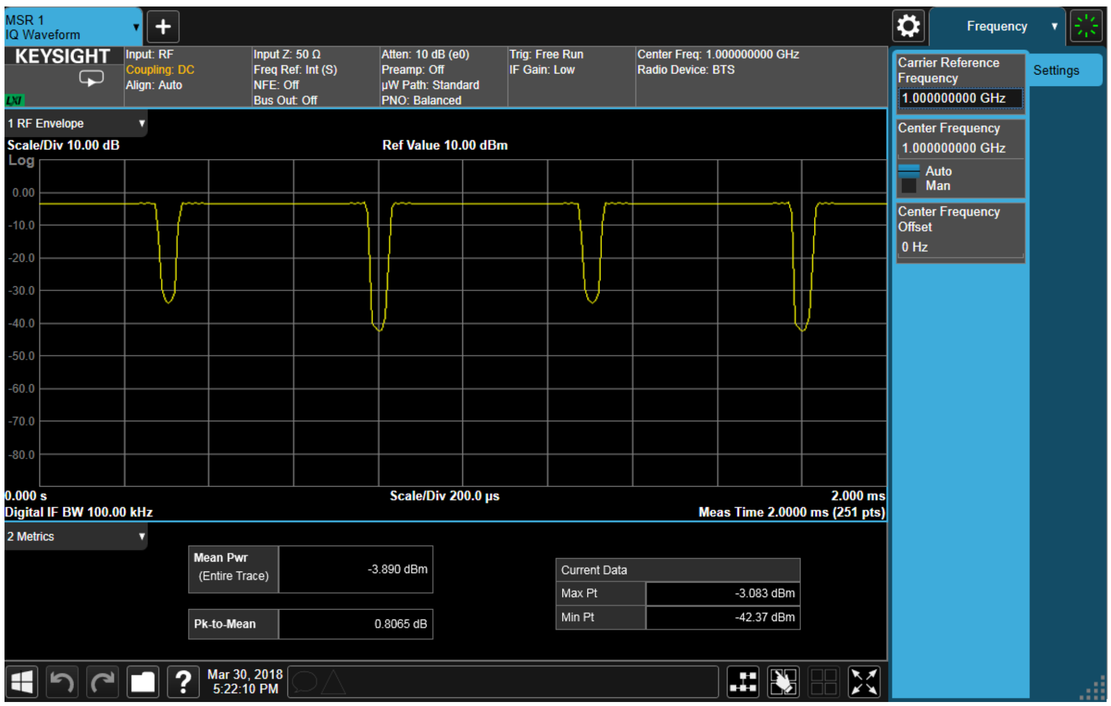
Remote Command	`:DISPlay:WAVeform:VIEW:NSELect <integer>` `:DISPlay:WAVeform:VIEW:NSELect?`
Example	`:DISP:WAV:VIEW:NSEL 1` `:DISP:WAV:VIEW:NSEL?`
Notes	View 1 is the RF Envelope View

	View 2 is the I/Q Waveform View
Preset	1
State Saved	Saved in instrument state
Min/Max	1/2

3.13.1.1 RF Envelope

Windows: "RF Envelope" on page 1643, "Metrics" on page 1644

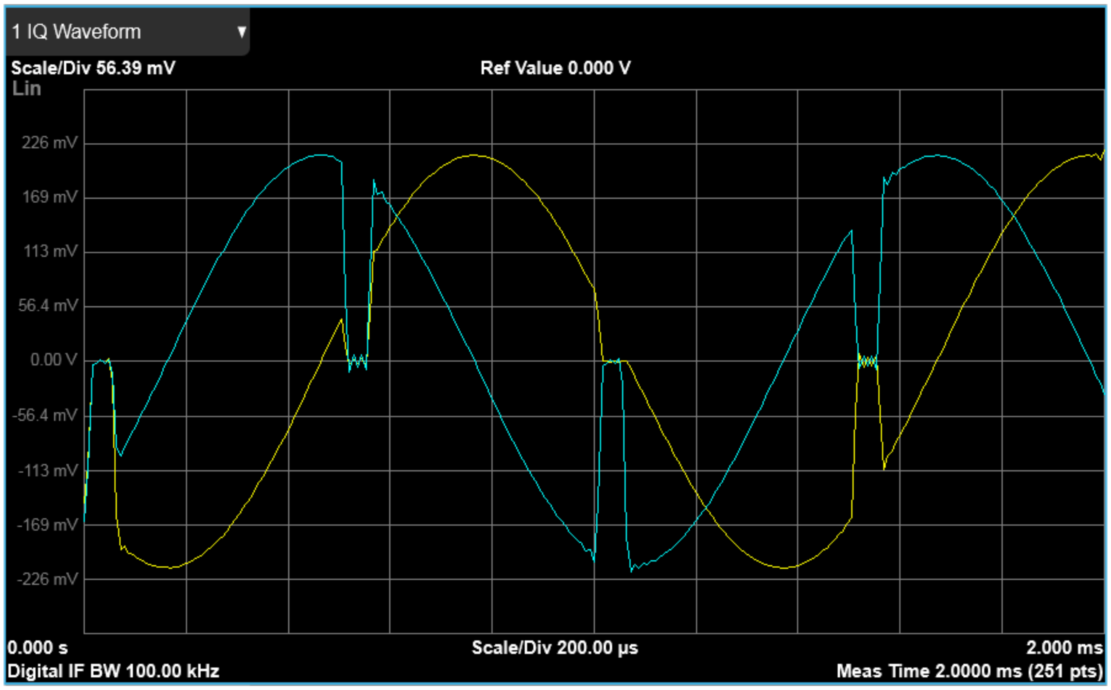
The RF Envelope View shows an RF envelope (magnitude) window and a metrics table showing the measured values for the mean power and peak-to-mean power.



3.13.1.2 I/Q Waveform

Windows: "I/Q Waveform" on page 1645

The I/Q Waveform View shows a window with I and Q voltages vs time. SCPI commands can also be used to query the I/Q pairs while in this View.



3.13.2 Windows

This section describes the windows available in the IQ Waveform measurement.

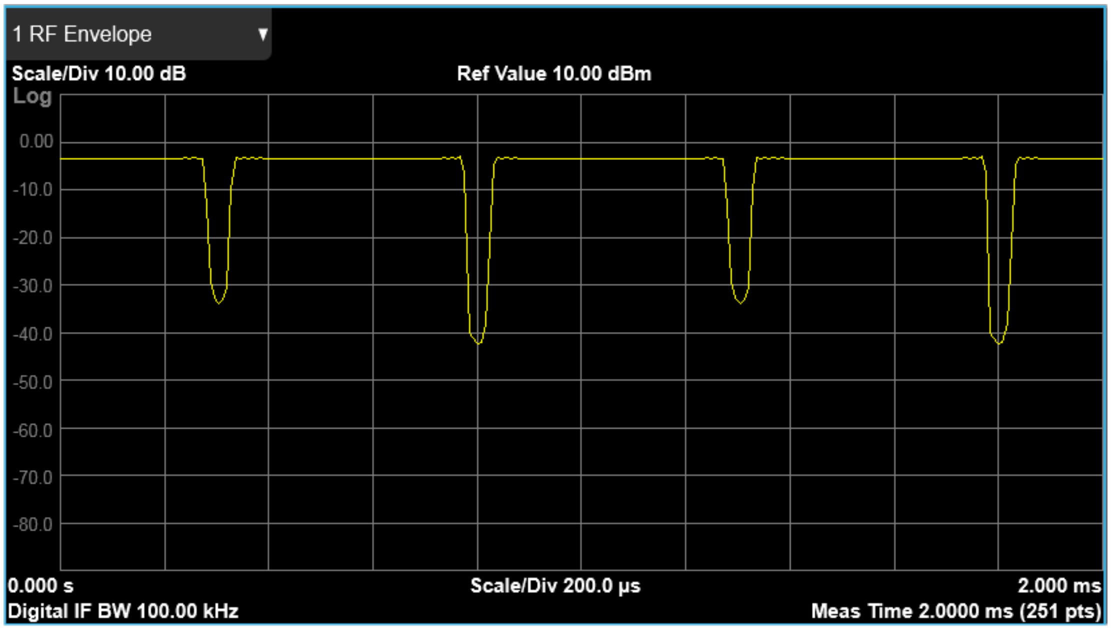
– "RF Envelope" on page 1643

– "Metrics" on page 1644

– "I/Q Waveform" on page 1645

3.13.2.1 RF Envelope

The RF Envelope window displays an amplitude-vs time (time domain) graph of the envelope (magnitude) of the RF waveform:



3.13.2.2 Metrics

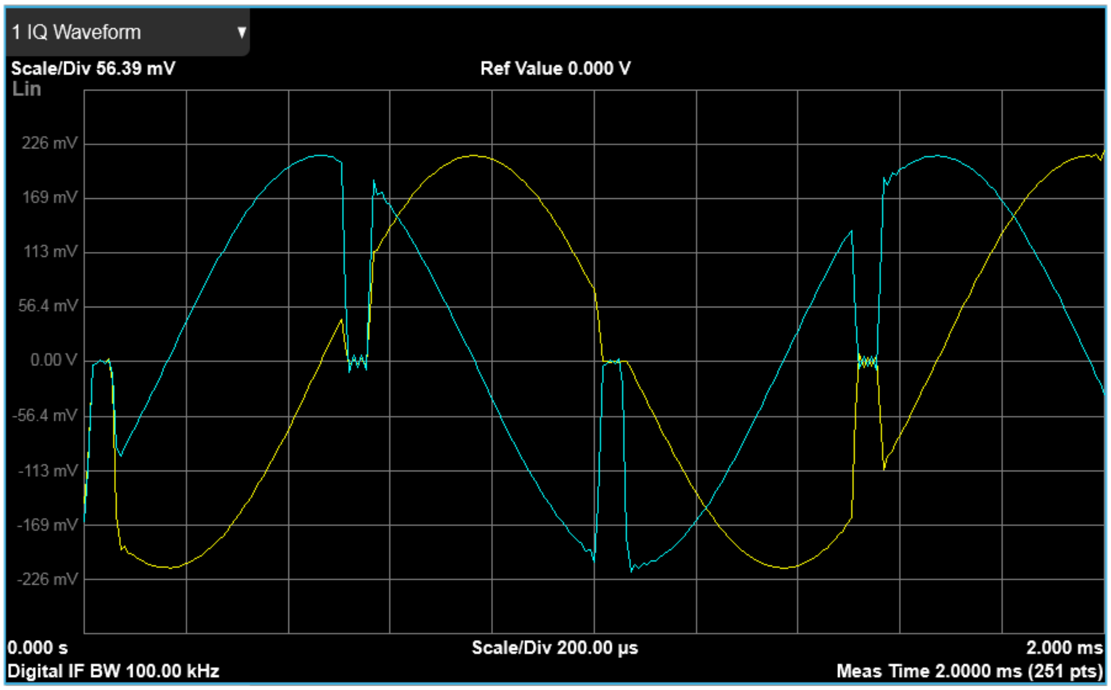
This text window shows an example of the measured values for the mean power and peak-to-mean power of the RF Envelope result of the waveform (time domain) measurements.

Numeric Results

Name	Type	Description	Unit	Format
Mean Pwr	Float64	The mean power (dBm). This is either the power across the entire trace, or the power between markers if the markers are enabled	dBm	XX.XX dBm
Pk-to-Mean	Float64	This is the ratio of the maximum signal level to the mean power	dB	XX.XX dB
Max Pt	Float64	The maximum of the most recently acquired data	dBm	XX.XX dBm
Min Pt	Float64	The minimum of the most recently acquired data	dBm	XX.XX dBm

3.13.2.3 I/Q Waveform

The I/Q Waveform window shows an amplitude-vs time (time domain) graph of the quadrature (I and Q) components of the RF waveform. This allows you to measure the phase of the waveform as well as its magnitude. The yellow trace is the I (real) component and the blue trace is the Q (imaginary) component.



3.13.3 Amplitude

The Amplitude front-panel key activates the Amplitude menu and selects Reference Level or Reference Value (depending on the measurement) as the active function.

3.13.3.1 Y Scale

The Y Scale Tab contains controls that pertain to the Y axis parameters of the measurement. These parameters control how data on the vertical (Y) axis is displayed and control instrument settings that affect the vertical axis.

Ref Value

This control enables you to set the value for the absolute power reference. The functionality depends on the selected window. The reference line is at the top, center, or bottom of the graticule, depending on the value of the Ref Position function.

Remote Command	:DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:Y[:SCALe]:RLEVel <amptd> :DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:Y[:SCALe]:RLEVel?
Example	:DISP:WAV:VIEW:WIND:TRAC:Y:RLEV -50 dBm 1-RF Envelope :DISP:WAV:VIEW2:WIND:TRAC:Y:RLEV 25 V 2-IQ Waveform
Notes	View 1 is the RF Envelope View View 2 is the I/Q Waveform View
Couplings	When Auto Scaling is On (default), this value is automatically determined by the measurement result. When you set a value manually, Auto Scaling changes to Off
Preset	10.00 dBm 1-RF Envelope 0 V 2-IQ Waveform
State Saved	Saved in instrument state
Min/Max	1-RF Envelope: -250.00 dBm/250.00 dBm 2-IQ Waveform: -250.00 V/250.00 V
Annotation	Ref <value> top of graph

Scale/Div

Enables you to set the units per division of vertical scale in the logarithmic display. However, since Auto Scaling is defaulted to On, this value is automatically determined by the measurement result. When you set a value manually, Auto Scaling automatically changes to Off.

This functionality depends on the selected view. The SCPI command and default parameters change depending on whether the View is RF Envelope or I/Q Waveform.

Remote Command	:DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:Y[:SCALe]:PDIVision <rel_ampl> :DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:Y[:SCALe]:PDIVision?
Example	:DISP:WAV:VIEW:WIND:TRAC:Y:PDIV 5 Sets Scale/Div for RF Envelope View :DISP:WAV:VIEW2:WIND:TRAC:Y:PDIV 25mV Sets Scale/Div for IQ Waveform View :DISP:WAV:VIEW:WIND:TRAC:Y:PDIV? Queries Scale/Div for RF Envelope View
Notes	View 1 is the RF Envelope View View 2 is the I/Q Waveform View

Couplings	When Auto Scaling is On, this value is automatically determined by the measurement result When you set a value manually, Auto Scaling automatically changes to Off
Preset	RF Envelope: 10.00 dB IQ Waveform: 100.0 mV
State Saved	Saved in instrument state
Min	RF Envelope: 0.10 dB IQ Waveform: 1.0 nV
Max	RF Envelope: 20.00 dB IQ Waveform: 20 V
Annotation	<value> dB/ left upper of graph

Ref Position

Enables you to position the reference level at the top, center, or bottom of the Y Scale display. Changing the reference position does not change the reference level value.

This functionality depends on the selected view. The SCPI command and default parameters change depending on whether the View is RF Envelope or I/Q Waveform.

Remote Command	`:DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:Y[:SCALe]:RPOSition TOP | CENTer | BOTTom` `:DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:Y[:SCALe]:RPOSition?`

Example	`:DISP:WAV:VIEW:WIND:TRAC:Y:RPOS CENT`
	RF Envelope
	`:DISP:WAV:VIEW2:WIND:TRAC:Y:RPOS CENT`
	IQ Waveform
	`:DISP:WAV:VIEW:WIND:TRAC:Y:RPOS?`

Notes	View 1 is the RF Envelope View View 2 is the I/Q Waveform View
Preset	RF Envelope: `TOP` IQ Waveform: `CENT`
State Saved	Saved in instrument state
Range	`TOP|CENTer|BOTTom`
Annotation	> and < are displayed both side of graph to indicate Reference Position

Auto Scaling

Enables you to toggle the Auto Scaling function between On and Off. When the Restart front-panel key is pressed, this function automatically determines the scale per division and reference values based on the measurement results.

Remote Command	`:DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:Y[:SCALe]:COUPle 0	1	OFF	ON` `:DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:Y[:SCALe]:COUPle?`
Example	`:DISP:WAV:VIEW:WIND:TRAC:Y:COUP OFF` `:DISP:WAV:VIEW:WIND:TRAC:Y:COUP?`
Couplings	When Auto Scaling is On, upon pressing the Restart front-panel key, this function automatically switches the scale per division and reference values into the defaults When you set a value to either Scale/Div or Ref Value manually, Auto Scaling automatically changes to Off
Preset	`OFF`
State Saved	Saved in instrument state
Range	`OFF|ON`

3.13.3.2 Attenuation

Controls the attenuator functions and interactions between the attenuation system components.

There are two attenuator configurations in the X-Series. One is a Dual-Attenuator configuration consisting of a mechanical attenuator and an optional electronic attenuator. The other configuration uses a single attenuator with combined mechanical and electronic sections thatcontrols all the attenuation functions. Different models in the X-Series come with different configurations.

– See "Dual-Attenuator Configurations" on page 1649

– See "Single-Attenuator Configuration" on page 1649

Most attenuation settings are the same for all measurements – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset.

This tab is only available when the hardware set includes an input attenuator, which is typically only the case when using Keysight’s box instruments. For example, this tab does not appear in:

– VXT models M9420A/21A/10A/11A

– E7760

– M9391A

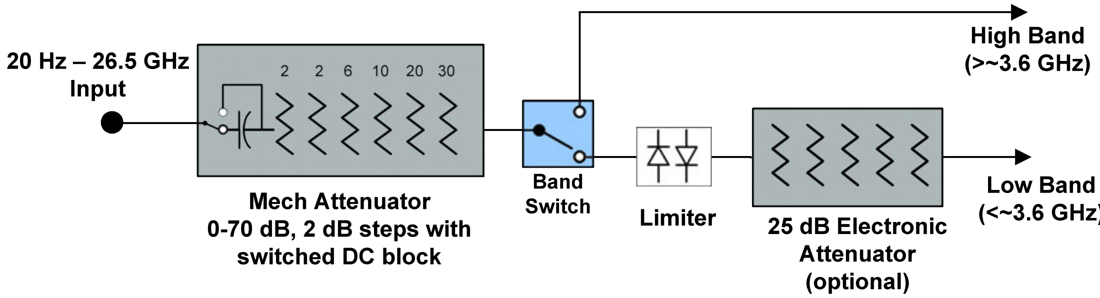
– M9393A

This tab also does not appear in UXM. In UXM all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

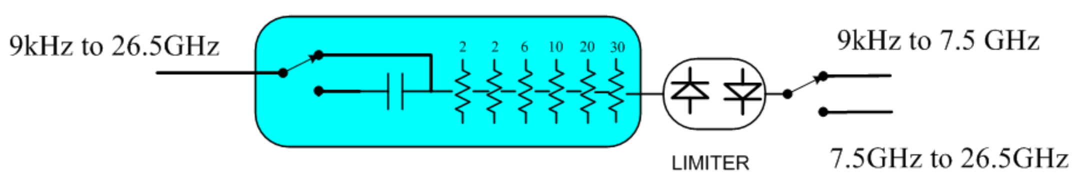
Dependencies	In measurements that support the I/Q inputs, this tab is unavailable when I/Q is the selected input, and is replaced by the Range tab in that case

Dual-Attenuator Configurations

Configuration 1: Mechanical attenuator + optional electronic attenuator

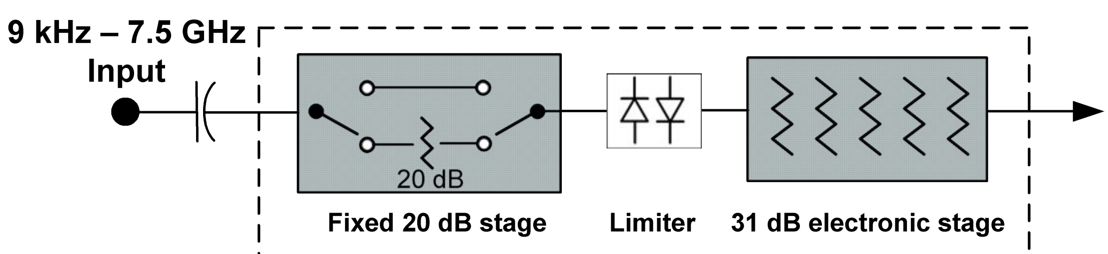


Configuration 2: Mechanical attenuator, no optional electronic attenuator



(note that Configuration 2 is not strictly speaking a dual-section attenuator, since there is no electronic section available. However, it behaves exactly like Configuration 1 without the Electronic Attenuator option EA3, therefore for the sake of this document it is grouped into the “Dual-Attenuator” configuration)

Single-Attenuator Configuration



You can tell which attenuator configuration you have by pressing the Attenuation tab, which (in most Modes) opensthe Attenuation menu. If the first control in the Attenuation menu says **Mech Atten** you have the Dual-Attenuator configuration. If the first control says **Atten** you have the Single-Attenuator configuration.

Dual Attenuator **Single Attenuator**

(Note that depending on the measurement, there may be no Auto/Man functionality on the Mech Atten control).

In the Single-Attenuator configuration, youcontrol the attenuation with a single control, as the fixed stage has only two states. In the Dual-Attenuator configuration, both stages have significant range so you are given separate control of the mechanical and electronic attenuator stages.

When you have the Dual-Attenuator configuration, you may still have only a Single-Attenuator, because unless option EA3 (the Electronic Attenuator option) is available, and you purchase it, you will have only the mechanical attenuator.

Full Range Atten

The **Full Range Atten** control and **Attenuator Summary** only appear in N9041B, when the RF input is selected and the RF Input Port is set to RF Input 2, and the Full Range Attenuator is installed. The Full Range Attenuator adds a second input attenuator at the beginning of the RF Input 2, which enhances the protection and optimizes the performance of the extra internal mixers used by RF Input 2.

Remote Command	`[:SENSe]:POWer[:RF]:FRATten <rel_ampl>` `[:SENSe]:POWer[:RF]:FRATten?`
Example	`:POW:FRAT 14` `:POW:FRAT?`
Notes	When you enter an amplitude value that falls between valid values, the value will be incremented to the next smallest valid value
Dependencies	Only appears if input RF is selected, and RF Input Port 2 is selected, and the Full Range Attenuator exists
Couplings	This value is never changed by any coupling, however other couplings use this value. See the **Reference Level** and "Mech Atten" on page 1750 command descriptions
Preset	20 dB
State Saved	Saved in instrument state
Min	0 dB
Max	Only valid values are 0, 6, 14, 20 dB
Annotation	When the Input is RF, and the Input Port is RF Input 2, and the Full Range Attenuator is installed: On the Meas Bar, the field “Atten” displays as follows:

- If the sweep is entirely < 50 GHz, the value shown after “Atten:” is equal to Mech Atten + Elec Atten + Full Range Atten
- If the sweep is entirely > 50 GHz, the value shown after “Atten:” is equal to Full Range Atten
- If the sweep straddles 50 GHz, the value shown after “Atten:” is preceded by the symbol “>=” and is equal to Full Range Atten

In the **Amplitude**, "Attenuation" on page 1747 menu, and the Atten Meas Bar dropdown menu panel, a summary is displayed as follows:

“Total Atten below 50 GHz” followed by the value of Full Range Atten + Mech Atten + Elec Atten

“Total Atten above 50 GHz” followed by the value of Full Range Atten

For example, if Mech Atten = 6 dB, Elec Atten = 4 dB, and Full Range Atten = 20 dB, the summary below is shown:

- Attenuator summary:
- Total Atten below 50 GHz: 30 dB
- Total Atten above 50 GHz: 20 dB

Mech Atten

This control is labeled **Mech Atten** in Dual-Attenuator models and **Atten** in Single-Attenuator models. In the Dual-Attenuator configuration, this control only affects the mechanical attenuator.

This control lets you modify the attenuation applied to the RF input signal path. This value is normally auto coupled to the Ref Level, the Internal Preamp Gain, any External Gain that is entered, and the Max Mixer Level, as described in the table below.

See "Attenuator Configurations and Auto/Man" on page 1653

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation <rel_ampl>`
	`[:SENSe]:POWer[:RF]:ATTenuation?`
	`[:SENSe]:POWer[:RF]:ATTenuation:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:POWer[:RF]:ATTenuation:AUTO?`

Example	`:POW:ATT 20`
	Dual-Attenuator configuration: sets the mechanical attenuator to 20 dB
	Single-Attenuator mode: sets the main attenuation to 20 dB (see below for definition of “main” attenuation)
	In either case, if the attenuator was in Auto, it is set to Manual
	`:POW:ATT:AUTO ON`
	Turn Auto Mech Atten ON

Dependencies	Some measurements do not support the Auto setting of "Mech Atten" on page 1651. In these measurements, the Auto/Man selection is not available, and the Auto/Man toggle function is not

	available In Dual-Attenuator configurations, when the electronic attenuator is enabled, the mechanical attenuator has no auto setting and the Auto/Man toggle function is not available. The state of Auto/Man is remembered and restored when the electronic attenuator is once again disabled. This is described in more detail in "Elec Atten" on page 1753 See "Attenuator Configurations and Auto/Man" on page 1653 for more information on the Auto/Man functionality `:POW:ATT:AUTO` is only available in measurements that support Mech Atten Auto, such as Swept SA
Couplings	If the RF Input Port is the RF Input: – If the USB Preamp is connected to USB, use 0 dB for Mech Atten – Otherwise compute the auto-selected value of Mech Atten based on **Reference Level**, Int Preamp, External Gain, Ref Level Offset, Max Mixer Level, µW Path Control and IF Gain settings. Limit this value to be no less than 6 dB (total attenuation below 6 dB can never be chosen by Auto) – In the N9041B, if the RF Input Port is RF Input 2, use the formula above and subtract the Full Range Atten value from the result to determine the Mech Atten. Limit the value so that it is never lower than 0 dB and so that total attenuation, including Full Range Atten, is never less than 6 dB (total attenuation, including Full Range Atten below 6 dB, can never be chosen by Auto) In External Mixingand BBIQ, where the Attenuator is not in the signal path, the Attenuator setting changes as described above when "Mech Atten" on page 1651 is in Auto, but no changes are made to the actual attenuator hardware setting until the input is changed back to the RF Input For CXA-m with option FSA (Fine-Step Attenuator or 2 dB steps), the FSA-like behavior is only available when the frequency setting is <= 7.5GHz. So, when the frequency is changed from below 7.5GHz to above 7.5GHz, the attenuation setting will be changed to a multiple of 10dB which will be no smaller than the previous setting. For example, 4dB attenuation will be changed to 10dB
Preset	The preset for Mech Attenuation is “Auto” The Auto value of attenuation is 10 dB `ON`
State Saved	Saved in instrument state
Min	0 dB The attenuation set by this control cannot be decreased below 6 dB with the knob or step keys. Values below 6 dB must be directly entered from the keypad or via SCPI. This protects against setting a dangerously small attenuation value, which can put the instrument at risk of damage to input circuitry. If the current mechanical attenuation is below 6 dB, it can be increased with the knob and step keys, but not decreased
Max	CXA Option 503 or 507: 50 dB EXA: 60 dB All other models: 70 dB Note that in the Single-Attenuator configuration, the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB.
Annotation	The current value for Total Atten is displayed in the Measurement Bar at the top of the display. A value appears for Electronic Attenuation only if the Electronic Attenuator is enabled. The annotation appears as

Atten: <total> dB (e<elec>)

The e letter is in amber in Single-Attenuator configurations

For example:

Dual-Attenuator configuration:

Atten: 24 dB (e14)

Indicating the total attenuation is at 24 dB and the electronic attenuation is at 14 dB

Single-Attenuator configuration:

A: 24 dB (e14)

Indicating the total attenuation is at 24 dB and the “soft” attenuation is at 14 dB (see below for definition of “soft” attenuation)

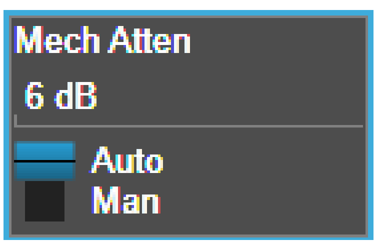
When in Manual, a # sign appears in front of Atten in the annotation

Attenuator Configurations and Auto/Man

As described in "Attenuation" on page 1747 , there are two distinct attenuator configurations available in the X-Series, the single attenuator and Dual-Attenuator configurations. In Dual-Attenuator configurations, we have the mechanical attenuation and the electronic attenuation, and the current total attenuation is the sum of the electronic + mechanical attenuation. In Single-Attenuator configurations, we refer to the attenuation set using "Mech Atten" on page 1651 (or `:POW:ATT`) as the “main” attenuation; and the attenuation that is set by `:POW:EATT` as the “soft” attenuation (`:POW:EATT` is honored even in the Single-Attenuator configuration, for compatibility purposes). Then the current total attenuation is the sum of the main + soft attenuation. See "Elec Atten" on page 1753 for more on “soft” attenuation.

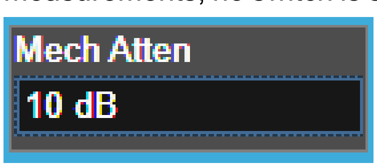
NOTE

In some measurements, the **Mech Atten** control has an Auto/Man function. In these measurements, an Auto/Man switch is shown on the **Mech Atten** control:



Note that in configurations that include an Electronic Attenuator, this switch is only shown when the Electronic Attenuator is disabled.

In other measurements, **Mech Atten** has no Auto/Man function. In these measurements, no switch is shown on the **Mech Atten** control:



Mech Atten also appears with no switch, as above, in configurations that include an Electronic Attenuator but when the Electronic Attenuator is enabled.

Elec Atten

Controls the Electronic Attenuator in Dual-Attenuator configurations. This control does not appear in Single-Attenuator configurations, as the control of both the mechanical and electronic stages of the Single-Attenuator is integrated into the single **Atten** control.

This control includes an Enable/Disable toggle switch; it is only possible to enter a value for the Electronic Attenuator when this switch is in the “Enable” position.

See "More Information" on page 1655

Remote Command	`[:SENSe]:POWer[:RF]:EATTenuation <rel_ampl>`
	`[:SENSe]:POWer[:RF]:EATTenuation?`
	`[:SENSe]:POWer[:RF]:EATTenuation:STATe OFF | ON | 0 | 1`
	`[:SENSe]:POWer[:RF]:EATTenuation:STATe?`

Example	`:POW:EATT 10`
	`:POW:EATT?`
	`:POW:EATT:STAT ON`
	`:POW:EATT:STAT?`

Notes	Electronic Attenuation’s specification is defined only when Mechanical Attenuation is 6 dB
Dependencies	This control only appears in Dual-Attenuator models with an Electronic Attenuator installed and licensed. It does not appear in models with the Single-Attenuator configuration, as in the Single-Attenuator configuration there is no “electronic attenuator” there is only a single integrated attenuator (which has both a mechanical and electronic stage). However, in the Single-Attenuator configuration, EATT SCPI commands are accepted for compatibility with other X-series instruments and set a “soft” attenuation as described in . The “soft” attenuation is treated as an addition to the “main” attenuation value set by the Atten control or the POW:ATT SCPI command and affects the total attenuation displayed on the Atten control and the Meas Bar The electronic attenuator (and the “soft” attenuation function provided in Single-Attenuator configurations) is unavailable above the low band (0-3.6 GHz, 0-3.4 GHz 0-3GHz, depending on the model). If the low band ranges from 0-3.6GHz, and Stop Frequency of the instrument is > 3.6 GHz, then the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed out If the Internal Preamp is on, meaning it is set to Low Band or Full, the electronic attenuator (and the “soft” attenuation function provided in Single-Attenuator configurations) is unavailable. In this case the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed out If either of the above is true, if the SCPI command is sent, an error indicating that the electronic attenuator is unavailable will be sent If both of the above are true, pressing the control will generate error message -221, in other words, the frequency range lockout takes precedence If the electronic/soft Attenuator is enabled, then the Stop Freq of the instrument is limited to 3.6 GHz and the Internal Preamp is unavailable The SCPI-only “soft” electronic attenuation for the single-attenuator configuration is not available in all measurements; in particular, it is not available in the Swept SA measurement

Couplings	Enabling and disabling the Electronic Attenuator affects the setting of the Mechanical Attenuator (in Dual-Attenuator configurations). This is described in more detail below and in the section "Attenuator Configurations and Auto/Man" on page 1752
Preset	OFF (Disabled) for Swept SA measurement ON (Enabled) for all other measurements that support the electronic attenuator
State Saved	Saved in instrument state
Min	0 dB
Max	Dual-Attenuator configuration: 24 dB Single-Attenuator configuration: the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB
Annotation	See Annotation under the **Mech Atten** control description

More Information

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear. These advantages primarily aid in remote operation and are negligible for front panel use. See "Using the Electronic Attenuator: Pros and Cons" on page 1656 for a detailed discussion of the pros and cons of using the electronic attenuator.

For the Single-Attenuator configuration, for SCPI backwards compatibility, the “soft” attenuation feature replaces the Dual-Attenuator configuration’s electronic attenuator. All the same couplings and limitations apply. See "Attenuator Configurations and Auto/Man" on page 1752

Mechanical Attenuator Transition Rules

When the Electronic Attenuator is enabled, the Mechanical Attenuator transitions to a state that has no Auto function. Below are the rules for transitioning the Mechanical Attenuator. Note that the information below ONLY applies to the Dual-Attenuator configurations, and ONLY when the Electronic Attenuator is installed:

When the Electronic Attenuation is enabled from a disabled state:

The Mechanical Attenuator is initialized to 10 dB (this is its optimal performance setting). You can then set it as desired with SCPI, numeric keypad, step keys, or knob, and it behaves as it normally would in manual mode

The Auto/Man state of (Mech) Atten is saved

The Auto/Man toggle on the (Mech) Atten control disappears and the auto rules are disabled

The Electronic Attenuator is set to 10 dB less than the previous value of the Mechanical Attenuator, within the limitation that it must stay within the range of 0 to 24 dB of attenuation

Examples in the Dual-Attenuator configuration:

Mech Atten at 20 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 10 dB. New total attenuation equals the value before Elec Atten enabled

Mech Atten at 0 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 0 dB. New total attenuation does not equal the value before Elec Atten enabled

Mech Atten at 40 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 24 dB. New total attenuation does not equal the value before Elec Atten enabled

When the Electronic Attenuation is disabled from an enabled state:

The Elec Atten control is grayed out

– The Auto/Man state of (Mech) Atten is restored

If now in Auto, (Mech) Atten recouples

If now in Man, (Mech) Atten is set to the value of total attenuation that existed before the Elec Atten was disabled. The resulting value is rounded up to the smallest value possible given the (Mech) Atten Step setting - (That is, 57 dB changes to 58 dB when (Mech) Atten Step is 2 dB)

Using the Electronic Attenuator: Pros and Cons

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear.

The “finer steps” advantage of the electronic attenuator is beneficial in optimizing the alignment of the instrument dynamic range to the signal power in the front panel as well as remote use. Thus, you can achieve improved relative signal measurement accuracy. Compared to a mechanical attenuator with 2 dB steps, the 1 dB resolution of the electronic attenuator only gives better resolution when the odd-decibel steps are used. Those odd-decibel steps are less accurately calibrated than the even-decibel steps, so one tradeoff for this superior relative accuracy is reduced absolute amplitude accuracy.

Another disadvantage of the electronic attenuator is that the spectrum analyzer loses its “Auto” setting, making operation less convenient.

Also, the relationship between the dynamic range specifications (TOI, SHI, compression, and noise) and instrument performance are less well-known with the electrical attenuator. With the mechanical attenuator, TOI, SHI, and compression threshold levels increase dB-for-dB with increasing attenuation, and the noise floor does as well. With the electronic attenuator, there is an excess attenuation of about 1 to 3 dB between 0 and 3.6 GHz, making the effective TOI, SHI, and so forth, less well known. Excess attenuation is the actual attenuation relative to stated attenuation. Excess attenuation is accounted for in the instrument calibration

Mech Atten Step

Controls thestep size used when making adjustments to the input attenuation.

This control is labeled **Mech Atten Step** in Dual-Attenuator models and **Atten Step** in Single-Attenuator models. In the Dual-Attenuator configuration, this control only affects the step size of the mechanical attenuator.

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement] 10 dB | 2 dB` `[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement]?`
Example	`:POW:ATT:STEP 2` `:POW:ATT:STEP?`
Notes	This feature has a toggle choice from the front panel, but it takes a specific value (in dB) when used remotely. The only valid values are 2 and 10
Dependencies	Blanked in EXA, CXA and CXA-m if option FSA (2 dB steps) is not present. If blanked, attempts to set it via SCPI yield an error
Couplings	When the attenuation step size changes, the current mechanical attenuation value is adjusted (if necessary) to be quantized to the new step size. That is, if step is set to 10 dB, mech atten is increased if necessary so it is a multiple of 10 dB
Preset	EXA, CXA and CXA-m: 10 dB (2 dB with option FSA) All other models: 2 dB
State Saved	Saved in instrument state

3.13.3.3 Range (Baseband Input models)

This tab is only available when Option BBA is present (I/Q Baseband Inputs), the current measurement supports option BBA, and I/Q is the selected input. It replaces the Attenuation tab in that case.

Each input channel (I and Q) has four internal gain ranges. The maximum allowed voltage in each gain range is slightly more than the nominal value, so the break point between ranges is a few millivolts higher than the nominal (setting a peak voltage of 0.502 mV will still map to the 0.5 V Peak range).

Gain Setting	Volts RMS	Volts Peak	Volts Peak - Peak	dBm (50Ω)	Break Point
0 dB	0.7071	1.0	2.0	10	n/a
6 dB	0.3536	0.5	1.0	4	0.502 V Peak
12 dB	0.1768	0.25	0.5	-2	0.252 V Peak
18 dB	0.0884	0.125	0.25	-8	0.127 V Peak

Dependencies	Available only when the selected input is I/Q. If the current measurement does not support baseband inputs, an error will be displayed: “No result; Meas invalid with I/Q inputs”
State Saved	No

3.13.3.4 Range (Non-attenuator models)

This tab is only available for Keysight's modular signal analyzers and certain other Keysight products. Examples include:

- VXT
- E7760
- M9391A
- M9393A

This tab also does not appear in UXM. In UXM, all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

State Saved	No

Range

Represents the amplitude of the largest sinusoidal signal that could be present within the IF without being clipped by the ADC. For signals with high peak-to-average ratios, the range may need to exceed the rms signal power by a significant amount to avoid clipping.

This is a measurement global setting.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe <real>` `[:SENSe]:POWer[:RF]:RANGe?`
Example	`:POW:RANG 10 dBm` `:POW:RANG?`
Notes	The MIN and MAX values are affected by the External Gain parameters, and by the **Center Frequency** The hardware compensates for frequency response and alters the Range setting
Preset	0 dBm
State Saved	Yes
Min	-100
Max	100
Annotation	Meas Bar

Adjust Range for Min Clipping

Sets the combination of attenuation and gain based on the current measured signal level so that clipping will be at a minimum.

This is an "immediate action" function, that is, it executes once, when the key is pressed.

This key does not appear in measurements that do not support this functionality.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate`
Notes	Executing Adjust Range for Min Clipping initiates the measurement
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760

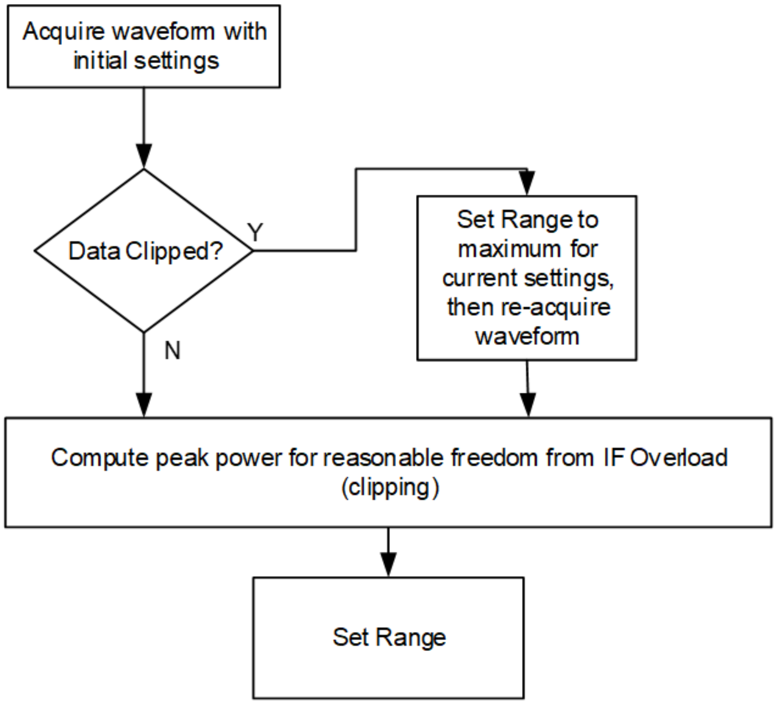
Pre-Adjust for Min Clipping

If this function is `ON`, it applies the adjustment described under Adjust Range For Min Clipping each time a measurement restarts. Therefore, in Continuous measurement mode, it only executes before the first measurement.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation OFF | ON | ELECtrical | COMBined` `[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation?`
Notes	Because there is no attenuator control available in these models, the control displays only `ON` and `OFF` choices. However, for SCPI compatibility with other platforms, all three parameters (`ELECtrical`, `COMBined`, and `ON`) are honored and all are mapped to `ELECtrical`, so if any of these three parameters is sent, a subsequent query will return `ELEC`
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760
Preset	`OFF` for Swept SA measurement; `ON` for all other measurements that support **Pre-Adjust for Min Clipping**
State Saved	Saved in instrument state

Adjustment Algorithm

The algorithm for the adjustment is documented below:



Peak-to-Average Ratio

Used with "Range (Non-attenuator models)" on page 1864 to optimize the level control in the instrument. The value is the ratio, in dB, of the peak power to the average power of the signal to be measured. A ratio of 0 should be used for sinusoidal signals; for 802.11g OFDM signals use 9 dB.

All Applications (Modes) show the current value of Peak-to-Average ratio on the control. However, some applications do not permit changing the value. In these situations, the control is grayed-out.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:PARatio <real>` `[:SENSe]:POWer[:RF]:RANGe:PARatio?`
Example	`:POW:RANG:PAR 12 dB`
Notes	In some Applications (Modes) this parameter is read-only; meaning the value will appear on the control and query via SCPI, but is not changeable. In such applications the control is grayed-out. Attempting to change the value via SCPI will be ignored but no error message will be generated
Dependencies	This control does not appear in Spectrum Analyzer Mode
Preset	10 dB VXT Models M9410A/11A: 0 dB
State Saved	Saved in instrument state
Min	0 dB
Max	20 dB

	VXT Models M9410A/11A: 50 dB

Mixer Lvl Offset

This is an advanced setting to adjust target Range at the input mixer, which in turn affects the signal level in the instrument's IF. This setting can be used when additional optimization is needed after setting "Peak-to-Average Ratio" on page 1866. Positive values of offset optimize noise performance over distortion, negative values optimize distortion performance over noise.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet <real>` `[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet?`
Example	`:POW:RANG:MIX:OFFS -5 dB`
Preset	0 dB
State Saved	Saved in instrument state
Min	-35 dB VXT Models M9410A/11A: -34 dB
Max	30 dB

3.13.3.5 Signal Path

Contains controls that pertain to the routing of the signal through the frontend of the instrument.

In general, this tab only appears in instruments whose hardware supports this signal routing. For example, this tab does not appear in many of the modular instrument products, including VXT Models M9420/21A. It also does not appear in UXM.

This tab *does* appear in VXT Models M9410A/11A because the Software Preselection control is in this tab, and VXT Models M9410A/11A implement a version of Software Preselection.

Presel Center

Pressing this control adjusts the centering of the preselector filter to optimize the amplitude accuracy at the frequency of the selected marker. If the selected marker is not on when **Presel Center** is pressed, the instrument turns on the selected marker, performs a peak search, and then performs centering on the marker's center frequency. If the selected marker is already on and between the start and stop frequencies of the instrument, the instrument performs the preselector calibration on that marker's frequency. If the selected marker is already on, but outside the frequency range between Start Freq and Stop Freq, the instrument first performs a peak search, and then performs centering on the marker's center frequency.

The value displayed on "Preselector Adjust" on page 1869 will change to reflect the new preselector tuning.

A number of considerations should be observed to ensure proper operation. See "Proper Preselector Operation" on page 1662.

Remote Command	`[:SENSe]:POWer[:RF]:PCENter`
Example	`:POW:PCEN`
Notes	Note that the rules outlined above under the control description apply for the remote command as well as the key. The result of the command is dependent on marker position, etc. Any message shown by the control press is also shown in response to the remote command
Dependencies	Does not appear in CXA-m Does not appear in VXT Models M9410A/11A Grayed-out if the microwave preselector is off – If the selected marker's frequency is below Band 1, an advisory message is generated "Preselector not used in this frequency range" and no action is taken – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz – Blank in models that do not include a preselector, such as option 503. If the remote command is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View
Couplings	The active marker position determines where the centering will be attempted If the instrument is in a measurement such as averaging when centering is initiated, the act of centering the preselector restarts averaging, but the first average trace will not be taken until the centering is completed The offset applied to do the centering reads out on the "Preselector Adjust" on page 1869 control
Status Bits/OPC dependencies	When centering the preselector, `*OPC` will not return true until the process is complete and a subsequent measurement has completed, nor will results be returned to `:READ` or `:MEASure` queries The Measuring bit should remain set while this command is operating and should not go false until the subsequent sweep/measurement has completed

Proper Preselector Operation

A number of considerations should be observed to ensure proper operation:

1 If the selected marker is off, the instrument turns on a marker, performs a peak search, and adjusts the preselector using the selected marker's frequency. It uses the "highest peak" peak search method unqualified by threshold or excursion, so that there is no chance of a 'no peak found' error. It continues with that peak, even if it is the peak of just noise. Therefore, for this operation to work properly, there should be a signal on screen in a preselected range for the peak search to find

2 If the selected marker is already on, the instrument attempts the centering at that marker's frequency. There is no preselector for signals below about 3.6 GHz, so if the marker is on a signal below 3.6 GHz, no centering will be attempted and an advisory message generated

3 In some models, the preselector can be bypassed. If it is bypassed, no centering will be attempted in that range and a message will be generated

Preselector Adjust

Allows you to manually adjust the preselector filter frequency to optimize its response to the signal of interest. This function is only available when "Presel Center" on page 1868is available.

For general purpose signal analysis, using **Presel Center** is recommended. Centering the filter minimizes the impact of long-term preselector drift. **Preselector Adjust** can be used instead to manually optimize the preselector. One application of manual optimization would be to peak the preselector response, which both optimizes the signal-to-noise ratio and minimizes amplitude variations due to small (short-term) preselector drifting.

When **Presel Center** is performed, the offset applied to do the centering becomes the new value of **Preselector Adjust**.

Remote Command	`[:SENSe]:POWer[:RF]:PADJust <freq>` `[:SENSe]:POWer[:RF]:PADJust?`
Example	`:POW:PADJ 100KHz` `:POW:PADJ?`
Notes	The value on the control reads out to 0.1 MHz resolution
Dependencies	– Does not appear in CXA-m – Does not appear in VXT Models M9410A/11A – Grayed-out if microwave preselector is off – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz – Blank in models that do not include a preselector, such as option 503. If the SCPI is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View
Preset	0 MHz
State Saved	The **Preselector Adjust** value set by "Presel Center" on page 1868, or by manually adjusting **Preselector Adjust** It is not saved in instrument state, and does not survive a Preset or power cycle
Min	-500 MHz
Max	500 MHz
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PADJust` `[:SENSe]:POWer[:RF]:MMW:PADJust`

Notes	PSA had multiple preselectors, and you could select which preselector to adjust. Since the X-Series has only one mm/uW preselector, the preselector selection control is no longer available. However, to provide backward compatibility, we accept the legacy remote commands The command form has no effect, the query always returns `MWAVe`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:PADJust:PRESelector MWAVe | MMWave | EXTernal` `[:SENSe]:POWer[:RF]:PADJust:PRESelector?`

Internal Preamp

Accesses a menu of controls for the internal preamps. Turning on the preamp gives a better noise figure, but a poorer inter-modulation distortion (TOI) to noise floor dynamic range. You can optimize this setting for your particular measurement.

The instrument takes the preamp gain into account as it sweeps. If you sweep outside of the range of the preamp, the instrument will also account for that. The displayed result always reflects the correct gain.

For some measurements, when the preamp is on and any part of the displayed frequency range is below the lowest frequency for which the preamp has specifications, a warning condition message appears in the status line. For example, for a preamp with a 9 kHz lowest specified frequency: "Preamp: Accy unspec'd below 9 kHz".

Selection	Example	Note
Off	`:POW:GAIN OFF`	
Low Band	`:POW:GAIN ON` `:POW:GAIN:BAND LOW`	Sets the internal preamp to use only the low band. The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Low Band selection in the dropdown
Full Range	`:POW:GAIN ON` `:POW:GAIN:BAND FULL`	Sets the internal preamp to use its full range. The low band (0-3.6 GHz, 0-3.4 GHz, 0-3GHz, depending on the model) is supplied by the low band preamp and the frequencies above low band are supplied by the high band preamp The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Full Range selection in the dropdown. If the high band option is not installed the Full Range selection does not appear

Remote Command	`[:SENSe]:POWer[:RF]:GAIN:BAND LOW | FULL` `[:SENSe]:POWer[:RF]:GAIN:BAND?`

	`[:SENSe]:POWer[:RF]:GAIN[:STATe] OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:GAIN[:STATe]?`

Example	`:POW:GAIN:BAND LOW`
	`:POW:GAIN:BAND?`
	`:POW:GAIN OFF`
	`:POW:GAIN?`

Dependencies	Preamp is not available on all hardware platforms. If the preamp is not present or is unlicensed, the control is not shown Does not appear in VXT Models M9410A/11A/15A If `:POW:GAIN:BAND FULL` is sent when a low band preamp is available, the preamp band parameter is set to `LOW` instead of `FULL`, and an "Option not installed" message is generated The preamp is not available when the electronic/soft attenuator is enabled
Preset	`LOW` `OFF`
State Saved	Saved in instrument state
Annotation	When the USB Preamp is not connected to USB, the Preamp annotation in the Meas Bar says "Off" if the preamp is off and displays the frequency range of the low band or full range preamp depending on the setting. For example, if the Preamp is set to Low Band and the Low Band is 3.6 GHz the annotation says "3.6 GHz". If it is a 13.6 GHz preamp and it is set to Full Range the annotation says "13.6 GHz" When the USB Preamp is connected to USB, the Preamp annotation says "Preamp: USB" if the internal preamp is off or "Preamp: USB, Int" if the internal preamp is on (only for measurements that support the USB preamp)

LNA

Lets you turn the Low Noise Amplifier (**LNA**) on or off.

The LNA is an additional preamplifier that provides superior DANL and frequency range compared to the Internal Preamp. The LNA provides lower system noise figure, especially at frequencies above 100 MHz, and can be operated up to the full range of 50 GHz instruments.

For best possible sensitivity, the LNA can be turned on together with the "Internal Preamp" on page 1870, although if you operate both preamps together, note that the TOI (distortion) specifications are impacted. The sensitivity improvement of this combination is substantial when operating in high band (frequencies above 3.6 GHz).

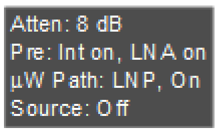
See "More Information" on page 1666

Remote Command	`[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe] OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe]?`
Example	`:POW:GAIN:LNA ON`
Dependencies	Requires option LNA

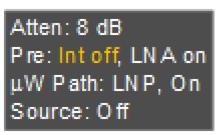
	Option LNA is not required by VXT model M9415A Does not appear in VXT models M9420A/21A/10A/11A May not appear in some measurements
Preset	OFF
State Saved	Saved in State

More Information

When the LNA is installed, the preamp annotation changes to show the state of both the LNA and the Internal Preamp. Below is an example:



Note that when operating entirely in the low band (below about 3.6 GHz), if the LNA is on, the Internal Preamp is switched off (even if you have its switch set to ON). This is because the noise performance is actually degraded in low band if both preamps are on. In this case, the annotation reflects the actual state of the two preamps, but the Internal Preamp annotation displays in amber, to warn you that the actual state of the Internal Preamp does not match the **Internal Preamp** switch control display:



µW Path Control

Options for this control include **µW Preselector Bypass** (Option MPB), **Low Noise Path** (Option LNP) and **Full Bypass Enable** in the High Band path circuits.

When the µW Preselector is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. When **Low Noise Path Enable** is selected, the instrument automatically bypasses certain circuitry in the high frequency bands that can contribute to noise, when it is appropriate based on other instrument settings.

For most applications, the preset state is **Standard Path**, which provides the best remote-control throughput, minimizes acoustic noise from switching and minimizes the risk of wear in the hardware switches, particularly in remote test scenarios where both low band and high band setups will follow in rapid succession. In this path, the bypass of the low band/high band switch and microwave preamp is never activated, which can cause some noise degradation but preserves the life of the bypass switch.

For applications that utilize the wideband IF paths, the preset state is **µW Preselector Bypas**s, if option MPB is present. This is because, when using a wideband IF such as

the 140 MHz IF, the µW Preselector's bandwidth can be narrower than the available IF bandwidth, causing degraded amplitude flatness and phase linearity, so it is desirable to bypass the preselector in the default case.

You may choose **Low Noise Path Enable** for a lower noise floor, especially in the 21-26.5 GHz region, though without improving many measures of dynamic range, and without giving the best possible noise floor. The preamp, if purchased and used, gives better noise floor than does **Low Noise Path Enable**, but the preamp's compression threshold and third-order intercept are much poorer than that of **Low Noise Path Enable**.

A fourth choice is **Full Bypass Enable**, which combines **µW Preselector Bypass** and **Low Noise Path Enable**. Because this can bypass most of the circuitry between the input and the first mixer, care should be taken when using this setting to avoid damaging the mixer. **Full Bypass Enable** is only available if both options LNP and MPB are present, as well as option FBP.

Path	Example	Note
Standard Path	`:POW:MW:PATH STD`	Normal setting for most measurements. µW Preselector in circuit, Low Noise Path disabled
Low Noise Path Enable	`:POW:MW:PATH LNP`	See "Low Noise Path Enable" on page 1671
µW Preselector Bypass	`:POW:MW:PATH MPB`	See "µW Preselector Bypass" on page 1672
Full Bypass Enable	`:POW:MW:PATH FULL`	See "Full Bypass Enable" on page 1673

Remote Command	`[:SENSe]:POWer[:RF]:MW:PATH STD | LNPath | MPBypass | FULL` `[:SENSe]:POWer[:RF]:MW:PATH?`

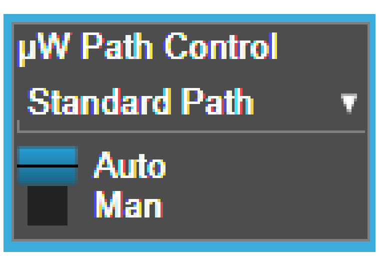
Example	`:POW:MW:PATH LNP`
	Enables the Low Noise path
	`:POW:MW:PATH?`

Notes	If "Presel Center" on page 1868 is performed, the instrument will momentarily switch to the Standard Path, regardless of the setting of **µW Path Control** The DC Block will always be switched in when the low noise path is switched in, to protect succeeding circuitry from DC. Note that this does not mean "when the low noise path is enabled" but when, based on the Low Noise Path rules, the path is actually switched in. This can happen when the selection is **Low Noise Path Enable** or **Full Bypass Enable.** In the case where the DC Block is switched in the instrument is now AC coupled. However, if you selected DC coupling, the UI would still behave as though it were DC coupled, including all annunciation, warnings, status bits, and responses to SCPI queries. This is because, based on other settings, the instrument could switch out the low noise path at any time and hence go back to being DC coupled Alignment switching ignores the settings in this menu, and restores them when finished
Dependencies	Does not appear in CXA-m Does not appear in VXT Models M9410A/11A Does not appear in BBIQ and External Mixing

	The **Low Noise Path Enable** selection does not appear unless Option LNP is present and licensed The **µW Preselector Bypass** selection does not appear unless Option MPB is present and licensed The **Full Bypass Enable** selection does not appear unless options LNP and MPB are both present as well as option FBP In any of these cases, if the required options are not present and the SCPI command is sent, error -241, "Hardware missing; Option not installed" is generated **Low Noise Path Enable** and **Full Bypass Enable** are grayed-out if the current measurement does not support them **Low Noise Path Enable** and **Full Bypass Enable** are not supported in Avionics and MMR Modes. In any of these cases (that is, the feature is not supported in either measurement or mode), if the SCPI command is sent, the following error is generated: -221, "Setting Conflict; Feature not supported for this measurement"
Preset	All except modes specified below: `STD` IQ Analyzer, VXA, Pulse and Avionics mode: – MPB option present and licensed: `MPB` – MPB option not present and licensed: `STD`
State Saved	Save in instrument state
Range	Standard Path|Low Noise Path Enable|µW Presel Bypass|Full Bypass Enable
Annotation	In the Meas Bar, if the Standard path is chosen, it says: µW Path: Standard If Low Noise Path is enabled but the LNP switch is not thrown, it shows: µW Path: LNP,Off If the Low Noise Path is enabled and the LNP switch IS thrown, it shows: µW Path: LNP,On If the preselctor is bypassed, it says: µW Path: Bypass If Full Bypass Enable is selected but the LNP switch is not thrown, it shows: µW Path: FByp,Off If Full Bypass Enable is selected and the LNP switch IS thrown, it shows: µW Path: FByp,On

µW Path Control Auto [Mode: VMA, WLAN, NR5G, CQM]

In VMA, WLAN, 5G NR, CQM modes, an Auto/Man switch is added to **µW Path Control**:



This allows the function to automatically switch based on certain Auto Rules as shown below:

VMA Mode

Measurement	When µW Path Control is in Auto:
Digital Demod	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Custom OFDM	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Presel Bypass
SEM	Always Presel Bypass
Spurious Emissions	Always Standard Path

WLAN Mode

Measurement	When µW Path Control is in Auto:
Modulation Analysis	Always Presel Bypass
Spectral Flatness	Always Presel Bypasss
Power vs Time	Always Presel Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Always Presel Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Always Presel Bypass
SEM	1. For 11be 320M, when ‘Enabled Wideband IF for FFT’ is OFF or ‘Sweep Type Rule’ is Best Dynamic Range, auto µW path is standard. 2. For other cases, auto µW path is presel bypass if presel bypass is enabled, auto µW path is standard if presel bypass is not enabled.
Spurious Emissions	Always Standard Path

5G NR Mode

Measurement	When µW Path Control is in Auto:
Modulation	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in

Measurement	When µW Path Control is in Auto:
Analysis	which case choose Full Bypass if conditions warrant(FBP Option is available and “Allow Full Bypass in Auto” is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and “Allow Full Bypass in Auto” is On), otherwise choose Preselector Bypass
Channel Power	Always Standard Path
Occupied BW	Always Standard Path
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Standard Path
SEM	Always Standard Path
Spurious Emissions	Always Standard Path
Transmit On|Off Power	Use Standard Path unless tuned frequency > 3.6 GHz and Info BW > 15 MHz, in which case choose Preselector Bypass

Channel Quality Mode

Measurement	When µW Path Control is in Auto:
Group Delay	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and “Allow Full Bypass in Auto” is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass

Remote Command	`[:SENSe]:POWer[:RF]:MW:PATH:AUTO ON | OFF | 1 | 0` `[:SENSe]:POWer[:RF]:MW:PATH:AUTO?`
Example	`:POW:MW:PATH:AUTO ON` `:POW:MW:PATH:AUTO?`
Dependencies	Only appears in VMA, WLAN, 5G NR and CQM modes
Couplings	See the tables above
Preset	ON
Range	ON|OFF

Low Noise Path Enable

You may select Low Noise Path Enable, which gives a lower noise floor under some circumstances, particularly when operating in the 21-26.5 GHz region. With the Low Noise Path enabled, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

- The instrument is not in the Low Band, meaning:
- the start frequency is above 3.5 GHz and
- the stop frequency is above 3.6 GHz
- the internal preamp is not installed or (if installed) is set to Off or Low Band

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the Low Noise Path Enable is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the Low Noise Path Enable is selected in the user interface. The only time the Low Noise Path is used is when Low Noise Path Enable is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

For measurements that use IQ acquisition, the low noise path is used when Center Frequency is in High Band (> 3.6 GHz) and no preamp is in use. In other words, the rules above are modified to use only the center frequency to qualify which path to switch in. This is not the case for FFTs in the Swept SA measurement; they use the same rules as swept measurements.

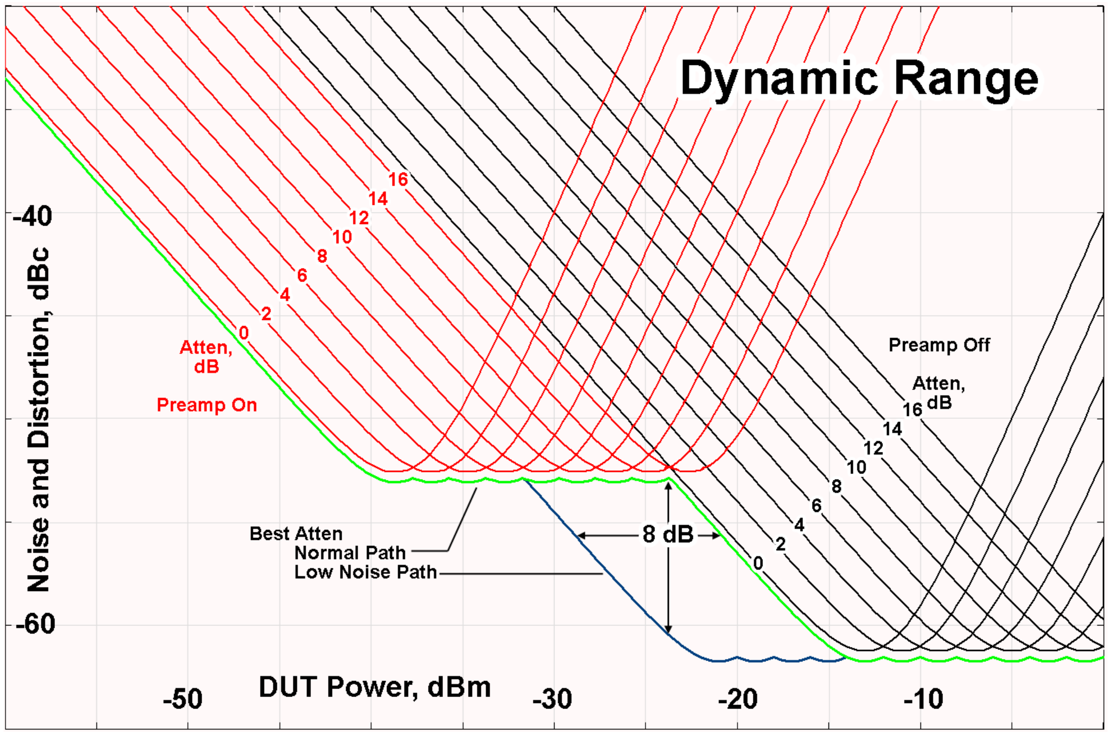
Note that the Low Noise Path, while giving improved DANL, has the disadvantage of decreased TOI performance and decreased gain compression performance relative to the standard path.

Note also that the bypass switch is a mechanical switch and has finite life, so if the Low Noise Path Enable is selected, it is possible to cause frequent cycling of this switch by frequently changing instrument settings such that the above conditions hold true only some of the time. A user making tests of this nature should consider opting for the Standard Path, which will never throw the bypass switch, at the expense of some degraded noise performance.

The low noise path is useful for situations where the signal level is so low that the instrument performance is dominated by noise even with 0 dB attenuation, but still high enough that the preamp option would have excessive third-order intermodulation or compression. The preamp, if purchased and used, gives better noise floor than does the “Low Noise Path.” However, its compression threshold and third-order intercept are much poorer than that of the non-preamp path.

There are some applications, typically for signals around –30 dBm, for which the third-order dynamic range of the standard path is good enough, but the noise floor is not low enough even with 0 dB input attenuation. When the third-order dynamic range of the preamp path is too little and the noise floor of the standard path is too high, the Low Noise Path can provide the best dynamic range

The graph below illustrates the concept. It shows, in red, the performance of an instrument at different attenuation settings, both with the preamp on and off, in a measurement that is affected by both instrument noise and instrument TOI. The green shows the best available dynamic range, offset by 0.5 dB for clarity. The blue shows how the best available dynamic range improves for moderate signal levels with the low noise path switched in. In this illustration, the preamp improves the noise floor by 15 dB while degrading the third-order intercept by 30 dB, and the low noise path reduces loss by 8 dB. The attenuator step size is 2 dB.



There are other times where selecting the low noise path improves performance, too. Compression-limited measurements such as finding the nulls in a pulsed-RF spectrum can profit from the low noise path in a way similar to the TOI-limited measurement illustrated. Accuracy can be improved when the low noise path allows the optimum attenuation to increase from a small amount like 0, 2 or 4 dB to a larger amount, giving better return loss at the instrument input. Harmonic measurements, such as second and third harmonic levels, are much improved using the low noise path because of the superiority of that path for harmonic (though not intermodulation) distortion performance.

µW Preselector Bypass

Toggles the preselector bypass switch for band 1 and higher. When the microwave presel is on, the signal path is preselected. When the microwave preselector is off, the signal path is not preselected. The preselected path is the normal path for the instrument.

The preselector is a tunable bandpass filter which prevents signals away from the frequency of interest from combining in the mixer to generate in-band spurious signals (images). The consequences of using a preselector filter are its limited bandwidth, the amplitude and phase ripple in its passband, and any amplitude and phase instability due to center frequency drift.

Option MPB or pre-selector bypass provides an unpreselected input mixer path for certain X-Series signal analyzers with frequency ranges above 3.6 GHz. This signal path allows a wider bandwidth and less amplitude variability, which is an advantage when doing modulation analysis and broadband signal analysis. The disadvantage is that, without the preselector, image signals will be displayed. Another disadvantage of bypassing the preselector is increased LO emission levels at the front panel input port.

Image responses are separated from the real signal by twice the 1st IF. For IF Paths of 10 MHz and 25 MHz, the 1st IF is 322.5 MHz, so the image response and the real signal will be separated by 645 MHz. The 1st IF will be different for other IF Path settings. When viewing a real signal and its corresponding image response in internal mixing, the image response will be to the left of the real signal.

Also, the image response and the real signal typically have the same amplitude and exhibit the same shape factor.

However, if Option FS1, Fast Sweep Capability, is enabled, the image response in the Swept SA measurement appears lower in amplitude and has a much wider shape factor compared to the real signal.

Full Bypass Enable

With **Full Bypass Enable** selected, the microwave preselector is bypassed. In addition, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

– The instrument is not in the Low Band, meaning:

– the start frequency is above 3.5 GHz and

– the stop frequency is above 3.6 GHz.

– the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. The only time the Low Noise Path is used is when **Full Bypass Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

CAUTION — When **Full Bypass Enable** is selected, and "Attenuation" on page 1747 is set to 0 dB, there will be a direct AC connection between the input and the first converter

when the Low Noise Path switches in (when Start Freq >3.6 GHz and the Preamp is either not licensed, set to Low Band, or Off). This puts the first converter at high risk to be damaged by high AC power. Consequently, whenever **Full Bypass Enable** is selected, a warning message appears in the status bar:

Full Bypass Enabled, maximum safe input power reduced

Microwave Preselector Bypass Backwards Compatibility

Example	`:POW:MW:PRES OFF` Bypasses the microwave preselector
Notes	Included for Microwave Preselector Bypass backwards compatibility The `ON` parameter sets the `STD` path (`:POW:MW:PATH STD`) The `OFF` parameter sets path `MPB` (`:POW:MW:PATH MPB`)
Preset	`ON`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe] ON | OFF | 0 | 1` `[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe]?`

Frequency Extender Preselection Bypass

Frequency Extender Preselection Bypass only applies to the high frequency path of the Frequency Extender and only if the Frequency Extender allows it. For example, the V3050A high frequency path is 50 – 110 GHz and does allow control of the preselector bypass.

When the Frequency Extender's preselection is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. For bandwidths greater than 2.5 [GHz], it is recommended that the signal bypass the Frequency Extender Preselector since the max bandwidth of the Preselector can be as narrow as 2.5 [GHz].

For most applications, the preset state is `OFF`, which gives the best remote-control throughput, minimizes acoustic noise from switching, minimizes out of band spurs, and minimizes the risk of wear in the hardware switches.

Coupling with Microwave Preselector Control

The control of whether to apply or bypass the Frequency Extender's preselection is dependent on the Microwave Path Control setting.

The coupling between the Microwave Path Control and Frequency Extender Preselector Bypass is described below.

UW PATH CTRL	UW PRESELECTOR	VIKING PRESELECTOR
Standard Path	On	**On**
Low Noise Path Enable	On	**On**
uW Presel Bypass	Off	**Off**
Full Bypass Enable	Off	**Off**

In other words…

uW Path Ctrl == Standard
uW Path Ctrl == Low Noise
Viking PreselBypass == Off

uW Path Ctrl == Bypass
uW Path Ctrl == Full Bypass
Viking PreselBypass == On

For the Frequency Extender Preselector Bypass to take effect, it requires a Frequency Extender device (such as V3050A) be connected and External RF (ERFIN) selected as the input.

The Frequency Extender Preselector is applied or bypassed depending on the Microwave Path Control setting only when the acquisition is above 50 [GHz]. Hence, it will be bypassed only when the acquisition is above 50 [GHz].

Preselector and Bandwidth Conflict

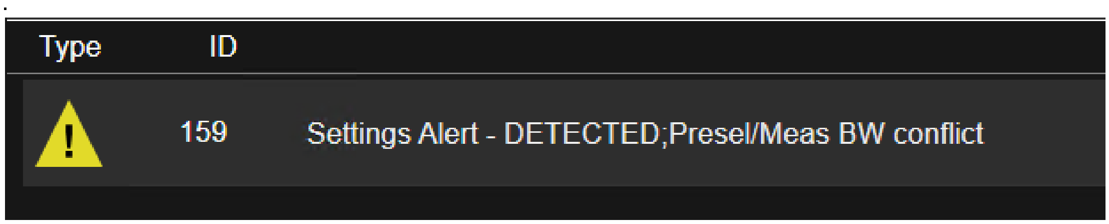
When the Frequency Extender Preselector is applied and the signal bandwidth is greater than 2.5 [GHz], then a settings alert message will show to warn the user that the signal may be distorted due to the limitation of the Frequency Extender Preselector bandwidth.

An example of the settings alert message is shown below.

Settings Alert message in the Status Bar at the bottom of the display.

Settings Alert message in the error queue

.



Software Preselection

Software Preselection is provided in some instruments, either to compensate for issues with provided hardware preselection or to provide the preselection function when there is no hardware preselector.

N9041B

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 50 GHz, software preselection must be used to suppress and separate images above 50 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

In the N9041B, Software Preselection only applies for frequencies above 50 GHz, therefore it is only used for RF Input 2. Even if it is turned on, it will not be used for other inputs and never for frequencies below 50 GHz. This is why the label of this control contains the parenthetical note “(>~50 GHz)”.

Note that in the N9041B, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

N9042B+V3050A

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 88 GHz, software preselection must be used to suppress and separate images above 88 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

For N9042B+V3050A, Software Preselection only applies for frequencies above 88 GHz, therefore it is only used for External RF. Even if it is turned on, it will not be used for other inputs and never for frequencies below 88 GHz. This is why the label of this control contains the parenthetical note “(>~88 GHz)”.

Note that for N9042B+V3050A, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

VXT models M9410A/11A

Software Preselection is used to provide the preselection function, as there is no hardware preselector in these models. Two background traces are taken and compared point by point, and the point with the lowest amplitude from the two traces is used. This provides a method to reduce spurs that are internally generated within the VXT, but the user should note the following when using Software

Preselection:

- There is some speed cost due to the need to take multiple captures

- Taking the point with the lowest amplitude in each trace will make the average noise level lower at all points that do not have a spur. This can reduce the accuracy of the measurement of noise and noise-like signals.

Because of the difficulty in identifying spurs manually, you are encouraged to leave Software Preselection ON at all times in VXT models M9410A/11A. If you turn it off in order to speed up your measurement or improve noise accuracy, be aware of unwanted onscreen spurs.

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel:STATe 0 | 1 | ON | OFF` `[:SENSe]:POWer[:RF]:SWPresel:STAT?`
Example	`:POW:SWPR:STAT 1` `:POW:SWPR:STAT?`
Dependencies	Only appears in N9041B, N9042B+V2050A, and VXT models M9410A/11A. Does not appear in all measurements
Couplings	Sweep Time is affected by SW Preselection. Also Auto Tune supports SW Preselection, so set SW Preselection state and then do Auto Tune
Preset	N9041B: OFF N9042B+V3050A: ON M9410A/11A: ON
State Saved	Saved in instrument state

SW Preselection Type

Specifies the algorithm used for software preselection.

Two hidden sweeps are taken in succession. The second sweep is offset in LO frequency by 2*IF/N. For each point in each trace, the smaller amplitude from the two traces is taken and placed in that point in the selected trace. The Peak detector is auto-selected to improve the image suppression effectiveness. Responses of each trace that lie on top of one another will remain and are valid signals. Other signals are images and are suppressed. The action of taking the smaller of the two traces will make the average noise level lower in all points that do not have an image, thus reducing the accuracy of the measurement of noise and noise-like signals.

- `NORMal` - mathematically removes all image and multiple responses of signals present at the input

- `ADVanced` - any trace processing (such as “max hold” or trace averaging) is performed on the points of both candidate traces before the “select minimum” operation occurs. This form of processing works better for non-stationary signals, such as pulsed-RF signals

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel NORMal | ADVanced` `[:SENSe]:POWer[:RF]:SWPResel?`
Example	`:POW:SWPR NORM` `:POW:SWPR?`
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed-out. Its grayout message is “Unavailable unless SW Presel enabled”
Preset	N9041B: `ADVanced` N9042B+V3050A: `NORMal`
State Saved	Saved in instrument state

SW Preselection BW

Specifies the effective bandwidth to be used for Software Preselection.

The choices are:

- `NORMal` – when making Swept measurements, a software preselection algorithm is used which takes up to 4 background acquisitions, then post-processes the result. This algorithm can remove images from signals with an occupied bandwidth up to around 3 GHz. (Default/Preset setting). When making FFT measurements, this algorithm is not used, instead the same algorithm is used as for `NARRow` (below)
- `NARRow`– a software preselection algorithm is used which takes two background acquisitions, then post-processes the result to detect and remove images from wideband signals with occupied bandwidths up to 2 GHz. This increases the risk of images failing to be rejected, but improves the measurement speed

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel:BW NORMal | NARRow` `[:SENSe]:POWer[:RF]:SWPResel:BW?`
Example	`:POW:SWPR:BW NARR`
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed out. Its grayout message is “Unavailable unless SW Presel enabled” For N9042B+V3050A the parameter is SCPI only and always set to `NARRow` when Software Preselection is enabled
Preset	N9041B: `NORMal` N9042B+V3050A: `NARRow`
State Saved	Saved in instrument state

High Freq Prefilter

Lets you set the state of Prefilter for Center Frequencies above 1310 MHz.

In VXT Models M9410A/11A, the Receiver RF path has a bank of filters that come after the RF Attenuator in the signal path. Since this bank of filters precedes the mixer they are known as the "Prefilter" bank. Their purpose is to eliminate unwanted in-band mixing products by filtering out all but the desired frequencies before the signals get to the mixer. There are 13 prefilter bands to cover the frequencies between 9 kHz and 6000 MHz. The Prefilter provides the necessary rejection of the unwanted signal.

Remote Command	`[:SENSe]:<measurement>:PFILter[:STATe] ON | OFF | 1 | 0` `[:SENSe]:<measurement>:PFILter[:STATe]?`

Example	For example, to enable High Freq Prefilter in IQ Analyzer Mode:
	For the Complex Spectrum Measurement:
	`:SPEC:PFIL ON`
	For the IQ Waveform Measurement:
	`:WAV:PFIL ON`
	`:`

Dependencies	This control only appears in VXT models M9410A/11A with center frequency above 1310 MHz
Preset	See "Prefilter Presets" below
State Saved	Saved in instrument state

Prefilter Presets

Meas	Mode	Preset
SPEC	BASIC	OFF
WAV	BASIC, WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
MON	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
RHO	WCDMA	OFF
CDP	WCDMA	OFF
PCON	WCDMA	OFF
EVMQ	WCDMA	OFF
CHP	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
OBW	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
ACP	WCDMA, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
SEM	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PST	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PVT	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF
EVM	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF

Meas	Mode	Preset
FLAT	WLAN	OFF
EVMM	WLAN	OFF
CEVM	LTEAFDD, LTEATDD	OFF
PAVT	5GNR, VMA	OFF
DDEM	VMA	OFF
OFDM	VMA	OFF
SAN	SA	ON
HARM	SA	ON

3.13.4 BW

The BW key opens the bandwidth menu. The Digital IF BW functions control filter bandwidth and filter type. There are two filter types: Gaussian and Flattop. The Gaussian filters have a response curve that is parabolic on a log scale. The Flattop filter shape is a close approximation of a rectangular filter.

3.13.4.1 Settings

The Settings tab contains the basic Bandwidth functions. It is the only tab under Bandwidth.

Digital IF BW

Sets the Digital IF (formerly Info BW) bandwidth of the instrument. When in Auto, it is set to the value that covers carriers set by carrier configuration.

Remote Command	`[:SENSe]:WAVeform:DIF:BANDwidth <freq>`
	`[:SENSe]:WAVeform:DIF:BANDwidth?`
	`[:SENSe]:WAVeform:DIF:BANDwidth:AUTO ON | OFF | 1 | 0`
	`[:SENSe]:WAVeform:DIF:BANDwidth:AUTO?`

Example	`:WAV:DIF:BAND 1kHz`
	`:WAV:DIF:BAND?`
	`:WAV:DIF:BAND:AUTO 0`
	`:WAV:DIF:BAND:AUTO?`

Notes	Auto/Man is available only for 5G NR, LTE, LTETDD, LTEAFDD, LTEA TDD
Dependencies	For applications that have the **IF Path** Selection menu, such as the `BASIC` mode:

	<table><tr><th>IF Path Auto State</th><th>Maximum Value Criteria</th></tr><tr><td>OFF</td><td>The maximum value depends on which IF Path is currently selected If 10 MHz, 25 MHz, 40 MHz, 85 MHz, 125 MHz, 140 MHz or 160 MHz, 255 MHz, or 510 MHz paths are selected, the maximum value of this parameter is 10, 25, 40, 85, 125, 140 or 160 MHz, 255 MHz, or 510 MHz respectively</td></tr><tr><td>ON</td><td>The maximum value is the maximum Digital IF BW available in the instrument, regardless of the current IF Path Selection For example, if the instrument has the options B25, B40, and B1X installed, the maximum available Digital IF BW of the instrument is 160 MHz. Thus, if IF Path Auto is ON and IF Path Selection is 25 MHz, the maximum Digital IF BW is not limited to 25 MHz, but is 160 MHz</td></tr></table>

Preset	GSM/EDGE: 510 kHz
	LTE, LTETDD, LTEAFDD, LTEATDD, 5G NR: Automatically calculated
	WLAN: Hardware Dependent
	– No option = 10 MHz
	– Option B25 = 25 MHz
	– Option B40:
	  – if Radio Std is 802.11a/b/g/n/ac/ax//be (20 MHz) = 25 MHz
	  – if Radio Std is 802.11n/ac/ax/be (40 MHz) = 40 MHz
	  – if Radio Std is 802.11ac/ax/be (80 MHz) = 80 MHz
	  – if Radio Std is 802.11ac/ax/be (160 MHz) = 160 MHz
	  – if Radio Std is 802.11be (320 MHz) = 320 MHz
	– Option B1X:
	  – if Radio Std is 802.11ac(80 MHz) = 80 MHz
	– Option B1Y:
	  – if Radio Std is 802.11ac(160 MHz) = 160 MHz
	All other Modes: 100 kHz
	ON

State Saved	Saved in instrument state
Min	All others: 10 Hz
Max	All others: Hardware Dependent: RF Input: – No Option = 10 MHz – Option B25 = 25 MHz

- Option B40 = 40 MHz
- Option B85 = 85.0 MHz
- Option B1A = 125.0 MHz
- Option B1X = 140 MHz
- Option B1Y = 160 MHz
- Option B2X = 255 MHz
- Option B5X = 510 MHz

VXT models M9410A/11A:

- M941xA-B3X = 300 MHz
- M941xA-B6X = 600 MHz
- M941xA-B12 = 1.2 GHz

VXT models M9415A:

- M9415A-B4X = 400 MHz
- M9415A-B8X = 800 MHz
- M9415A-B12 = 1.2 GHz

I/Q Input:

- No Option = 10 MHz per channel (20 MHz for I+jQ)
- Option B25 = 25 MHz per channel (50 MHz for I+jQ)
- Option S40 = 40 MHz per channel (80 MHz for I+jQ)

Backwards Compatibility SCPI	`[:SENSe]:WAVeform:BANDwidth[:RESolution]` `[:SENSe]:WAVeform:BWIDth[:RESolution]`

Filter Type

Enables you to select the type of bandwidth filter that is used.

Besides the Gaussian filter shape, a variety of other filter types are available with variable alpha settings for maximum control over the filter shape.

Remote Command	`[:SENSe]:WAVeform:DIF:FILTer:TYPE GAUSsian | FLATtop`
	`[:SENSe]:WAVeform:DIF:FILTer:TYPE?`
	With DIF40 and/or WBDIF:
	`[:SENSe]:WAVeform:DIF:FILTer:TYPE GAUSsian | FLATtop | SNYQuist | RSNYquist | RCOSine | RRCosine`

	`[:SENSe]:WAVeform:DIF:FILTer:TYPE?`
Example	`:WAV:DIF:FILT:TYPE GAUS` `:WAV:DIF:FILT:TYPE?`
Dependencies	Gaussian and Flattop are available in all DIF configurations. For the other filter types, the filters are only available when Option DP2, B40, or wider IF Bandwidth option is installed When you select a filter type other than Gaussian or Flattop when using Option B40, B85, B1A, or B1X WBDIF, but then you either explicitly select an IF Path Selection of 10 MHz or 25 MHz B10M/B25M or set a Digital IF BW equal to or narrower than 25 MHz with IF Path Selection Auto ON, the filter type will automatically select the default filter type which is Flattop. If you then again set the IF Path Selection to 85 MHz B85, 125 MHz B125M, or 140 MHz B140M, the filter type will remain as Flattop
Couplings	See the description above
Preset	BASIC with DP2, B40, or wider IF Bandwidth option: FLATtop 5G NR, WLAN, Channel Quality: FLATtop All other apps: GAUSsian
State Saved	Saved in instrument state

Range	`GAUSsian|FLATtop`
	When Option DP2, B40, or wider IF Bandwidth option is installed, the range is as follows.
	`GAUSsian|FLATtop|SNYQuist|RSNYquist|RCOSine|RRCosine`

Backwards Compatibility SCPI	`[:SENSe]:WAVeform:BANDwidth:SHAPe`
	`[:SENSe]:WAVeform:BWIDth:SHAPe`
	`[:SENSe]:WAVeform:BANDwidth|BWIDth[:RESolution]:TYPE`

Gaussian

When Option DP2, B40, or wider IF Bandwidth option is installed, the capability for arbitrary Digital IF bandwidths is available. However, for instruments without DP2, B40, or wider IF Bandwidth option , the selectable Gaussian filter bandwidths are predetermined. There are 160 Info BWs (RBWs) arranged in a 24-per-decade sequence from 1 Hz through 3 MHz, plus 4, 5, 6 and 8 MHz settings.

Flattop

When Option DP2, B40, or wider IF Bandwidth option is installed, the capability for arbitrary Digital IF bandwidths is available. However, for instruments without Option DP2, B40 or wider IF Bandwidth option, , the selectable Flattop filter bandwidths are predefined. There are 134 Digital IF BWs (RBWs) arranged in a 6-per-decade sequence from 3 Hz through 3 MHz, plus 4, 5, 6 and 8 MHz settings.

Filter BW

This feature is only available when Option DP2, B40, or wider IF Bandwidth option is installed.

Remote Command	`[:SENSe]:WAVeform:DIF:FILTer:BANDwidth <freq>`

	[:SENSe]:WAVeform:DIF:FILTer:BANDwidth? [:SENSe]:WAVeform:DIF:FILTer:BANDwidth:AUTO ON | OFF | 1 | 0 [:SENSe]:WAVeform:DIF:FILTer:BANDwidth:AUTO?
Example	:WAV:DIF:FILT:BAND 1MHz :WAV:DIF:FILT:BAND? :WAV:DIF:FILT:BAND:AUTO 0 :WAV:DIF:FILT:BAND:AUTO?
Dependencies	Only available when Option DP2, B40, or wider IF Bandwidth option is installed. Disabled when the Filter Type is “Flattop”
Couplings	Sets the same value as the current Digital IF BW value on Preset, or when Channel Filter Bandwidth Auto is ON
Preset	Same value as Digital IF BW ON
State Saved	Saved in instrument state
Range	Auto | Man
Min	10 Hz
Max	Clipped to the current Digital IF BW value

Filter Alpha

Sets the filter alpha for the DIF filter. This feature is only available when Option DP2, B40, or wider IF Bandwidth option is installed.

Remote Command	[:SENSe]:WAVeform:DIF:FILTer:ALPHa <real> [:SENSe]:WAVeform:DIF:FILTer:ALPHa?
Example	:WAV:DIF:FILT:ALPH 0.5 :WAV:DIF:FILT:ALPH?
Dependencies	This feature is only available when Option DP2, B40, or wider IF Bandwidth option is installed. Disabled when the Filter Type is FLATtop
Preset	0.2
State Saved	Saved in instrument state
Min	0.01
Max	1.00
Backwards Compatibility SCPI	[:SENSe]:WAVeform:WBIF:FILTer:ALPHa

Channel Filter Bandwidth Bwcc (Remote Command Only)

This is the backwards compatibility command for Channel Filter Bandwidth for the IQ Waveform measurement.

Dependencies	This feature is only available when Option DP2, B40, or wider IF Bandwidth option is installed
Couplings	The value is determined by the following equation ChannelFilterBwBwcc = (ChannelFilterBw/(DigitalIFBw*OverSampleRatio))
Preset	0.8
State Saved	Saved in instrument state
Min	0.01
Max	1.0
Backwards Compatibility SCPI	`[:SENSe]:WAVeform:WBIF:FILTer:BANDwidth <real>` `[:SENSe]:WAVeform:WBIF:FILTer:BANDwidth?`

3.13.5 Display

The Display Menu lets you configure display items for the current Mode, Measurement View or Window.

3.13.5.1 View

Contains controls for selecting the current **View**, and for editing User Views.

Views

You can select the measurement view you want to use from the Mode/Measurement/View selector screen.

View Selection by name

You can program the View you want by name:

Remote Command	`:DISPlay:WAVeform:VIEW[:SELect] RFENvelope | IQ` `:DISPlay:WAVeform:VIEW[:SELect]?`
Example	`:DISP:WAV:VIEW RFEN` `:DISP:WAV:VIEW?`
Preset	`RFENvelope`
State Saved	Saved in instrument state
Range	RF Envelope|I/Q Waveform

View Selection by number

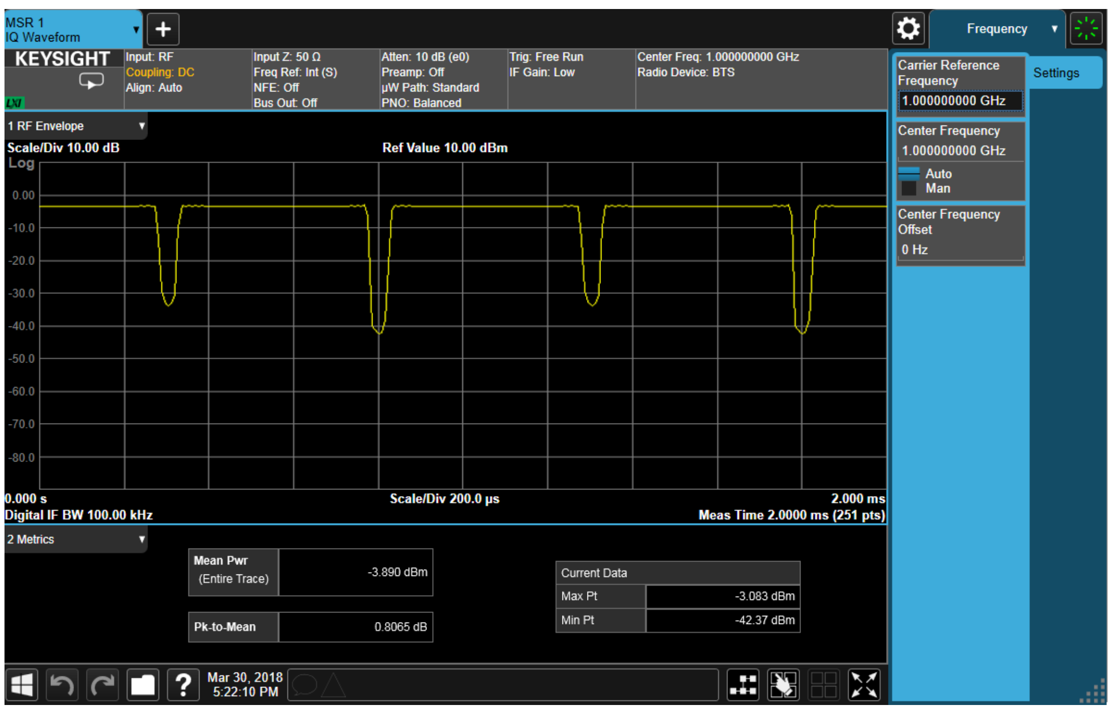
You can program the View you want by number:

Remote Command	`:DISPlay:WAVeform:VIEW:NSELect <integer>` `:DISPlay:WAVeform:VIEW:NSELect?`
Example	`:DISP:WAV:VIEW:NSEL 1` `:DISP:WAV:VIEW:NSEL?`
Notes	View 1 is the RF Envelope View View 2 is the I/Q Waveform View
Preset	1
State Saved	Saved in instrument state
Min/Max	1/2

RF Envelope

Windows: "RF Envelope" on page 1643, "Metrics" on page 1644

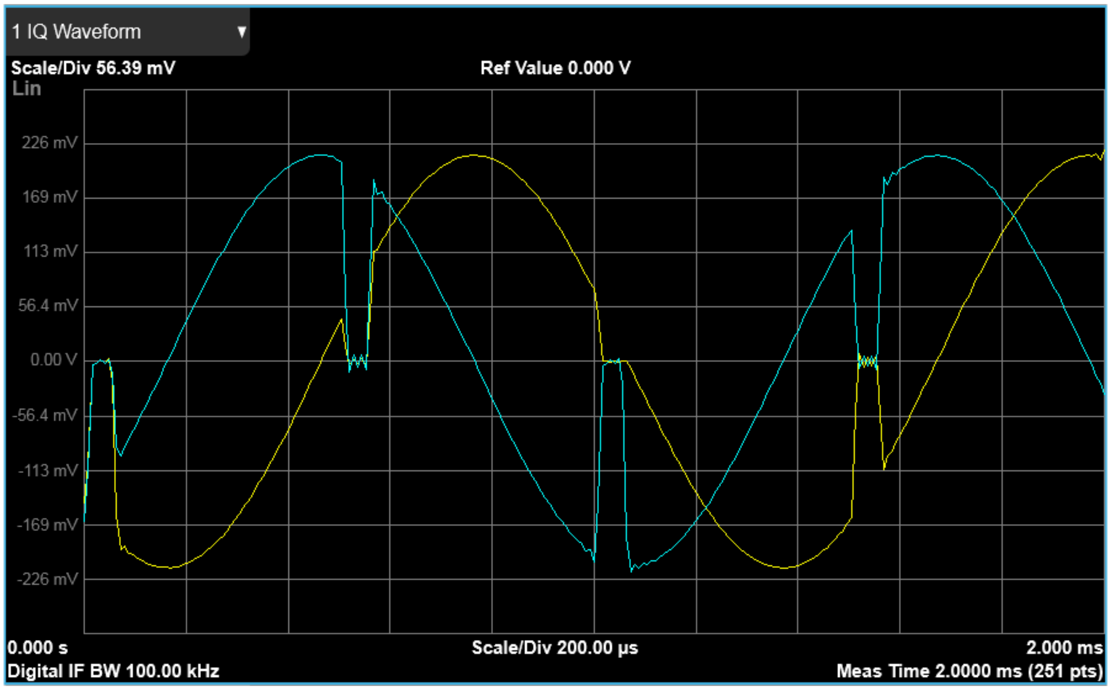
The RF Envelope View shows an RF envelope (magnitude) window and a metrics table showing the measured values for the mean power and peak-to-mean power.



I/Q Waveform

Windows: "I/Q Waveform" on page 1645

The I/Q Waveform View shows a window with I and Q voltages vs time. SCPI commands can also be used to query the I/Q pairs while in this View.



User View

Lets you choose a View from the saved User Views for the current measurement. This panel only appears if a User View exists for the current measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:SELect <alphanumeric>` `:DISPlay:VIEW:ADVanced:SELect?`
Example	Select Baseband as the current View `:DISP:VIEW:ADV:SEL “Baseband”`
Notes	You must be in the measurement whose View you are trying to set to send the command. You can only set Views for the current measurement using this command For predefined views, the parameter is derived from the view name that is shown in the View list in the user interface. For example, if you are trying to select the Trace Zoom view in the Swept SA measurement, you send: `:DISP:VIEW:ADV:SEL "Trace Zoom"` because “Trace Zoom” is the name of the View as seen in the Mode/Meas dialog or in the Display, View menu You *cannot* use the legacy View parameter (which in this case would be `TZOom`) with `:DISP:VIEW:ADV:SEL` `<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case. Thus, both of the following forms work: `:DISP:VIEW:ADV:SEL "Trace Zoom"`

	`:DISP:VIEW:ADV:SEL "TRACE ZOOM"` If the specified view is not a valid View, the query returns the error message "-224, Illegal parameter value; View with the name <alphanumeric> does not exist" If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated
Backwards Compatibility SCPI	The legacy node `:DISPlay:VIEW[:SELect]` is retained for backwards compatibility, but it only supports predefined views

Restore Layout to Default

Restores the Layout to the default for Basic.

Modified Views are very temporary; if you exit the current measurement they are discarded, and they are not saved in State. To retain this View for later use, and to be able to return easily to your original Basic View, you can save your edited View as a "User View".

Save Layout as New View

Saves your new View as a User View. An alpha keyboard appears, which lets you name your new View; the default is the old View name plus a number.

Remote Command	`:DISPlay:VIEW:ADVanced:NAME <alphanumeric>`
Example	`:DISP:VIEW:ADV:NAME "Baseband"` Creates a new View named `Baseband` from the current View, and selects it as the current View
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If `<alphanumeric>` name already exists as a View, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; User View SCPI cannot be used while Display is disabled" is generated

Re-Save User View

You can re-edit a User View; if you make changes, then an asterisk will appear next to the User View's name. You can then tap **Re-Save User View** to save it back to its existing name, or **Save Layout as New View** to add another, new User View.

This is a front panel function only, there is no remote command available to perform this function. To do this remotely, you must first perform **Save Layout as New View**, then delete the old User View and rename the new one with the name of the View you just deleted.

Rename User View

You can rename the current View by giving it a new unique name. Only User Views can be renamed, if the current View is a Predefined View, an error occurs.

Remote Command	:DISPlay:VIEW:ADVanced:REName <alphanumeric>
Example	:DISP:VIEW:ADV:REN "Baseband"
Notes	<alphanumeric> is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the <alphanumeric> specifying the new name is already present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot rename a Predefined View" is generated If the display is disabled (via :DISP:ENAB OFF) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete User View

You can delete the current View if it is a User View. The default view becomes the current view for the Measurement.

Remote Command	:DISPlay:VIEW:ADVanced:DELete
Example	:DISP:VIEW:ADV:DEL
Notes	<alphanumeric> is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the <alphanumeric> is not present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> does not exist" is generated If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot delete a Predefined View" is generated If the display is disabled (via :DISP:ENAB OFF) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete All User Views

Deletes all previously saved User Views. The default view becomes the current view for the Measurement if a User View was the current view when this command was executed.

Remote Command	:DISPlay:VIEW:ADVanced:DELete:ALL
Example	:DISP:VIEW:ADV:DEL:ALL
Notes	Disabled if there are no User Views

View Editor Remote Commands

The following remote commands help you manage Views and User Views. Note that the SCPI node for User Views handles both Predefined and User Views. The legacy nodes, `:DISPlay:VIEW[:SELect]` and `:DISPlay:VIEW:NSEL`, are retained for backwards compatibility, but they only support predefined views.

View Listing Query

Returns a string containing a comma-separated list of names for *all* the Views, including User Views, available for the current Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:CATalog?`
Example	`:DISP:VIEW:ADV:CAT?`
Notes	Returns a quoted string of the available Views for the current measurement, separated by commas. The list includes names for *all* the Views, including User Views, available for the current Measurement Example: `"Normal,Trace Zoom,Spectrogram,Baseband,myView1,yourView1"` No distinction is made between Predefined and User Views If you switch measurements with the display disabled (via `:DISP:ENAB OFF`), then query the list of available Views, the result is undefined

User View Listing Query

Returns a string containing a comma-separated list of names for *only* the User Views available for the current Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:USER:CATalog?`
Example	`:DISP:VIEW:ADV:USER:CAT?`
Notes	Returns a quoted string of the available User Views for the current measurement, separated by commas. Example: `"Baseband,myView1,yourView1"` If you switch measurements with the display disabled (see "Display Enable (Remote Command Only)" on page 1894), then query the list of available Views, the result is undefined

3.13.5.2 Annotation

Contains controls for setting up the annotation for the current Mode or Measurement.

Graticule

Turns the display graticule On or Off for all windows with graticules in all measurements in the current Mode. Also turns the graticule Y-Axis annotation on and off.

Remote Command	`:DISPlay:GRATicule[:STATe] OFF | ON | 0 | 1` `:DISPlay:GRATicule[:STATe]?`
Example	`:DISP:GRAT OFF`
Notes	The graticule is the set of horizontal and vertical lines that make up the grid/divisions for the X-Axis and Y-Axis
Preset	`ON`
State Saved	Saved in instrument state

Backwards Compatibility SCPI	`:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe] OFF | ON | 0 | 1`
	`:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe]?`
	This command is accepted for backwards compatibility with older instruments, but the `WINDow`, `TRACe` and `GRID` parameters are ignored

Screen Annotation

Controls the display of the annunciation and annotation around the graticule, including any annotation on lines (such as the display line, the threshold line, etc.) and the Y-Axis annotation, for all windows with screen annotation in all measurements in the current Mode.

This does *not* include marker annotation (or the N dB result). When `OFF`, the graticule expands to fill the entire graticule area, leaving only the 1.5% gap above the graticule, as described in the **Trace** section.

Remote Command	`:DISPlay:ANNotation:SCReen[:STATe] OFF | ON | 0 | 1` `:DISPlay:ANNotation:SCReen[:STATe]?`
Example	`:DISP:ANN:SCR OFF`
Dependencies	Grayed-out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Trace Annotation

Turns on and off the labels on the traces, showing their detector (or their Math Mode) as described in the **Trace** section, for all windows in all measurements in the current Mode for which Trace Annotation on/off is supported.

If Trace Math is being performed on a trace, then the Trace Math annotation replaces the detector annotation.

For measurements that support limit lines, this key also turns on and off the labels on the Limit Lines. The label is the Limit number annotation and Limit Comment displayed on the graph. If the length of the comment is greater than 20 characters, the first 8 characters and the last 8 characters are displayed, joined with ....

Remote Command	`:DISPlay:ANNotation:TRACe[:STATe] ON | OFF | 1 | 0` `:DISPlay:ANNotation:TRACe[:STATe]?`
Example	`:DISP:ANN:TRAC OFF`
Preset	`OFF`
State Saved	Saved in instrument state

Control Annotation

Turns on and off the display of values on the Active Function controls for all measurements in the current Mode. This is a security feature.

Remote Command	`:DISPlay:ACTivefunc[:STATe] ON | OFF | 1 | 0` `:DISPlay:ACTivefunc[:STATe]?`
Example	`:DISP:ACT OFF`
Dependencies	Grayed out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Meas Bar

Turns the Measurement Bar at the top of the screen on and off for all measurements in the current Mode. When `OFF`, the graticule area expands to fill the area formerly occupied by the Measurement Bar.

Remote Command	`:DISPlay:ANNotation:MBAR[:STATe] OFF | ON | 0 | 1` `:DISPlay:ANNotation:MBAR[:STATe]?`
Example	`:DISP:ANN:MBAR OFF`
Dependencies	Grayed out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Display Enable (Remote Command Only)

Turns the display on/off, including the display drive circuitry. The backlight stays lit to confirm that the instrument is on. The display enable setting is mode global. Theare three reasons for turning the display off:

1. To increase speed as much as possible by freeing the instrument from having to update the display
2. To reduce emissions from the display, drive circuitry
3. For security purposes

If you have turned off the display:

– and you are in local operation, the display can be turned back on by pressing any key or by sending `:SYSTem:DEFaults MISC` or `:DISPlay:ENABle ON` (neither `*RST` nor :SYSTem:PRESet enable the display)

– and you are in remote operation, the display can be turned back on by pressing the **Local** or **Esc** keys, or by sending `:SYSTem:DEFaults MISC` or `:DISPlay:ENABle ON` (neither `*RST` nor `:SYSTem:PRESet` enable the display)

– and you are using either the `:SYSTem:KLOCk` command or GPIB local lockout, then *no* front-panel key press will turn the display back on. You must turn it back on remotely.

If the display is `OFF`, many SCPI commands related to User Views and Multiscreen functionality do not work, and return the error messages "-221, Settings conflict; Screen SCPI cannot be used when Display is disabled" or "221, Settings conflict; View SCPI cannot be used while Display is disabled". These commands include:

Name	Command
Select User View	`:DISPlay:VIEW:ADVanced:SELect`
Rename User View	`:DISPlay:VIEW:ADVanced:REName`
Delete User View	`:DISPlay:VIEW:ADVanced:DELete`
Create User View	`:DISPlay:VIEW:ADVanced:NAME`
Select Screen	`:INSTrument:SCReen:SELect`
Delete Screen	`:INSTrument:SCReen:DELete`
Delete All But This Screen	`:INSTrument:SCReen:DELete:ALL`
Add Screen	`:INSTrument:SCReen:CREate`
Rename Screen	`:INSTrument:SCReen:REName`
Sequencer On/Off	`:SYSTem:SEQuencer`

Remote Command	`:DISPlay:ENABle OFF | ON | 0 | 1` `:DISPlay:ENABle?`

Example	:DISP:ENAB OFF
Couplings	:DISP:ENAB OFF turns Backlight OFF and :DISP:ENAB ON turns Backlight ON, but changing Backlight settings does *not* change the state of :DISP:ENAB
Preset	ON Set by :SYST:DEF MISC, but not affected by *RST or :SYSTem:PRESet
State Saved	Not saved in instrument state
Backwards Compatibility Notes	:SYST:PRES no longer turns on :DISPlay:ENABle as it did in legacy analyzers

3.13.6 Freq

The Freq key opens the Frequency menu, which contains controls that allow you to control the Frequency and Channel parameters of the instrument.

Some features in the Frequency menu are the same for all measurements in the current Mode – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset. For example, the Center Freq setting is the same for all measurements - it does not change as you change measurements.

3.13.6.1 Settings

The Settings Tab contains controls that pertain to the X axis parameters of the measurement. These parameters control how data on the vertical (X) axis is displayed and control instrument settings that affect the horizontal axis.

Center Frequency

Sets the frequency that corresponds to the horizontal center of the graticule. While adjusting the Center Frequency the Span is held constant.

The center frequency setting is the same for all measurements within a mode, that is, it is Meas Global. Some modes are also able to share a Mode Global center frequency value. If this is the case, the Mode will have a Global tab in its Meas Setup menu.

The Center Freq function sets (and queries) the Center Frequency for the currently selected input. If your instrument has multiple inputs, and you select another input, the Center Freq changes to the value for that input. SCPI commands are available to directly set the Center Freq for a specific input.

Center Freq is remembered as you go from input to input. Thus, you can set a Center Freq of 10 GHz with the RF Input selected, change to BBIQ, and set a Center Freq of 20 MHz, then switch to External Mixing and set a Center Freq of 60 GHz, and when

you go back to the RF Input the Center Freq will go back to 10 GHz; back to BBIQ and it is 20 MHz; back to External Mixing and it is 60 GHz.

For more details, see the following:

– "RF Center Freq (Remote Command Only)" on page 1698
– "Ext Mix Center Freq (Remote Command Only)" on page 1698
– "I/Q Center Freq (Remote Command Only)" on page 1699
– "Center Frequency Presets" on page 1696
– "VXT Models with Radio Heads/CIU Frequency Range" on page 1698

Remote Command	`[:SENSe]:FREQuency:CENTer <freq>` `[:SENSe]:FREQuency:CENTer?`

Example	`:FREQ:CENT 50 MHz`
	Sets Center Frequency to 50 MHz
	`:FREQ:CENT UP`
	Increments the Center Frequency by the value of CF Step
	`:FREQ:CENT?`
	Returns the current value of Center Frequency

Notes	This command sets the RF, External Mixing or I/Q Center Frequency depending on the selected input – For RF input it is equivalent to `FREQ:RF:CENT` – For I/Q input it is equivalent to `FREQ:IQ:CENT` – For External Mixer it is equivalent to `FREQ:EMIX:CENT` Preset and Max values are dependent on Hardware Options (5xx) If no terminator (e.g., MHz) is sent the terminator Hz is used. If a terminator with unit other than Frequency is used, an invalid suffix error message is generated
Preset	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 1696, "RF Center Freq (Remote Command Only)" on page 1698, "Ext Mix Center Freq (Remote Command Only)" on page 1698, "I/Q Center Freq (Remote Command Only)" on page 1699 and "VXT Models with Radio Heads/CIU Frequency Range" on page 1698
State Saved	Saved in instrument state
Min/Max	Depends on instrument minimum/maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 1696, "RF Center Freq (Remote Command Only)" on page 1698, "Ext Mix Center Freq (Remote Command Only)" on page 1698, "I/Q Center Freq (Remote Command Only)" on page 1699 and "VXT Models with Radio Heads/CIU Frequency Range" on page 1698
Status Bits/OPC dependencies	Non-overlapped

Remote Command	`[:SENSe]:FREQuency:CENTer:AUTO ON | OFF | 1 | 0` `[:SENSe]:FREQuency:CENTer:AUTO?`
Example	`:FREQ:CENT:AUTO OFF` `:FREQ:CENT:AUTO?`
Dependencies	This is only available for Monitor Spectrum, Power Stat CCDF and IQ waveform measurements in the MSR, LTE-Advanced FDD/TDD and 5G NR modes
Couplings	When the Center Frequency is changed, the state is automatically changed to Manual Center Frequency, Center Frequency Offset and Carrier Reference Frequency are coupled. When Carrier Reference Frequency changes: Center Frequency : Auto Center Frequency = Carrier Reference Frequency + Center Frequency Offset (fixed) Center Frequency : Man Center Frequency (fixed) = Carrier Reference Frequency + Center Frequency Offset
Preset	ON
State Saved	Saved in instrument state
Range	Auto|Man

Center Frequency Presets

The following table provides the Center Frequency Presets for the Spectrum Analyzer mode, and the Max Freq, for the various frequency options:

Freq Option	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
503 (all but CXA)	1.805 GHz	3.6 GHz	3.7 GHz
503 (CXA)	1.505 GHz	3.0 GHz	3.08 GHz
507 (all but CXA)	3.505 GHz	7.0 GHz	7.1 GHz
507 (CXA)	3.755 GHz	7.5 GHz	7.58 GHz
508 (all but MXE)	1.805 GHz	3.6 GHz	8.5 GHz
508 (MXE)	4.205 GHz	8.4 GHz	8.5 GHz
513	6.805 GHz	13.6 GHz	13.8 GHz
526 (except CXA and MXE)	13.255 GHz	26.5 GHz	27.0 GHz*
526 (CXA)	13.255 GHz	26.5 GHz	26.55 GHz
526 (MXE)	1.805 GHz	3.6 GHz	27.0 GHz
532	16.005 GHz	32.0 GHz	32.5 GHz
540	20.005 GHz	40.0 GHz	40.5 GHz
543	21.505 GHz	43.0 GHz	43.0 GHz
544	22.005 GHz	44.0 GHz	45.0 GHz
550	25.005 GHz	50.0 GHz	52 GHz
F03 (CXA-m)	1.505 GHz	3.0 GHz	3.08 GHz

Freq Option	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
F07 (CXA-m)	3.755 GHz	7.5 GHz	7.575 GHz
F13 (CXA-m)	6.805 GHz	13.6 GHz	13.8 GHz
F26 (CXA-m)	13.255 GHz	26.5 GHz	26.55 GHz
504 (M9420A/21A, M8920A)	2.145 GHz	3.88GHz	3.88 GHz
506 (M9420A/21A, M8920A)	3.245 GHz	6.08GHz	6.08 GHz
F06 (M9410A/11A)	1.0 GHz	6.08 GHz	6.08 GHz
F06 (M9415A)	1 GHz	1.08 GHz	6.6 GHz
F08 (M9415A)	1 GHz	1.08 GHz	8.6 GHz
F12 (M9415A)	1 GHz	1.08 GHz	12.9 GHz

*For option 526, the Max CF in RTSA is 26.999999995 GHz.

N9041B Center Freq Presets

Input	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
Input 1, all models	25.005 GHz	50.0 GHz	52 GHz
Input 2, opt 585	42.505 GHz	85.0 GHz	86 GHz
Input 2, opt 590	45.005 GHz	90.0 GHz	92 GHz
Input 2, opt 5CX	55.005 GHz	110.0 GHz	110 GHz

Input 2, CXA and MXE

Model	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
CXA opt C75	0.7505 GHz	1.5 GHz	1.58 GHz
MXE	505 MHz	1 GHz	1.000025 GHz

Tracking Generator Frequency Limits (CXA only)

Tracking Generator Option	Min Freq (clips to this freq when turn TG on and can't tune below while TG on)	If above this Freq, Stop Freq clipped to this Freq when TG turned on	Max Freq (can't tune above) while TG on
T03	9 kHz	3.0 GHz	3.08 GHz
T06	9 kHz	6.0 GHz	6.05 GHz

Tracking Generator Frequency Limits(CXA-m only)

Tracking Generator Option	Min Freq (clips to this freq when turn TG on and can't tune below while TG on)	If above this Freq, Stop Freq clipped to this Freq when TG turned on	Max Freq (can't tune above) while TG on
T03	2 MHz	3.08 GHz	3.08 GHz
T07	2 MHz	7.575 GHz	7.575 GHz
T13	2 MHz	13.8 GHz	13.8 GHz
T26	2 MHz	26.55 GHz	26.55 GHz

VXT Models with Radio Heads/CIU Frequency Range

The following table shows the Center Frequency Presets and Range for VXT modes with Radio Heads/CIU.

Products with Radio Heads/CIU	Preset	Start frequency	Stop frequency
M9421A + CIU	6 GHz	5.9 GHz	12 GHz
M9410A + CIU	6 GHz	5.9 GHz	12 GHz
M9410A + CIU + RRH	25 GHz	24.25 GHz	43.5 GHz

RF Center Freq (Remote Command Only)

Specifies the RF Center Frequency. This command sets the Center Frequency to be used when the RF input is selected, even if the RF input is not the input that is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:RF:CENTer <freq>` `[:SENSe]:FREQuency:RF:CENTer?`
Example	`:FREQ:RF:CENT 30 MHz` `:FREQ:RF:CENT?`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So, the value is independent in each mode and common across all the measurements in the mode
Dependencies	If the electronic/soft attenuator is enabled, any attempt to set Center Frequency such that the Stop Frequency would be >3.6 GHz fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning
Preset	See table above
State Saved	Saved in instrument state
Min	-79.999995 MHz
Max	See table above. Basically, instrument maximum frequency - 5 Hz

Ext Mix Center Freq (Remote Command Only)

Specifies the External Mixer Center Frequency. This command sets the Center Frequency to be used when the External Mixer is selected, even if the External Mixer input is not the input that is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:EMIXer:CENTer <freq>` `[:SENSe]:FREQuency:EMIXer:CENTer?`
Example	`:FREQ:EMIX:CENT 60 GHz` `:FREQ:EMIX:CENT?`
Notes	This command is the same in all Modes, but the parameter is Measurement Global. So, the value is independent in each Mode and common across all the measurements in the Mode
Couplings	When returning to External Mixing after having been switched to one of the other inputs (for example, RF), you will be returned to the settings that existed when you left External Mixing. So, you will be returned to the band you were in, with the Center Frequency that you had. However, Span is not an input-dependent parameter, therefore the Span setting from the other input is retained. Thus, the instrument returns to the Span setting from the previous input, limited as necessary by the current mixer setup
Preset	When a Mode Preset is performed while in External Mixing, the Start frequency of the current Mode is set to the nominal Min Freq of the lowest harmonic range in the Harmonic Table for the current mixer setup. Similarly, the Stop frequency of the current Mode is set to the nominal Max Freq of the highest harmonic range in the Harmonic Table. The Center Freq thus presets to the point arithmetically equidistant from these two frequencies Note that, if the current measurement has a limited Span available to it, and cannot achieve the Span shown in the table (Span=Stop Freq – Start Freq), the instrument uses the maximum Span the measurement allows, and still sets the Center Freq to the midpoint of the Start and Stop Freq values in the Harmonic Table When Restore Input/Output Defaults is performed, the mixer presets to the 11970A, whose Start and Stop frequencies are 26.5 and 40 GHz respectively. The center of these two frequencies is 33.25 GHz Therefore, after a Restore Input/Output Defaults, if you go into External Mixing and do a Mode Preset while in the Spectrum Analyzer Mode, the resulting Center Freq is 33.25 GHz
State Saved	Yes
Min	The minimum frequency in the currently selected mixer band + 5 Hz
Max	The maximum frequency in the currently selected mixer band - 5 Hz

I/Q Center Freq (Remote Command Only)

Specifies the I/Q Center Frequency. This command sets the Center Frequency to be used when the I/Q input is selected, even if the I/Q input is not the input that is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:IQ:CENTer <freq>` `[:SENSe]:FREQuency:IQ:CENTer?`
Example	`:FREQ:IQ:CENT: 30 MHz`
Notes	This command is the same in all Modes, but the parameter is Measurement Global. So, the value is independent in each Mode and common across all the measurements in the Mode

Preset	0 Hz
State Saved	Saved in instrument state
Min	-40.049995 MHz
Max	40.049995 MHz

CF Step

Enables you to change the step size for the Center Frequency and Start/Stop frequency functions. Once a step size has been selected and the Center Frequency function is active, the step keys (and the UP|DOWN parameters for **Center Frequency** from remote commands) change the Center Frequency by the step-size value. The step size function is useful for finding harmonics and sidebands beyond the current frequency span of the instrument.

Note that the Start and Stop frequencies also step by the **CF Step** value.

Remote Command	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement] <freq>`
	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement]?`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO?`

Example	`:FREQ:CENT:STEP 500 MHz`
	`:FREQ:CENT UP`
	Increases the current center frequency value by 500 MHz
	`:FREQ:CENT:STEP?`
	`:FREQ:CENT:STEP:AUTO ON`
	`:FREQ:CENT:STEP:AUTO?`

Notes	Preset and Max values are dependent on Hardware Options (5xx)
Dependencies	Only available in VMA, W-CDMA, and WLAN Modes If the electronic/soft attenuator is enabled, any attempt to change the value of the center frequency >3.6 GHz by pressing the **Up-arrow** key fails, and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a “-221, Settings conflict” warning
Couplings	When auto-coupled in a non-zero span, the center frequency step size is set to 10% of the span. When auto-coupled in zero span, the center frequency step size is set to the equivalent -3 dB RBW value
Preset	Auto ON
State Saved	Saved in instrument state
Min	– (the maximum frequency of the instrument). That is, 27 GHz max freq instrument has a CF step range of +/- 27 GHz. Note that this is the maximum frequency given the current settings of the instrument, so in External Mixing, for example, it is the maximum frequency of the current mixer band

Max	The maximum frequency of the instrument. That is, 27 GHz max freq instrument has a CF step range of +/- 27 GHz. Note that this is the maximum frequency given the current settings of the instrument, so in External Mixing, for example, it is the maximum frequency of the current mixer band
Status Bits/OPC dependencies	non-overlapped

3.13.7 Marker

Displays a menu that enables you to select, set up and control the markers for the current measurement.

If there are no active markers, **Marker** selects `Marker 1`, sets it to `POSition` (Normal) mode, and places it at the center of the display. If the selected marker is `OFF`, it is set to `POSition` mode and placed at the center of the screen, on the trace determined by the Marker Trace rules.

For details of the `POSition`, `DELTa`, and `OFF` mode options, see "Marker Mode" on page 1704.

3.13.7.1 Select Marker

Sets the selected marker. The term "selected marker" is used throughout this document to specify which marker will be affected when you change marker settings, perform a **Peak Search**, etc.

The **Select Marker** control appears above the menu panel, indicating that it applies to all controls in the **Marker** menu panels. **Select Marker** is blanked if you select a tab whose controls do *not* depend on the selected marker (for example, **Counter**).

On any menu tab that includes **Select Marker**, the first control is always **Marker Frequency|Time**.

Notes	The selected marker is remembered even when not in the **Marker** menu and is used if a Search is done or a Band Function is turned on or for Signal Track or Continuous Peak
Preset	Marker 1
State Saved	The number of the selected marker is saved in instrument state
Annunciation	Appears in the marker results block label for `POSition` and Delta markers

3.13.7.2 Settings

The controls on the **Settings** tab include the Marker active function and a radio button selection of the marker control mode (`POSition`, `DELTa`, or `OFF`) for the selected marker, as well as additional functions that help you use markers.

Marker Time

The **Marker Time** control is the fundamental control that you use to move a marker around on the trace. Because it is the default active function in the **Marker** menu, all you need to do is press **Marker** and turn the knob to move the marker left and right on the display. This is always the first control on any **Marker** menu page that follows the Selected Marker.

The SCPI command sets the marker X-Axis value in the current marker X-Axis Scale unit. The marker that is addressed becomes the selected marker. It has no effect (other than to cause the marker to become selected) if the control mode is OFF, but it is the SCPI equivalent of entering an X value if the control mode is POSition or DELTa.

Remote Command	:CALCulate:WAVeform:MARKer[1]|2|...|12:X <time> :CALCulate:WAVeform:MARKer[1]|2|...|12:X?
Example	:CALC:WAV:MARK1:X 1 :CALC:WAV:MARK1:X?
Notes	If no suffix is sent it will use the fundamental units for the current marker X Axis Scale. If a suffix is sent that does not match the current marker X Axis Scale unit, an invalid suffix message will be generated The query returns the marker's absolute X-Axis value if the control mode is POSition. It returns the offset from the marker's reference marker if the control mode is DELTa. The query is returned in the fundamental units for the current marker X-Axis scale: seconds for **Time**. If the marker is OFF the response is Not A Number
Dependencies	Grayed out and displays three dashes for the value when the selected Marker is OFF
Preset	LTE, LTE-A, 5G NR: 5ms All other Modes: 1.0 ms
Min/Max	– infinity/+ infinity Unlike legacy instruments, where the markers were forced to be on screen, X-Series marker values are not limited and do not clip
Backwards Compatibility SCPI	:CALCulate:MARKer[1]|2|...|4:X:CENTer This alias is provided for compatibility with the Band Power function in PSA and ESA

Marker X Axis Position (Remote Command Only)

Sets the marker X position in trace points. It has no effect if the control mode is OFF, but is the SCPI equivalent of entering a value if the control mode is Normal or Delta. The entered value is immediately translated into the current X Axis Scale units for setting the value of the marker.

Remote Command	:CALCulate:WAVeform:MARKer[1]|2|...|12:X:POSition <real> :CALCulate:WAVeform:MARKer[1]|2|...|12:X:POSition?
Example	:CALC:WAV:MARK:X:POS 500

	`:CALC:WAV:MARK:X:POS?`
Notes	The query returns the marker's absolute X-Axis value in trace points if the control mode is `POSition`, or the offset from the marker's reference marker in trace points if the control mode is `DELTa`. The value is returned as a real number, not an integer, corresponding to the translation from X-Axis Scale units to trace points
Preset	After a preset, all markers are turned `OFF`, so Marker X-Axis Value query returns a *Not A Number* (`NAN`)
State Saved	No
Min	-9.9E+37
Max	9.9E+37

Marker Y Axis Value (Remote Command Only)

Queries the marker Y-Axis result value in the current marker Y-Axis unit. The "result" of a marker is the value that is displayed on the second line of the Marker Result block. To properly interpret the returned value, you must also know how the instrument's Y-Axis Unit is set, as described below.

A marker can have up to two results, only one of which is displayed or returned in a query, as follows:

- Absolute Result: every marker has an Absolute Result. For `POSition` and `DELTa` markers, the Y-axis value of the trace point the marker is currently on. The Absolute Result is displayed in the result block or returned as a query, unless the marker control mode is `DELTa`
- Relative Result: if a marker's control mode is `DELTa`, the *relative* result is displayed in the result block or returned in a query. This is the ratio of the Absolute Result of a delta marker to the Absolute Result of its reference marker. The ratio is expressed in dB

Remote Command	`:CALCulate:WAVeform:MARKer[1]|2|...|12:Y?`
Example	`:CALC:WAV:MARK11:Y?`

Notes	When the marker is on, IQ waveform returns I and Q values
	Case #1 - Trace RF, I or Q: returns a single double value
	`>:CALC:WAV:MARK1:Y?`
	`-2.402406506109E+001`
	Case #2 - Trace IQ: returns a double array of two values, the first is I, and the second is Q
	`>:CALC:WAV:MARK1:Y?`
	`-3.006944493834E-003,+9.9870666467354E-004`
	The IQ selection is for backwards compatibility purposes. For new designs, use the I and/or Q selection instead
	You must be in a Mode that includes the Waveform measurement to use this command. Use `:INSTrument:SELect` to set the mode

Preset	Result dependent on the marker setup and signal source
State Saved	No
Backwards Compatibility SCPI	`:CALCulate:WAVeform:MARKer[1]|2|...|12:FUNCtion:RESult?`

Marker Mode

Sets the marker control mode to POSition, DELTa, or OFF. All interactions and dependencies detailed under the control description are enforced when the remote command is sent. If the selected marker is OFF, pressing **Marker** sets it to POSition (Normal) and places it at the center of the screen on the trace determined by the Marker Trace rules. At the same time, Marker X-Axis Value appears on the Active Function area.

The default active function is the active function for the currently selected marker control mode. If the current control mode is OFF, there is no active function and the active function is turned off.

Remote Command	`:CALCulate:WAVeform:MARKer[1]|2|...|12:MODE POSition | DELTa | OFF` `:CALCulate:WAVeform:MARKer[1]|2|...|12:MODE?`
Example	`:CALC:WAV:MARK:MODE OFF` `:CALC:WAV:MARK:MODE?`
Preset	OFF
State Saved	Saved in instrument state
Range	POSition|DELTa|OFF
Annotation	Mkr # <X value> and <Marker value> upper right on graph When Marker Trace is Polar in WCDMA mode: Mkr # <Chip Value (RHO & QPSKEVM)/Symbol Value (CDP)>, <X value> and <Y value> upper right on graph

Backwards Compatibility SCPI Commands

Sets or queries the state of a marker. Setting a marker that is OFF to state ON or 1 puts it in POSition mode and places it at the center of the screen.

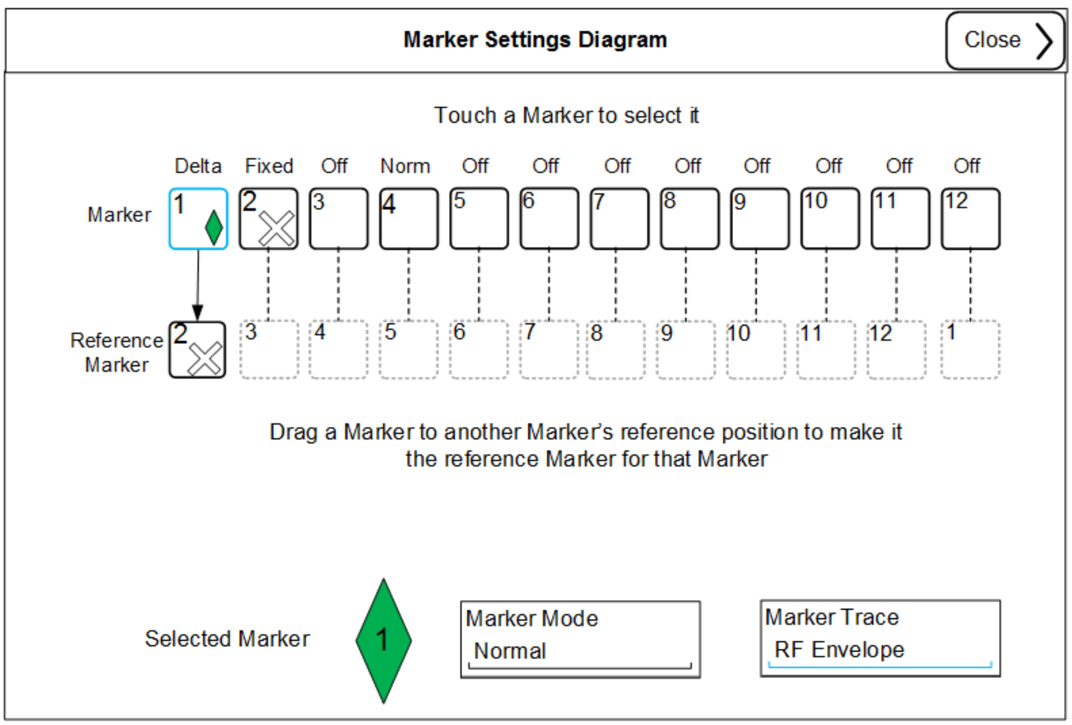
Preset	OFF
State Saved	Saved in instrument state
Range	OFF|ON
Backwards Compatibility SCPI	`:CALCulate:WAVeform:MARKer[1]|2|...|12:STATe OFF | ON | 0 | 1` `:CALCulate:WAVeform:MARKer[1]|2|...|12:STATe?`

Delta Marker (Reset Delta)

Pressing this control is exactly the same as pressing the `DELTa` selection on the "Marker Mode" on page 1704 radio button. The selected marker becomes a Delta Marker. If the selected marker is already a Delta marker, the reference marker is moved to the current position of the selected marker, thus resetting the Delta to zero.

Marker Settings Diagram

The Marker Settings Diagram enables you to configure the Marker system using a visual utility.



All Markers Off

Turns off all markers.

Remote Command	`:CALCulate:WAVeform:MARKer:AOFF`
Example	`:CALC:WAV:MARK:AOFF`

Couple Markers

When this function is ON, moving any marker causes an equal X-Axis movement of every other marker that is not OFF. By "equal X-Axis movement" we mean that we preserve the difference between each marker's X-Axis value (in the fundamental x-axis units of the trace that marker is on) and the X-Axis value of the marker being moved (in the same fundamental x-axis units).

This may result in markers going off screen.

Remote Command	`:CALCulate:WAVeform:MARKer:COUPle[:STATe] ON | OFF | 1 | 0` `:CALCulate:WAVeform:MARKer:COUPle[:STATe]?`
Example	`:CALC:WAV:MARK:COUP ON` `:CALC:WAV:MARK:COUP?`
Preset	OFF Presets on Mode Preset and "All Markers Off" on page 1705
State Saved	Saved in instrument state

3.13.7.3 Peak Search

The controls on the **Peak Search** tab allow you to move the marker to selected peaks of the signal, giving you enormous analysis capabilities, particularly when combined with the Delta Marker function.

NOTE: Pressing the **Peak Search** hardkey automatically moves you to the **Peak Search** page of the **Marker** menu *and* performs a Peak Search.

Pressing the **Peak Search** tab once you are already *in* the **Marker** menu does *not* perform a Peak Search.

Marker Time

The **Marker Time** control is the fundamental control that you use to move a marker around on the trace. This is the same as "Marker Time" on page 1702 on the Settings tab.

Peak Search

Pressing the **Peak Search** control moves the selected marker to the trace point that has the maximum Y-Axis value for that marker's trace.

NOTE	Pressing the **Peak Search** hardkey automatically moves you to the **Peak Search** page of the **Marker** menu *and* performs a Peak Search.

Remote Command	`:CALCulate:WAVeform:MARKer[1]|2|...|12:MAXimum`

Example	`:CALC:WAV:MARK2:MAX`
	`:SYST:ERR?`
	can be used to query the errors to determine if a peak is found. The message “No peak found” (-200) will be returned after an unsuccessful search

Notes	Sending this command selects the subopcoded marker In W-CDMA Mode, this command does *not* work when the selected marker is located on the Polar trace. In this case, the command is ignored

Next Peak

Pressing the **Next Peak** control moves the selected marker to the peak that is next lower in amplitude than the current marker value.

If the selected marker was `OFF`, then it is turned `ON` as a `POSition` marker, and a Peak Search is performed.

Remote Command	`:CALCulate:WAVeform:MARKer[1]|2|...|12:MAXimum:NEXT`
Example	`:CALC:WAV:MARK:MAX:NEXT`
Notes	Sending this command selects the subopcoded marker
State Saved	Not part of saved state

Minimum Peak

Moves the selected marker to the minimum Y-Axis value on the current trace.

If the selected marker is `OFF`, it is turned `ON` before the minimum search is performed.

Remote Command	`:CALCulate:WAVeform:MARKer[1]|2|...|12:MINimum`
Example	`:CALC:WAV:MARK:MIN`
Notes	Sending this command selects the subopcoded marker
State Saved	Not part of saved state

Marker Delta

Pressing this control is exactly the same as pressing the **Delta** selection on the "Marker Mode" on page 1704 radio button on the **Settings** tab. The selected marker becomes a Delta Marker. If the selected marker is already a Delta marker, the reference marker is moved to the current position of the selected marker, thus resetting the Delta to zero.

The control is duplicated here in the **Peak Search** menu to allow you to conveniently perform a Peak Search and change the marker's control mode to Delta, without having to access two separate menus.

3.13.7.4 Marker Function

The controls in the **Marker Function** tab perform post-processing operations on marker data.

The **Marker Function** menu controls which marker functions are turned on, and allows you to adjust the setup parameters for each function. These parameters include the following, but only one parameter can be assigned to a given marker:

- Marker Noise
- Interval Power
- Interval Density
- Off

More Information

The post-processing operations on markers, in the Waveform measurement, are based on the measurement specifications. Marker Functions are distinct from measurement functions, which automatically perform complex sequences of setup, data acquisition, and display operations in order to measure specified signal characteristics. Marker Functions are specified for each individual marker, and may be turned on individually for each marker.

Marker Time

The **Marker Time** control is the fundamental control that you use to move a marker around on the trace. This is the same as "Marker Time" on page 1702 on the **Settings** tab.

Interval Function

Sets the marker control function type to one of:

Option	Parameter
Marker Noise	`NOISe`
Interval Power	`BPOWer`
Interval Density	`BDENsity`
Marker Function Off	`OFF`

All interactions and dependencies detailed under the control description are enforced when the remote command is sent.

Remote Command	:CALCulate:WAVeform:MARKer[1]|2|...|12:FUNCtion NOISe | BPOWer | BDENsity | OFF :CALCulate:WAVeform:MARKer[1]|2|...|12:FUNCtion?
Example	:CALC:WAV:MARK:FUNC BPOW :CALC:WAV:MARK:FUNC?
Preset	OFF
State Saved	Saved in instrument state
Range	Marker Noise | Interval Power | Interval Density | Off
Annotation	Mkr # <X value> and <Marker value> upper right on graph

Interval Span

Sets the width of the Span for the selected marker.

Remote Command	:CALCulate:WAVeform:MARKer[1]|2|...|12:FUNCtion:BAND:SPAN <time> :CALCulate:WAVeform:MARKer[1]|2|...|12:FUNCtion:BAND:SPAN?
Example	:CALC:WAV:MARK:FUNC:BAND:SPAN 20 ms :CALC:WAV:MARK:FUNC:BAND:SPAN?
Couplings	Changing the **Interval Span** necessarily changes the "Interval Left" on page 1709 and "Interval Right" on page 1710 values
Preset	10% of Meas Time
State Saved	Saved in instrument state
Min	0
Max	100 s

Interval Left

Sets the left edge time for the band of the selected marker.

Remote Command	:CALCulate:WAVeform:MARKer[1]|2|...|12:FUNCtion:BAND:LEFT <time> :CALCulate:WAVeform:MARKer[1]|2|...|12:FUNCtion:BAND:LEFT?
Example	:CALC:WAV:MARK12:FUNC:BAND:LEFT 1 s :CALC:WAV:MARK12:FUNC:BAND:LEFT?
Couplings	Changing the **Interval Left** necessarily changes the "Interval Span" on page 1709 and "Interval Right" on page 1710 values
Preset	5% of Meas Time
State Saved	Yes

Min	0
Max	100 s

Interval Right

Sets the right edge time for the band of the selected marker.

Remote Command	`:CALCulate:WAVeform:MARKer[1]|2|...|12:FUNCtion:BAND:RIGHt <time>` `:CALCulate:WAVeform:MARKer[1]|2|...|12:FUNCtion:BAND:RIGHt?`
Example	`:CALC:WAV:MARK12:FUNC:BAND:RIGH 1 s` `:CALC:WAV:MARK12:FUNC:BAND:RIGH?`
Notes	You must be in the IQ Waveform measurement to use this command
Couplings	Changing the **Interval Right** necessarily changes the "Interval Left" on page 1709 and "Interval Span" on page 1709 values
Preset	5% of Meas Time
State Saved	Yes
Min	0
Max	100 s

3.13.7.5 Properties

The controls on the **Properties** tab are used to set certain properties of the selected marker.

Marker Time

The **Marker Time** control is the fundamental control that you use to move a marker around on the trace. This is the same as "Marker Time" on page 1702 on the **Settings** tab.

Relative To

Selects the marker to which the selected marker is relative (its reference marker).

Every marker has another marker to which it is relative. This marker is referred to as the "*reference marker*" for that marker. This attribute is set by the **Marker**, **Properties**, **Relative To** key. The marker must be a Delta Marker to make this attribute relevant. If it is a Delta Marker, the reference marker determines how the marker is controlled and how its value is displayed. A marker cannot be relative to itself.

Remote Command	`:CALCulate:WAVeform:MARKer[1]|2|...|12:REFerence <integer>` `:CALCulate:WAVeform:MARKer[1]|2|...|12:REFerence?`

Example	:CALC:WAV:MARK:REF 8 :CALC:WAV:MARK:REF?
Notes	This command causes the marker specified with the subopcode to become selected A marker cannot be relative to itself so that choice is not available, and if sent from SCPI generates error -221: "Settings conflict; marker cannot be relative to itself" When queried, a single value is returned (the specified marker number's relative marker)
Couplings	The act of specifying the selected marker's reference marker makes the selected marker a Delta marker If the reference marker is OFF, it is turned on in POSition mode at the delta marker location
Preset	The preset default "Relative To" marker (reference marker) is the next higher numbered marker (current marker +1). For example, if Marker 2 is selected, then its default reference marker is Marker 3. The exception is Marker 12, which has a default reference of Marker 1 Set to the defaults by using **Restore Mode Defaults**. This is not reset by **Marker Off**, **All Markers Off**, or **Preset**
State Saved	Saved in instrument state. Not affected by Marker Off and hence not affected by Preset or power cycle
Range	1 to 12 Remote Command only: if the range is exceeded, then the value is clipped
Min	1
Max	12
Annunciation	Appears in the marker label of a **Delta** marker

Marker Trace

Assigns the specified marker to the designated trace.

Remote Command	:CALCulate:WAVeform:MARKer[1]|2|...|12:TRACe RFENvelope | I | Q | IQ :CALCulate:WAVeform:MARKer[1]|2|...|12:TRACe?
Example	:CALC:WAV:MARK:TRAC RFEN :CALC:WAV:MARK:TRAC?
Notes	The IQ selection is for backwards compatibility purposes. For new designs, use the I and/or Q selection instead
Preset	RFEN
State Saved	Yes
Range	RFENvelope|I|Q|IQ

Marker Settings Diagram

The **Marker Settings Diagram** lets you configure the Marker system using a visual utility. This is the same as the "Marker Settings Diagram" on page 1705 control on the **Settings** tab.

3.13.8 Meas Setup

The Meas Setup menu panel contains functions for setting up the measurement parameters and also contains functions for setting up parameters global to all measurements in the mode.

3.13.8.1 Settings

The **Settings** tab contains frequently used Meas Setup functions to which you will want the fastest access.

Avg/Hold Number

Sets the number of sweeps (average counts) that are averaged. After the specified number of sweeps, the "Average Mode" on page 1712 (terminal control) setting determines the averaging action.

This control also lets you turn Averaging on and off.

Remote Command	`[:SENSe]:WAVeform:AVERage:COUNt <integer>`
	`[:SENSe]:WAVeform:AVERage:COUNt?`
	`[:SENSe]:WAVeform:AVERage[:STATe] OFF | ON | 0 | 1`
	`[:SENSe]:WAVeform:AVERage[:STATe]?`

Example	`:WAV:AVER:COUN 1001`
	`:WAV:AVER:COUN?`
	`:WAV:AVER ON`
	`:WAV:AVER?`

Preset	10 OFF
State Saved	Saved in instrument state Saved in instrument state
Range	OFF|ON
Min/Max	1/20001
Annotation	The average count is displayed in the measurement bar on the front panel display. The annotation appears in the format n/N, where n is the current average and N is the average count

Average Mode

Sets the Average Mode:

- EXPonential, The measurement averaging continues using the specified number of averages to compute each averaged value. The average is displayed at the end of each sweep
- REPeat: The measurement resets the average counter each time the specified number of averages is reached

Remote Command	[:SENSe]:WAVeform:AVERage:TCONtrol EXPonential | REPeat [:SENSe]:WAVeform:AVERage:TCONtrol?
Example	:WAV:AVER:TCON REP :WAV:AVER:TCON?
Preset	EXPonential
State Saved	Saved in instrument state
Range	EXPonential|REPeat

Average Type

Sets the type of averaging. When AUTO is selected, the instrument chooses the type of averaging. Available Average Types are:

Option	Parameter
Log-Pwr Avg	LOG
Power (RMS)	RMS
Voltage	SCALar

When one of the average types is selected manually, the instrument uses that type regardless of other instrument settings, and shows Man on the **Average Type** control.

Remote Command	[:SENSe]:WAVeform:AVERage:TYPE LOG | MAXimum | MINimum | RMS | SCALar [:SENSe]:WAVeform:AVERage:TYPE? For EXT-C, E6630A, E6640A, M90XA, use the following command. [:SENSe]:WAVeform:AVERage:TYPE LOG | RMS | SCALar [:SENSe]:WAVeform:AVERage:TYPE:AUTO ON | OFF | 1 | 0 [:SENSe]:WAVeform:AVERage:TYPE:AUTO?
Example	:WAV:AVER:TYPE RMS :WAV:AVER:TYPE? :WAV:AVER:TYPE:AUTO 0 :WAV:AVER:TYPE:AUTO?
Notes	The selections MAX and MIN are retained for backwards compatibility, but they are removed from the front panel access because they are not an Average function
Couplings	AUTO selects Power (RMS) averaging if a Marker Function (Marker Noise, Band/Intvl Power) is on
Preset	RMS

	ON
State Saved	Saved in instrument state
Range	Log-Pwr Avg|Power (RMS)|Voltage

Time Avg Num

Sets the number of HW averages to be executed per each data acquisition.

HW Averaging

Changes the number of time averages to be made using hardware. This averaging is much faster than the standard averaging done in software. The hardware averaging is done on the complex voltage time trace data before any measurement application averaging is done. Both types of averaging (HW and SW) can be done on the same measurement data.

When time averaging is being done in HW, each trace update represents N fresh data acquisitions averaged together, where N is the number of time averages. You cannot access the individual time data. Note that this averaging is done prior to the SW averaging done within the application. Thus, if time averaging is turned on, the trace in this measurement shows the result of HW averaging even if the normal (SW) averaging is turned off. Subsequent normal (SW) averaging is orthogonal to this hardware-based time averaging.

Thus, it is possible to turn off normal (SW) averaging within the application but still have the HW averaging set to a certain number greater than 1. In other words, turning averaging off within the measurement will not affect HW averaging. If HW averaging needs to be turned off, simply set the HW Averaging parameter to 1.

The Auto/Man feature of Time Avg Num works differently than other parameters. Since it is time averaging, a trigger source something other than Free Run should be used to synchronize successive data acquisitions to avoid cancelling out the signal to be measured. It is most useful for a periodic signal with known periods used in conjunction with the Periodic trigger. Thus, when in Auto, the Trigger Source automatically changes to Periodic trigger when Time Avg Num is turned ON. The trigger period will be set to the current Meas Time value. Any changes to Meas Time will change the Periodic trigger period to the same value and vice versa. If a trigger source other than Periodic trigger is manually selected, the Time Avg Num Auto/Man toggle is set to Man.

Remote Command	`[:SENSe]:WAVeform:AVERage:TACount <integer>`
	`[:SENSe]:WAVeform:AVERage:TACount?`
	`[:SENSe]:WAVeform:AVERage:TACount:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:WAVeform:AVERage:TACount:AUTO?`

Example	`:WAV:AVER:TAC 10`

	:WAV:AVER:TAC? :WAV:AVER:TAC:AUTO ON :WAV:AVER:TAC:AUTO?
Notes	This feature is only available when Option DP2, B40, or wider IF Bandwidth option is installed
Preset	1 ON
State Saved	Saved in instrument state
Range	Auto|Man
Min/Max	1/65535

Meas Time

Enables you to set how long the measurement is performed. X Scale only changes the scale of the display.

Remote Command	[:SENSe]:WAVeform:SWEep:TIME <time> [:SENSe]:WAVeform:SWEep:TIME?
Example	:WAV:SWE:TIME 50 ms :WAV:SWE:TIME?
Notes	Specifies and returns how long the measurement is performed. It is the time record length of the measurement waveform. The Max time may be reduced when the sample frequency is high due to the memory limitation
Preset	LTE, LTETDD, LTEAFDD, LTEATDD, 5G NR: 10 ms All other Modes: 2.000000 ms
State Saved	Saved in instrument state
Range	1.000 us to 100.00 s
Min/Max	1.000 us/100.0 s 1.000 us/3200 s

Sample Rate

Sets an arbitrary sample rate for the acquired data to be processed.

Remote Command	[:SENSe]:WAVeform:SRATe <freq> [:SENSe]:WAVeform:SRATe?
Example	:WAV:SRAT 1.3636 MHz
Notes	The command and query are available when Option DP2, B40, or wider IF Bandwidth option is installed. For other configuration, only the query is available
Preset	BASIC: 125.0 kHz BASIC: 100 MHz

	PNOISE: 125.0 kHz WCDMA: 125.0 kHz LTEA FDD/TDD, 5G NR: Automatically calculated WLAN: 31.25 MHz EDGEGSM: 637.5 kHz MSR: 125.0 kHz
Min/Max	12.5 Hz/Option dependent For Option DP2, B40 or wider IF Bandwidth option:

Digital IF 10 MHz path	12.5 MHz
Digital IF 25 MHz path	31.25 MHz
Digital IF 40 MHz path	50 MHz
Option B85 85 MHz path	106.25 MHz
Option B1A 125 MHz path	156.25 MHz
Option B1X 140 MHz path	175 MHz
Option B1Y 160 MHz path	200 MHz
Option B2X 255 MHz path	300 MHz
Option B5X 510 MHz path	300 MHz

For all other configurations:

10 MHz path	15 MHz
Option B25 25 MHz path	45 MHz

Meas Setup Summary Table

The **Meas Setup Summary Table** enables you to view and access many of the parameters in the **Meas Setup** menus on one screen.

Spur Avoidance

Because the VXT models M9410A/11A/15A are direct-conversion (zero-IF) receivers, feedthrough leakage from the local oscillator appears as a spurious signal (spur) at the center frequency. The **Spur Avoidance** function is provided to eliminate this spur, at the expense of some measurement speed.

When **Spur Avoidance** is enabled (the default), the instrument uses a software algorithm to remove this spur from the displayed measurement data, but the algorithm only operates under certain conditions. Specifically, it only operates when the Digital IF BW<= maxBW/2.5. See "More Information" on page 1717.

You can disable this function to speed up your measurement, by setting **Spur Avoidance** to “Disabled”.

Note that when **Spur Avoidance** is not in effect, either because you have disabled it or because the Digital IF BW > maxBW/2.5, the following warning message will appear in the status bar: "Settings Alert; Spur Avoidance Off". This is to alert you that measurement accuracy might be impacted by the fact that **Spur Avoidance** is not in effect.

Remote Command	`[:SENSe]:WAVeform:SAVoid[:STATe] ON | OFF | 0 | 1` `[:SENSe]:WAVeform:SAVoid[:STATe]?`
Example	`:WAV:SAVoid ON` `:WAV:SAVoid?`
Dependencies	This control only appears in VXT models M9410A/11A/15A
Preset	`OFF`
State Saved	Saved in instrument state
Range	`ON|OFF`

More Information

The Maximum Digital IF BW depends on the installed options, and selected Center Frequency.

VXT models M9410A/11A

Option limitation:

Option	Max Digital IF BW
B40	40 MHz
B3X	300 MHz
B6X	600 MHz
B12	1200 MHz

Center frequency limitation:

Center Frequency	Max Digital IF BW
330 MHz ~ 380 MHz	(CF – 330 MHz) * 2
380 MHz ~ 550 MHz	100 MHz
550 MHz ~ 1310 MHz	200 MHz
1310 MHz ~ 2000 MHz (without Option EP6)	600 MHz
2000 MHz ~ 5480 MHz (without Option EP6)	1200 MHz
5480 MHz ~ 6080 MHz (without Option EP6)	(6080 MHz – CF) * 2
1310 MHz ~ 1900 MHz (Option EP6)	600 MHz
1900 MHz ~ 6000 MHz (Option EP6)	1200 MHz
6000 MHz ~ 6600 MHz (Option EP6)	(6600 MHz – CF) * 2

VXT model M9415A

Option limitation:

Option	Max Digital IF BW
B4X	400 MHz
B8X	800 MHz
B12	1200 MHz

Center frequency limitation:

Center Frequency	Max Digital IF BW
330 MHz ~ 380 MHz	(CF – 330 MHz) * 2
380 MHz ~ 550 MHz	100 MHz
550 MHz ~ 1310 MHz	200 MHz
1310 MHz ~ 2000 MHz	600 MHz
2000 MHz ~ 12300 MHz	1200 MHz
12300 MHz ~ 12900 MHz	(12900 MHz – CF) * 2

Auto Couple

Immediately puts all Auto/Man functions into Auto. The **Auto Couple** action is confined to the current measurement only. It does not affect other measurements in the mode.

In the Auto state, Auto/Man functions are said to be “coupled”, meaning their values change as you make changes to other values in the measurement. This helps ensure accurate measurements and optimum dynamic range. Auto Couple is an immediate action function, and when it is executed, all the Auto/Man controls for the current measurement are set to Auto, and all measurement settings coupled to the Auto/Man parameters are automatically set to their optimal value.

For further details of measurement-specific settings (if any), see "Measurement-Specific Details" on page 1719 below.

Remote Command	`:COUPle ALL`
Example	`:COUP ALL`
Backwards Compatibility SCPI	`:COUPLE ALL | NONE`
Backwards Compatibility Notes	`:COUP:NONE` puts all Auto/Man parameters in manual mode, decoupling all the coupled instrument parameters. It is retained for backwards compatibility and is *not* recommended for making measurements or new designs

All Auto/Man parameter couplings in the measurement are set to Auto. This includes couplings that may be unavailable or grayed-out due to the current state. For example, in the Swept SA measurement, there is no Auto/Man coupling for RBW while in Zero Span. Nonetheless, if **Auto Couple** were executed while in Zero Span it would set RBW to Auto "behind the scenes" so that, on exit from Zero Span, it would be in Auto.

Any Auto/Man selection specific (local) to the other measurements in the current Mode will not be affected by **Auto Couple**. Any functions that are *not* coupled with other instrument parameters, such as ranging or leveling variables, such as "AutoRange" or "AutoScale", will not be affected.

Executing the **Auto Couple** command generates the informational message, "All Auto/Man functions have been set to Auto".

Each parameter, upon being set to Auto, selects and sets the appropriate auto-coupled value based on that parameter's coupling rules. The Dependency Resolver orchestrates the couplings for parameters that are dependent on one or more other parameters. The coupling and dependency rules for each parameter are defined in the chapter describing that parameter.

Executing the **Auto Couple** command *does not* affect markers, marker functions, trace or display attributes, or any other instrument setting other than those specifically mentioned above.

Measurement-Specific Details

TOI

Parameters affected by Auto Couple are:

- Center Frequency Step
- Resolution Bandwidth
- Span/RBW Ratio
- Sweep Time
- Video BandwidthVBW/RBW ratio
- Upper and Lower Tone (set to Sense
-)Zero span measurement Resolution Bandwidth
- Zero span measurement Dwell Time

Harmonics

For Harmonics, these parameters are:

- Resolution Bandwidth
- Fundamental Frequency
- Dwell Time
- Range Table Resolution Bandwidths
- Range Table Dwell Times

Meas Preset

Restores all the measurement parameters to their default values.

Remote Command	`:CONFigure:WAVeform`
Example	`:CONF:WAV`
Notes	Restore default values of all parameters

3.13.8.2 Radio

The Radio tab contains controls to select the Radio Device, and enable or disable HSPA/HSPA+ options.

Radio Device

Allows you to specify the device to be used.

Remote Command	`[:SENSe]:RADio:STANdard:DEVice BTS | MS` `[:SENSe]:RADio:STANdard:DEVice?`
Example	`:RAD:STAN:DEV MS` `:RAD:STAN:DEV?`
Preset	BTS
State Saved	Saved in instrument state.
Range	BTS | MS
Backwards Compatibility SCPI	`[:SENSe]:RADio:DEVice`

HSPA Enable

Allows you to turn on or off the HSDPA/HSUPA option enable. This selection is necessary because some of the auto detection functions that expect an HSPA signal are less tolerant when the signal is noisy or distorted. When the HSPA signal is not expected, turn HSPA Enable off.

Remote Command	`[:SENSe]:RADio:CONFigure:HSDPa[:STATe] 0 | 1 | OFF | ON` `[:SENSe]:RADio:CONFigure:HSDPa[:STATe]?`
Example	`:RAD:CONF:HSDP 0` `:RAD:CONF:HSDP?`
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

HSPA+ Enable

Allows you to turn on or off the HSPA+ option enable. This selection is necessary because some of the auto detection functions that expect an HSPA+ signal are less tolerant when the signal is noisy or distorted. When the HSPA+ signal is not expected, turn HSPA+ Enable off.

Remote Command	`[:SENSe]:RADio:CONFigure:EHSPa[:STATe] OFF | ON | 0 | 1` `[:SENSe]:RADio:CONFigure:EHSPa[:STATe]?`
Example	`:RAD:CONF:EHSP 0` `:RAD:CONF:EHSP?`
Notes	When HSPA enable is OFF, HSPA+ function is disabled too.
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

3.13.8.3 Advanced

This tab contains advanced functions that are used for specific applications. These settings should not be changed for most measurements.

This tab does not appear in VXT, M9393A, and M9391A

Phase Noise Optimization

Sets the LO (local oscillator) phase noise behavior for various desired operating conditions.

Remote Command	`[:SENSe]:WAVeform:FREQuency:SYNThesis[:STATe] 1 | ... | 5`

	For the meaning of each numeric option value, see "Parameter Options & Installed Options" on page 1722 below
	`[:SENSe]:WAVeform:FREQuency:SYNThesis[:STATe]?`
	`[:SENSe]:WAVeform:FREQuency:SYNThesis:AUTO[:STATe] OFF | ON | 0 | 1`
	`[:SENSe]:WAVeform:FREQuency:SYNThesis:AUTO[:STATe]?`

Example	`:WAV:FREQ:SYNT 2`
	Selects optimization for best wide offset phase noise
	`:WAV:FREQ:SYNT:AUTO ON`

Dependencies	Does not appear in all models. For models that do not display this control, the SCPI command is accepted for compatibility, but no action is taken This control is not available in VXT models M9410A/11A
Preset	Because this function is in AUTO after Preset, the state of this function after Preset will be automatically calculated ON
State Saved	Saved in instrument state
Range	See "Ranges" on page 1726 below
Annotation	EP0: Balanced | Best Wide | Fast | Best Close | Best Spurs Other than EP0: Best Close | Best Wide | Fast Found in the Meas Bar under **PNO** When not in Auto, label changes to **#PNO**

Parameter Options & Installed Options

The Phase Noise Optimization control lets you optimize the setup and behavior of the Local Oscillator (LO) depending on your specific measurement conditions. You may wish to trade off noise and speed, for example, to make a measurement faster without regard to noise or with optimum noise characteristics without regard to speed.

Parameter Values Summary

Option	#	Description
"Balanced" on page 1723	1	– In instruments with EP0, balances close-in phase noise with spur avoidance – In instruments without EP0 optimizes phase noise for small frequency offsets from the carrier
"Best Wide-offset" on page 1724	2	Optimizes phase noise for wide frequency offsets from the carrier
"Fast Tuning"	3	Optimizes LO for tuning speed

Option	#	Description
on page 1724		
"Best Close-in" on page 1723	4 or 1*	– In instruments with EP0, emphasizes close-in phase noise performance without regard to spur avoidance – In instruments without EP0, this setting is accepted but no action is taken
"Best Spurs" on page 1724	5	– In instruments with EP0, emphasizes spur avoidance over close-in phase noise performance – In instruments without EP0, this setting is accepted but no action taken
Auto	-	Automatically selects LO (local oscillator) phase noise behavior to optimize dynamic range and speed for various instrument operating conditions

*Dependent on Option EP0 installation. See "Best Close-in" on page 1723 below.

The actual behavior varies somewhat depending on model number and option; for example, you always get Fast Tuning by choosing Option #3, but in some models, "Fast Tuning" on page 1724 is identical in effect to "Best Close-in" on page 1723.

Best Close-in

Without option EP0

```
:FREQ:SYNT 1
```

The LO phase noise is optimized for smaller offsets from the carrier, at the expense of phase noise farther out.

The actual frequency offset within which noise is optimized is shown with in square brackets, as this can vary depending on the hardware set in use. For example, in some instruments this annotation appears as [offset <20 kHz]

With option EP0

```
:FREQ:SYNT 4
```

In instruments with Option EP0, the LO is configured for the best possible close-in phase noise (offsets up to 600 kHz from the carrier), regardless of spurious products that occur with some center frequencies. Because this is generally less desirable for close-in measurements than the "Balanced" on page 1723 setting, parameter 1 selects "Balanced" on page 1723 in EP0 instruments, in the interests of optimizing code compatibility across the family. Parameter 4 selects "Best Close-in" on page 1723, which is usually not as good a choice as "Balanced" on page 1723.

Balanced

```
:FREQ:SYNT 1
```

In instruments with EP0, the LO is configured for the best possible phase noise at offsets up to 600 kHz from the carrier whenever there are no significant spurs within the span observed with an on-screen carrier. When there will be such a spur, the LO is reconfigured in a way that allows the phase noise to increase by 7 dB mostly within ±1 octave around 400 kHz offset. The spurs will always be below –70 dBc.

Best Spurs

`:FREQ:SYNT 5`

In instruments with EP0, the LO is configured for better phase noise than the "Best Wide-offset" on page 1724 case close to the carrier, but the configuration has 11 dB worse phase noise than the "Best Close-in" on page 1723 case mostly within ±1 octave around 300 kHz offset. Spurs are even lower than in the "Balanced" on page 1723 case at better than –90 dBc, whether or not the carrier is on-screen.

This setting is never selected when Phase Noise Optimization is in Auto, you must select it manually.

Best Wide-offset

`:FREQ:SYNT 2`

The LO phase noise is optimized for wider offsets from the carrier. Optimization is especially improved for offsets from 70 kHz to 300 kHz. Closer offsets are compromised and the throughput of measurements (especially remote measurements where the center frequency is changing rapidly), is reduced.

The actual frequency offset beyond which noise is optimized is shown with in square brackets, as this can vary depending on the hardware set in use. For example, in some instruments this annotation appears as [offset >30 kHz]

In instruments with Option EP0, the LO is configured for the best possible phase noise at offsets up to 600 kHz from the carrier whenever there are no significant spurs within the span observed with an on-screen carrier. When there will be such a spur, the LO is reconfigured in a way that allows the phase noise to increase by 7 dB mostly within ±1 octave around 400 kHz offset. The spurs will always be below –70 dBc.

Fast Tuning

`:FREQ:SYNT 3`

In this mode, the LO behavior compromises phase noise at many offsets from the carrier in order to allow rapid measurement throughput when changing the center frequency or span. The term "Fast Tuning" on page 1724 refers to the time it takes to move the local oscillator to the start frequency and begin a sweep; this setting does not impact the actual sweep time in any way.

In instruments with EP1, the LO behavior compromises phase noise at offsets below 4 MHz in order to improve measurement throughput. The throughput is especially affected when moving the LO more than 2.5 MHz and up to 10 MHz from the stop frequency to the next start frequency.

In instruments with Option EP0, this is the same configuration as "Best Spurs" on page 1724. It is available with the "Fast Tuning" on page 1724 label for convenience, and to make the user interface more consistent with other X-Series instrument family members.

(In models whose hardware does not provide for a "Fast Tuning" on page 1724 option, the settings for "Best Close-in" on page 1723 are used if "Fast Tuning" on page 1724 is selected. This gives the fastest possible tuning for that hardware set.)

Auto

```
:FREQ:SYNT:AUTO ON
```

Selects the LO (local oscillator) phase noise behavior to optimize dynamic range and speed for various instrument operating conditions. The selection rules are as follows.

Auto Optimization Rules

X-Series instruments have several grades of LO, offering different configurations when in the Auto Mode. The rules for Auto selection are as follows:

Models with Option	Conditions	Selection
EP0 Models with option EP0 have a two stage local oscillator, which switches to a single loop for fast tuning (available in UXA)	Center frequency is < 699.9 kHz	"Balanced" on page 1723
	Span > 114.1 MHz, *or* RBW > 800 kHz	"Fast Tuning" on page 1724
	RBW > 290 kHz, *or* Span > 4.2 MHz	"Best Wide-offset" on page 1724
	Other conditions	"Balanced" on page 1723
EP1 Models with option EP1 have a two-loop local oscillator, which switches to a single loop for fast tuning (available in PXA)	Span > 44.44 MHz, *or* RBW > 1.9 MHz, *or* Source Mode is set to “Tracking”	"Fast Tuning" on page 1724
	Center frequency is < 195 kHz, *or* CF >= 1 MHz *and* Span <= 1.3 MHz *and* RBW <= 75 kHz	"Best Close-in" on page 1723
	All other conditions	"Best Wide-offset" on page 1724
EP2 Models with option EP2 use a different loop bandwidth for the fast-tuning choice, which is a compromise between tuning speed and phase noise, giving good tuning speed at all	CF < 130 kHz , *or* CF > 12 MHz *and* Span < 495 kHz *and* RBW < 40 kHz	"Best Close-in" on page 1723

Models with Option	Conditions	Selection
offsets. Although not as good as for "Best Close-in" on page 1723; this is useful when you have to look across a wide range of spans (available, for example, in MXA for excellent phase noise)	Span > 22 MHz, *or* RBW > 400 kHz, *or* CF ≤ 12 MHz *and* Span < 495 kHz *and* RBW < 23 kHz	"Fast Tuning" on page 1724
	All other conditions	"Best Wide-offset" on page 1724
EP4 (available in CXA for improved phase noise)	Span > 101 MHz *or* RBW > 1.15 MHz *or* Source Mode is set to “Tracking”	"Fast Tuning" on page 1724
	CF is < 109 kHz *or* CF >= 4.95 MHz *and* Span <= 666 kHz *and* RBW < 28 kHz	"Best Close-in" on page 1723
	All other conditions	"Best Wide-offset" on page 1724
All Other Models Note that in these models, the hardware does not actually provide for an extra-fast tuning option, so the settings for "Fast Tuning" on page 1724 are actually the same as "Best Close-in" on page 1723, but the rules are implemented this way so that the user who doesn't care about phase noise but does care about tuning speed doesn't have to remember which of the other two settings gives faster tuning	Span > 12.34 MHz, *or* RBW > 250 kHz, *or* Source Mode is set to “Tracking”	"Fast Tuning" on page 1724
	Center frequency is < 25 kHz, *or* CF >= 1 MHz *and* Span <= 141.4 kHz *and* RBW <= 5 kHz	"Best Close-in" on page 1723
	All other conditions	"Best Wide-offset" on page 1724

In all the above cases:

– The RBW to be used in the calculations is the equivalent –3 dB bandwidth of the current RBW filter

– The rules apply whether in swept spans, zero span, or FFT spans

Ranges

Option	Option #	Phase Noise Option	Range
No EPx Option	1	Best Close-in	[offset < 20 kHz]
	2	Best Wide-offset	[offset > 30 kHz]
	3	Fast Tuning	[same as Best Close-In]

Option	Option #	Phase Noise Option	Range
EP0	4	Best Close-in	[offset < 600 kHz]
	1	Balanced	[offset < 600 kHz]
	5	Best Spurs	[offset < 600 kHz]
	2	Best Wide-offset	[offset > 800 kHz]
	3	Fast Tuning	[same as Best Close-In]
EP1	1	Best Close-in	[offset < 140 kHz]
	2	Best Wide-offset	[offset > 160 kHz]
	3	Fast Tuning	[single loop]
EP2, EP3, EP5	1	Best Close-in	[offset < 70 kHz]
	2	Best Wide-offset	[offset > 100 kHz]
	3	Fast Tuning	[medium loop bw]
EP4	1	Best Close-in	[offset < 90 kHz]
	2	Best Wide-offset	[offset > 130 kHz]
	3	Fast Tuning	[same as Best Close-In]

ADC Dither

Toggles the dither function On and Off. The dither function improves linearity for low level signals, at the expense of a higher noise floor.

The reduced clipping-to-noise ratio results in higher noise because the clipping level of the ADC relative to the front terminals remains unchanged with the introduction of dither. The enhanced linearity is mostly improved scale fidelity.

With dither on, the third-order distortions are usually invisible for mixer levels below -35 dBm. With dither off, these distortions can be visible, with typical power levels of -110 dBm referred to the mixer. Detection nonlinearity can reach 1 dB for dither off at mixer levels around -70 dBm and lower, while the specified nonlinearity is many times smaller with dither on.

Remote Command	`[:SENSe]:WAVeform:ADC:DITHer[:STATe] OFF | ON | 0 | 1`
	`[:SENSe]:WAVeform:ADC:DITHer[:STATe]?`
	`[:SENSe]:WAVeform:ADC:DITHer:AUTO[:STATe] OFF | ON | 0 | 1`
	`[:SENSe]:WAVeform:ADC:DITHer:AUTO[:STATe]?`

Example	`:WAV:ADC:DITH ON`
	`:WAV:ADC:DITH?`
	`:WAV:ADC:DITH:AUTO ON`
	`:WAV:ADC:DITH:AUTO?`

Notes	The dither function improves linearity for low level signals, at the expense of a higher noise floor Sets ADC dithering to automatically select whether dithering is needed

	The dither function improves linearity for low level signals, at the expense of a higher noise floor
Preset	`OFF` `OFF`
State Saved	Saved in instrument state Saved in instrument state
Range	ON|OFF `Auto|Man`
Backwards Compatibility SCPI	`[:SENSe]:WAVeform:WBIF:ADC:DITHer` `[:SENSe]:WAVeform:PDITher`

LO Dither

When **LO Dither** is turned on, the local oscillator frequency is rapidly changed by small, random amounts. This helps spread the power of spurious signals within the passband, which lowers their level, thus increasing dynamic range. This is only required in very wide passbands, so this feature only appears with Option H1G.

Remote Command	`[:SENSe]:WAVeform:LO:DITHer[:STATe] ON | OFF | 1 | 0` `[:SENSe]:WAVeform:LO:DITHer[:STATe]?`
Example	`:WAV:LO:DITH 1` `:WAV:LO:DITH?`
Dependencies	Only available when the instrument has the Option H1G installed. If you try to turn `ON` LO Dither in any other case, an error message is generated, -241,"Hardware missing; Option H1G required" Only appears in some Modes (for example, VMA and IQ Analyzer) The **LO Dither** function is turned `OFF` and grayed-out when the **IF Path** is set to a path other than 1 GHz. If you press the grayed-out control, a warning message "LO Dither only available with IF Path 1 GHz" is shown. If you try to set **LO Dither** to `ON` remotely while it is grayed-out, a message "-221,Settings conflict; LO Dither only available with IF Path 1 GHz" is returned When **LO Dither** is turned `ON`, the **Phase Noise Optimization** control is grayed-out. If you try to change the PNO value via front panel or SCPI in that case, an error is generated, "LO Dither must be turned off to change this value"
Couplings	As with most parameters with an AUTO state, AUTO COUPLE sets it to Auto, which then selects `AUTOrange`. Setting any specific value (`AUTOrange`, `LOW` or `HIGH`) sets the AUTO state to false When **LO Dither** is turned `ON`, **Phase Noise Optimization** is set to "Best Close-In". If the **Phase Noise Optimization** value changes due to turning on **LO Dither**, a warning message "Phase Noise Optimization changed due to LO Dither activation" is displayed
Preset	`OFF`
State Saved	Saved in instrument state

IF Gain

Selects the range of IF gain.

When in AUTOrange mode, the IF checks its range once for data acquisition, to provide the best signal to noise ratio. You can specify the range for the best speed, and optimize for noise or for large signals.

When **IF Gain** is set to AUTOrange, the IF Gain is set to HIGH initially for each chunk of data. The data is then acquired. If the IF overloads, then the IF Gain is set to LOW and the data is re-acquired. Because of this operation, the AUTOrange setting requires more measurement time, as the instrument checks/resets its range. You can get faster measurement speed by forcing the range to either the HIGH or LOW gain setting, *but* you must ensure that your measurement conditions will not overload the IF (in the HIGH gain range), that your signals are well above the noise floor (for the LOW gain range), and that the signals are not changing.

When **Digital Bus Out** (under the **Input/Output** menu) is ON, the IF Gain State AUTOrange selection is not allowed. Thus, in this case IF Gain State will be set to LOW.

This only applies to the RF input. It does not apply to baseband I/Q input.

Remote Command	`[:SENSe]:WAVeform:IF:GAIN[:STATe] AUTOrange | LOW | HIGH | OTHer`
	`[:SENSe]:WAVeform:IF:GAIN[:STATe]?`
	`[:SENSe]:WAVeform:IF:GAIN:AUTO[:STATe] ON | OFF | 1 | 0`
	`[:SENSe]:WAVeform:IF:GAIN:AUTO[:STATe]?`

Example	`:WAV:IF:GAIN HIGH`
	`:WAV:IF:GAIN?`
	`:WAV:IF:GAIN:AUTO ON`
	`:WAV:IF:GAIN:AUTO?`

Notes	This only applies to the RF input and does not apply to baseband I/Q input Activates the auto rules for IF Gain
Dependencies	If you try to select AUTOrange via SCPI while **Digital Bus Out** is ON, an error message -224, “Illegal parameter value; "IF Gain Autorange not allowed when Digital Bus Out is on" is displayed If you try to select AUTOrange via the front panel while **Digital Bus Out** is ON, an error message -221 “Settings conflict; "IF Gain Autorange not allowed when Digital Bus Out is ON" is displayed
Couplings	As with most parameters that have an AUTO state, AUTO COUPLE sets it to AUTOrange, which then selects LOW or HIGH depending on the IF Path. Setting any specific value (AUTOrange, LOW, HIGH, or OTHer) sets the AUTO state to false
Preset	LOW ON
State Saved	Saved in instrument state
Range	Autorange (Slower Follows Signals)|Low (Best for Large Signals)|High (Best Noise Level)|Other (Explicit) OFF|ON

IF Gain Offset

Sets the **IF Gain Offset** for the 40 MHz, 140 MHz, 160 MHz IF Paths in 1 dB step from the minimum gain available to the maximum. Increasing the gain can increase the amplitude of small signals, as long as you don't overdrive the hardware. Wideband gain should usually be adjusted after setting the input attenuation.

Internally, the **IF Gain** value will change based on the current configuration of the Hardware. You can choose to offset this value with this parameter. Hence the value specified is not an absolute value but relative to the current internal **IF Gain** setting.

For example:

- IF Gain Low + IF Gain Offset +4 dB = Total IF Gain of +4 dB (0 + 4 = 4)
- IF Gain High + IF Gain Offset +4 dB = Total IF Gain of +14 dB (10 + 4 = 14)
- IF Gain Low + IF Gain Offset -6 dB = Total IF Gain of -6 dB (0 – 6 = -6)
- IF Gain High + IF Gain Offset -6 dB = Total IF Gain of +6dB (10 – 6 = 4)

The available IF Gain depends on the IF Path and center frequency. The maximum IF Gain may not be achievable at all times depending on the configuration.

Remote Command	`[:SENSe]:WAVeform:IF:GAIN:OFFSet <rel_ampl>` `[:SENSe]:WAVeform:IF:GAIN:OFFSet?`
Example	`:WAV:IF:GAIN:OFFS 2` Sets the IF Gain offset to 2
Couplings	This control is not available in E7760, EXM, UXM, M9393A or M9391A When "IF Gain" on page 1729 State is set to `OTHer`, the "Other IF Gain" on page 1730 value is used and the **IF Gain Offset** value is ignored
Preset	0
State Saved	Saved in instrument state
Min/Max	Depends upon hardware present

Other IF Gain

Explicitly specifies the IF gain value.

This parameter is only applicable when the "IF Gain" on page 1729 is set to `OTHer`. When **IF Gain** is set to `AUTOrange`, `LOW`, or `HIGH`, this value is ignored.

Remote Command	`[:SENSe]:WAVeform:IF:GAIN:LEVel <rel_ampl>` `[:SENSe]:WAVeform:IF:GAIN:LEVel?`

Example	`:WAV:IF:GAIN:LEV -10` `:WAV:IF:GAIN:LEV?`
Preset	0
State Saved	Saved in instrument state
Min/Max	Depends upon hardware present

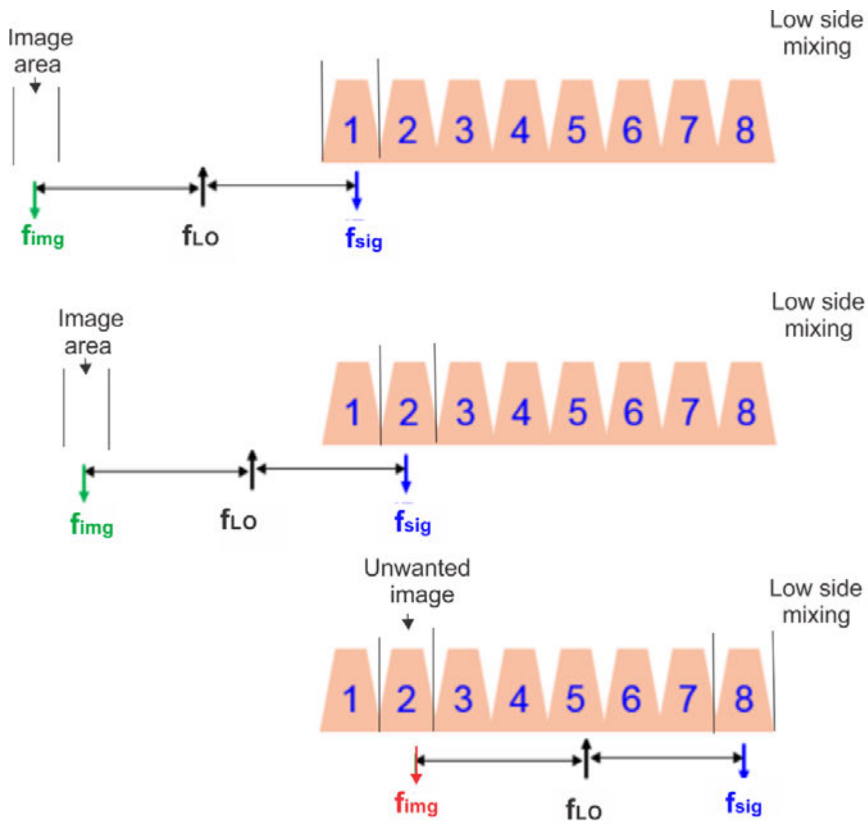
Mixing Mode

Mixing Mode enables you to alternate between mixing modes for the Local Oscillator (LO). The default setting is `NORMal` LO mixing mode, which is determined by the instrument configuration to be either “high side” or “low side”. Typically, “high side” mixing mode is used for the `NORMal` LO mixing mode. Selecting the `ALTernate` mixing mode selects “low side” mixing when the `NORMal` mixing mode is “high side” mixing, and selects “high side” mixing mode when the `NORMal` mixing mode is “low side” mixing.

This function can be useful in eliminating images that may be seen from adjacent channels. Whenever you have signals that are twice the IF above your signal of interest, they will alias on top of your signal. To eliminate this issue, switch to `ALTernate` side mixing and your measurement will be image free.

Example

When testing a 5G signal with all 8 channels ON, where each channel is 100 MHz wide, there may be cases where you see images from adjacent channels. To measure the highest frequency carrier, you will need to switch to alternate side mixing, to avoid the 8th carrier from aliasing on top of other carriers.



Select Alternate Mixing Mode

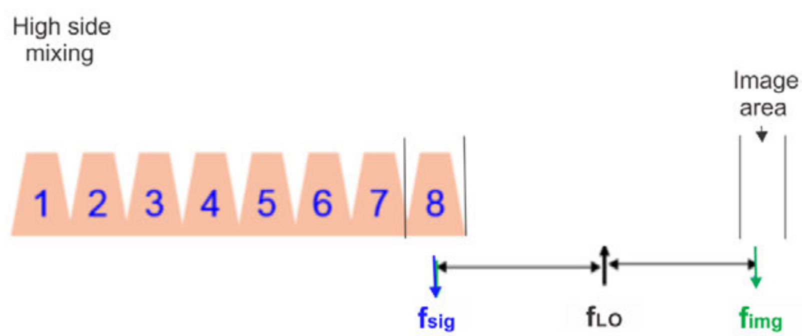


Image is now outside of the signal.

Remote Command	[:SENSe]:WAVeform:LO:MIXMode NORMal | ALTernate [:SENSe]:WAVeform:LO:MIXMode?
Example	:WAV:LO:MIXM NORM :WAV:LO:MIXM?
Dependencies	This control is not available in N9000B. This control is grayed-out when the RF Input is set to something other than RF (such as External Mixer). If you press the grayed-out control, a warning message “Feature only available with Signal Input RF” is shown

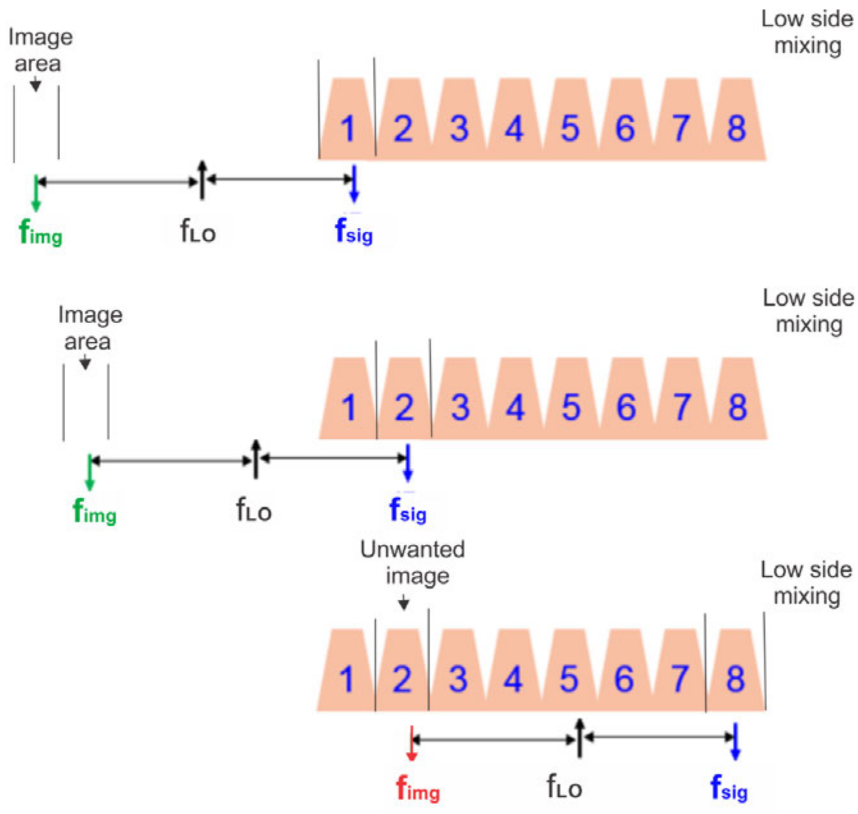
	If you try to set Mixing Mode via SCPI when disabled, a message -221,"Settings conflict; Feature only available with signal input RF" is returned
Preset	`NORMal`
State Saved	Yes
Range	`NORMal|ALTernate`

Mixing Mode State (Remote Command Only)

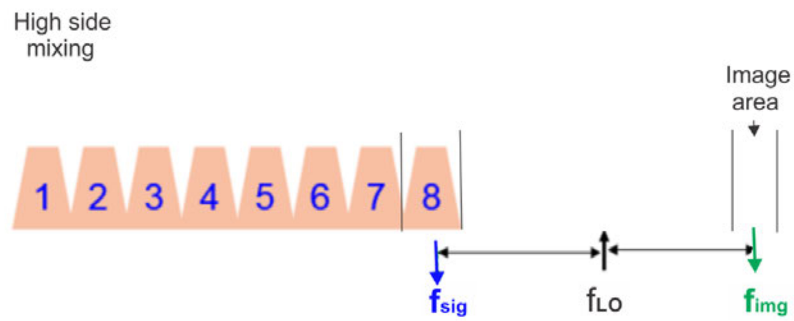
This query is available *only* in the Complex Spectrum and Waveform measurements.

Mixing Mode enables you to alternate between mixing modes for the Local Oscillator (LO). The default setting is `NORMal` LO mixing mode, which is determined by the instrument configuration to be either “high side” or “low side”. The Mixing Mode State query returns “High” or “Low” to determine if the mixing is “high side” or “low side”. If Mixing Mode is toggled between `NORMal` and `ALTernate`, then Mixing Mode State also toggles between “High” and “Low”.

When testing a 5G signal with all 8 channels `ON`, where each channel is 100 MHz wide, there may be cases where images from adjacent channels are visible. To measure the highest frequency carrier, you will need to switch to alternate side mixing to avoid the 8th carrier from aliasing on top of other carriers.



Returns



Remote Command	`[:SENSe]:SPECtrum:LO:MIXMode:SIDE?` `[:SENSe]:WAVeform:LO:MIXMode:SIDE?`
Example	`:SPEC:LO:MIXM:SIDE?` `:WAV:LO:MIXM:SIDE?`
Dependencies	This control is not available in N9000B
Couplings	When the Mixing Mode is toggled between `NORMal` and `ALTernate`, Mixing Mode State also toggles between High and Low
Range	High | Low

IF Frequency (Remote Command Only)

This query is available *only* in the Complex Spectrum and Waveform measurements.

It returns the current IF Frequency used in the IF Path.

Remote Command	`[:SENSe]:SPECtrum:IF:FREQuency?` `[:SENSe]:WAVeform:IF:FREQuency?`
Example	`:SPEC:IF:FREQ?` `:WAV:IF:FREQ?`
Couplings	A change in Span, Digital IF BW or IF Path parameters can result in a change of the IF Frequency value
Range	High | Low

3.13.8.4 Global

The controls in this menu apply to all Modes in the instrument.

Some controls (for example, **Global Center Freq**) allow you to switch certain Meas Global parameters to a Mode Global state. These switches apply to all Modes that support global settings. For example, no matter what Mode you are in when you set **Global Center Freq** to `ON`, it applies to all Modes that support Global Settings.

Other controls (for example, **Extend Low Band**) are actually set in this menu, but apply to all Modes.

Global Center Freq

The software maintains a Mode Global value called **Global Center Freq**.

When **Global Center Freq** is switched `ON`, the current Mode's center frequency is copied into the **Global Center Frequency**, and from then on all Modes that support global settings use the **Global Center Frequency**, so you can switch between any of these Modes and the Center Freq will remain unchanged.

Adjusting the Center Freq of any Mode that supports Global Settings, while **Global Center Freq** is `ON`, modifies the Global Center Frequency.

When **Global Center Freq** is switched `OFF`, the Center Freq of the current Mode is unchanged, but now the Center Freq of each Mode is once again independent.

When **Mode Preset** is pressed while **Global Center Freq** is `ON`, the Global Center Freq is preset to the preset Center Freq of the current Mode.

This function is reset to `OFF` when "Restore Defaults" on page 1737 (in this tab) is pressed, or when **System**, **Restore Defaults**, **All Modes** is pressed.

Remote Command	`:INSTrument:COUPle:FREQuency:CENTer ALL | NONE` `:INSTrument:COUPle:FREQuency:CENTer?`
Example	`:INST:COUP:FREQ:CENT ALL` `:INST:COUP:FREQ:CENT?`
Preset	Set to `OFF` on **Global** Settings, **Restore Defaults** and **System, Restore Defaults, All Modes**
Range	`ALL|NONE`

Preset	OFF
Backwards Compatibility SCPI	:GLOBal:FREQuency:CENTer[:STATe] 1 | 0 | ON | OFF :GLOBal:FREQuency:CENTer[:STATe]?

Global EMC Std

When this control is switched ON, the current Mode's EMC Std is copied into the **Global EMC Std**, and from then on all Modes that support global settings use the Global EMC Std, so you can switch between any of these Modes and the EMC Std will remain unchanged.

Adjusting the EMC Std of any Mode that supports Global Settings, while Global EMC Std is ON, will modify the **Global EMC Std**.

When **Global EMC Std** is switched OFF, the EMC Std of the current Mode is unchanged, but now the EMC Std of each Mode is once again independent. When **Mode Preset** is pressed while **Global EMC Std** is ON, the Global EMC Std is preset to the preset EMC Std of the current Mode.

This function is reset to OFF when "Restore Defaults" on page 1737 (in this tab) is pressed, or when **System, Restore Defaults, All Modes** is pressed.

Remote Command	:INSTrument:COUPle:EMC:STANdard ALL | NONE :INSTrument:COUPle:EMC:STANdard?
Example	:INST:COUP:EMC:STAN ALL :INST:COUP:EMC:STAN?
Dependencies	Only available if option EMC is installed
Preset	Set to OFF on **Global** Settings, **Restore Defaults** and **System, Restore Defaults, All Modes**
Range	ALL|NONE

Extend Low Band

The software maintains a Mode Global value called **Extend Low Band**.

Under the current sweep configuration crossing over two bands, when **Extend Low Band** is turned ON, the instrument checks whether one band can cover the whole sweep frequency range or not. If it can, then the instrument locks the band; otherwise, it does nothing (the band crossover occurs).

This function does *not* work when **Band Lock** under **System** > **Service** > **Lock Functions** is not -1 (no Band Lock). In that case, **Band Lock** takes priority over **Extend Low Band**.

This function is reset to OFF when "Restore Defaults" on page 1737 (in this tab) is pressed, or when **System**, **Restore Defaults**, **All Modes** is pressed.

This parameter is available for SA, RTSA, WCDMA, WIMAX OFDMA, LTEAFDD, LTEATDD Modes.

Remote Command	`:INSTrument:COUPle:FREQuency:BAND:EXTend 0 | 1 | ON | OFF` `:INSTrument:COUPle:FREQuency:BAND:EXTend?`
Example	`:INST:COUP:FREQ:BAND:EXT 1` `:INST:COUP:FREQ:BAND:EXT?`
Dependencies	Only applies to UXA, PXA, MXA and EXA
Preset	Set to `OFF` by **Global** Settings > **Restore Defaults** and **System** > **Restore Defaults** > **All Modes**
Range	`ON|OFF`

Restore Defaults

Resets all of the functions in the **Global** Settings menu to `OFF`. This also occurs when **System**, **Restore Defaults**, **All Modes** is pressed.

Remote Command	`:INSTrument:COUPle:DEFault`
Example	`:INST:COUP:DEF`
Backwards Compatibility SCPI	`:GLOBal:DEFault`

3.13.8.5 Sample Period (Aperture) Setting (Remote Command Only)

Returns the time between samples (sample period or aperture).

Remote Command	`[:SENSe]:WAVeform:APERture?`
Example	`:WAV:APER?`
Notes	Query only
Couplings	Coupled to Sample Rate by the following equation Sample Period = 1/(Sample Rate)
Preset	1/(Sample Rate Default)
Min/Max	1/(Max Sample Rate)/1/(Min Sample Rate)

3.13.9 Sweep

The **Sweep** key accesses controls that enable you configure and control the acquisition of data and the X-axis parameters of the instrument. These controls might include Sweep Time, Continuous/Single, Pause/Resume, X Scale, and number of Points.

3.13.9.1 Sweep/Control

Contains controls for the Sweep and Control functions of the instrument, such as Sweep Time and Continuous/Single.

Restart

The **Restart** function restarts the current sweep, or measurement, or set of averaged/held sweeps or measurements. In measurements that support pausing, if you are Paused, pressing **Restart** performs a **Resume**.

The Restart function is accessed in several ways:

- Pressing the **Restart** key
- Sending the remote command `:INIT:IMM`
- Sending the remote command `:INIT:REST`

See "More Information" on page 1739

Remote Command	`:INITiate[:IMMediate]` `:INITiate:RESTart`
Example	`:INIT:IMM` `:INIT:REST`
Notes	`:INIT:REST` and `:INIT:IMM` and the front-panel **Restart** key perform exactly the same function
Couplings	Resets average/hold count k For the first sweep, overwrites all active (update=on) traces with new current data For application modes, resets other parameters as required by the measurement
Status Bits/OPC dependencies	This is an Overlapped command The `:STATus:OPERation` register bits 0 through 8 are cleared The `:STATus:QUEStionable` register bit 9 (INTegrity sum) is cleared The `SWEEPING` bit is set The `MEASURING` bit is set
Backwards Compatibility Notes	For Spectrum Analysis mode in ESA and PSA, the **Restart** hardkey and the `:INIT:REST` command restart trace averages (displayed average count reset to 1) for a trace in **Clear Write**, but did not restart **Max Hold** and **Min Hold** In the X-Series, the **Restart** hardkey and the `:INIT:REST` command restart not only **Trace Average**, but **Max Hold** and **Min Hold** traces as well For wireless comms modes in ESA and PSA, the **Restart** hardkey and the `:INIT:REST` command restarted every measurement, including all traces and numeric results. There is no change to this operation

More Information

The **Restart** function first aborts the current sweep or measurement as quickly as possible. It then resets the sweep and trigger systems, sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is in the process of aligning when a Restart is executed, the alignment finishes before the restart function is performed.

Even when set for Single operation, multiple sweeps may be taken when **Restart** is pressed (for example, when averaging/holding is on). Thus when we say that Restart "restarts a measurement," depending on the current settings, we may mean:

- It restarts the current sweep
- It restarts the current measurement
- It restarts the current set of sweeps if any trace is in Trace Average, Max Hold or Min Hold
- It restarts the current set of measurements if Averaging, or Max Hold, or Min Hold is on for the measurement

With Average/Hold Number (in Meas Setup menu) set to 1, or Averaging off, or no trace in Trace Average or Hold, a single sweep is equivalent to a single measurement. A single sweep is taken after the trigger condition is met; and the instrument stops sweeping once that sweep has completed. However, with Average/Hold Number >1 and at least one trace set to Trace Average, Max Hold, or Min Hold (SA Measurement) or Averaging on (most other measurements), multiple sweeps/data acquisitions are taken for a single measurement. The trigger condition must be met prior to each sweep. The sweep is stopped when the average count k equals the number N set for Average/Hold Number. A measurement average usually applies to all traces, marker results, and numeric results, but sometimes only applies to the numeric results.

Once the full set of sweeps has been taken, the instrument will go to the idle state. To take one more sweep without resetting the average count, increment the average count by 1, by pressing the step up key while Average/Hold Number is the active function, or by sending the remote command `:CALC:AVER:TCON UP`.

Pause/Resume

Pauses a measurement after the current data acquisition is complete.

When a measurement is paused:

- The label on this control changes to **Resume**. Pressing **Resume** un-pauses the measurement.

– Pressing **Restart** also performs a **Resume**.

Remote Command	`:INITiate:PAUSe` `:INITiate:RESume`
Example	`:INIT:PAUS` `:INIT:RES`
Dependencies	Not displayed in Modes that do not support pausing
Couplings	When Averaging is On, if the measurement is paused no more updates will occur until either a Resume or Restart occurs If the measurement is resumed, the averaging continues to use the traces from before the Pause occurred and continues to use the traces from the point where the Resume occurred. This still provides real-time traces, but they will no longer be gap free In a view with a Waterfall window, when the measurement is paused, the Waterfall stops updating. When Resume is selected, the Waterfall will retain the existing traces and continue updating using traces from the point at which Resume was selected. The time stamp of the individual Waterfall traces will show the time from the beginning of the measurement the trace relates to, showing there was a gap in the Waterfall capture In Density view, when the measurement is paused, the Density Display stops updating. When the measurement is resumed, if Persistence is `ON`, the persistence fading will continue from the point when the measurement was paused If a Restart occurs, the average counter is reset and all results are discarded. The measurement begins again, using traces after the Restart occurred

Abort (Remote Command Only)

This command stops the current measurement. It aborts the current measurement as quickly as possible, resets the sweep and trigger systems, and puts the measurement into an "idle" state. If the instrument is in the process of aligning when `:ABORt` is sent, the alignment finishes before the abort function is performed, so `:ABORt` does *not* abort an alignment.

If the instrument is set for Continuous measurement, it sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is set for Single measurement, it remains in the "idle" state until an `:INIT:IMM` command is received.

Remote Command	`:ABORt`
Example	`:ABOR`
Notes	If `:INIT:CONT` is `ON`, then a new continuous measurement will start immediately, with sweep (data acquisition) occurring once the trigger condition has been met If `:INIT:CONT` is `OFF`, then `:INIT:IMM` is used to start a single measurement, with sweep (data acquisition) occurring once the trigger condition has been met
Dependencies	For continuous measurement, `:ABORt` is equivalent to the **Restart** key

	Not all measurements support the abort command
Status Bits/OPC dependencies	The :STATus:OPERation register bits 0 through 8 are cleared The :STATus:QUEStionable register bit 9 (INTegrity sum) is cleared Since all the bits that feed into OPC are cleared by :ABORt, the :ABORt will cause the *OPC query to return true

3.13.9.2 X Scale

This tab accesses controls that enable you to set the horizontal scale parameters.

Ref Value

Sets the display X reference value.

Remote Command	:DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:X[:SCALe]:RLEVel <time> :DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:X[:SCALe]:RLEVel?
Example	:DISP:WAV:VIEW:WIND:TRAC:X:RLEV 10 ms :DISP:WAV:VIEW:WIND:TRAC:X:RLEV?
Notes	View 1 is the RF Envelope View View 2 is the I/Q Waveform View
Couplings	If X "Auto Scaling" on page 1742 is ON, this value is automatically determined by the measurement result. When you set a value manually, X **Auto Scaling** automatically changes to OFF
Preset	0.000 s
State Saved	Saved in instrument state
Min/Max	-1 s /10.0 s
Annotation	<value> s bottom left of graph

Scale/Div

Sets the display X scale/division value.

Remote Command	:DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:X[:SCALe]:PDIVision <time> :DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:X[:SCALe]:PDIVision?
Example	:DISP:WAV:VIEW:WIND:TRAC:X:PDIV 500 us :DISP:WAV:VIEW:WIND:TRAC:X:PDIV?
Notes	View 1 is the RF Envelope View View 2 is the I/Q Waveform View
Couplings	If X "Auto Scaling" on page 1742 is ON, this value is automatically determined by the measurement result. When you set a value manually, X **Auto Scaling** automatically changes to OFF
Preset	200.0 us

State Saved	Saved in instrument state
Min	1.00 ns
Max	320 s

Ref Position

Sets the reference position for the X axis to `LEFT`, `CENTer` or `RIGHt`.

Remote Command	`:DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:X[:SCALe]:RPOSition LEFT | CENTer | RIGHt` `:DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:X[:SCALe]:RPOSition?`
Example	`:DISP:WAV:VIEW:WIND:TRAC:X:RPOS LEFT` `:DISP:WAV:VIEW:WIND:TRAC:X:RPOS?`
Preset	`LEFT`
State Saved	Yes Saved in instrument state
Range	`LEFT|CENTer|RIGHt`

Auto Scaling

Toggles the scale coupling function between `ON` and `OFF`.

Remote Command	`:DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:X[:SCALe]:COUPle 0 | 1 | OFF | ON` `:DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:X[:SCALe]:COUPle?`
Example	`:DISP:WAV:VIEW:WIND:TRAC:X:COUP ON` `:DISP:WAV:VIEW:WIND:TRAC:X:COUP?`
Couplings	When **Auto Scaling** is `ON` and the **Restart** front-panel key is pressed, this function automatically determines the scale per division and reference values based on the measurement results When you set a value to either "Scale/Div" on page 1741 or "Ref Value" on page 1741 manually, **Auto Scaling** automatically changes to `OFF`
Preset	`ON`
State Saved	Saved in instrument state
Range	`OFF|ON`

3.13.10 Trace

There are no Trace controls in this measurement.

3.14 Combined WCDMA Measurement

Combined W-CDMA is a special measurement for manufacturing of W-CDMA devices. The aim of this measurement is to optimize measurement speed. Some measurements are combined into a single package to prevent time-consuming measurement switching. In addition to this, ACP can be measured simultaneously with EVM measurements.

Currently, the following measurements are supported:

- Modulation Accuracy (Rho)
- QPSK EVM
- Adjacent Channel Power (ACP)

For more information on measurement setup, see "Parameter List" on page 1747.

Combined WCDMA Measurement Commands

The following commands and queries can be used to retrieve the measurement results:

:CONFigure:CWCDma

:CONFigure:CWCDma:NDEFault

:FETCh:CWCDma[n]?

:INITiate:CWCDma

:MEASure:CWCDma[n]?

:READ:CWCDma[n]?

Remote Command Results for Combined W-CDMA

For the queries listed above, the results returned depend on the value of n, as follows.

n	Results Returned
0	Returns unprocessed I/Q trace data of Capture Interval, as a series of trace point values. In each pair, the I-values are listed first using the 0 through even-indexed values. The Q values are the odd-indexed values
1 (or not specified)	Returns scalar results Total results length and the returned values depend on the number of enabled frequencies and Result Selection. Results only for enabled frequencies are returned. The length becomes shorter if some results are disabled Note that the condition where no result is set to invisible and multiple frequencies are enabled is assumed here Scalar results consist of the following blocks: 1. Rho (or QPSK EVM) results for Frequency 1 2. ACP results for Frequency 1 3. Rho (or QPSK EVM) results for Frequency 2

n	Results Returned
	4. ACP results for Frequency 2
	5. Rho (or QPSK EVM) results for Frequency 3
	…

The content of each results block is as follows.

Rho results block

Consists of the following values, where the first index of the block is denoted by R:

R	RMS EVM	A floating point number (in percent) of EVM
R+1	Peak EVM	A floating point number (in percent) of the peak EVM
R+2	Magnitude error	A floating point number (in percent) of the average magnitude error
R+3	Phase error	A floating point number (in degree) of the average phase error
R+4	I/Q origin offset	A floating point number (in dB) of the I and Q error (magnitude squared) offset from the origin
R+5	Frequency error	A floating point number (in Hz) of the frequency error in the measured signal
R+6	Rho	A floating point number of Rho
R+7	Peak Code Domain Error	A floating point number (in dB) of the Peak Code Domain Error relative to the mean power
R+8	Peak Code Domain Error Channel Number	The channel number in which the peak code domain error is detected
R+9	Number of active channels	
R+10	Time offset	A floating point number (in chips) of the pilot phase timing from the acquisition trigger point
R+11	CPICH power over a slot	A floating point number (in dB) of the CPICH power over a measurement slot. In the MS mode, the value returned is –999
R+12	Total power over a slot	A floating point number (in dBm) of the total RF power over a measurement slot
R+13	First Slot Number	An integer number of the first slot in Capture Interval. This is not averaged even if the averaging function is On. It is always the last cycle of the measurement

R+14	DPCCH Slot Format	(floating)
		– If Sync Type is DPCCH, the DPCCH slot format value used for synchronization is returned:
		  – 0.0: Slot Format 0
		  – 1.0: Slot Format 1
		  – 2.0: Slot Format 2
		  – 3.0: Slot Format 3
		  – 4.0: Slot Format 4
		  – 5.0: Slot Format 5
		– If Sync Type is PRACH, the value returned is -999.0
		In BTS mode, the value returned is -999.0

R+15	Preamble Signature	(floating)
		– BTS mode
		  – The returned value is always -999.0
		– MS mode
		  – In Preamble Signature auto-detection mode, the detected signature code number (from 0.0 to 15.0) is returned when the Sync Type is PRACH Message

n	Results Returned		
			– In Preamble Signature manual setting mode, the retuned value is the same as the parameter setting. When the Sync Type is not PRACH Message, the returned value is -999.0
	R+16	I Offset	A floating point number (in V) of the I offset
	R+17	Q Offset	A floating point number (in V) of the Q offset

QPSK EVM results block

Consists of the following values, where the first index of the block is denoted by Q:

Q	RMS EVM	A floating point number (in percent) of EVM
Q+1	Peak EVM	A floating point number (in percent) of peak EVM
Q+2	Magnitude Error	A floating point number (in percent) of magnitude error
Q+3	Phase Error	A floating point number (in degrees) of phase error
Q+4	Frequency Error	A floating point number (in Hz) of the frequency error in the measured signal
Q+5	I/Q Origin Offset	A floating point number (in dB) of the I and Q error (magnitude squared) offset from the origin

ACP results block

Consists of the following values, where the first index of the block is denoted by A:

A	Carrier Power (dBm)
A+1	-5MHz Offset Relative Power (dB)
A+2	-5MHz Offset Absolute Power (dBm)
A+3	+5MHz Offset Relative Power (dB)
A+4	+5MHz Offset Absolute Power (dBm)
A+5	-10MHz Offset Relative Power (dB)
A+6	-10MHz Offset Absolute Power (dBm)
A+7	+10MHz Offset Relative Power (dB)
A+8	+10MHz Offset Absolute Power (dBm)

2 Returns information about scalar results (n = 1)

Total results length and the returned values depend on the number of enabled frequencies. Information only for enabled frequencies is returned

0. Number of Enabled Frequencies
1. First Index of Index List for Frequency 1 (zero-based)
2. First Index of Index List for Frequency 2 (zero-based)

...

Each Index List consists of the following values, where the first index of the block is denoted by F:

F	First Index of Rho results in scalar results (zero-based)
F+1	First Index of QPSK EVM results in scalar results (zero-based)
F+2	First Index of ACP results in scalar results (zero-based)

If there are no results for the measurement, -999 is returned as index

For example, `2, 3, 6, 0, -999, 15, 18, -999, 33` means:

- There are 2 enabled frequencies
- Index List block for Frequency 1 starts at index 3 in this list
- Index List block for Frequency 2 starts at index 6 in this list
- Rho results for Frequency 1 start at index 0 in scalar results (n = 1)
- There is no QPSK EVM result for Frequency 1 in scalar results (n = 1)
- ACP results for Frequency 1 start at index 15 in scalar results (n = 1)

n	Results Returned
	– Rho results for Frequency 2 start at index 18 in scalar results (n = 1) – There is no QPSK EVM result for Frequency 2 in scalar results (n = 1) – ACP results for Frequency 2 start at index 33 in scalar results (n = 1)

3.14.1 Views

Allows you to select the desired measurement view from the following selections:

- MLISt –"Measurement List" on page 1746
- PARameter – "Parameter List" on page 1747
- RESult - "Result Metrics" on page 1747

Remote Command	`:DISPlay:CWCDma:VIEW[:SELect] MLISt | PARameter | RESult` `:DISPlay:CWCDma:VIEW[:SELect]?`
Example	`:DISP:CWCD:VIEW RES` `:DISP:CWCD:VIEW?`
Preset	`RESult`
State Saved	Saved in instrument state
Range	Measurement List|Parameter List|Result Metrics

3.14.2 Windows

Window Number List

Window	Number
Measurement List	1
Parameter List	2
Result Metrics	3

Measurement List

By default, this window shows the current status of enabled measurements and items.

If the “Show All Items” parameter is enabled via its control, all available measurements and items are displayed. When the measurement is disabled, measurement name and items that belong to the measurement are grayed out.

Combination view of the I/Q demodulated signals using vector lines to connect the chip dots.

Example	`:DISP:CWCD:VIEW MLIS`

Parameter List

This window shows the name, remote command and value of available commands for this measurement. The user can verify and change values by using the menu and front panel keys.

Example	`:DISP:CWCD:VIEW PAR`

Result Metrics

This window displays measurement results in the same order as they are returned by the remote results (n=1) query.

Example	`:DISP:CWCD:VIEW RES`

3.14.3 Amplitude

The Amplitude front-panel key activates the Amplitude menu.

3.14.3.1 Attenuation

Controls the attenuator functions and interactions between the attenuation system components.

There are two attenuator configurations in the X-Series. One is a Dual-Attenuator configuration consisting of a mechanical attenuator and an optional electronic attenuator. The other configuration uses a single attenuator with combined mechanical and electronic sections thatcontrols all the attenuation functions. Different models in the X-Series come with different configurations.

– See "Dual-Attenuator Configurations" on page 1748

– See "Single-Attenuator Configuration" on page 1749

Most attenuation settings are the same for all measurements – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset.

This tab is only available when the hardware set includes an input attenuator, which is typically only the case when using Keysight's box instruments. For example, this tab does not appear in:

– VXT models M9420A/21A/10A/11A

– E7760

– M9391A

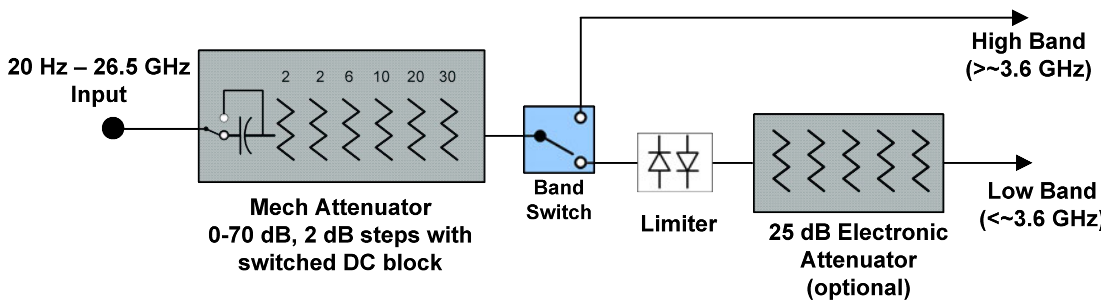
– M9393A

This tab also does not appear in UXM. In UXM all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

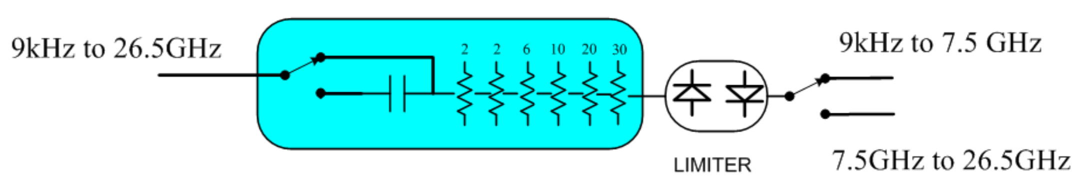
Dependencies	In measurements that support the I/Q inputs, this tab is unavailable when I/Q is the selected input, and is replaced by the Range tab in that case

Dual-Attenuator Configurations

Configuration 1: Mechanical attenuator + optional electronic attenuator

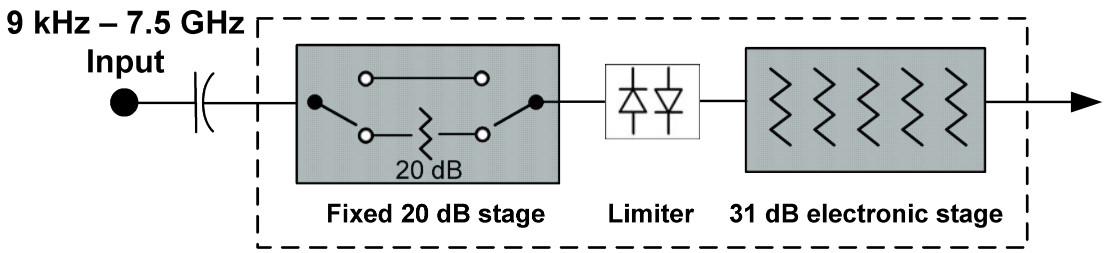


Configuration 2: Mechanical attenuator, no optional electronic attenuator

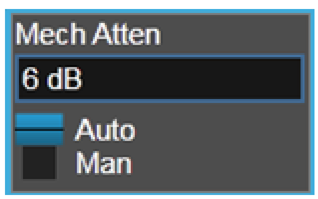


(note that Configuration 2 is not strictly speaking a dual-section attenuator, since there is no electronic section available. However, it behaves exactly like Configuration 1 without the Electronic Attenuator option EA3, therefore for the sake of this document it is grouped into the "Dual-Attenuator" configuration)

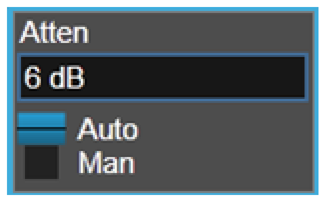
Single-Attenuator Configuration



You can tell which attenuator configuration you have by pressing the Attenuation tab, which (in most Modes) opensthe Attenuation menu. If the first control in the Attenuation menu says **Mech Atten** you have the Dual-Attenuator configuration. If the first control says **Atten** you have the Single-Attenuator configuration.



Dual Attenuator



Single Attenuator

(Note that depending on the measurement, there may be no Auto/Man functionality on the Mech Atten control).

In the Single-Attenuator configuration, youcontrol the attenuation with a single control, as the fixed stage has only two states. In the Dual-Attenuator configuration, both stages have significant range so you are given separate control of the mechanical and electronic attenuator stages.

When you have the Dual-Attenuator configuration, you may still have only a Single-Attenuator, because unless option EA3 (the Electronic Attenuator option) is available, and you purchase it, you will have only the mechanical attenuator.

Full Range Atten

The **Full Range Atten** control and **Attenuator Summary** only appear in N9041B, when the RF input is selected and the RF Input Port is set to RF Input 2, and the Full Range Attenuator is installed. The Full Range Attenuator adds a second input attenuator at the beginning of the RF Input 2, which enhances the protection and optimizes the performance of the extra internal mixers used by RF Input 2.

Remote Command	`[:SENSe]:POWer[:RF]:FRATten <rel_ampl>` `[:SENSe]:POWer[:RF]:FRATten?`
Example	`:POW:FRAT 14` `:POW:FRAT?`
Notes	When you enter an amplitude value that falls between valid values, the value will be incremented to the

	next smallest valid value
Dependencies	Only appears if input RF is selected, and RF Input Port 2 is selected, and the Full Range Attenuator exists
Couplings	This value is never changed by any coupling, however other couplings use this value. See the **Reference Level** and "Mech Atten" on page 1750 command descriptions
Preset	20 dB
State Saved	Saved in instrument state
Min	0 dB
Max	Only valid values are 0, 6, 14, 20 dB
Annotation	When the Input is RF, and the Input Port is RF Input 2, and the Full Range Attenuator is installed: On the Meas Bar, the field “Atten” displays as follows: – If the sweep is entirely < 50 GHz, the value shown after “Atten:” is equal to Mech Atten + Elec Atten + Full Range Atten – If the sweep is entirely > 50 GHz, the value shown after “Atten:” is equal to Full Range Atten – If the sweep straddles 50 GHz, the value shown after “Atten:” is preceded by the symbol “>=” and is equal to Full Range Atten In the **Amplitude**, "Attenuation" on page 1747 menu, and the Atten Meas Bar dropdown menu panel, a summary is displayed as follows: “Total Atten below 50 GHz” followed by the value of Full Range Atten + Mech Atten + Elec Atten “Total Atten above 50 GHz” followed by the value of Full Range Atten For example, if Mech Atten = 6 dB, Elec Atten = 4 dB, and Full Range Atten = 20 dB, the summary below is shown: – Attenuator summary: – Total Atten below 50 GHz: 30 dB – Total Atten above 50 GHz: 20 dB

Mech Atten

This control is labeled **Mech Atten** in Dual-Attenuator models and **Atten** in Single-Attenuator models. In the Dual-Attenuator configuration, this control only affects the mechanical attenuator.

This control lets you modify the attenuation applied to the RF input signal path. This value is normally auto coupled to the Ref Level, the Internal Preamp Gain, any External Gain that is entered, and the Max Mixer Level, as described in the table below.

See "Attenuator Configurations and Auto/Man" on page 1752

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation <rel_ampl>` `[:SENSe]:POWer[:RF]:ATTenuation?`

	`[:SENSe]:POWer[:RF]:ATTenuation:AUTO OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:ATTenuation:AUTO?`

Example	`:POW:ATT 20`
	Dual-Attenuator configuration: sets the mechanical attenuator to 20 dB
	Single-Attenuator mode: sets the main attenuation to 20 dB (see below for definition of "main" attenuation)
	In either case, if the attenuator was in Auto, it is set to Manual
	`:POW:ATT:AUTO ON`
	Turn Auto Mech Atten ON

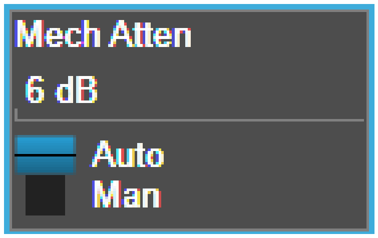
Dependencies	Some measurements do not support the Auto setting of "Mech Atten" on page 1750. In these measurements, the Auto/Man selection is not available, and the Auto/Man toggle function is not available In Dual-Attenuator configurations, when the electronic attenuator is enabled, the mechanical attenuator has no auto setting and the Auto/Man toggle function is not available. The state of Auto/Man is remembered and restored when the electronic attenuator is once again disabled. This is described in more detail in "Elec Atten" on page 1753 See "Attenuator Configurations and Auto/Man" on page 1752 for more information on the Auto/Man functionality `:POW:ATT:AUTO` is only available in measurements that support Mech Atten Auto, such as Swept SA
Couplings	If the RF Input Port is the RF Input: – If the USB Preamp is connected to USB, use 0 dB for Mech Atten – Otherwise compute the auto-selected value of Mech Atten based on **Reference Level**, Int Preamp, External Gain, Ref Level Offset, Max Mixer Level, µW Path Control and IF Gain settings. Limit this value to be no less than 6 dB (total attenuation below 6 dB can never be chosen by Auto) – In the N9041B, if the RF Input Port is RF Input 2, use the formula above and subtract the Full Range Atten value from the result to determine the Mech Atten. Limit the value so that it is never lower than 0 dB and so that total attenuation, including Full Range Atten, is never less than 6 dB (total attenuation, including Full Range Atten below 6 dB, can never be chosen by Auto) In External Mixingand BBIQ, where the Attenuator is not in the signal path, the Attenuator setting changes as described above when "Mech Atten" on page 1750 is in Auto, but no changes are made to the actual attenuator hardware setting until the input is changed back to the RF Input For CXA-m with option FSA (Fine-Step Attenuator or 2 dB steps), the FSA-like behavior is only available when the frequency setting is <= 7.5GHz. So, when the frequency is changed from below 7.5GHz to above 7.5GHz, the attenuation setting will be changed to a multiple of 10dB which will be no smaller than the previous setting. For example, 4dB attenuation will be changed to 10dB
Preset	The preset for Mech Attenuation is "Auto" The Auto value of attenuation is 10 dB ON
State Saved	Saved in instrument state
Min	0 dB The attenuation set by this control cannot be decreased below 6 dB with the knob or step keys. Values below 6 dB must be directly entered from the keypad or via SCPI. This protects against setting a

	dangerously small attenuation value, which can put the instrument at risk of damage to input circuitry. If the current mechanical attenuation is below 6 dB, it can be increased with the knob and step keys, but not decreased
Max	CXA Option 503 or 507: 50 dB EXA: 60 dB All other models: 70 dB Note that in the Single-Attenuator configuration, the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB.
Annotation	The current value for Total Atten is displayed in the Measurement Bar at the top of the display. A value appears for Electronic Attenuation only if the Electronic Attenuator is enabled. The annotation appears as Atten: <total> dB (e<elec>) The e letter is in amber in Single-Attenuator configurations For example: Dual-Attenuator configuration: Atten: 24 dB (e14) Indicating the total attenuation is at 24 dB and the electronic attenuation is at 14 dB Single-Attenuator configuration: A: 24 dB (e14) Indicating the total attenuation is at 24 dB and the “soft” attenuation is at 14 dB (see below for definition of “soft” attenuation) When in Manual, a # sign appears in front of Atten in the annotation

Attenuator Configurations and Auto/Man

As described in "Attenuation" on page 1747 , there are two distinct attenuator configurations available in the X-Series, the single attenuator and Dual-Attenuator configurations. In Dual-Attenuator configurations, we have the mechanical attenuation and the electronic attenuation, and the current total attenuation is the sum of the electronic + mechanical attenuation. In Single-Attenuator configurations, we refer to the attenuation set using "Mech Atten" on page 1750 (or `:POW:ATT`) as the “main” attenuation; and the attenuation that is set by `:POW:EATT` as the “soft” attenuation (`:POW:EATT` is honored even in the Single-Attenuator configuration, for compatibility purposes). Then the current total attenuation is the sum of the main + soft attenuation. See "Elec Atten" on page 1753 for more on “soft” attenuation.

NOTE	In some measurements, the **Mech Atten** control has an Auto/Man function. In these measurements, an Auto/Man switch is shown on the **Mech Atten** control:



Note that in configurations that include an Electronic Attenuator, this switch is only shown when the Electronic Attenuator is disabled.

In other measurements, **Mech Atten** has no Auto/Man function. In these measurements, no switch is shown on the **Mech Atten** control:

Mech Atten also appears with no switch, as above, in configurations that include an Electronic Attenuator but when the Electronic Attenuator is enabled.

Elec Atten

Controls the Electronic Attenuator in Dual-Attenuator configurations. This control does not appear in Single-Attenuator configurations, as the control of both the mechanical and electronic stages of the Single-Attenuator is integrated into the single **Atten** control.

This control includes an Enable/Disable toggle switch; it is only possible to enter a value for the Electronic Attenuator when this switch is in the “Enable” position.

See "More Information" on page 1754

Remote Command	[:SENSe]:POWer[:RF]:EATTenuation <rel_ampl> [:SENSe]:POWer[:RF]:EATTenuation? [:SENSe]:POWer[:RF]:EATTenuation:STATe OFF | ON | 0 | 1 [:SENSe]:POWer[:RF]:EATTenuation:STATe?
Example	:POW:EATT 10 :POW:EATT? :POW:EATT:STAT ON :POW:EATT:STAT?
Notes	Electronic Attenuation’s specification is defined only when Mechanical Attenuation is 6 dB
Dependencies	This control only appears in Dual-Attenuator models with an Electronic Attenuator installed and licensed. It does not appear in models with the Single-Attenuator configuration, as in the Single-Attenuator configuration there is no “electronic attenuator” there is only a single integrated attenuator

	(which has both a mechanical and electronic stage). However, in the Single-Attenuator configuration, EATT SCPI commands are accepted for compatibility with other X-series instruments and set a "soft" attenuation as described in . The "soft" attenuation is treated as an addition to the "main" attenuation value set by the Atten control or the POW:ATT SCPI command and affects the total attenuation displayed on the Atten control and the Meas Bar The electronic attenuator (and the "soft" attenuation function provided in Single-Attenuator configurations) is unavailable above the low band (0-3.6 GHz, 0-3.4 GHz 0-3GHz, depending on the model). If the low band ranges from 0-3.6GHz, and Stop Frequency of the instrument is > 3.6 GHz, then the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed out If the Internal Preamp is on, meaning it is set to Low Band or Full, the electronic attenuator (and the "soft" attenuation function provided in Single-Attenuator configurations) is unavailable. In this case the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed out If either of the above is true, if the SCPI command is sent, an error indicating that the electronic attenuator is unavailable will be sent If both of the above are true, pressing the control will generate error message -221, in other words, the frequency range lockout takes precedence If the electronic/soft Attenuator is enabled, then the Stop Freq of the instrument is limited to 3.6 GHz and the Internal Preamp is unavailable The SCPI-only "soft" electronic attenuation for the single-attenuator configuration is not available in all measurements; in particular, it is not available in the Swept SA measurement
Couplings	Enabling and disabling the Electronic Attenuator affects the setting of the Mechanical Attenuator (in Dual-Attenuator configurations). This is described in more detail below and in the section "Attenuator Configurations and Auto/Man" on page 1752
Preset	`OFF` (Disabled) for Swept SA measurement `ON` (Enabled) for all other measurements that support the electronic attenuator
State Saved	Saved in instrument state
Min	0 dB
Max	Dual-Attenuator configuration: 24 dB Single-Attenuator configuration: the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB
Annotation	See Annotation under the **Mech Atten** control description

More Information

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear. These advantages primarily aid in remote operation and are negligible for front panel use. See "Using the Electronic Attenuator: Pros and Cons" on page 1755 for a detailed discussion of the pros and cons of using the electronic attenuator.

For the Single-Attenuator configuration, for SCPI backwards compatibility, the "soft" attenuation feature replaces the Dual-Attenuator configuration's electronic attenuator. All the same couplings and limitations apply. See "Attenuator Configurations and Auto/Man" on page 1752

Mechanical Attenuator Transition Rules

When the Electronic Attenuator is enabled, the Mechanical Attenuator transitions to a state that has no Auto function. Below are the rules for transitioning the Mechanical Attenuator. Note that the information below ONLY applies to the Dual-Attenuator configurations, and ONLY when the Electronic Attenuator is installed:

When the Electronic Attenuation is enabled from a disabled state:

The Mechanical Attenuator is initialized to 10 dB (this is its optimal performance setting). You can then set it as desired with SCPI, numeric keypad, step keys, or knob, and it behaves as it normally would in manual mode

The Auto/Man state of (Mech) Atten is saved

The Auto/Man toggle on the (Mech) Atten control disappears and the auto rules are disabled

The Electronic Attenuator is set to 10 dB less than the previous value of the Mechanical Attenuator, within the limitation that it must stay within the range of 0 to 24 dB of attenuation

Examples in the Dual-Attenuator configuration:

Mech Atten at 20 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 10 dB. New total attenuation equals the value before Elec Atten enabled

Mech Atten at 0 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 0 dB. New total attenuation does not equal the value before Elec Atten enabled

Mech Atten at 40 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 24 dB. New total attenuation does not equal the value before Elec Atten enabled

When the Electronic Attenuation is disabled from an enabled state:

The Elec Atten control is grayed out

- The Auto/Man state of (Mech) Atten is restored

If now in Auto, (Mech) Atten recouples

If now in Man, (Mech) Atten is set to the value of total attenuation that existed before the Elec Atten was disabled. The resulting value is rounded up to the smallest value possible given the (Mech) Atten Step setting - (That is, 57 dB changes to 58 dB when (Mech) Atten Step is 2 dB)

Using the Electronic Attenuator: Pros and Cons

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear.

The “finer steps” advantage of the electronic attenuator is beneficial in optimizing the alignment of the instrument dynamic range to the signal power in the front panel as well as remote use. Thus, you can achieve improved relative signal measurement accuracy. Compared to a mechanical attenuator with 2 dB steps, the 1 dB resolution

of the electronic attenuator only gives better resolution when the odd-decibel steps are used. Those odd-decibel steps are less accurately calibrated than the even-decibel steps, so one tradeoff for this superior relative accuracy is reduced absolute amplitude accuracy.

Another disadvantage of the electronic attenuator is that the spectrum analyzer loses its "Auto" setting, making operation less convenient.

Also, the relationship between the dynamic range specifications (TOI, SHI, compression, and noise) and instrument performance are less well-known with the electrical attenuator. With the mechanical attenuator, TOI, SHI, and compression threshold levels increase dB-for-dB with increasing attenuation, and the noise floor does as well. With the electronic attenuator, there is an excess attenuation of about 1 to 3 dB between 0 and 3.6 GHz, making the effective TOI, SHI, and so forth, less well known. Excess attenuation is the actual attenuation relative to stated attenuation. Excess attenuation is accounted for in the instrument calibration

Adjust Atten for Min Clipping

Sets the combination of mechanical and electronic attenuation and gain based on the current measured signal level so that clipping will be at a minimum.

This is an "immediate action" function, that is, it executes once, when the control is pressed.

The algorithms that are used for the adjustment are documented under "Pre-Adjust for Min Clipping" on page 1757.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate`
Example	`:POW:RANG:OPT IMM`
Notes	Executing Adjust Atten for Min Clipping initiates the measurement.
Dependencies	Does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum measurements For the Waveform measurement, this control is available only in 5G NR Mode

Adjust Atten

Allows you to select;

- Electric attenuator only
- Combination of Electric attenuator and Mechanical attenuator

when the command `[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate` is executed.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize:TYPE EONLy | COMBined` `[:SENSe]:POWer[:RF]:RANGe:OPTimize:TYPE?`

Example	`:POW:RANG:OPT:TYPE EONL` `:POW:RANG:OPT:TYPE?`
Dependencies	Does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum measurements For the Waveform measurement, this control is available only in 5G NR Mode
Preset	`COMBined`
State Saved	Saved in instrument state

Pre-Adjust for Min Clipping

If this function is ON, it applies the adjustment described under "Adjust Atten for Min Clipping" on page 1756 each time a measurement restarts. Therefore, in Continuous measurement mode, it only executes before the first measurement.

In Dual-Attenuator models, you can set **Elec+Mech Atten**, in which case both attenuators participate in the autoranging, or **Elec Atten Only**, in which case the mechanical attenuator does not participate in the autoranging. This latter case results in less wear on the mechanical attenuator and is usually faster.

See "Adjustment Algorithm" on page 1758

Selection	Example	Note
Off	`:POW:RANGe:OPT:ATT OFF`	This is the default setting
Elec Atten Only	`:POW:RANGe:OPT:ATT ELEC`	Selects only the electric attenuator to participate in auto ranging. This offers less wear on the mechanical attenuator and is usually faster
Mech + Elec Atten	`:POW:RANGe:OPT:ATT COMB`	In Dual-Attenuator models, this selects both attenuators to participate in the autoranging

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation OFF | ON | ELECtrical | COMBined` `[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation?`
Example	`:POW:RANG:OPT:ATT OFF` `:POW:RANG:OPT:ATT?`
Notes	The parameter option `ELECtrical` sets this function to ON in Single-Attenuator models The parameter option `COMBined` is mapped to `ELECtrical` in Single-Attenuator models. If you send `COMBined`, it sets the function to ON and returns `ELEC` to a query For SCPI compatibility with models that do not have an input attenuator, the ON parameter is honored and mapped to `COMBined`
Dependencies	This control only appears in Dual-Attenuator models with an Electronic Attenuator installed In instruments with Dual-Attenuator model, when **Enable** "Elec Atten" on page 1753 is `OFF` or grayed-out, "Pre-Adjust for Min Clipping" on page 1757 is grayed-out This control does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum

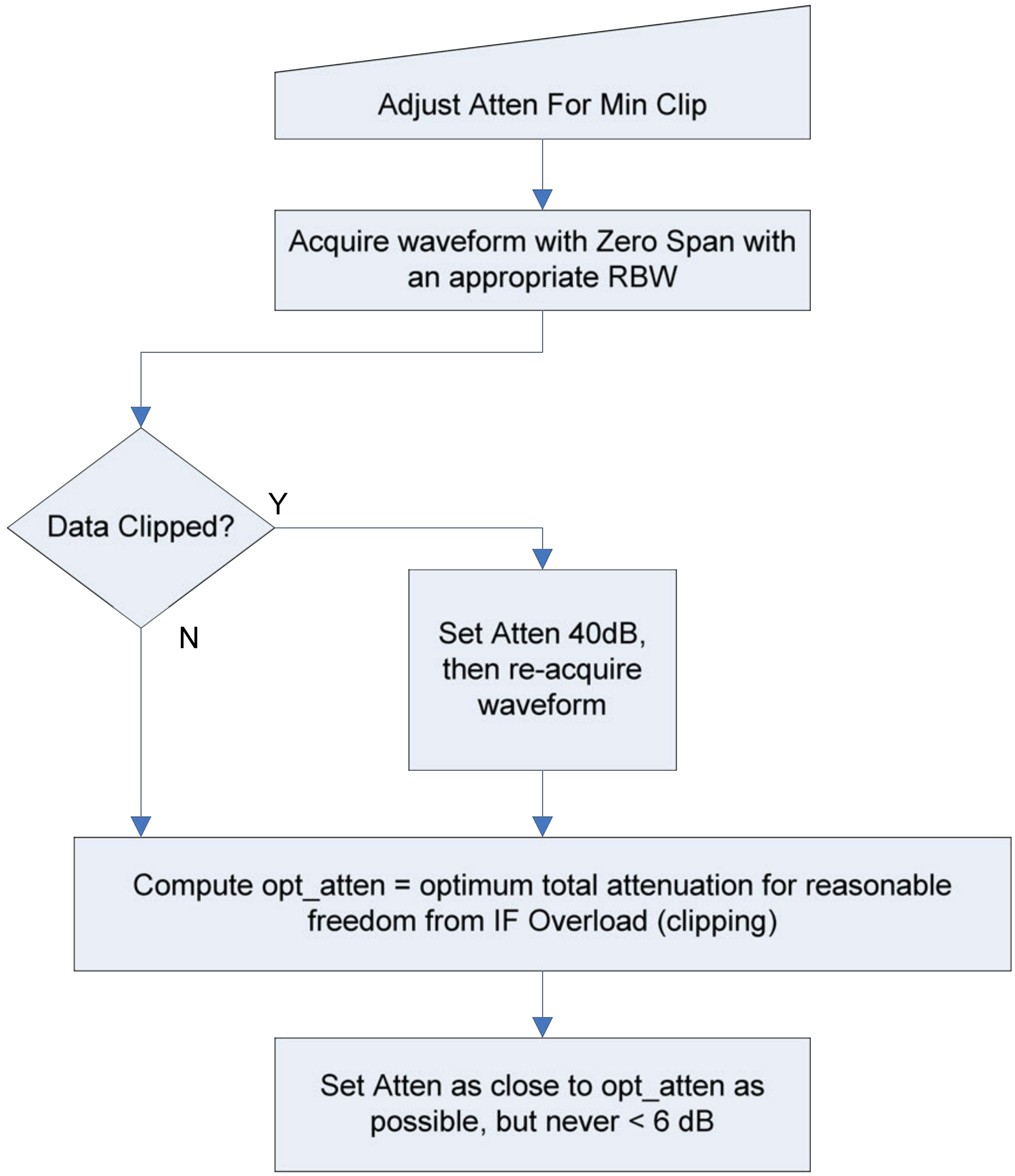
	measurements For the Waveform measurement, this control is available only in 5G NR Mode
Preset	`OFF` when Elec Atten is Disabled at preset, otherwise `ELEC`
State Saved	Saved in instrument state
Range	Dual-Attenuator models: Off | Elec Atten Only | Mech + Elec Atten Single-Attenuator models: Off | On

Notes	`ON` aliases to "Elec Atten Only" (`:POW:RANG:OPT:ATT ELEC`) `OFF` aliases to "Off" (`:POW:RANG:OPT:ATT OFF`) `:POW:RANG:AUTO?` returns true if `:POW:RANG:OPT:ATT` is not `OFF`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:RANGe:AUTO ON | OFF | 1 | 0` `[:SENSe]:POWer[:RF]:RANGe:AUTO?`

Adjustment Algorithm

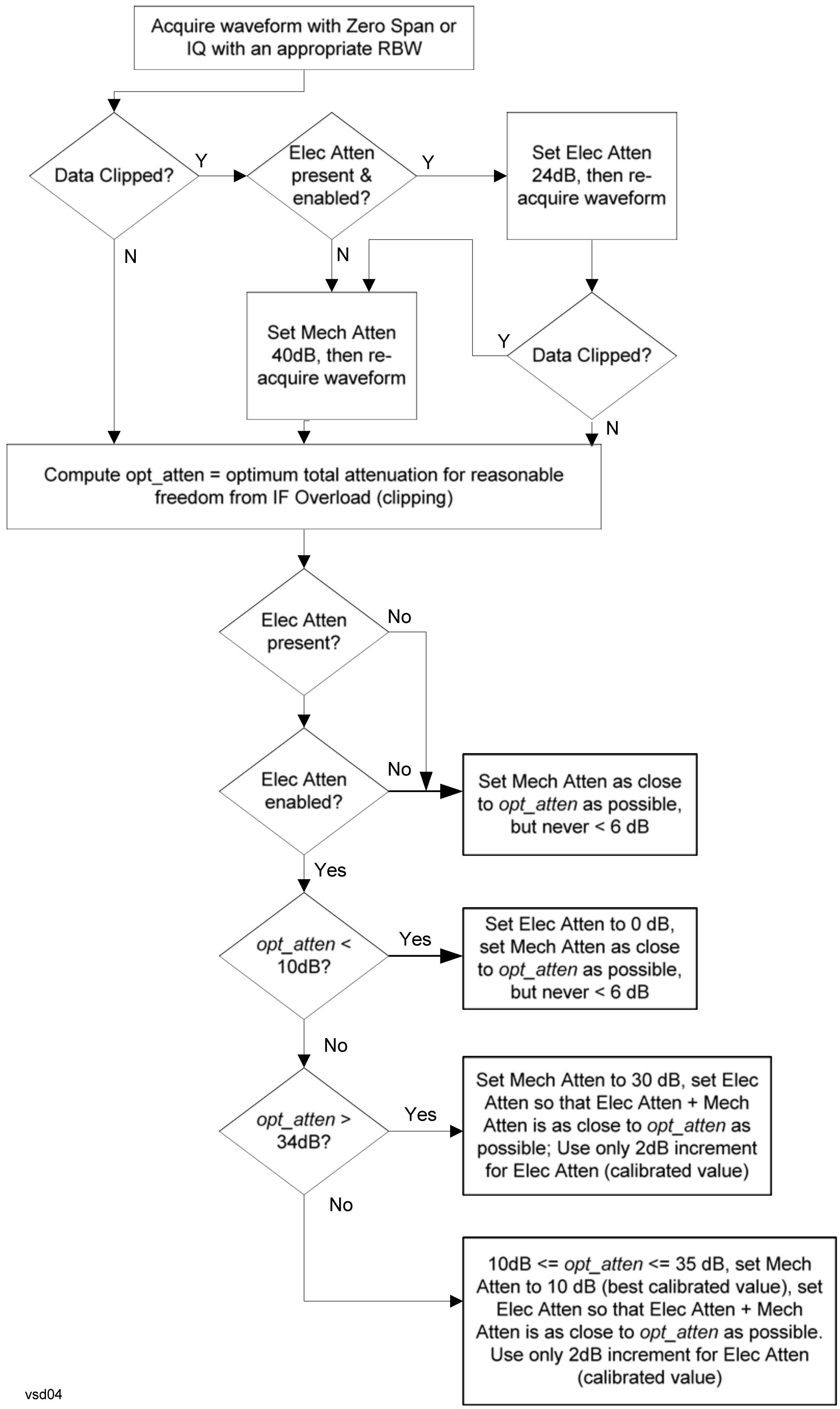
The algorithms for the adjustment are documented below:

Single-Attenuator Models

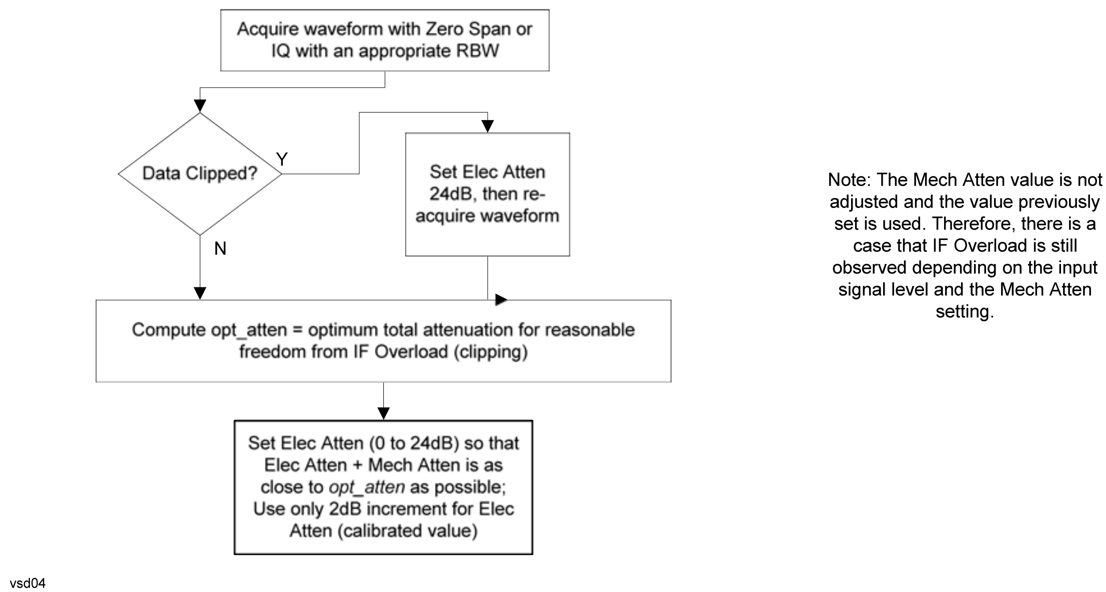


Dual-Attenuator models

"Adjust Atten for Min Clipping" on page 1756 or "Pre-Adjust for Min Clipping" on page 1757 selection is Mech + Elec Atten:


Acquire waveform with Zero Span or IQ with an appropriate RBW
Data Clipped?
Y
N
Elec Atten present & enabled?
Y
N
Set Elec Atten 24dB, then re-acquire waveform
Set Mech Atten 40dB, then re-acquire waveform
Y
Data Clipped?
N
Compute opt_atten = optimum total attenuation for reasonable freedom from IF Overload (clipping)
Elec Atten present?
No
Elec Atten enabled?
No
Set Mech Atten as close to opt_atten as possible, but never < 6 dB
Yes
opt_atten < 10dB?
Yes
Set Elec Atten to 0 dB, set Mech Atten as close to opt_atten as possible, but never < 6 dB
No
opt_atten > 34dB?
Yes
Set Mech Atten to 30 dB, set Elec Atten so that Elec Atten + Mech Atten is as close to opt_atten as possible; Use only 2dB increment for Elec Atten (calibrated value)
No
10dB <= opt_atten <= 35 dB, set Mech Atten to 10 dB (best calibrated value), set Elec Atten so that Elec Atten + Mech Atten is as close to opt_atten as possible. Use only 2dB increment for Elec Atten (calibrated value)
vsd04

"Pre-Adjust for Min Clipping" on page 1757 selection is Elec Only:



Mech Atten Step

Controls thestep size used when making adjustments to the input attenuation.

This control is labeled **Mech Atten Step** in Dual-Attenuator models and **Atten Step** in Single-Attenuator models. In the Dual-Attenuator configuration, this control only affects the step size of the mechanical attenuator.

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement] 10 dB | 2 dB` `[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement]?`
Example	`:POW:ATT:STEP 2` `:POW:ATT:STEP?`
Notes	This feature has a toggle choice from the front panel, but it takes a specific value (in dB) when used remotely. The only valid values are 2 and 10
Dependencies	Blanked in EXA, CXA and CXA-m if option FSA (2 dB steps) is not present. If blanked, attempts to set it via SCPI yield an error
Couplings	When the attenuation step size changes, the current mechanical attenuation value is adjusted (if necessary) to be quantized to the new step size. That is, if step is set to 10 dB, mech atten is increased if necessary so it is a multiple of 10 dB
Preset	EXA, CXA and CXA-m: 10 dB (2 dB with option FSA) All other models: 2 dB
State Saved	Saved in instrument state

Max Mixer Level

Allows you to set the maximum level to be applied to the mixer for a signal at the top of the screen. By setting this value up or down you can allow more or less signal through the system.

The major impact of changes to **Max Mixer Level** is seen in changes to the value to which **Reference Level** is limited. Max Ref Level depends on Max Mixer Level and Attenuation, and therefore a higher Max Mixer Level may let you set Ref Level higher. However, changing this value can impact your TOI, compression, or dynamic range. The preset value of this function is best for most measurements.

See also "Max Mixer Lvl Rules" on page 1762.

Remote Command	`[:SENSe]:POWer[:RF]:MIXer:RANGe[:UPPer] <real>` `[:SENSe]:POWer[:RF]:MIXer:RANGe[:UPPer]?`
Example	`:POW:MIX:RANG -15 dBm` `:POW:MIX:RANG?`
Dependencies	Only appears in Swept SA and RTSA measurements
Preset	-10 dBm
State Saved	Saved in instrument state
Min	-50 dBm
Max	0 dBm

Max Mixer Lvl Rules

Allows you to optimize the Max Mixer Level setting for certain kinds of measurements.

- `NORMal` – The historical, and thus backwards compatible, setting range (–50 to 0 dBm) and default setting (–10 dBm). The instrument has been designed so that, at the default setting, any signal below the **Reference Level** is extremely unlikely to create ADC overloads. At this mixer level the scale fidelity will be within specifications, thus compression with be negligible.
- `TOI` – Allows a range of settings of the "Max Mixer Level" on page 1762, –50 to –10 dBm, that can be optimum for measurements limited by the instrument third-order dynamic range. The default setting, –25 dBm, is commonly appropriate but RBW affects this. A good setting for Max Mixer Level would be higher than the optimum mixer level by half of the attenuator step size.
- `COMPression` – Allows a range of settings of the Max Mixer Level, –10 to +10 dBm or more, that can be optimum for measurements limited by the tradeoffs between instrument accuracy due to compression, and dynamic range due to the noise floor. The default setting, –3 dBm, is commonly appropriate, representing mixer drive levels that cause 1 dB or less compression at most carrier

frequencies. Typical measurements that would be optimized by this setting are the measurement of low sideband levels, including nulls, in angle-modulated signals (FM and PM). Also pulsed-RF measurements, including finding nulls to estimate pulse width, which are often best done with significant overdrive (compression) of the front end.

Setting Name (readback)	Setting Name (verbose)	Max Mixer Level Preset Value, dBm	Max Mixer Level minimum value, dBm	Max Mixer Level maximum value, dBm
NORMal	Normal – balance TOI, noise, and compression	–10	–50	0
TOI	TOI-limited dynamic range	–25	–50	–10
COMPression	Compression-limited dynamic range	–3	–10	+30

Remote Command	[:SENSe]:POWer[:RF]:MIXer:RULEs NORMal | TOI | COMPression [:SENSe]:POWer[:RF]:MIXer:RULEs?
Example	:POW:MIX:RULE:COMP
Dependencies	Only appears in Swept SA and RTSA
Preset	NORM

3.14.3.2 Range (Non-attenuator models)

This tab is only available for Keysight's modular signal analyzers and certain other Keysight products. Examples include:

- VXT
- E7760
- M9391A
- M9393A

This tab also does not appear in UXM. In UXM, all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

State Saved	No

Range

Represents the amplitude of the largest sinusoidal signal that could be present within the IF without being clipped by the ADC. For signals with high peak-to-average ratios, the range may need to exceed the rms signal power by a significant amount to avoid clipping.

This is a measurement global setting.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe <real>` `[:SENSe]:POWer[:RF]:RANGe?`
Example	`:POW:RANG 10 dBm` `:POW:RANG?`
Notes	The MIN and MAX values are affected by the External Gain parameters, and by the **Center Frequency** The hardware compensates for frequency response and alters the Range setting
Preset	0 dBm
State Saved	Yes
Min	-100
Max	100
Annotation	Meas Bar

Adjust Range for Min Clipping

Sets the combination of attenuation and gain based on the current measured signal level so that clipping will be at a minimum.

This is an "immediate action" function, that is, it executes once, when the key is pressed.

This key does not appear in measurements that do not support this functionality.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate`
Notes	Executing Adjust Range for Min Clipping initiates the measurement
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760

Pre-Adjust for Min Clipping

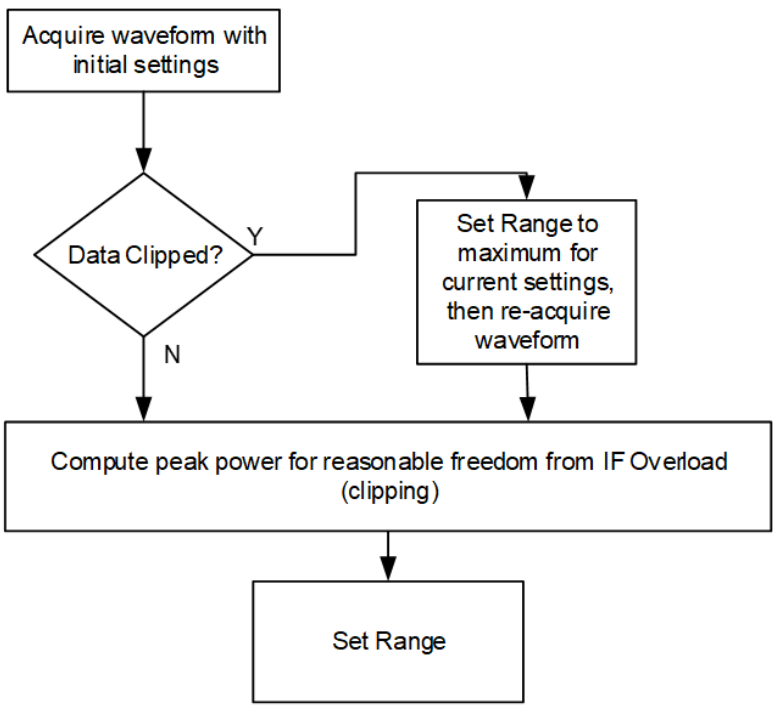
If this function is `ON`, it applies the adjustment described under Adjust Range For Min Clipping each time a measurement restarts. Therefore, in Continuous measurement mode, it only executes before the first measurement.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation OFF | ON | ELECtrical`

	| COMBined [:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation?
Notes	Because there is no attenuator control available in these models, the control displays only ON and OFF choices. However, for SCPI compatibility with other platforms, all three parameters (ELECtrical, COMBined, and ON) are honored and all are mapped to ELECtrical, so if any of these three parameters is sent, a subsequent query will return ELEC
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760
Preset	OFF for Swept SA measurement; ON for all other measurements that support **Pre-Adjust for Min Clipping**
State Saved	Saved in instrument state

Adjustment Algorithm

The algorithm for the adjustment is documented below:



Peak-to-Average Ratio

Used with "Range (Non-attenuator models)" on page 1864 to optimize the level control in the instrument. The value is the ratio, in dB, of the peak power to the average power of the signal to be measured. A ratio of 0 should be used for sinusoidal signals; for 802.11g OFDM signals use 9 dB.

All Applications (Modes) show the current value of Peak-to-Average ratio on the control. However, some applications do not permit changing the value. In these situations, the control is grayed-out.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:PARatio <real>` `[:SENSe]:POWer[:RF]:RANGe:PARatio?`
Example	`:POW:RANG:PAR 12 dB`
Notes	In some Applications (Modes) this parameter is read-only; meaning the value will appear on the control and query via SCPI, but is not changeable. In such applications the control is grayed-out. Attempting to change the value via SCPI will be ignored but no error message will be generated
Dependencies	This control does not appear in Spectrum Analyzer Mode
Preset	10 dB VXT Models M9410A/11A: 0 dB
State Saved	Saved in instrument state
Min	0 dB
Max	20 dB VXT Models M9410A/11A: 50 dB

Mixer Lvl Offset

This is an advanced setting to adjust target Range at the input mixer, which in turn affects the signal level in the instrument's IF. This setting can be used when additional optimization is needed after setting "Peak-to-Average Ratio" on page 1866. Positive values of offset optimize noise performance over distortion, negative values optimize distortion performance over noise.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet <real>` `[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet?`
Example	`:POW:RANG:MIX:OFFS -5 dB`
Preset	0 dB
State Saved	Saved in instrument state
Min	-35 dB VXT Models M9410A/11A: -34 dB
Max	30 dB

3.14.3.3 Signal Path

Contains controls that pertain to the routing of the signal through the frontend of the instrument.

In general, this tab only appears in instruments whose hardware supports this signal routing. For example, this tab does not appear in many of the modular instrument products, including VXT Models M9420/21A. It also does not appear in UXM.

This tab *does* appear in VXT Models M9410A/11A because the Software Preselection control is in this tab, and VXT Models M9410A/11A implement a version of Software Preselection.

Presel Center

Pressing this control adjusts the centering of the preselector filter to optimize the amplitude accuracy at the frequency of the selected marker. If the selected marker is not on when **Presel Center** is pressed, the instrument turns on the selected marker, performs a peak search, and then performs centering on the marker's center frequency. If the selected marker is already on and between the start and stop frequencies of the instrument, the instrument performs the preselector calibration on that marker's frequency. If the selected marker is already on, but outside the frequency range between Start Freq and Stop Freq, the instrument first performs a peak search, and then performs centering on the marker's center frequency.

The value displayed on "Preselector Adjust" on page 1869 will change to reflect the new preselector tuning.

A number of considerations should be observed to ensure proper operation. See "Proper Preselector Operation" on page 1768.

Remote Command	`[:SENSe]:POWer[:RF]:PCENter`
Example	`:POW:PCEN`
Notes	Note that the rules outlined above under the control description apply for the remote command as well as the key. The result of the command is dependent on marker position, etc. Any message shown by the control press is also shown in response to the remote command
Dependencies	Does not appear in CXA-m Does not appear in VXT Models M9410A/11A Grayed-out if the microwave preselector is off – If the selected marker's frequency is below Band 1, an advisory message is generated "Preselector not used in this frequency range" and no action is taken – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz – Blank in models that do not include a preselector, such as option 503. If the remote command is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View
Couplings	The active marker position determines where the centering will be attempted If the instrument is in a measurement such as averaging when centering is initiated, the act of centering the preselector restarts averaging, but the first average trace will not be taken until the centering is completed The offset applied to do the centering reads out on the "Preselector Adjust" on page 1869 control
Status Bits/OPC dependencies	When centering the preselector, `*OPC` will not return true until the process is complete and a subsequent measurement has completed, nor will results be returned to `:READ` or `:MEASure` queries

The Measuring bit should remain set while this command is operating and should not go false until the subsequent sweep/measurement has completed

Proper Preselector Operation

A number of considerations should be observed to ensure proper operation:

1 If the selected marker is off, the instrument turns on a marker, performs a peak search, and adjusts the preselector using the selected marker's frequency. It uses the "highest peak" peak search method unqualified by threshold or excursion, so that there is no chance of a 'no peak found' error. It continues with that peak, even if it is the peak of just noise. Therefore, for this operation to work properly, there should be a signal on screen in a preselected range for the peak search to find

2 If the selected marker is already on, the instrument attempts the centering at that marker's frequency. There is no preselector for signals below about 3.6 GHz, so if the marker is on a signal below 3.6 GHz, no centering will be attempted and an advisory message generated

3 In some models, the preselector can be bypassed. If it is bypassed, no centering will be attempted in that range and a message will be generated

Preselector Adjust

Allows you to manually adjust the preselector filter frequency to optimize its response to the signal of interest. This function is only available when "Presel Center" on page 1868is available.

For general purpose signal analysis, using **Presel Center** is recommended. Centering the filter minimizes the impact of long-term preselector drift. **Preselector Adjust** can be used instead to manually optimize the preselector. One application of manual optimization would be to peak the preselector response, which both optimizes the signal-to-noise ratio and minimizes amplitude variations due to small (short-term) preselector drifting.

When **Presel Center** is performed, the offset applied to do the centering becomes the new value of **Preselector Adjust**.

Remote Command	`[:SENSe]:POWer[:RF]:PADJust <freq>` `[:SENSe]:POWer[:RF]:PADJust?`
Example	`:POW:PADJ 100KHz` `:POW:PADJ?`
Notes	The value on the control reads out to 0.1 MHz resolution
Dependencies	– Does not appear in CXA-m

	– Does not appear in VXT Models M9410A/11A – Grayed-out if microwave preselector is off – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz – Blank in models that do not include a preselector, such as option 503. If the SCPI is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View
Preset	0 MHz
State Saved	The **Preselector Adjust** value set by "Presel Center" on page 1868, or by manually adjusting **Preselector Adjust** It is not saved in instrument state, and does not survive a Preset or power cycle
Min	-500 MHz
Max	500 MHz
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PADJust` `[:SENSe]:POWer[:RF]:MMW:PADJust`

Notes	PSA had multiple preselectors, and you could select which preselector to adjust. Since the X-Series has only one mm/uW preselector, the preselector selection control is no longer available. However, to provide backward compatibility, we accept the legacy remote commands The command form has no effect, the query always returns `MWAVe`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:PADJust:PRESelector MWAVe | MMWave | EXTernal` `[:SENSe]:POWer[:RF]:PADJust:PRESelector?`

Internal Preamp

Accesses a menu of controls for the internal preamps. Turning on the preamp gives a better noise figure, but a poorer inter-modulation distortion (TOI) to noise floor dynamic range. You can optimize this setting for your particular measurement.

The instrument takes the preamp gain into account as it sweeps. If you sweep outside of the range of the preamp, the instrument will also account for that. The displayed result always reflects the correct gain.

For some measurements, when the preamp is on and any part of the displayed frequency range is below the lowest frequency for which the preamp has specifications, a warning condition message appears in the status line. For example, for a preamp with a 9 kHz lowest specified frequency: "Preamp: Accy unspec'd below 9 kHz".

Selection	Example	Note
Off	:POW:GAIN OFF	
Low Band	:POW:GAIN ON :POW:GAIN:BAND LOW	Sets the internal preamp to use only the low band. The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Low Band selection in the dropdown
Full Range	:POW:GAIN ON :POW:GAIN:BAND FULL	Sets the internal preamp to use its full range. The low band (0-3.6 GHz, 0-3.4 GHz, 0-3GHz, depending on the model) is supplied by the low band preamp and the frequencies above low band are supplied by the high band preamp The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Full Range selection in the dropdown. If the high band option is not installed the Full Range selection does not appear

Remote Command	[:SENSe]:POWer[:RF]:GAIN:BAND LOW | FULL [:SENSe]:POWer[:RF]:GAIN:BAND? [:SENSe]:POWer[:RF]:GAIN[:STATe] OFF | ON | 0 | 1 [:SENSe]:POWer[:RF]:GAIN[:STATe]?
Example	:POW:GAIN:BAND LOW :POW:GAIN:BAND? :POW:GAIN OFF :POW:GAIN?
Dependencies	Preamp is not available on all hardware platforms. If the preamp is not present or is unlicensed, the control is not shown Does not appear in VXT Models M9410A/11A/15A If :POW:GAIN:BAND FULL is sent when a low band preamp is available, the preamp band parameter is set to LOW instead of FULL, and an "Option not installed" message is generated The preamp is not available when the electronic/soft attenuator is enabled
Preset	LOW OFF
State Saved	Saved in instrument state
Annotation	When the USB Preamp is not connected to USB, the Preamp annotation in the Meas Bar says “Off” if the preamp is off and displays the frequency range of the low band or full range preamp depending on the setting. For example, if the Preamp is set to Low Band and the Low Band is 3.6 GHz the annotation says “3.6 GHz”. If it is a 13.6 GHz preamp and it is set to Full Range the annotation says “13.6 GHz” When the USB Preamp is connected to USB, the Preamp annotation says “Preamp: USB” if the internal

	preamp is off or “Preamp: USB, Int” if the internal preamp is on (only for measurements that support the USB preamp)

LNA

Lets you turn the Low Noise Amplifier (**LNA**) on or off.

The LNA is an additional preamplifier that provides superior DANL and frequency range compared to the Internal Preamp. The LNA provides lower system noise figure, especially at frequencies above 100 MHz, and can be operated up to the full range of 50 GHz instruments.

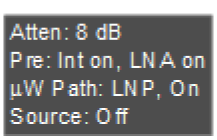
For best possible sensitivity, the LNA can be turned on together with the "Internal Preamp" on page 1870, although if you operate both preamps together, note that the TOI (distortion) specifications are impacted. The sensitivity improvement of this combination is substantial when operating in high band (frequencies above 3.6 GHz).

See "More Information" on page 1771

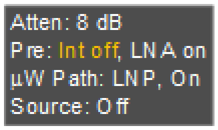
Remote Command	`[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe] OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe]?`
Example	`:POW:GAIN:LNA ON`
Dependencies	Requires option LNA Option LNA is not required by VXT model M9415A Does not appear in VXT models M9420A/21A/10A/11A May not appear in some measurements
Preset	`OFF`
State Saved	Saved in State

More Information

When the LNA is installed, the preamp annotation changes to show the state of both the LNA and the Internal Preamp. Below is an example:



Note that when operating entirely in the low band (below about 3.6 GHz), if the LNA is on, the Internal Preamp is switched off (even if you have its switch set to ON). This is because the noise performance is actually degraded in low band if both preamps are on. In this case, the annotation reflects the actual state of the two preamps, but the Internal Preamp annotation displays in amber, to warn you that the actual state of the Internal Preamp does not match the **Internal Preamp** switch control display:



µW Path Control

Options for this control include **µW Preselector Bypass** (Option MPB), **Low Noise Path** (Option LNP) and **Full Bypass Enable** in the High Band path circuits.

When the µW Preselector is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. When **Low Noise Path Enable** is selected, the instrument automatically bypasses certain circuitry in the high frequency bands that can contribute to noise, when it is appropriate based on other instrument settings.

For most applications, the preset state is **Standard Path**, which provides the best remote-control throughput, minimizes acoustic noise from switching and minimizes the risk of wear in the hardware switches, particularly in remote test scenarios where both low band and high band setups will follow in rapid succession. In this path, the bypass of the low band/high band switch and microwave preamp is never activated, which can cause some noise degradation but preserves the life of the bypass switch.

For applications that utilize the wideband IF paths, the preset state is **µW Preselector Bypas**s, if option MPB is present. This is because, when using a wideband IF such as the 140 MHz IF, the µW Preselector's bandwidth can be narrower than the available IF bandwidth, causing degraded amplitude flatness and phase linearity, so it is desirable to bypass the preselector in the default case.

You may choose **Low Noise Path Enable** for a lower noise floor, especially in the 21-26.5 GHz region, though without improving many measures of dynamic range, and without giving the best possible noise floor. The preamp, if purchased and used, gives better noise floor than does **Low Noise Path Enable**, but the preamp's compression threshold and third-order intercept are much poorer than that of **Low Noise Path Enable**.

A fourth choice is **Full Bypass Enable**, which combines **µW Preselector Bypass** and **Low Noise Path Enable**. Because this can bypass most of the circuitry between the input and the first mixer, care should be taken when using this setting to avoid damaging the mixer. **Full Bypass Enable** is only available if both options LNP and MPB are present, as well as option FBP.

Path	Example	Note
Standard Path	`:POW:MW:PATH STD`	Normal setting for most measurements. µW Preselector in circuit, Low Noise Path disabled
Low Noise Path Enable	`:POW:MW:PATH LNP`	See "Low Noise Path Enable" on page 1776
µW Preselector Bypass	`:POW:MW:PATH MPB`	See "µW Preselector Bypass" on page 1778
Full Bypass	`:POW:MW:PATH`	See "Full Bypass Enable" on page 1779

Path	Example	Note
Enable	FULL	

Remote Command	[:SENSe]:POWer[:RF]:MW:PATH STD | LNPath | MPBypass | FULL [:SENSe]:POWer[:RF]:MW:PATH?
Example	:POW:MW:PATH LNP Enables the Low Noise path :POW:MW:PATH?
Notes	If "Presel Center" on page 1868 is performed, the instrument will momentarily switch to the Standard Path, regardless of the setting of **µW Path Control** The DC Block will always be switched in when the low noise path is switched in, to protect succeeding circuitry from DC. Note that this does not mean "when the low noise path is enabled" but when, based on the Low Noise Path rules, the path is actually switched in. This can happen when the selection is **Low Noise Path Enable** or **Full Bypass Enable.** In the case where the DC Block is switched in the instrument is now AC coupled. However, if you selected DC coupling, the UI would still behave as though it were DC coupled, including all annunciation, warnings, status bits, and responses to SCPI queries. This is because, based on other settings, the instrument could switch out the low noise path at any time and hence go back to being DC coupled Alignment switching ignores the settings in this menu, and restores them when finished
Dependencies	Does not appear in CXA-m Does not appear in VXT Models M9410A/11A Does not appear in BBIQ and External Mixing The **Low Noise Path Enable** selection does not appear unless Option LNP is present and licensed The **µW Preselector Bypass** selection does not appear unless Option MPB is present and licensed The **Full Bypass Enable** selection does not appear unless options LNP and MPB are both present as well as option FBP In any of these cases, if the required options are not present and the SCPI command is sent, error -241, "Hardware missing; Option not installed" is generated **Low Noise Path Enable** and **Full Bypass Enable** are grayed-out if the current measurement does not support them **Low Noise Path Enable** and **Full Bypass Enable** are not supported in Avionics and MMR Modes. In any of these cases (that is, the feature is not supported in either measurement or mode), if the SCPI command is sent, the following error is generated: -221, "Setting Conflict; Feature not supported for this measurement"
Preset	All except modes specified below: STD IQ Analyzer, VXA, Pulse and Avionics mode: – MPB option present and licensed: MPB – MPB option not present and licensed: STD
State Saved	Save in instrument state
Range	Standard Path|Low Noise Path Enable|µW Presel Bypass|Full Bypass Enable
Annotation	In the Meas Bar, if the Standard path is chosen, it says:

µW Path: Standard

If Low Noise Path is enabled but the LNP switch is not thrown, it shows:

µW Path: LNP,Off

If the Low Noise Path is enabled and the LNP switch IS thrown, it shows:

µW Path: LNP,On

If the preselctor is bypassed, it says:

µW Path: Bypass

If Full Bypass Enable is selected but the LNP switch is not thrown, it shows:

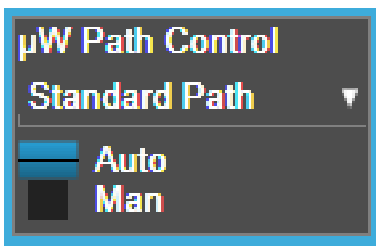
µW Path: FByp,Off

If Full Bypass Enable is selected and the LNP switch IS thrown, it shows:

µW Path: FByp,On

µW Path Control Auto [Mode: VMA, WLAN, NR5G, CQM]

In VMA, WLAN, 5G NR, CQM modes, an Auto/Man switch is added to **µW Path Control**:



This allows the function to automatically switch based on certain Auto Rules as shown below:

VMA Mode

Measurement	When µW Path Control is in Auto:
Digital Demod	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Custom OFDM	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Presel Bypass
SEM	Always Presel Bypass
Spurious Emissions	Always Standard Path

WLAN Mode

Measurement	When µW Path Control is in Auto:
Modulation Analysis	Always Presel Bypass
Spectral Flatness	Always Presel Bypasss
Power vs Time	Always Presel Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Always Presel Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Always Presel Bypass
SEM	1. For 11be 320M, when 'Enabled Wideband IF for FFT' is OFF or 'Sweep Type Rule' is Best Dynamic Range, auto µW path is standard. 2. For other cases, auto µW path is presel bypass if presel bypass is enabled, auto µW path is standard if presel bypass is not enabled.
Spurious Emissions	Always Standard Path

5G NR Mode

Measurement	When µW Path Control is in Auto:
Modulation Analysis	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and "Allow Full Bypass in Auto" is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and "Allow Full Bypass in Auto" is On), otherwise choose Preselector Bypass
Channel Power	Always Standard Path
Occupied BW	Always Standard Path
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Standard Path
SEM	Always Standard Path
Spurious Emissions	Always Standard Path
Transmit On|Off Power	Use Standard Path unless tuned frequency > 3.6 GHz and Info BW > 15 MHz, in which case choose Preselector Bypass

Channel Quality Mode

Measurement	When µW Path Control is in Auto:
Group Delay	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and

Measurement	When µW Path Control is in Auto:
	"Allow Full Bypass in Auto" is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass

Remote Command	`[:SENSe]:POWer[:RF]:MW:PATH:AUTO ON | OFF | 1 | 0` `[:SENSe]:POWer[:RF]:MW:PATH:AUTO?`
Example	`:POW:MW:PATH:AUTO ON` `:POW:MW:PATH:AUTO?`
Dependencies	Only appears in VMA, WLAN, 5G NR and CQM modes
Couplings	See the tables above
Preset	`ON`
Range	`ON|OFF`

Low Noise Path Enable

You may select **Low Noise Path Enable**, which gives a lower noise floor under some circumstances, particularly when operating in the 21–26.5 GHz region. With the Low Noise Path enabled, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

- The instrument is not in the Low Band, meaning:
- the start frequency is above 3.5 GHz and
- the stop frequency is above 3.6 GHz
- the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Low Noise Path Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Low Noise Path Enable** is selected in the user interface. The only time the Low Noise Path is used is when **Low Noise Path Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

For measurements that use IQ acquisition, the low noise path is used when **Center Frequency** is in High Band (> 3.6 GHz) and no preamp is in use. In other words, the rules above are modified to use only the center frequency to qualify which path to switch in. This is not the case for FFTs in the Swept SA measurement; they use the same rules as swept measurements.

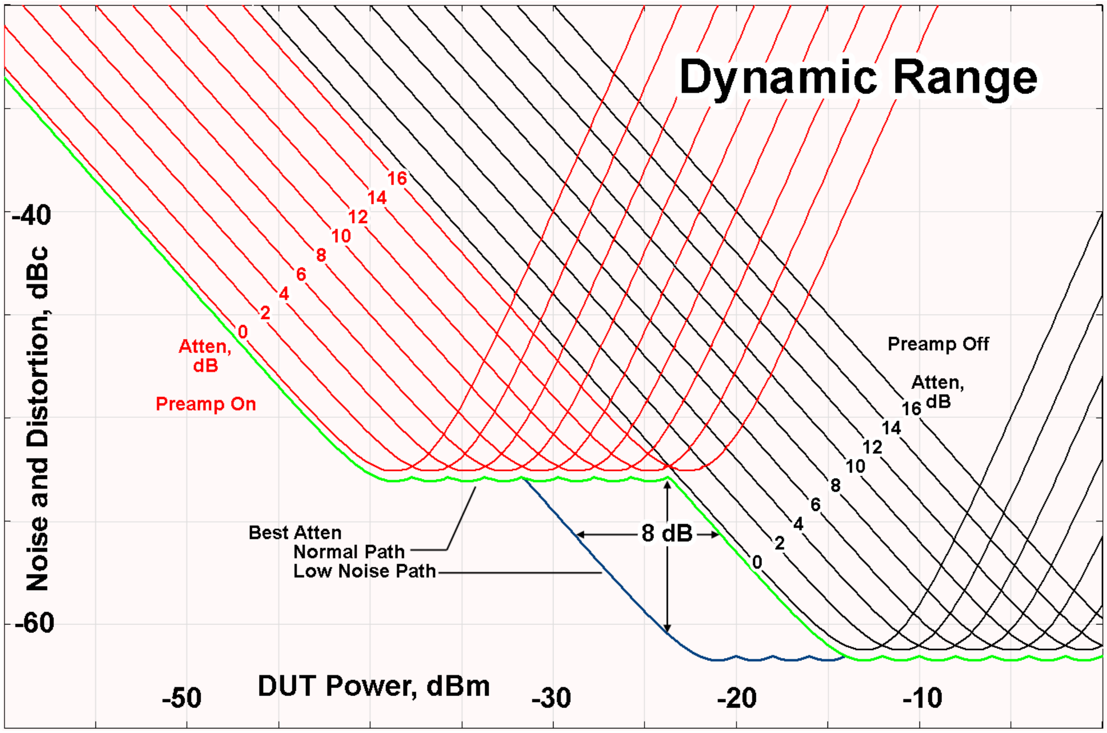
Note that the Low Noise Path, while giving improved DANL, has the disadvantage of decreased TOI performance and decreased gain compression performance relative to the standard path.

Note also that the bypass switch is a mechanical switch and has finite life, so if the **Low Noise Path Enable** is selected, it is possible to cause frequent cycling of this switch by frequently changing instrument settings such that the above conditions hold true only some of the time. A user making tests of this nature should consider opting for the **Standard Path**, which will never throw the bypass switch, at the expense of some degraded noise performance.

The low noise path is useful for situations where the signal level is so low that the instrument performance is dominated by noise even with 0 dB attenuation, but still high enough that the preamp option would have excessive third-order intermodulation or compression. The preamp, if purchased and used, gives better noise floor than does the “Low Noise Path.” However, its compression threshold and third-order intercept are much poorer than that of the non-preamp path.

There are some applications, typically for signals around –30 dBm, for which the third-order dynamic range of the standard path is good enough, but the noise floor is not low enough even with 0 dB input attenuation. When the third-order dynamic range of the preamp path is too little and the noise floor of the standard path is too high, the Low Noise Path can provide the best dynamic range

The graph below illustrates the concept. It shows, in red, the performance of an instrument at different attenuation settings, both with the preamp on and off, in a measurement that is affected by both instrument noise and instrument TOI. The green shows the best available dynamic range, offset by 0.5 dB for clarity. The blue shows how the best available dynamic range improves for moderate signal levels with the low noise path switched in. In this illustration, the preamp improves the noise floor by 15 dB while degrading the third-order intercept by 30 dB, and the low noise path reduces loss by 8 dB. The attenuator step size is 2 dB.



There are other times where selecting the low noise path improves performance, too. Compression-limited measurements such as finding the nulls in a pulsed-RF spectrum can profit from the low noise path in a way similar to the TOI-limited measurement illustrated. Accuracy can be improved when the low noise path allows the optimum attenuation to increase from a small amount like 0, 2 or 4 dB to a larger amount, giving better return loss at the instrument input. Harmonic measurements, such as second and third harmonic levels, are much improved using the low noise path because of the superiority of that path for harmonic (though not intermodulation) distortion performance.

µW Preselector Bypass

Toggles the preselector bypass switch for band 1 and higher. When the microwave presel is on, the signal path is preselected. When the microwave preselector is off, the signal path is not preselected. The preselected path is the normal path for the instrument.

The preselector is a tunable bandpass filter which prevents signals away from the frequency of interest from combining in the mixer to generate in-band spurious signals (images). The consequences of using a preselector filter are its limited bandwidth, the amplitude and phase ripple in its passband, and any amplitude and phase instability due to center frequency drift.

Option MPB or pre-selector bypass provides an unpreselected input mixer path for certain X-Series signal analyzers with frequency ranges above 3.6 GHz. This signal path allows a wider bandwidth and less amplitude variability, which is an advantage when doing modulation analysis and broadband signal analysis. The disadvantage is that, without the preselector, image signals will be displayed. Another disadvantage of bypassing the preselector is increased LO emission levels at the front panel input port.

Image responses are separated from the real signal by twice the 1st IF. For IF Paths of 10 MHz and 25 MHz, the 1st IF is 322.5 MHz, so the image response and the real signal will be separated by 645 MHz. The 1st IF will be different for other IF Path settings. When viewing a real signal and its corresponding image response in internal mixing, the image response will be to the left of the real signal.

Also, the image response and the real signal typically have the same amplitude and exhibit the same shape factor.

However, if Option FS1, Fast Sweep Capability, is enabled, the image response in the Swept SA measurement appears lower in amplitude and has a much wider shape factor compared to the real signal.

Full Bypass Enable

With **Full Bypass Enable** selected, the microwave preselector is bypassed. In addition, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

- The instrument is not in the Low Band, meaning:
- the start frequency is above 3.5 GHz and
- the stop frequency is above 3.6 GHz.
- the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. The only time the Low Noise Path is used is when **Full Bypass Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

CAUTION When **Full Bypass Enable** is selected, and "Attenuation" on page 1747 is set to 0 dB, there will be a direct AC connection between the input and the first converter when the Low Noise Path switches in (when Start Freq >3.6 GHz and the Preamp is either not licensed, set to Low Band, or Off). This puts the first converter at high risk to be damaged by high AC power. Consequently, whenever **Full Bypass Enable** is selected, a warning message appears in the status bar:

Full Bypass Enabled, maximum safe input power reduced

Microwave Preselector Bypass Backwards Compatibility

Example	`:POW:MW:PRES OFF` Bypasses the microwave preselector
Notes	Included for Microwave Preselector Bypass backwards compatibility The `ON` parameter sets the `STD` path (`:POW:MW:PATH STD`) The `OFF` parameter sets path `MPB` (`:POW:MW:PATH MPB`)
Preset	`ON`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe] ON | OFF | 0 | 1` `[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe]?`

Frequency Extender Preselection Bypass

Frequency Extender Preselection Bypass only applies to the high frequency path of the Frequency Extender and only if the Frequency Extender allows it. For example, the V3050A high frequency path is 50 – 110 GHz and does allow control of the preselector bypass.

When the Frequency Extender's preselection is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. For bandwidths greater than 2.5 [GHz], it is recommended that the signal bypass the Frequency Extender Preselector since the max bandwidth of the Preselector can be as narrow as 2.5 [GHz].

For most applications, the preset state is `OFF`, which gives the best remote-control throughput, minimizes acoustic noise from switching, minimizes out of band spurs, and minimizes the risk of wear in the hardware switches.

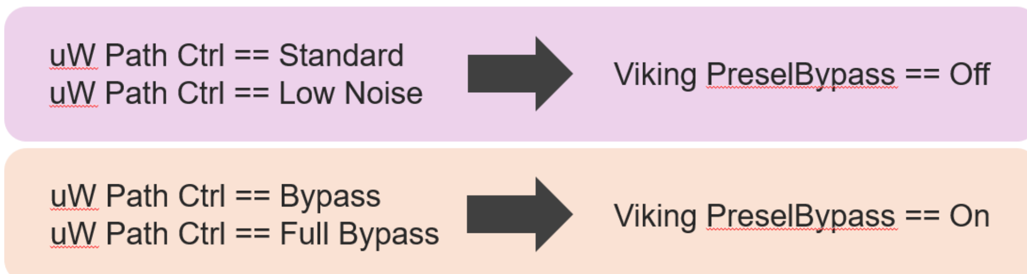
Coupling with Microwave Preselector Control

The control of whether to apply or bypass the Frequency Extender's preselection is dependent on the Microwave Path Control setting.

The coupling between the Microwave Path Control and Frequency Extender Preselector Bypass is described below.

UW PATH CTRL	UW PRESELECTOR	VIKING PRESELECTOR
Standard Path	On	**On**
Low Noise Path Enable	On	**On**
uW Presel Bypass	Off	**Off**
Full Bypass Enable	Off	**Off**

In other words…



For the Frequency Extender Preselector Bypass to take effect, it requires a Frequency Extender device (such as V3050A) be connected and External RF (ERFIN) selected as the input.

The Frequency Extender Preselector is applied or bypassed depending on the Microwave Path Control setting only when the acquisition is above 50 [GHz]. Hence, it will be bypassed only when the acquisition is above 50 [GHz].

Preselector and Bandwidth Conflict

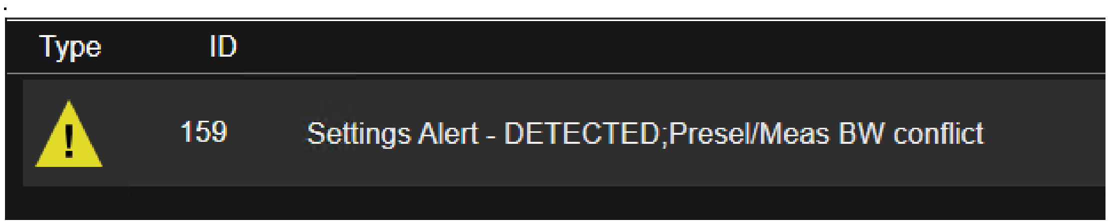
When the Frequency Extender Preselector is applied and the signal bandwidth is greater than 2.5 [GHz], then a settings alert message will show to warn the user that the signal may be distorted due to the limitation of the Frequency Extender Preselector bandwidth.

An example of the settings alert message is shown below.

Settings Alert message in the Status Bar at the bottom of the display.

Settings Alert message in the error queue

.



Software Preselection

Software Preselection is provided in some instruments, either to compensate for issues with provided hardware preselection or to provide the preselection function when there is no hardware preselector.

N9041B

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 50 GHz, software preselection must be used to suppress and separate images above 50 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

In the N9041B, Software Preselection only applies for frequencies above 50 GHz, therefore it is only used for RF Input 2. Even if it is turned on, it will not be used for other inputs and never for frequencies below 50 GHz. This is why the label of this control contains the parenthetical note “(>~50 GHz)”.

Note that in the N9041B, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

N9042B+V3050A

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 88 GHz, software preselection must be used to suppress and separate images above 88 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

For N9042B+V3050A, Software Preselection only applies for frequencies above 88 GHz, therefore it is only used for External RF. Even if it is turned on, it will not be used for other inputs and never for frequencies below 88 GHz. This is why the label of this control contains the parenthetical note “(>~88 GHz)”.

Note that for N9042B+V3050A, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

VXT models M9410A/11A

Software Preselection is used to provide the preselection function, as there is no hardware preselector in these models. Two background traces are taken and compared point by point, and the point with the lowest amplitude from the two traces is used. This provides a method to reduce spurs that are internally generated within the VXT, but the user should note the following when using Software

Preselection:

– There is some speed cost due to the need to take multiple captures

– Taking the point with the lowest amplitude in each trace will make the average noise level lower at all points that do not have a spur. This can reduce the accuracy of the measurement of noise and noise-like signals.

Because of the difficulty in identifying spurs manually, you are encouraged to leave Software Preselection ON at all times in VXT models M9410A/11A. If you turn it off in order to speed up your measurement or improve noise accuracy, be aware of unwanted onscreen spurs.

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel:STATe 0 | 1 | ON | OFF` `[:SENSe]:POWer[:RF]:SWPresel:STAT?`
Example	`:POW:SWPR:STAT 1` `:POW:SWPR:STAT?`
Dependencies	Only appears in N9041B, N9042B+V2050A, and VXT models M9410A/11A. Does not appear in all measurements
Couplings	Sweep Time is affected by SW Preselection. Also Auto Tune supports SW Preselection, so set SW Preselection state and then do Auto Tune
Preset	N9041B: OFF N9042B+V3050A: ON M9410A/11A: ON
State Saved	Saved in instrument state

SW Preselection Type

Specifies the algorithm used for software preselection.

Two hidden sweeps are taken in succession. The second sweep is offset in LO frequency by 2*IF/N. For each point in each trace, the smaller amplitude from the two traces is taken and placed in that point in the selected trace. The Peak detector is auto-selected to improve the image suppression effectiveness. Responses of each trace that lie on top of one another will remain and are valid signals. Other signals are images and are suppressed. The action of taking the smaller of the two traces will make the average noise level lower in all points that do not have an image, thus reducing the accuracy of the measurement of noise and noise-like signals.

– `NORMal` - mathematically removes all image and multiple responses of signals present at the input

– `ADVanced` - any trace processing (such as “max hold” or trace averaging) is performed on the points of both candidate traces before the “select minimum” operation occurs. This form of processing works better for non-stationary signals, such as pulsed-RF signals

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel NORMal | ADVanced` `[:SENSe]:POWer[:RF]:SWPResel?`
Example	`:POW:SWPR NORM` `:POW:SWPR?`
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed-out. Its grayout message is “Unavailable unless SW Presel enabled”
Preset	N9041B: `ADVanced` N9042B+V3050A: `NORMal`
State Saved	Saved in instrument state

SW Preselection BW

Specifies the effective bandwidth to be used for Software Preselection.

The choices are:

– `NORMal` – when making Swept measurements, a software preselection algorithm is used which takes up to 4 background acquisitions, then post-processes the result. This algorithm can remove images from signals with an occupied bandwidth up to around 3 GHz. (Default/Preset setting). When making FFT measurements, this algorithm is not used, instead the same algorithm is used as for `NARRow` (below)

– `NARRow`– a software preselection algorithm is used which takes two background acquisitions, then post-processes the result to detect and remove images from wideband signals with occupied bandwidths up to 2 GHz. This increases the risk of images failing to be rejected, but improves the measurement speed

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel:BW NORMal | NARRow` `[:SENSe]:POWer[:RF]:SWPResel:BW?`
Example	`:POW:SWPR:BW NARR`
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed out. Its grayout message is “Unavailable unless SW Presel enabled” For N9042B+V3050A the parameter is SCPI only and always set to `NARRow` when Software Preselection is enabled
Preset	N9041B: `NORMal` N9042B+V3050A: `NARRow`
State Saved	Saved in instrument state

High Freq Prefilter

Lets you set the state of Prefilter for Center Frequencies above 1310 MHz.

In VXT Models M9410A/11A, the Receiver RF path has a bank of filters that come after the RF Attenuator in the signal path. Since this bank of filters precedes the mixer they are known as the “Prefilter” bank. Their purpose is to eliminate unwanted in-band mixing products by filtering out all but the desired frequencies before the signals get to the mixer. There are 13 prefilter bands to cover the frequencies between 9 kHz and 6000 MHz. The Prefilter provides the necessary rejection of the unwanted signal.

Remote Command	`[:SENSe]:<measurement>:PFILter[:STATe] ON | OFF | 1 | 0` `[:SENSe]:<measurement>:PFILter[:STATe]?`

Example	For example, to enable High Freq Prefilter in IQ Analyzer Mode:
	For the Complex Spectrum Measurement:
	`:SPEC:PFIL ON`
	For the IQ Waveform Measurement:
	`:WAV:PFIL ON`
	`:`

Dependencies	This control only appears in VXT models M9410A/11A with center frequency above 1310 MHz
Preset	See “Prefilter Presets” below
State Saved	Saved in instrument state

Prefilter Presets

Meas	Mode	Preset
SPEC	BASIC	OFF
WAV	BASIC, WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
MON	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
RHO	WCDMA	OFF
CDP	WCDMA	OFF
PCON	WCDMA	OFF
EVMQ	WCDMA	OFF
CHP	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
OBW	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
ACP	WCDMA, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
SEM	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PST	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PVT	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF
EVM	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF

Meas	Mode	Preset
FLAT	WLAN	OFF
EVMM	WLAN	OFF
CEVM	LTEAFDD, LTEATDD	OFF
PAVT	5GNR, VMA	OFF
DDEM	VMA	OFF
OFDM	VMA	OFF
SAN	SA	ON
HARM	SA	ON

3.14.4 BW

BW is not supported in the C-WCDMA Measurement.

3.14.5 Display

The Display Menu lets you configure display items for the current Mode, Measurement View or Window.

3.14.5.1 Meas Display

The Meas Display tab contains controls for setting up the display for the current Measurement, View or Window.

Show All Items

Allows you to specify display settings of the Measurement List view. By default (OFF), the current status of enabled measurements, items are displayed.

Notes	No remote command, only menu control is available.
Preset	OFF
State Saved	Saved in instrument state.
Range	On|Off

Index

Allows you to specify an index of array for editing the value of specified index. This control appears only when a list type of SCPI is selected on Parameter List view. The maximum value of this index corresponds to the length of selected SCPI.

Value

Allows you to edit the value of selected SCPI on Parameter List view.

3.14.5.2 View

Contains controls for selecting the current **View**, and for editing User Views.

Views

Allows you to select the desired measurement view from the following selections:

- `MLISt` – "Measurement List" on page 1746
- `PARameter` – "Parameter List" on page 1747
- `RESult` - "Result Metrics" on page 1747

Remote Command	`:DISPlay:CWCDma:VIEW[:SELect] MLISt | PARameter | RESult` `:DISPlay:CWCDma:VIEW[:SELect]?`
Example	`:DISP:CWCD:VIEW RES` `:DISP:CWCD:VIEW?`
Preset	`RESult`
State Saved	Saved in instrument state
Range	Measurement List|Parameter List|Result Metrics

User View

Lets you choose a View from the saved User Views for the current measurement. This panel only appears if a User View exists for the current measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:SELect <alphanumeric>` `:DISPlay:VIEW:ADVanced:SELect?`

Example	Select Baseband as the current View `:DISP:VIEW:ADV:SEL "Baseband"`

Notes	You must be in the measurement whose View you are trying to set to send the command. You can only set Views for the current measurement using this command
	For predefined views, the parameter is derived from the view name that is shown in the View list in the user interface. For example, if you are trying to select the Trace Zoom view in the Swept SA measurement, you send:
	`:DISP:VIEW:ADV:SEL "Trace Zoom"`
	because "Trace Zoom" is the name of the View as seen in the Mode/Meas dialog or in the Display, View menu
	You *cannot* use the legacy View parameter (which in this case would be `TZOom`) with `:DISP:VIEW:ADV:SEL`
	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case. Thus, both of the following forms work:
	`:DISP:VIEW:ADV:SEL "Trace Zoom"`
	`:DISP:VIEW:ADV:SEL "TRACE ZOOM"`
	If the specified view is not a valid View, the query returns the error message "-224, Illegal parameter value; View with the name <alphanumeric> does not exist"
	If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Backwards Compatibility SCPI	The legacy node `:DISPlay:VIEW[:SELect]` is retained for backwards compatibility, but it only supports predefined views

Restore Layout to Default

Restores the Layout to the default for Basic.

Modified Views are very temporary; if you exit the current measurement they are discarded, and they are not saved in State. To retain this View for later use, and to be able to return easily to your original Basic View, you can save your edited View as a "User View".

Save Layout as New View

Saves your new View as a User View. An alpha keyboard appears, which lets you name your new View; the default is the old View name plus a number.

Remote Command	`:DISPlay:VIEW:ADVanced:NAME <alphanumeric>`
Example	`:DISP:VIEW:ADV:NAME "Baseband"` Creates a new View named `Baseband` from the current View, and selects it as the current View

Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If `<alphanumeric>` name already exists as a View, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; User View SCPI cannot be used while Display is disabled" is generated

Re-Save User View

You can re-edit a User View; if you make changes, then an asterisk will appear next to the User View's name. You can then tap **Re-Save User View** to save it back to its existing name, or **Save Layout as New View** to add another, new User View.

This is a front panel function only, there is no remote command available to perform this function. To do this remotely, you must first perform **Save Layout as New View**, then delete the old User View and rename the new one with the name of the View you just deleted.

Rename User View

You can rename the current View by giving it a new unique name. Only User Views can be renamed, if the current View is a Predefined View, an error occurs.

Remote Command	`:DISPlay:VIEW:ADVanced:REName <alphanumeric>`
Example	`:DISP:VIEW:ADV:REN "Baseband"`
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the `<alphanumeric>` specifying the new name is already present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot rename a Predefined View" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete User View

You can delete the current View if it is a User View. The default view becomes the current view for the Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:DELete`
Example	`:DISP:VIEW:ADV:DEL`
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case

	If the `<alphanumeric>` is not present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> does not exist" is generated If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot delete a Predefined View" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete All User Views

Deletes all previously saved User Views. The default view becomes the current view for the Measurement if a User View was the current view when this command was executed.

Remote Command	`:DISPlay:VIEW:ADVanced:DELete:ALL`
Example	`:DISP:VIEW:ADV:DEL:ALL`
Notes	Disabled if there are no User Views

View Editor Remote Commands

The following remote commands help you manage Views and User Views. Note that the SCPI node for User Views handles both Predefined and User Views. The legacy nodes, `:DISPlay:VIEW[:SELect]` and `:DISPlay:VIEW:NSEL`, are retained for backwards compatibility, but they only support predefined views.

View Listing Query

Returns a string containing a comma-separated list of names for *all* the Views, including User Views, available for the current Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:CATalog?`
Example	`:DISP:VIEW:ADV:CAT?`
Notes	Returns a quoted string of the available Views for the current measurement, separated by commas. The list includes names for *all* the Views, including User Views, available for the current Measurement Example: `"Normal,Trace Zoom,Spectrogram,Baseband,myView1,yourView1"` No distinction is made between Predefined and User Views If you switch measurements with the display disabled (via `:DISP:ENAB OFF`), then query the list of available Views, the result is undefined

User View Listing Query

Returns a string containing a comma-separated list of names for *only* the User Views available for the current Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:USER:CATalog?`
Example	`:DISP:VIEW:ADV:USER:CAT?`
Notes	Returns a quoted string of the available User Views for the current measurement, separated by commas. Example: `"Baseband,myView1,yourView1"` If you switch measurements with the display disabled (see "Display Enable (Remote Command Only)" on page 1894), then query the list of available Views, the result is undefined

3.14.5.3 Annotation

Contains controls for setting up the annotation for the current Mode or Measurement.

Graticule

Turns the display graticule On or Off for all windows with graticules in all measurements in the current Mode. Also turns the graticule Y-Axis annotation on and off.

Remote Command	`:DISPlay:GRATicule[:STATe] OFF | ON | 0 | 1` `:DISPlay:GRATicule[:STATe]?`
Example	`:DISP:GRAT OFF`
Notes	The graticule is the set of horizontal and vertical lines that make up the grid/divisions for the X-Axis and Y-Axis
Preset	`ON`
State Saved	Saved in instrument state

Backwards Compatibility SCPI	`:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe] OFF | ON | 0 | 1`
	`:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe]?`
	This command is accepted for backwards compatibility with older instruments, but the `WINDow`, `TRACe` and `GRID` parameters are ignored

Screen Annotation

Controls the display of the annunciation and annotation around the graticule, including any annotation on lines (such as the display line, the threshold line, etc.)

and the Y-Axis annotation, for all windows with screen annotation in all measurements in the current Mode.

This does *not* include marker annotation (or the N dB result). When OFF, the graticule expands to fill the entire graticule area, leaving only the 1.5% gap above the graticule, as described in the **Trace** section.

Remote Command	:DISPlay:ANNotation:SCReen[:STATe] OFF | ON | 0 | 1 :DISPlay:ANNotation:SCReen[:STATe]?
Example	:DISP:ANN:SCR OFF
Dependencies	Grayed-out and forced to OFF when **System Display Settings**, **Annotation** is OFF
Preset	ON This remains OFF through a Preset when **System Display Settings**, **Annotation** is set to OFF
State Saved	Saved in instrument state

Trace Annotation

Turns on and off the labels on the traces, showing their detector (or their Math Mode) as described in the **Trace** section, for all windows in all measurements in the current Mode for which Trace Annotation on/off is supported.

If Trace Math is being performed on a trace, then the Trace Math annotation replaces the detector annotation.

For measurements that support limit lines, this key also turns on and off the labels on the Limit Lines. The label is the Limit number annotation and Limit Comment displayed on the graph. If the length of the comment is greater than 20 characters, the first 8 characters and the last 8 characters are displayed, joined with ….

Remote Command	:DISPlay:ANNotation:TRACe[:STATe] ON | OFF | 1 | 0 :DISPlay:ANNotation:TRACe[:STATe]?
Example	:DISP:ANN:TRAC OFF
Preset	OFF
State Saved	Saved in instrument state

Control Annotation

Turns on and off the display of values on the Active Function controls for all measurements in the current Mode. This is a security feature.

Remote Command	:DISPlay:ACTivefunc[:STATe] ON | OFF | 1 | 0 :DISPlay:ACTivefunc[:STATe]?
Example	:DISP:ACT OFF
Dependencies	Grayed out and forced to OFF when **System Display Settings**, **Annotation** is OFF

Preset	ON This remains OFF through a Preset when **System Display Settings**, **Annotation** is set to OFF
State Saved	Saved in instrument state

Meas Bar

Turns the Measurement Bar at the top of the screen on and off for all measurements in the current Mode. When OFF, the graticule area expands to fill the area formerly occupied by the Measurement Bar.

Remote Command	`:DISPlay:ANNotation:MBAR[:STATe] OFF | ON | 0 | 1` `:DISPlay:ANNotation:MBAR[:STATe]?`
Example	`:DISP:ANN:MBAR OFF`
Dependencies	Grayed out and forced to OFF when **System Display Settings**, **Annotation** is OFF
Preset	ON This remains OFF through a Preset when **System Display Settings**, **Annotation** is set to OFF
State Saved	Saved in instrument state

Display Enable (Remote Command Only)

Turns the display on/off, including the display drive circuitry. The backlight stays lit to confirm that the instrument is on. The display enable setting is mode global. Theare three reasons for turning the display off:

1. To increase speed as much as possible by freeing the instrument from having to update the display
2. To reduce emissions from the display, drive circuitry
3. For security purposes

If you have turned off the display:

- and you are in local operation, the display can be turned back on by pressing any key or by sending `:SYSTem:DEFaults MISC` or `:DISPlay:ENABle ON` (neither `*RST` nor :SYSTem:PRESet enable the display)
- and you are in remote operation, the display can be turned back on by pressing the **Local** or **Esc** keys, or by sending `:SYSTem:DEFaults MISC` or `:DISPlay:ENABle ON` (neither `*RST` nor `:SYSTem:PRESet` enable the display)
- and you are using either the `:SYSTem:KLOCk` command or GPIB local lockout, then *no* front-panel key press will turn the display back on. You must turn it back on remotely.

If the display is OFF, many SCPI commands related to User Views and Multiscreen functionality do not work, and return the error messages “-221, Settings conflict;

Screen SCPI cannot be used when Display is disabled" or "221, Settings conflict; View SCPI cannot be used while Display is disabled". These commands include:

Name	Command
Select User View	:DISPlay:VIEW:ADVanced:SELect
Rename User View	:DISPlay:VIEW:ADVanced:REName
Delete User View	:DISPlay:VIEW:ADVanced:DELete
Create User View	:DISPlay:VIEW:ADVanced:NAME
Select Screen	:INSTrument:SCReen:SELect
Delete Screen	:INSTrument:SCReen:DELete
Delete All But This Screen	:INSTrument:SCReen:DELete:ALL
Add Screen	:INSTrument:SCReen:CREate
Rename Screen	:INSTrument:SCReen:REName
Sequencer On/Off	:SYSTem:SEQuencer

Remote Command	:DISPlay:ENABle OFF | ON | 0 | 1 :DISPlay:ENABle?
Example	:DISP:ENAB OFF
Couplings	:DISP:ENAB OFF turns Backlight OFF and :DISP:ENAB ON turns Backlight ON, but changing Backlight settings does *not* change the state of :DISP:ENAB
Preset	ON Set by :SYST:DEF MISC, but not affected by *RST or :SYSTem:PRESet
State Saved	Not saved in instrument state
Backwards Compatibility Notes	:SYST:PRES no longer turns on :DISPlay:ENABle as it did in legacy analyzers

3.14.6 Freq

The Freq key opens the Frequency menu, which contains controls that allow you to control the Frequency and Channel parameters of the instrument.

Some features in the Frequency menu are the same for all measurements in the current Mode – they do not change as you change measurements. Settings like these are called "Meas Global" and are unaffected by Meas Preset. For example, the Center Freq setting is the same for all measurements - it does not change as you change measurements.

3.14.6.1 Settings

The Settings Tab contains controls that pertain to the X axis parameters of the measurement. These parameters control how data on the vertical (X) axis is displayed and control instrument settings that affect the horizontal axis.

Center Frequency

Sets the frequency that corresponds to the horizontal center of the graticule. While adjusting the Center Frequency the Span is held constant.

The center frequency setting is the same for all measurements within a mode, that is, it is Meas Global. Some modes are also able to share a Mode Global center frequency value. If this is the case, the Mode will have a **Global** tab in its **Meas Setup** menu.

The **Center Freq** function sets (and queries) the Center Frequency for the currently selected input. If your analyzer has multiple inputs, and you select another input, the Center Freq changes to the value for that input. SCPI commands are available to directly set the Center Freq for a specific input.

Center Freq is remembered as you go from input to input. Thus you can set a Center Freq of 10 GHz with the RF Input selected, change to BBIQ and set a Center Freq of 20 MHz, then switch to External Mixing and set a Center Freq of 60 GHz, and when you go back to the RF Input the Center Freq will go back to 10 GHz; back to BBIQ and it is 20 MHz; back to External Mixing and it is 60 GHz.

See "RF Center Freq" on page 1797

See "Ext Mix Center Freq" on page 1798

See "I/Q Center Freq" on page 1799

See "Center Frequency Presets" on page 1796

Remote Command	`[:SENSe]:FREQuency:CENTer <freq>` `[:SENSe]:FREQuency:CENTer?`

Example	Sets the Center Frequency to 50 MHz
	`:FREQ:CENT 50 MHz`
	Increments the Center Frequency by the value of the CF Step
	`:FREQ:CENT UP`
	Returns the current value of the Center Frequency
	`:FREQ:CENT?`

Notes	This command sets the RF, External Mixing or I/Q Center Frequency depending on the selected input. For RF input it is equivalent to FREQ:RF:CENT For I/Q input it is equivalent to FREQ:IQ:CENT

	For External Mixer it is equivalent to FREQ:EMIX:CENT Preset and Max values are dependent on Hardware Options (5xx) If no terminator (e.g. MHz) is sent the terminator Hz is used. If a terminator with unit other than Frequency is used, an invalid suffix error message is generated.
Preset	Depends on instrument maximum frequency, mode, measurement, and selected input. See "Center Frequency Presets" on page 1796 and "RF Center Freq" on page 1797 and "Ext Mix Center Freq" on page 1798 and "I/Q Center Freq" on page 1799.
State Saved	Saved in instrument state
Min	Depends on instrument maximum frequency, mode, measurement, and selected input. See "Center Frequency Presets" on page 1796 and "RF Center Freq" on page 1797 and "Ext Mix Center Freq" on page 1798 and "I/Q Center Freq" on page 1799.
Max	Depends on instrument maximum frequency, mode, measurement, and selected input.. See "Center Frequency Presets" on page 1796 and "RF Center Freq" on page 1797 and "Ext Mix Center Freq" on page 1798 and "I/Q Center Freq" on page 1799.
Status Bits/OPC Dependencies	Non-overlapped

Center Frequency Presets

The following table provides the Center Frequency Presets for the Spectrum Analyzer mode, and the Max Freq, for the various frequency options:

Freq Option	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
503 (all but CXA)	1.805 GHz	3.6 GHz	3.7 GHz
503 (CXA)	1.505 GHz	3.0 GHz	3.08 GHz
507 (all but CXA)	3.505 GHz	7.0 GHz	7.1 GHz
507 (CXA)	3.755 GHz	7.5 GHz	7.58 GHz
508 (all but MXE)	1.805 GHz	3.6 GHz	8.5 GHz
508 (MXE)	4.205 GHz	8.4 GHz	8.5 GHz
513	6.805 GHz	13.6 GHz	13.8 GHz
526 (all but CXA and MXE)	13.255 GHz	26.5 GHz	27.0 GHz*
526	13.255 GHz	26.5 GHz	26.55 GHz

(CXA)			
526	1.805 GHz	3.6 GHz	27.0 GHz
(MXE)			
532	16.005 GHz	32.0 GHz	32.5 GHz
543	21.505 GHz	43.0 GHz	43.0 GHz
544	22.005 GHz	44.0 GHz	44.5 GHz
550	25.005 GHz	50.0 GHz	52 GHz

*For option 526, the Max CF in RTSA is 26.999999995 GHz.

Input 2:

Model	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
CXA opt C75	0.7505 GHz	1.5 GHz	1.58 GHz
MXE	505 MHz	1 GHz	1.000025 GHz

Tracking Generator Frequency Limits (CXA only):

Tracking Generator Option	Min Freq (clips to this freq when turn TG on and can't tune below while TG on)	If above this Freq, Stop Freq clipped to this Freq when TG turned on	Max Freq (can't tune above) while TG on
T03	9 kHz	3.0 GHz	3.08 GHz
T06	9 kHz	6.0 GHz	6.05 GHz

RF Center Freq

SCPI command for specifying the RF Center Frequency. This command will set the Center Frequency to be used when the RF input is selected, even if the RF input is not the input that is selected at the time the command is sent. Note that the Center Freq function in the Frequency menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:RF:CENTer <freq>` `[:SENSe]:FREQuency:RF:CENTer?`
Example	`:FREQ:RF:CENT 30 MHz` `:FREQ:RF:CENT?`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode.

Dependencies	If the electronic/soft attenuator is enabled, any attempt to set Center Frequency such that the Stop Frequency would be >3.6 GHz fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning.
Preset	See table above
State Saved	Saved in instrument state.
Min	-79.999995 MHz
Max	See table above. Basically instrument maximum frequency - 5 Hz.

Ext Mix Center Freq

SCPI command for specifying the External Mixer Center Frequency. This command will set the Center Frequency to be used when the External Mixer is selected, even if the External Mixer input is not the input which is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:EMIXer:CENTer <freq>` `[:SENSe]:FREQuency:EMIXer:CENTer?`
Example	`:FREQ:EMIX:CENT 60 GHz` `:FREQ:EMIX:CENT?`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode.
Couplings	When returning to External Mixing after having been switched to one of the other inputs (e.g., RF), you will come back into the settings that you had when you left External Mixing. So you will come back to the band you were in with the Center Frequency that you had. However, Span is not an input-dependent parameter, therefore you will bring the span over from the other input. Therefore, the analyzer comes back with the span from the previous input, limited as necessary by the current mixer setup.
Preset	When a Mode Preset is performed while in External Mixing, the Start frequency of the current Mode is set to the nominal Min Freq of the lowest harmonic range in the Harmonic Table for the current mixer setup. Similarly, the Stop frequency of the current Mode is set to the nominal Max Freq of the highest harmonic range in the Harmonic Table. The Center Freq thus presets to the point arithmetically equidistant from these two frequencies. NOTE: If the current measurement has a limited Span available to it, and cannot achieve the Span shown in the table (Span=Stop Freq – Start Freq), the analyzer uses the maximum Span the measurement allows, and still sets the Center Freq to the midpoint of the Start and Stop Freq values in the Harmonic Table. When Restore Input/Output Defaults is performed, the mixer presets to the 11970A, whose Start and Stop frequencies are 26.5 and 40 GHz respectively. The center of these two frequencies is 33.25 GHz. Therefore, after a Restore Input/Output Defaults, if you go into External Mixing and do a Mode Preset while in the Spectrum Analyzer Mode, the resulting Center Freq is 33.25 GHz.
State Saved	Saved in instrument state.

Min	The minimum frequency in the currently selected mixer band + 5 Hz
Max	The maximum frequency in the currently selected mixer band - 5 Hz

I/Q Center Freq

SCPI command for specifying the I/Q Center Frequency. This command will set the Center Frequency to be used when the I/Q input is selected, even if the I/Q input is not the input which is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:IQ:CENTer <freq>` `[:SENSe]:FREQuency:IQ:CENTer?`
Example	`:FREQ:IQ:CENT 30 MHz`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode.
Preset	0 Hz
State Saved	Saved in instrument state.
Min	-40.049995 MHz
Max	40.049995 MHz

CF Step

Changes the step size for the center frequency and start and stop frequency functions. Once a step size has been selected and the center frequency function is active, the step keys (and the UP|DOWN parameters for Center Frequency from remote commands) change the center frequency by the step-size value. The step size function is useful for finding harmonics and sidebands beyond the current frequency span of the analyzer.

Note that the start and stop frequencies also step by the CF Step value.

Remote Command	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement] <freq>`
	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement]?`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO?`

Example	`:FREQ:CENT:STEP 500 MHz`
	Increases the current center frequency value by 500 MHz
	`:FREQ:CENT UP`

	:FREQ:CENT:STEP?
	:FREQ:CENT:STEP:AUTO ON
	:FREQ:CENT:STEP:AUTO?
Notes	Preset and Max values are depending on Hardware Options (503, 507, 508, 513, 526)
Notes	Preset and Max values are dependent on Hardware Options (5xx)
Dependencies	Span, RBW, Center frequency If the electronic/soft attenuator is enabled, any attempt to change the value of the center frequency >3.6 GHz by pressing the Up-arrow key, fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning.
Couplings	When auto-coupled in a non-zero span, the center frequency step size is set to 10% of the span. When auto-coupled in zero span, the center frequency step size is set to the equivalent -3 dB RBW value.
Preset	Auto
State Saved	Saved in instrument state
Min	– (the maximum frequency of the instrument). That is, 27 GHz max freq instrument has a CF step range of +/- 27 GHz. Note that this is the maximum frequency given the current settings of the instrument, so in External Mixing, for example, it is the maximum frequency of the current mixer band.
Max	The maximum frequency of the instrument. That is, 27 GHz max freq instrument has a CF step range of +/- 27 GHz. Note that this is the maximum frequency given the current settings of the instrument, so in External Mixing, for example, it is the maximum frequency of the current mixer band.
Status Bits/OPC dependencies	non-overlapped

3.14.7 Marker

Marker is not supported in the C-WCDMA Measurement.

3.14.8 Meas Setup

The Meas Setup menu panel contains functions for setting up the measurement parameters.

3.14.8.1 Radio

The Radio tab contains controls to select the Radio Device, and enable or disable HSPA/HSPA+ options.

Radio Device

Allows you to specify the device to be used.

Remote Command	`[:SENSe]:RADio:STANdard:DEVice BTS | MS` `[:SENSe]:RADio:STANdard:DEVice?`
Example	`:RAD:STAN:DEV MS` `:RAD:STAN:DEV?`
Preset	BTS
State Saved	Saved in instrument state.
Range	BTS | MS
Backwards Compatibility SCPI	`[:SENSe]:RADio:DEVice`

HSPA Enable

Allows you to turn on or off the HSDPA/HSUPA option enable. This selection is necessary because some of the auto detection functions that expect an HSPA signal are less tolerant when the signal is noisy or distorted. When the HSPA signal is not expected, turn HSPA Enable off.

Remote Command	`[:SENSe]:RADio:CONFigure:HSDPa[:STATe] 0 | 1 | OFF | ON` `[:SENSe]:RADio:CONFigure:HSDPa[:STATe]?`
Example	`:RAD:CONF:HSDP 0` `:RAD:CONF:HSDP?`
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

HSPA+ Enable

Allows you to turn on or off the HSPA+ option enable. This selection is necessary because some of the auto detection functions that expect an HSPA+ signal are less tolerant when the signal is noisy or distorted. When the HSPA+ signal is not expected, turn HSPA+ Enable off.

Remote Command	`[:SENSe]:RADio:CONFigure:EHSPa[:STATe] OFF | ON | 0 | 1` `[:SENSe]:RADio:CONFigure:EHSPa[:STATe]?`
Example	`:RAD:CONF:EHSP 0` `:RAD:CONF:EHSP?`
Notes	When HSPA enable is OFF, HSPA+ function is disabled too.

Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

3.14.8.2 Global

The controls in this menu apply to all Modes in the instrument.

Some controls (e.g., Global center Freq) allow you to switch certain Meas Global parameters to a Mode Global state. These switches apply to all Modes that support global settings. For example, no matter what Mode you are in when you set the “Global Center Frequency” switch to on, it applies to all Modes that support Global Settings.

Other controls (e.g., Extend Low Band) are actually set in this menu but apply to all Modes.

Global Center Freq

The software maintains a Mode Global value called “Global Center Freq”.

When the **Global Center Freq** control is switched to **On** in any mode, the current mode’s center frequency is copied into the Global Center Frequency, and from then on all modes that support global settings use the Global Center Frequency. So you can switch between any of these modes and the Center Freq will remain unchanged.

Adjusting the Center Freq of any mode which supports Global Settings, while **Global Center Freq** is **On**, will modify the Global Center Frequency.

When **Global Center Freq** is turned **Off**, the Center Freq of the current mode is unchanged, but now the Center Freq of each mode is once again independent.

When **Mode Preset** is pressed while **Global Center Freq** is **On**, the Global Center Freq is preset to the preset Center Freq of the current mode.

This function is reset to Off when the Restore Defaults control is pressed in the Global Settings menu, or when **System**, **Restore Defaults**, **All Modes** is pressed.

Remote Command	`:INSTrument:COUPle:FREQuency:CENTer ALL | NONE` `:INSTrument:COUPle:FREQuency:CENTer?`
Example	`:INST:COUP:FREQ:CENT ALL` `:INST:COUP:FREQ:CENT?`
Preset	Set to Off on Global Settings, Restore Defaults and System, Restore Defaults, All Modes
Range	On|Off

Remote Command	`:GLOBal:FREQuency:CENTer[:STATe] 1 | 0 | ON | OFF` `:GLOBal:FREQuency:CENTer[:STATe]?`
Preset	Off

Extend Low Band

The software maintains a Mode Global value called “Extend Low Band.”

Under the current sweep configuration crossing over two bands, when Extend Low Band is turned on, the analyzer checks whether one band can cover the whole sweep frequency range or not. If it's true, the analyzer locks the band; otherwise, does nothing (the band crossover occurs).

This function doesn’t work when Band Lock under [System]-[Service]-[Lock Functions] is not -1 (no band lock). In that case, Band Lock takes priority of Extend Low Band.

This function is reset to Off when the Restore Defaults control is pressed in the Global Settings menu, or when **System**, **Restore Defaults**, **All Modes** is pressed.

This parameter is available for SA, RTSA, WCDMA, WIMAX OFDMA, LTEAFDD, LTEATDD modes.

Remote Command	`:INSTrument:COUPle:FREQuency:BAND:EXTend 0 | 1 | ON | OFF` `:INSTrument:COUPle:FREQuency:BAND:EXTend?`
Example	`:INST:COUP:FREQ:BAND:EXT 1` `:INST:COUP:FREQ:BAND:EXT?`
Dependencies	Only applies to UXA, PXA, MXA and EXA.
Preset	Set to Off by pressing Global Settings > Restore Defaults and System > Restore Defaults > All Modes
Range	On|Off

Restore Defaults

This control resets all of the functions in the Global Settings menu to Off. This also occurs when **System**, **Restore Defaults**, **All Modes** is pressed.

Remote Command	`:INSTrument:COUPle:DEFault`
Example	`:INST:COUP:DEF`
Backwards Compatibility SCPI	`:GLOBal:DEFault`

3.14.8.3 Avg Number (Remote Command Only)

Sets the number of data acquisitions that are averaged. After the specified number of average counts is reached, the averaging mode (termination control) setting determines the averaging action.

Remote Command	`[:SENSe]:CWCDma:AVERage:COUNt <integer>`
	`[:SENSe]:CWCDma:AVERage:COUNt?`
	`[:SENSe]:CWCDma:AVERage[:STATe] OFF | ON | 0 | 1`
	`[:SENSe]:CWCDma:AVERage[:STATe]?`

Example	`:CWCD:AVER:COUN 100`
	`:CWCD:AVER:COUN?`
	`:CWCD:AVER OFF`
	`:CWCD:AVER?`

Preset	10
State Saved	Saved in instrument state.
Min/Max	1/10000

3.14.8.4 Avg Mode (Remote Command Only)

Selects the type of termination control used for the averaging function. This determines the averaging action after the specified number of data acquisitions (average count) is reached. You can select between the Exp (exponential) and Repeat averaging modes. This selection only affects the averaging result after the number of N averages is reached. You can use the Avg Number to set N.

SCPI	Mode
EXPonential	When Measure is set at Cont, data acquisitions continue indefinitely. After N averages, exponential averaging is used with a weighting factor of N (the displayed average count stops at N). Exponential averaging weights new data more than old data, which allows tracking of slow-changing signals.
REPeat	When Measure is set at Cont, data acquisitions continue indefinitely. After N averages is reached, all previous result data is cleared and the average count is set back to 1. This is equivalent to being in Measure Single and pressing the Restart key when the Single measurement finishes.

Remote Command	`[:SENSe]:CWCDma:AVERage:TCONtrol EXPonential | REPeat` `[:SENSe]:CWCDma:AVERage:TCONtrol?`

Example	:CWCD:AVER:TCON EXP :CWCD:AVER:TCON?
Preset	REPeat
State Saved	Saved in instrument state.

3.14.8.5 RRC Filter Control (Remote Command Only)

Specifies the alpha value of the Root Raised Cosine (RRC) filter and changes its status (ON/OFF). This ON/OFF state change requires a measurement restart.

Remote Command	[:SENSe]:CWCDma:FILTer[:RRC]:ALPHa <real> [:SENSe]:CWCDma:FILTer[:RRC]:ALPHa? [:SENSe]:CWCDma:FILTer[:RRC][:STATe] OFF | ON | 0 | 1 [:SENSe]:CWCDma:FILTer[:RRC][:STATe]?
Example	:CWCD:FILT:ALPH 0.3 :CWCD:FILT:ALPH? :CWCD:FILT ON :CWCD:FILT?
Preset	0.22
State Saved	Saved in instrument state.
Min/Max	0.01/0.50

3.14.8.6 IF Gain (Remote Command Only)

Enables you to control an internally switched IF amplifier with approximately 10 dB of gain. Using this amplifier allows you to take full advantage of the RF dynamic range of the analyzer. When the amplifier can be turned on without an overload, the dynamic range is always better when the amplifier is set to On, than when it is set to Off. The **IF Gain** can be used to set the IF Gain function to Auto, On (additional 10 dB), or Off. These settings affect sensitivity and IF overloads.

Remote Command	[:SENSe]:CWCDma:IF:GAIN[:STATe] ON | OFF | 1 | 0 [:SENSe]:CWCDma:IF:GAIN[:STATe]? [:SENSe]:CWCDma:IF:GAIN:AUTO[:STATe] OFF | ON | 0 | 1 [:SENSe]:CWCDma:IF:GAIN:AUTO[:STATe]?
Example	:CWCD:IF:GAIN OFF :CWCD:IF:GAIN?

	`:CWCD:IF:GAIN:AUTO OFF` `:CWCD:IF:GAIN:AUTO?`
Notes	ON = high gain OFF = low gain
Dependencies	This SCPI command is not supported in VXT, M9393A, M9391A or UXM
Preset	OFF
State Saved	Saved in instrument state.

3.14.8.7 Capture Setup

There is currently only one command in this group:

"Step Capture Interval (Remote Command Only)" on page 1806

Step Capture Interval (Remote Command Only)

Sets capture time of a step.

Remote Command	`[:SENSe]:CWCDma:CAPTure[:TIME] <time>` `[:SENSe]:CWCDma:CAPTure[:TIME]?`
Example	`:CWCD:CAPT 5ms` `:CWCD:CAPT?`
Notes	The following condition must be met for all enabled measurements: (Calculation Length) + (Calculation Offset) <= (Step Capture Interval) Any value lower than (Calculation Length) + (Calculation Offset) is clipped to (Calculation Length) + (Calculation Offset). When Calculation Length or Calculation Offset is increased, this parameter is adjusted only if the condition is not met.
Preset	5ms
State Saved	Saved in instrument state.
Min/Max	9.10230e-05/0.1

3.14.8.8 Gate Setup

Gate settings determine the timing to start capture of second and later steps. In this case, Gate functionality is a trigger feature. Trigger and common gate settings are used for gate settings except in source and recovery time.

Gate Source (Remote Command Only)

Sets gate source type. If set to IMMediate, the next capture starts immediately after the gate recovery time is elapsed. If not, capture starts after gate condition to be met after gate recovery time is elapsed.

Remote Command	`[:SENSe]:CWCDma:GATE:SOURce IMMediate | EXTernal1 | EXTernal2 | RFBurst | FRAMe` `[:SENSe]:CWCDma:GATE:SOURce?`
Example	`:CWCD:GATE:SOUR RFB` `:CWCD:GATE:SOUR?`
Preset	IMMediate
State Saved	Saved in instrument state.
Range	Immediate|Video|External1|External2|RF Burst|Frame

Gate Recovery Time (Remote Command Only)

Sets gate recovery time. After frequency hopping, it is necessary to wait for waveform stabilization.

Remote Command	`[:SENSe]:CWCDma:GATE:RTIMe <time>` `[:SENSe]:CWCDma:GATE:RTIMe?`
Example	`:CWCD:GATE:RTIM 500e-6` `:CWCD:GATE:RTIM?`
Preset	1 ms
State Saved	Saved in instrument state.
Min/Max	1 us/10 ms

3.14.8.9 Frequency List Setup

"Frequency List (Remote Command Only)" on page 1807

"State List (Remote Command Only)" on page 1808

Frequency List (Remote Command Only)

Sets list of frequencies to be measured.

Remote	`[:SENSe]:CWCDma:LIST:FREQuency <freq>, …`

Command	`[:SENSe]:CWCDma:LIST:FREQuency?`
Example	`:CWCD:LIST:FREQ 900e6, 1.0e9, 1.1e9, 0, 0, 0, 0, 0, 0, 0, 0, 0` `:CWCD:LIST:FREQ?`
Notes	The length of returned list is fixed at 12, but a shorter list is acceptable. If the number of received items is less than 12, unsent values are not changed. The Center Frequency setting under Freq/Channel front panel key or [:SENSe]:FREQuency:CENTer overwrites the first frequency in this list. CAUTION: When list acquisition is performed, the maximum frequency is 3.6GHz even if all frequencies in the list are the same. When only the first list is used (see [:SENSe]:CWCDma:LIST:STATe), there is no limitation.
Preset	1.0e9, 1.0e9, 1.0e9, 1.0e9, 1.0e9, 1.0e9, 1.0e9, 1.0e9, 1.0e9, 1.0e9, 1.0e9, 1.0e9
State Saved	Saved in instrument state.
Min/Max	-79.999995 MHz/Hardware Dependent: Same as Center Frequency

State List (Remote Command Only)

Sets list of states. If the state of the element is false, the element is skipped.

Remote Command	`[:SENSe]:CWCDma:LIST:STATe ON | OFF | 1 | 0, …` `[:SENSe]:CWCDma:LIST:STATe?`
Example	`:CWCD:LIST:STAT 1,1,0,0,0,0,0,0,0,0,0,0` `:CWCD:LIST:STAT?`
Notes	The length of the returned list is fixed at 12, but a shorter list is acceptable. If the number of received items is less than 12, unsent values are not changed. The first element is fixed at ON.
Preset	1,0,0,0,0,0,0,0,0,0,0,0
State Saved	Saved in instrument state.

3.14.8.10 Rho Related Setting Commands

The following commands and settings relate to the measurement of Modulation Accuracy (Rho):

– "Measurement Enable/Disable (Remote Command Only)" on page 1809

– "Rho Calculation Length (Remote Command Only)" on page 1810

– "Rho Calculation Offset (Remote Command Only)" on page 1810

Measurement Enable/Disable (Remote Command Only)

Allows you to enable or disable the Rho measurement. Note that the Rho measurement and the QPSK EVM measurement cannot be enabled at the same time

Remote Command	`[:SENSe]:CWCDma:RHO[:ENABle] OFF | ON | 0 | 1` `[:SENSe]:CWCDma:RHO[:ENABle]?`

Example	:CWCD:RHO OFF :CWCD:RHO?
Couplings	Enabling the Rho measurement disables the QPSK EVM measurement if it is enabled.
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

Rho Calculation Length (Remote Command Only)

Sets the calculation length of the Rho measurement.

Remote Command	[:SENSe]:CWCDma:RHO:SWEep:LENGth <time> [:SENSe]:CWCDma:RHO:SWEep:LENGth?
Example	:CWCD:RHO:SWE:LENG 5ms :CWCD:RHO:SWE:LENG?
Preset	3.383334ms
State Saved	Saved in instrument state.
Min/Max	3.383334ms/22.716667ms

Rho Calculation Offset (Remote Command Only)

Sets the calculation offset of a Rho measurement. The accuracy of the first part of a step can be affected by measurement frequency hopping. Specified length of the first portion is discarded if non-zero value is set.

Remote Command	[:SENSe]:CWCDma:RHO:SWEep:OFFSet <time> [:SENSe]:CWCDma:RHO:SWEep:OFFSet?
Example	:CWCD:RHO:SWE:OFFS 100us :CWCD:RHO:SWE:OFFS?
Preset	0.0
State Saved	Saved in instrument state.
Min/Max	0.0/18.838866ms

Rho Result Selection (Remote Command Only)

Sets the composition of Rho result block in scalar results. If an item is disabled (off), the item is not shown and is not contained in remote results.

The number and the order of this list correspond to Rho result block in remote result (n = 1).

Remote Command	`[:SENSe]:CWCDma:RHO:RESult ON | OFF | 0 | 1, …` `[:SENSe]:CWCDma:RHO:RESult?`
Example	`:CWCD:RHO:RES 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0` `:CWCD:RHO:RES?`
Preset	1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,0,0
State Saved	Saved in instrument state.

Sync Type

Enables you to select the synchronization channel for use. The available functionality depends on the current setting of **Radio Device** (BTS or MS). See:

"Sync Type (Remote Command Only)" on page 1811

"Sync Type (Remote Command Only)" on page 1813

Sync Type (Remote Command Only)

Enables you to select the channel to synchronize with, and to set features, such as Symbol Rate, that may affect synchronization. You can select from the following types of channels and features listed in the menu:

- CPICH - Synchronize with the common pilot channel (CPICH).
- SCH - Synchronize with the synchronization channel (SCH).
- Symbol Based - Allows you to access the menu that allows you to select the code symbol to synchronize with.
- Symbol Rate - Allows you to set the symbol rate, ranging from 7.5 to 960 ksps. The parameter automatically sets the maximum value for Code Number when appropriate.
- Code Number - Allows you to set the code number. The range is 0 to 511, depending on the Symbol Rate setting.

- Antenna-2 CPICH - Allows you to synchronize with the STTD Antenna-2 common pilot channel.
- STTD Diff - Allows you to synchronize to the common pilot channel at STTD antenna-1 and antenna-2 to make Diversity Time Error measurements.
- TSTD SCH Antenna1 – Allows you to synchronize the antenna1 of TSTD SCH.
- TSTD SCH Antenna2 – Allows you to synchronize the antenna2 of TSTD SCH.

Remote Command	`[:SENSe]:CWCDma:RHO:SYNC[:BTS] CPICh | SCH | SYMBol | STTD | A2CPich | A1SCh | A2SCh` `[:SENSe]:CWCDma:RHO:SYNC[:BTS]?`
Example	`:CWCD:RHO:SYNC SCH` `:CWCD:RHO:SYNC?`
Notes	This command is effective when [:SENSe]:RADio:DEVice is set to BTS.
Couplings	The SYMBol selection is synchronized to the code symbol specified by [:SENSe]:CWCD:RHO:SYNC:SYMBol:SRATe and [:SENSe]:CWCD:RHO:SYNC:SYMBol:SPRead.
Preset	CPICh
State Saved	Saved in instrument state.

Synchronization Symbol Rate (Remote Command Only)

Sets the symbol rate of the code symbol to synchronize with. The parameter automatically sets the maximum value for the Code Number when appropriate.

This command is currently available only for BTS.

Remote Command	`[:SENSe]:CWCDma:RHO:SYNC:SYMBol:SRATe <integer>` `[:SENSe]:CWCDma:RHO:SYNC:SYMBol:SRATe?`
Example	`:CWCD:RHO:SYNC:SYMB:SRAT 15000` `:CWCD:RHO:SYNC:SYMB:SRAT?`
Notes	This command is effective when [:SENSe]:RADio:DEVice is set to BTS, and [:SENSe]:CWCD:RHO:SYNC[:BTS] is set to SYMBol.
Preset	7500
State Saved	Saved in instrument state.
Range	7500|15000|30000|60000|120000|240000|480000|960000

Synchronization Code Number (Remote Command Only)

Sets the spread code number of the code symbol to synchronize with. The range depends on the Symbol Rate setting.

This command is available only for BTS.

Remote Command	`[:SENSe]:CWCDma:RHO:SYNC:SYMBol:SPRead <integer>` `[:SENSe]:CWCDma:RHO:SYNC:SYMBol:SPRead?`
Example	`:CWCD:RHO:SYNC:SYMB:SPR 3` `:CWCD:RHO:SYNC:SYMB:SPR?`
Notes	This command is effective when [:SENSe]:RADio:DEVice is set to BTS, and [:SENSe]:CWCDma:RHO:SYNC[:BTS] is set to SYMBol.
Preset	1
State Saved	Saved in instrument state.
Min/Max	0/Dependant on Synchronization Symbol Rate 511, when [:SENSe]:CWCDma:RHO:SYNC:SYMBol:SRATe =7500 255, when [:SENSe]:CWCDma:RHO:SYNC:SYMBol:SRATe =15000 127, when [:SENSe]:CWCDma:RHO:SYNC:SYMBol:SRATe =30000 63, when [:SENSe]:CWCDma:RHO:SYNC:SYMBol:SRATe =60000 31, when [:SENSe]:CWCDma:RHO:SYNC:SYMBol:SRATe =120000 15, when [:SENSe]:CWCDma:RHO:SYNC:SYMBol:SRATe =240000 7, when [:SENSe]:CWCDma:RHO:SYNC:SYMBol:SRATe =480000 3, when [:SENSe]:CWCDma:RHO:SYNC:SYMBol:SRATe =960000

Sync Type (Remote Command Only)

Accesses a menu that allows you to select the channel to synchronize with. You can select from the following types listed in the menu:

- **DPCCh** - Synchronize to DPCCH and the Slot Format which is specified by [:SENSe]:CWCDma:RHO:SFORmat:MS
- **PMESsage** - Synchronize to PRACH Message and the Slot Format which is specified by [:SENSe]:CWCDma:RHO:PRACh:SIGNature and [:SENSe]:CWCDma:RHO:SFORmat:MS.

Remote Command	`[:SENSe]:CWCDma:RHO:SYNC:MS DPCCh | PMESsage` `[:SENSe]:CWCDma:RHO:SYNC:MS?`
Example	`:CWCD:RHO:SYNC:MS DPCC` `:CWCD:RHO:SYNC:MS?`

Notes	This command is effective when [:SENSe]:RADio:DEVice is set to MS.
Preset	DPCCh
State Saved	Saved in instrument state.

Primary Scramble Code (Remote Command Only)

Set the BTS primary scramble code for synchronization. The BTS scramble code number (Down Link) is determined by the “Primary Scramble Code”, “Scramble Code Offset” and “Scramble Code Type”.

The following information is an excerpt from TS25.213 Section 5.2.2 Scramble Code.

A total of 2^{18}-1 = 262,143 scrambling codes, numbered 0…262,142 can be generated. However, not all the scrambling codes are used. The scrambling codes are divided into 512 sets, each consisting of a primary scrambling code and 15 secondary scrambling codes.

The primary scrambling codes consist of scrambling codes n = 16*i where i = 0…511. The i:th set of secondary scrambling codes consists of scrambling codes 16*i + k, where k = 1…15.

There is a one-to-one mapping between each primary scrambling code and the 15 secondary scrambling codes in a set such that i:th primary scrambling code corresponds to i:th set of secondary scrambling codes.

Hence, according to the above, scrambling codes k = 0, 1, …, 8191 are used. Each of these codes is associated with a left alternative scrambling code and a right alternative scrambling code that may be used for compressed frames. The left alternative scrambling code corresponding to scrambling code k is scrambling code number k + 8192, while the right alternative scrambling code corresponding to scrambling code k is scrambling code number k + 16384. The alternative scrambling codes can be used for compressed frames. In this case, the left alternative scrambling code is used if n < SF/2, and the right alternative scrambling code is used if n ³ SF/2, where $c_{ch,SF,n}$ is the channelization code used for non-compressed frames. The usage of an alternative scrambling code for compressed frames is signalled by higher layers for each physical channel respectively.

The Primary Scramble Code corresponds to i (i = 0 … 511), the Scramble Code Offset corresponds to k (k = 1 … 15: Secondary Scramble Code, 0: Primary Scramble Code) and Scramble Code Type Left and Right correspond to +8192 and +16384 offsets respectively.

If the Device is set to BTS, you can enter a numeric value for the primary scramble code. The range is 0 to 511.

If the Device is set to MS, the label of this parameter changes to **Slot Format** to define the DPCCH pilot pattern to synchronize with. You can enter either 0 or 2 slot formats.

Remote Command	[:SENSe]:CWCDma:RHO:SYNC:SCRamble[:BTS] <integer> [:SENSe]:CWCDma:RHO:SYNC:SCRamble[:BTS]?
Example	:CWCD:RHO:SYNC:SCR 100 :CWCD:RHO:SYNC:SCR?
Notes	This command is effective when [:SENSe]:RADio:DEVice is set to BTS.
Preset	0
State Saved	Saved in instrument state.
Min/Max	0/511

Slot Format (Remote Command Only)

Defines the uplink DPCCH pilot pattern to synchronize with. The command is effective when the **Sync Type** ([:SENSe]:CWCDma:RHO:SYNC:MS command: see "Sync Type (Remote Command Only)" on page 1813) is set to DPCCh.

Slot formats 0A, 0B, 2A, 2B, 5A and 5B (as specified in Table 2 of Section 5.2.1 of TS25.211 V.3.9.0) are not supported, because the compressed mode is not supported.

Remote Command	[:SENSe]:CWCDma:RHO:SFORmat:MS SF0 | SF1 | SF2 | SF3 | SF4 | SF5 [:SENSe]:CWCDma:RHO:SFORmat:MS?
Example	:CWCD:RHO:SFOR:MS SF0 :CWCD:RHO:SFOR:MS?
Notes	This command is effective when [:SENSe]:RADio:DEVice is set to MS, and [:SENSe]:CWCDma:RHO:SYNC:MS is set to DPCCh.
Preset	SF0
State Saved	Saved in instrument state.
Range	SF0|SF1|SF2|SF3|SF4|SF5

Table 2:

Preamble Signature (Remote Command Only)

Sets the PRACH Preamble Signature number for PRACH Message detection. Based on this value, the code allocation of the PRACH message control part is calculated. This command is effective when the **Sync Type** ([:SENSe]:CWCDma:RHO:SYNC:MS command: see "Sync Type (Remote Command Only)" on page 1813) is set to PMESsage (PRACH Message).

PRACH message (Control) has only Slot Format #0. The field lengths are defined in the table below. Demod attribute information is colored according to the given Slot Format parameter. Using input parameter Slot Format #i, bit data is colored accordingly (for example, N_{pilot} and N_{TFCI}).

PRACH message Control field Information (TS25.211 V.3.9.0, Section 5.2.2.1.3)

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Frame	Bits/ Slot	N_{pilot}	N_{TFCI}
0	15	15	256	150	10	8	2

Available settings are Auto (ON) or Man (Manual: OFF).

When Auto (ON) is selected, the instrument searches and synchronizes the PRACH Message control part automatically. The code for the control part is assigned according to the PRACH Preamble Signature number. It can find the code number for the control part from 16 possible cases, but requires more time than manual setting. "---" is shown initially.

When Man (OFF) is selected, the instrument synchronizes with the code specified by the Preamble Signature.

The value is set at its auto number and "---" is replaced with the detected number, if PRACH Search is set to Auto and PRACH Message sync is completed successfully (PRACH Message control part is detected). Otherwise the value is not changed.

NOTE: This function does not check the Preamble Signature itself. Instead, using this information, it identifies the code location for the PRACH Message control part. The relationship between "Preamble Signature" and "code location for PRACH Message control part" is a one-to-one correspondence.

Remote Command	`[:SENSe]:CWCDma:RHO:PRACh:SIGNature <integer>`
	`[:SENSe]:CWCDma:RHO:PRACh:SIGNature?`
	`[:SENSe]:CWCDma:RHO:PRACh:SIGNature:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:CWCDma:RHO:PRACh:SIGNature:AUTO?`

Example	`:CWCD:RHO:PRAC:SIGN 3`
	`:CWCD:RHO:PRAC:SIGN?`
	`:CWCD:RHO:PRAC:SIGN:AUTO OFF`
	`:CWCD:RHO:PRAC:SIGN:AUTO?`

Notes	This command is effective when [:SENSe]:RADio:DEVice is set to MS, and [:SENSe]:CWCDma:RHO:SYNC:MS is set to PMESsage. Set Signature Auto mode ON for PRACH Preamble detection.

Preset	0
State Saved	Saved in instrument state.
Min/Max	0/15

Scramble Code Offset (Remote Command Only)

Sets the number of scramble code offsets needed to make the modulation accuracy measurement.

Remote Command	`[:SENSe]:CWCDma:RHO:SYNC:SCRamble[:BTS]:OFFSet <integer>` `[:SENSe]:CWCDma:RHO:SYNC:SCRamble[:BTS]:OFFSet?`
Example	`:CWCD:RHO:SYNC:SCR:OFFS 5` `:CWCD:RHO:SYNC:SCR:OFFS?`
Notes	This command is effective when [:SENSe]:RADio:DEVice is set to BTS.
Preset	0
State Saved	Saved in instrument state.
Range	0 to 15 (0 for the primary scramble code; 1 to 15 for the secondary scramble code)
Min/Max	0/15

Scramble Code (Remote Command Only)

Set the MS scramble code for synchronization.

Remote Command	`[:SENSe]:CWCDma:RHO:SYNC:SCRamble:MS <integer>` `[:SENSe]:CWCDma:RHO:SYNC:SCRamble:MS?`
Example	`:CWCD:RHO:SYNC:SCR:MS 10000000` `:CWCD:RHO:SYNC:SCR:MS?`
Notes	This command is effective when [:SENSe]:RADio:DEVice is set to MS.
Preset	0 (0x0
State Saved	Saved in instrument state.
Range	0 to 16777215 (0x0 to 0xFFFFFF; 24 bits)
Min/Max	0/16777215

Scramble Code Type (Remote Command Only)

Sets the BTS primary scramble code type for synchronization.

Enables you to set the scramble code type to either Std (standard), Left, or Right to make the modulation accuracy measurement.

- LEFT – the left alternative scrambling code, whose value is the primary scramble code number + 8192, is used.
- RIGHt – the right alternative scrambling code, whose value is the primary scrambling code number + 16384, is used.
- STANdard – the standard scrambling code, whose value is the primary scrambling code number, is used.

Remote Command	`[:SENSe]:CWCDma:RHO:SYNC:SCRamble[:BTS]:TYPE LEFT | RIGHt | STANdard` `[:SENSe]:CWCDma:RHO:SYNC:SCRamble[:BTS]:TYPE?`
Example	`:CWCD:RHO:SYNC:SCR:TYPE LEFT`
Notes	This command is effective when [:SENSe]:RADio:DEVice is set to BTS.
Preset	STANdard
State Saved	Saved in instrument state.

Symbol Boundary (Remote Command Only)

The symbol boundary detection modes are used to make the modulation accuracy measurement.

Auto Detect

- AUTO - Sets symbol boundary detection to the automatic mode. Various code channels are measured and the most appropriate code channel is selected as the reference channel.

Test Model 1

The following selections of DPCH channel numbers are available for making the Mod Accuracy Measurement.

- TM1D16 - Select this to set the Mod Accuracy Measurement to the Test Model 1 with 16 DPCH channels and 1 S-CCPCH channel.
- TM1D32 - Select this to set the Mod Accuracy Measurement to Test Model 1 with 32 DPCH channels and 1 S-CCPCH channel.

– TM1D64 - Select this to set the Mod Accuracy Measurement to Test Model 1 with 64 DPCH channels and 1 S-CCPCH channel.

3GPP TS25.141 Table 6.1: Test Model 1 (2002-09 version) (S-CCPCH included)

Type	Number of Channels	Fraction of Power (%)	Level setting (dB)	Channelization Code	Timing offset (x256T_{chip})
P-CCPCH+SCH	1	10	-10	1	0
Primary CPICH	1	10	-10	0	0
PICH	1	1.6	-18	16	120
S-CCPCH containing PCH (SF=256)	1	1.6	-18	3	0
DPCH (SF=128)	16/32/64	76.8 in total	see 3GPP TS25.141 Table 6.2	see 3GPP TS25.141 Table 6.2	see 3GPP TS25.141 Table 6.2

Test Model 2

– TM2SC - Select this to set the Mod Accuracy Measurement to Test Model 2 with 1 S-CCPCH channel.

3GPP TS25.141 Table 6.3: Test Model 2 (2002-09 version) (S-CCPCH included)

Type	Number of Channels	Fraction of Power (%)	Level setting (dB)	Channelization Code	Timing offset (x256T_{chip})
P-CCPCH+SCH	1	10	-10	1	0
Primary CPICH	1	10	-10	0	0
PICH	1	5	-13	16	120
S-CCPCH containing PCH (SF=256)	1	5	-13	3	0
DPCH (SF=128)	3	2 x 10,1 x 50	2 x –10, 1 x –3	24, 72, 120	1, 7, 2

Test Model 3

- TM3D16SC - Select this to set the Mod Accuracy Measurement to Test Model 3 with 16 DPCH channels and 1 S-CCPCH channel.
- TM3D32SC - Select this to set the Mod Accuracy Measurement to Test Model 3 with 32 DPCH channels and 1 S-CCPCH channel.

3GPP TS25.141 Table 6.4: Test Model 3 (2002-09 version)

Type	Number of Channels	Fraction of Power (%) 16/32	Level settings (dB) 16/32	Channelization Code	Timing offset ($x256T_{chip}$)
P-CCPCH+SCH	1	12,6/7,9	-9 / -11	1	0
Primary CPICH	1	12,6/7,9	-9 / -11	0	0
PICH	1	5/1.6	-13/-18	16	120
S-CCPCH containing PCH (SF=256)	1	5/1.6	-13/-18	3	0
DPCH (SF=256)	16/32	63,7/80,4 in total	see 3GPP TS25.141 Table 6.5	see 3GPP TS25.141 Table 6.5	see 3GPP TS25.141 Table 6.5

Test Model 4

- TM4CP - Select this to set the Mod Accuracy Measurement to Test Model 4 with 1 CPICH channel.
- TM4 - Select this to set the Mod Accuracy Measurement to Test Model 4 (no CPICH channel).

3GPP TS25.141, Table 6.6: Test Model 4 Active Channels (2001-09 version)

Type	Number of Channels	Fraction of Power (%)	Level setting (dB)	Channelization Code	Timing offset
PCCPCH+SCH	1	50 to 1.6	-3 to -18	1	0
Primary CPICH1	1	10	-10	0	0

Note 1: The CPICH channel is optional.

Test Model 5

– TM5H2 - Select this to set the Mod Accuracy Measurement to Test Model 5 with 2 HS-PDSCH channels and 6 DPCH channels.

– TM5H4 - Select this to set the Mod Accuracy Measurement to Test Model 5 with 4 HS-PDSCH channels and 14 DPCH channels.

– TM5H8 - Select this to set the Mod Accuracy Measurement to Test Model 5 with 8 HS-PDSCH channels and 30 DPCH channels.

3GPP TS25.141 Table 6.6A: Test Model 5 Active Channels (2009-12 version)

Type	Number of Channels	Fraction of Power (%)	Level setting (dB)	Channelization Code	Timing offset (x256Tchip)
P-CCPCH+SCH	1	7.9	-11	1	0
Primary CPICH	1	7.9	-11	0	0
PICH	1	1.3	-19	16	120
S-CCPCH containing PCH (SF=256)	1	1.3	-19	3	0
DPCH (SF=128)	30/14/6/4*	14/14.2/14.4/14.2 in total	See 3GPP TS25.141 table 6.6.B	See 3GPP TS25.141 table 6.6B	See 3GPP TS25.141 table 6.6.B
HS-SCCH	2	4 in total	See 3GPP TS25.141 table 6.6C	See 3GPP TS25.141 table 6.6C	See 3GPP TS25.141 table 6.6C
HS-PDSCH (16QAM)	8/4/2*	63.6/63.4/63.2 in total	See 3GPP TS25.141 table 6.6D	See 3GPP TS25.141 table 6.6D	See 3GPP TS25.141 table 6.6D

Table Note *: 2 HS-PDSCH shall be taken together with 6 DPCH, 4 HS-PDSCH shall be taken with 14 DPCH or (for Home BS only) 4 DPCH, and 8 HS-PDSCH shall be taken together with 30 DPCH.

Custom

CUSTom – “Custom” choice provides a flexible way to specify predefined active channels. By choosing it, you can specify a customized list of active channels using the following remote command: Initialize List, Append List and Replace List.

The following commands handle the list of custom active channel list for BTS:

– INIT – Cleans up (clears) all channel entries. Then stores given parameter to the 1st channel entry. See "Initialize List (Remote Command Only)" on page 1823.

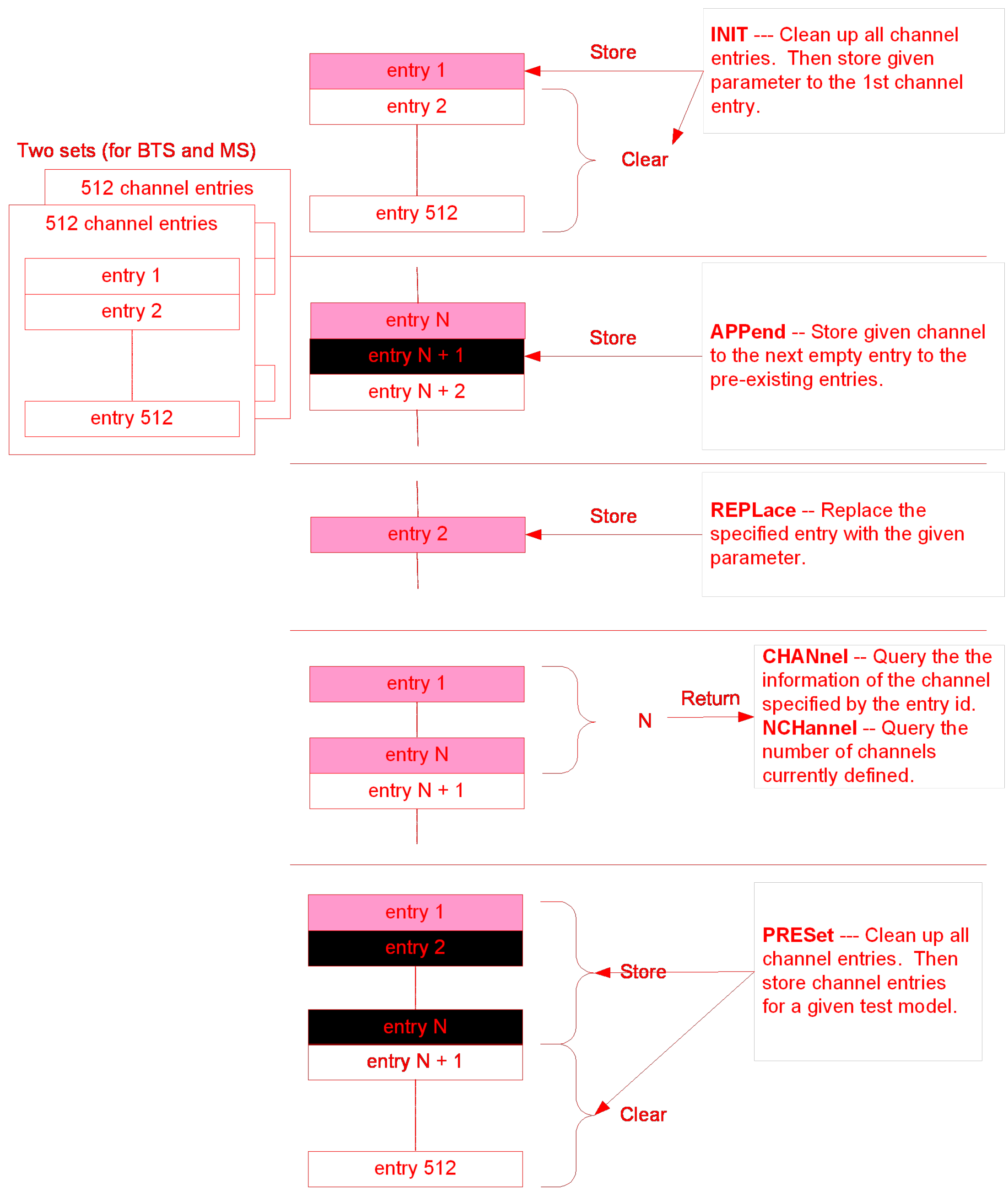
– APPend – Stores the given channel to the next empty entry to the pre-existing entries. See "Append List (Remote Command Only)" on page 1825.

– REPLace - Replaces the specified entry with the given parameter. See "Replace List (Remote Command Only)" on page 1828.

– CHANnel – Queries the information of the channel specified by the entry id. See "Query List (Remote Command Only)" on page 1830.

– NCHannel - Queries the number of channels currently defined. See "Number of entries (Remote Query Only)" on page 1832.

– PRESet – Cleans up (clears) all channel entries. Then stores channel entries for a given test model. See "Load Preset Setting (Remote Command Only)" on page 1832.



Initialize List (Remote Command Only)

Initializes the current custom active channel list. This creates a new entry with the specified parameters.

1st parameter:

<symbol_rate>	Specifies symbol rate of the channel.

2nd parameter:

<code_num>	Specifies code number of the channel.

3rd parameter:

QPSK	Specifies the channel's modulation scheme is QPSK.
QAM16	Specifies the channel's modulation scheme is QAM16. This choice is available only for channels with a symbol rate of 240000.

Remote Command	`[:SENSe]:CWCDma:RHO:SBOundary:LIST[:BTS]:INIT <symbol_rate>, <code_num>, QPSK | QAM16`

Example	To predefine the following channels:
	- CPICH (C8(0))
	- P-CCPCH (C8(1))
	- S-CCPCH(C8(3))
	- PICH(C8(16))
	- HS-DPCCH (C4(15)) 16QAM modulated
	Send the following sequence:
	`CWCD:RHO:SBO:LIST:BTS:INIT 15000, 0, QPSK`
	`CWCD:RHO:SBO:LIST:BTS:APP 15000,1, QPSK`
	`CWCD:RHO:SBO:LIST:BTS:APP 15000,3, QPSK`
	`CWCD:RHO:SBO:LIST:BTS:APP 15000,16, QPSK`
	`CWCD:RHO:SBO:LIST:BTS:APP 240000, 15, QAM16`
	`CWCD:RHO:SBO:LIST:NCH:BTS?`
	5
	`CWCD:RHO:SBO:LIST:BTS:CHAN? 1`
	`15000,0, QPSK`
	`CWCD:RHO:SBO:LIST:BTS:CHAN? 2`
	`15000,1, QPSK`
	`CWCD:RHO:SBO:LIST:BTS:CHAN? 3`
	`15000,3, QPSK`
	`CWCD:RHO:SBO:LIST:BTS:CHAN? 4`
	`15000,16, QPSK`
	`CWCD:RHO:SBO:LIST:BTS:CHAN? 5`
	`240000,15, QAM16`

Notes	(1) This command is effective when [:SENSe]:RADio:DEVice is set to BTS and [:SENSe]:CWCDma:RHO:SBOundary[:BTS] is set to CUSTom.

	(2) QAM16 for the 4th parameter is available only if HSDPA/HSUPA Enable is On Error messages associated with this parameter: One of the following error messages is logged if the given parameter is invalid. If an error is reported, the SCPI command is rejected and the instrument's settings do not change. (1) "Missing Parameter" This error is reported if the number of parameters is less than 3. For example, :SENSe:CWCDma:RHO:SBOundary:LIST:BTS:INIT, 15000, 0 <- 3rd parameter is missing. (2) "Illegal parameter value" This error is reported if parameter type is invalid or if enum value is invalid For example, :SENSe:CWCDma:RHO:SBOundary:LIST:BTS:INIT, 15000, ON, QPSK <- 2nd parameter must be integer :SENSe:CWCDma:RHO:SBOundary:LIST:BTS:INIT 15001, 8, QPSK <- 1st parameter value (Symbol Rate) is not allowed Only the values given in the Range field are valid for the Symbol Rate. You may specify these in numeric form, but they are interpreted as an enumeration and the error results if the value does not translate to one in the list (3) "Data out of range" This error is reported if parameter value is out of range For example, :SENSe:CWCDma:RHO:SBOundary:LIST:BTS:INIT 15000, 256, QPSK <- 2nd parameter is out of range (4) "Setting Conflict" This error is reported if the given code channel overlaps another code channel in modulation accuracy For example, if a user sends the following two commands, the second command causes the error message because C7(0) overlaps C8(0) :SENSe:CWCDma:RHO:SBOundary:LIST:BTS:INIT 15000, 0, QPSK <- OK :SENSe:CWCDma:RHO:SBOundary:LIST:BTS:APPend 30000, 0, QPSK <- C7(0) overlaps C8(0)
State Saved	Saved in instrument state
Range	symbol_rate = 7500 | 15000 | 30000 | 60000 | 120000 | 240000 | 480000 | 960000 0<= code_num <= 511 if symbol_rate = 7500 0<= code_num <= 255 if symbol_rate = 15000 0<= code_num <= 127 if symbol_rate = 30000 0<= code_num <= 63 if symbol_rate = 60000 0<= code_num <= 31 if symbol_rate = 120000 0<= code_num <= 15 if symbol_rate = 240000 0<= code_num <= 7 if symbol_rate = 480000 0<= code_num <= 3 if symbol_rate = 960000 QAM16 for the 3rd parameter is available only for channels with a symbol rate of 240000. For other channels, specify QPSK

Append List (Remote Command Only)

Appends the entry on the list of custom active channel list for BTS.

1st parameter:

<symbol_rate>	Specifies symbol rate of the channel

2nd parameter:

<code_num>	Specifies code number of the channel

3rd parameter:

QPSK	Specifies the channel's modulation scheme is QPSK
QAM16	Specifies the channel's modulation scheme is QAM16 This choice is available only for channels with a symbol rate of 240000

Remote Command	`[:SENSe]:CWCDma:RHO:SBOundary:LIST[:BTS]:APPend <symbol_rate>, <code_num>, QPSK | QAM16`

Example	To predefine the following channels:
	- CPICH (C8(0))
	- P-CCPCH (C8(1))
	- S-CCPCH(C8(3))
	- PICH(C8(16))
	- HS-DPCCH (C4(15)) 16QAM modulated
	Send the following sequence:
	`CWCD:RHO:SBO:LIST:BTS:INIT 15000, 0, QPSK`
	`CWCD:RHO:SBO:LIST:BTS:APP 15000,1, QPSK`
	`CWCD:RHO:SBO:LIST:BTS:APP 15000,3, QPSK`
	`CWCD:RHO:SBO:LIST:BTS:APP 15000,16, QPSK`
	`CWCD:RHO:SBO:LIST:BTS:APP 240000, 15, QAM16`
	`CWCD:RHO:SBO:LIST:NCH:BTS?`
	5
	`CWCD:RHO:SBO:LIST:BTS:CHAN? 1`
	`15000,0, QPSK`
	`CWCD:RHO:SBO:LIST:BTS:CHAN? 2`
	`15000,1, QPSK`
	`CWCD:RHO:SBO:LIST:BTS:CHAN? 3`
	`15000,3, QPSK`
	`CWCD:RHO:SBO:LIST:BTS:CHAN? 4`
	`15000,16, QPSK`

	`CWCD:RHO:SBO:LIST:BTS:CHAN? 5` `240000,15, QAM16`
Notes	(1) This command is effective when [:SENSe]:RADio:DEVice is set to BTS and [:SENSe]:CWCDma:RHO:SBOundary[:BTS] is set to CUSTom (2) QAM16 for the 4th parameter, is available only if HSDPA/HSUPA Enable is On (3) The maximum number of entries is 512 Error messages associated with this parameter: One of the following error messages is logged if the given parameter is invalid. If an error is reported, the SCPI command is rejected and the instrument's settings do not change (1) "Missing Parameter" This error is reported if the number of parameters is less than 4 For example, :SENSe:CWCDma:RHO:SBOundary:LIST:BTS:APPend, 15000, 0<- 3rd parameter is missing (2) "Illegal parameter value" This error is reported if parameter type is invalid or if enum value is invalid For example, :SENSe:CWCDma:RHO:SBOundary:LIST:BTS:APPend 15000, ON, QPSK <- 2nd parameter must be integer :SENSe:CWCDma:RHO:SBOundary:LIST:BTS:APPend, 15001, 8, QPSK <- 1st parameter value (Symbol Rate) is not allowed Only the values given in the Range field are valid for the Symbol Rate. You may specify these in numeric form, but they are interpreted as an enumeration and the error results if the value does not translate to one in the list (3) "Data out of range" This error is reported if parameter value is out of range For example, :SENSe:CWCDma:RHO:SBOundary:LIST:BTS:APPend 15000, 256, QPSK <- 2nd parameter is out of range (4) "Setting Conflict" This error is reported if the given code channel overlaps another code channel in Combined WCDMA. For example, if a user sends the following two commands, the second command causes the error message because C7(0) overlaps C8(0) :SENSe:CWCDma:RHO:SBOundary:LIST:BTS:INIT, 15000, 0, QPSK <- OK :SENSe:CWCDma:RHO:SBOundary:LIST:BTS:APPend 30000, 0, QPSK <- C7(0) overlaps C8(0)
State Saved	Saved in instrument state
Range	symbol_rate = 7500 | 15000 | 30000 | 60000 | 120000 | 240000 | 480000 | 960000 0<= code_num <= 511 if symbol_rate = 7500 0<= code_num <= 255 if symbol_rate = 15000 0<= code_num <= 127 if symbol_rate = 30000 0<= code_num <= 63 if symbol_rate = 60000 0<= code_num <= 31 if symbol_rate = 120000 0<= code_num <= 15 if symbol_rate = 240000

0<= code_num <= 7 if symbol_rate = 480000

0<= code_num <= 3 if symbol_rate = 960000

QAM16 for the 3rd parameter is available only for channels with a symbol rate of 240000. For other channels, specify QPSK

Replace List (Remote Command Only)

Replaces the entry of the custom active channel list for BTS.

1st parameter:

<entry_id>	Specifies entry ID of the channel to replace

2nd parameter:

<symbol_rate>	Specifies symbol rate of the channel

3rd parameter:

<code_num>	Specifies code number of the channel

4th parameter:

QPSK	Specifies the channel's modulation scheme is QPSK.
QAM16	Specifies the channel's modulation scheme is QAM16 This choice is available only for channels with a symbol rate of 240000

Remote Command	`[:SENSe]:CWCDma:RHO:SBOundary:LIST[:BTS]:REPLace <entry_id>, <symbol_rate>, <code_num>, QPSK | QAM16`

Example	To predefine the following channels:
	- CPICH (C8(0))
	- P-CCPCH (C8(1))
	- S-CCPCH(C8(3))
	- PICH(C8(16))
	- HS-DPCCH (C4(15)) 16QAM modulated
	:Send the following sequence:
	`CWCD:RHO:SBO:LIST:BTS:INIT 15000,0,QPSK`
	`CWCD:RHO:SBO:LIST:BTS:APP 15000,1,QPSK`
	`CWCD:RHO:SBO:LIST:BTS:APP 15000,3,QPSK`
	`CWCD:RHO:SBO:LIST:BTS:APP 15000,16,QPSK`
	`CWCD:RHO:SBO:LIST:BTS:APP 240000, 15, QAM16`
	`And, P-CCPCH(C8(3)) is replaced as follows:`
	`CWCD:RHO:SBO:LIST:BTS:REPL 3, 15000, 5, QPSK`

	`CWCDma:RHO:SBOundary:LIST:NCHannels:BTS?`
	5
	`CWCD:RHO:SBO:LIST:BTS:CHAN? 1`
	`15000,0, QPSK`
	`CWCD:RHO:SBO:LIST:BTS:CHAN? 2`
	`15000,1, QPSK`
	`CWCD:RHO:SBO:LIST:BTS:CHAN? 3`
	`15000,5, QPSK`
	`CWCD:RHO:SBO:LIST:BTS:CHAN? 4`
	`15000,16, QPSK`
	`CWCD:RHO:SBO:LIST:BTS:CHAN? 5`
	`240000,15, QAM16`

Notes	(1) This command is effective when [:SENSe]:RADio:DEVice is set to BTS and [:SENSe]:CWCDma:RHO:SBOundary[:BTS] is set to CUSTom (2) QAM16 for the 4th parameter is available only if HSDPA/HSUPA Enable is On (3) The maximum number of entries is 512 Error messages associated with this parameter: One of the following error messages is logged if the given parameter is invalid. If an error is reported, the SCPI command is rejected and the instrument's settings do not change (1) "Missing Parameter" This error is reported if the number of parameters is less than 4 For example, :SENSe:CWCDma:RHO:SBOundary:LIST:BTS:REPLace 1,15000, 0 <- 4th parameter is missing (2) "Illegal parameter value" This error is reported if parameter type is invalid or if enum value is invalid For example, :SENSe:CWCDma:RHO:SBOundary:LIST:BTS:REPLace 1,15000, ON, QPSK <- 3rd parameter must be integer :SENSe:CWCDma:RHO:SBOundary:LIST:BTS:REPLace 1,15001, 8, QPSK <- 2nd parameter value (Symbol Rate) is not allowed Only the values given in the Range field are valid for the Symbol Rate. You may specify these in numeric form, but they are interpreted as an enumeration and the error results if the value does not translate to one in the list (3) "Data out of range" This error is reported if parameter value is out of range For example, :SENSe:CWCDma:RHO:SBOundary:LIST:BTS:REPLace 1,15000, 256, QPSK <- 3rd parameter is out of range "Setting Conflict"

	This error is reported if the given code channel overlaps another code channel in Combined WCDMA For example, if a user sends the following two commands, the second command causes the error message because C7(0) overlaps C8(0). :SENSe:CWCDma:RHO:SBOundary:LIST:BTS:INIT 15000, 0, QPSK <- OK :SENSe:CWCDma:RHO:SBOundary:LIST:BTS:REPLace 1,30000, 0, QPSK <- C7(0) overlaps C8(0) (5) The entry ID out of range: 1 <= entry_id <= The number of entries which is currently appended
State Saved	Saved in instrument state
Range	The entry ID must be: 1 <= entry_id <= The number of entries which is currently appended. symbol_rate = 7500 | 15000 | 30000 | 60000 | 120000 | 240000 | 480000 | 960000 0<= code_num <= 511 if symbol_rate = 7500 0<= code_num <= 255 if symbol_rate = 15000 0<= code_num <= 127 if symbol_rate = 30000 0<= code_num <= 63 if symbol_rate = 60000 0<= code_num <= 31 if symbol_rate = 120000 0<= code_num <= 15 if symbol_rate = 240000 0<= code_num <= 7 if symbol_rate = 480000 0<= code_num <= 3 if symbol_rate = 960000 QAM16 for the 4th parameter is available only for channels with a symbol rate of 240000. For other channels, specify QPSK

Query List (Remote Command Only)

This command returns the entry of the custom active channel list for BTS.

1st parameter:

<entry_id>	Specifies entry ID of the channel to query

Remote Command	`[:SENSe]:CWCDma:RHO:SBOundary:LIST[:BTS]:CHANnel? <entry_id>`

Example	To predefine the following channels:
	- CPICH (C8(0))
	- P-CCPCH (C8(1))
	- S-CCPCH(C8(3))
	- PICH(C8(16))
	- HS-DPCCH (C4(15)) 16QAM modulated
	Send the following sequence:
	`CWCD:RHO:SBO:LIST:BTS:INIT 15000,0,QPSK`
	`CWCD:RHO:SBO:LIST:BTS:APP 15000,1,QPSK`

	`CWCD:RHO:SBO:LIST:BTS:APP 15000,3,QPSK`
	`CWCD:RHO:SBO:LIST:BTS:APP 15000,16,QPSK`
	`CWCD:RHO:SBO:LIST:BTS:APP 240000, 15, QAM16`
	`CWCD:RHO:SBO:LIST:NCH:BTS?`
	5
	`CWCD:RHO:SBO:LIST:BTS:CHAN? 1`
	`15000,0,QPSK`
	`CWCD:RHO:SBO:LIST:BTS:CHAN? 2`
	`15000,1, QPSK`
	`CWCD:RHO:SBO:LIST:BTS:CHAN? 3`
	`15000,3, QPSK`
	`CWCD:RHO:SBO:LIST:BTS:CHAN? 4`
	`15000,16, QPSK`
	`CWCD:RHO:SBO:LIST:BTS:CHAN? 5`
	`240000,15, QAM16`

Notes	(1) This command is effective when [:SENSe]:RADio:DEVice is set to BTS and [:SENSe]:CWCDma:RHO:SBOundary[:BTS] is set to CUSTom (2) QAM16 for the 4th parameter is available only if HSDPA/HSUPA Enable is On (3) The maximum number of entries is 512 Default value of the parameter By default, one channel is defined. (CPICH C8(0)) In order to query the default entry, specify 1 for <entry_id>: :SENSe:CWCDma:RHO:SBOundary:LIST:BTS:CHANnel? 1 The instrument returns an array of three values: 15000, 0, QPSK The <entry_id> parameter is always required for the query The range of the parameter is from 1 to the total number of channels you have defined. For example, if you have defined two channels, you can query them as follows: :SENSe:CWCDma:RHO:SBOundary:LIST:BTS:CHANnel? 1 :SENSe:CWCDma:RHO:SBOundary:LIST:BTS:CHANnel? 2 If you want to know the number of channels you have defined, send the following query command: :SENSe:CWCDma:RHO:SBOundary:LIST:BTS:NCHannels? Error messages associated with this parameter: The following error message is logged if the given parameter is invalid. (If an error is reported, the SCPI command is rejected and the instrument's settings do not change) <entry_id> out of range The entry ID must be: 1 <= entry_id <= The number of entries which is currently appended

Preset	15000, 0, QPSK
State Saved	Saved in instrument state
Range	1 <= entry_id <= the number of channels defined <= 512 (<entry_id> is an integer ranging from 1 to 512)

Number of entries (Remote Query Only)

Returns the number of entries in the custom predefined active channel list BTS. This is a query only command.

Remote Command	`[:SENSe]:CWCDma:RHO:SBOundary:LIST[:BTS]:NCHannels?`
Example	`:CWCD:RHO:SBO:LIST:NCH?`
Notes	This command is effective when [:SENSe]:RADio:DEVice is set to BTS and [:SENSe]:CWCDma:RHO:SBOundary[:BTS] is set to CUSTom This command is a query-only command
Preset	1
State Saved	No

Load Preset Setting (Remote Command Only)

Loads preset setting to the custom active channel list BTS. This is a command-only command; it does not support a query.

Remote Command	`[:SENSe]:CWCDma:RHO:SBOundary:LIST[:BTS]:PRESet TM1D16 | TM1D32 | TM1D64 | TM1D16SC | TM1D32SC | TM1D64SC | TM2 | TM2SC | TM3D16 | TM3D32 | TM3D16SC | TM3D32SC | TM4 | TM4CP | TM5H2 | TM5H4 | TM5H8`
Example	`:CWCD:RHO:SBO:LIST:PRES TM1D64`
Notes	(1) This command is effective when [:SENSe]:RADio:DEVice is set to BTS and [:SENSe]:CWCDma:RHO:SBOundary[:BTS] is set to CUSTom (2) TM5H2, TM5H4, TM5H8 parameters are allowed if HSDPA/HSUPA Enable is On This command is a command-only command; it does not support a query
State Saved	No
Range	TM1D16 | TM1D32 | TM1D64 | TM1D16SC | TM1D32SC | TM1D64SC | TM2 | TM2SC | TM3D16 | TM3D32 | TM3D16SC | TM3D32SC | TM4 | TM4CP | TM5H2 | TM5H4 | TM5H8

Remote Command	`[:SENSe]:CWCDma:RHO:SBOundary[:BTS] AUTO | TM1D16 | TM1D32 | TM1D64 | TM1D16SC | TM1D32SC | TM1D64SC | TM2 | TM2SC | TM3D16 | TM3D32 | TM3D16SC | TM3D32SC | TM4 | TM4CP | TM5H2 | TM5H4 | TM5H8 | CUSTom` `[:SENSe]:CWCDma:RHO:SBOundary[:BTS]?`
Example	`:CWCD:RHO:SBO:BTS TM1D16`

	:CWCD:RHO:SBO:BTS?
Notes	This command is effective when [:SENSe]:RADio:DEVice is set to BTS
Preset	AUTO
State Saved	Saved in instrument state
Range	AUTO | TM1D16 | TM1D32 | TM1D64 | TM1D16SC | TM1D32SC | TM1D64SC | TM2 | TM2SC | TM3D16 | TM3D32 | TM3D16SC | TM3D32SC | TM4 | TM4CP | TM5H2 | TM5H4 | TM5H8 | CUSTom

Symbol Boundary MS (Remote Command Only)

Selects the symbol boundary detection mode for MS, which allows you to specify the active channel detection scheme for the uplink.

Auto Detect

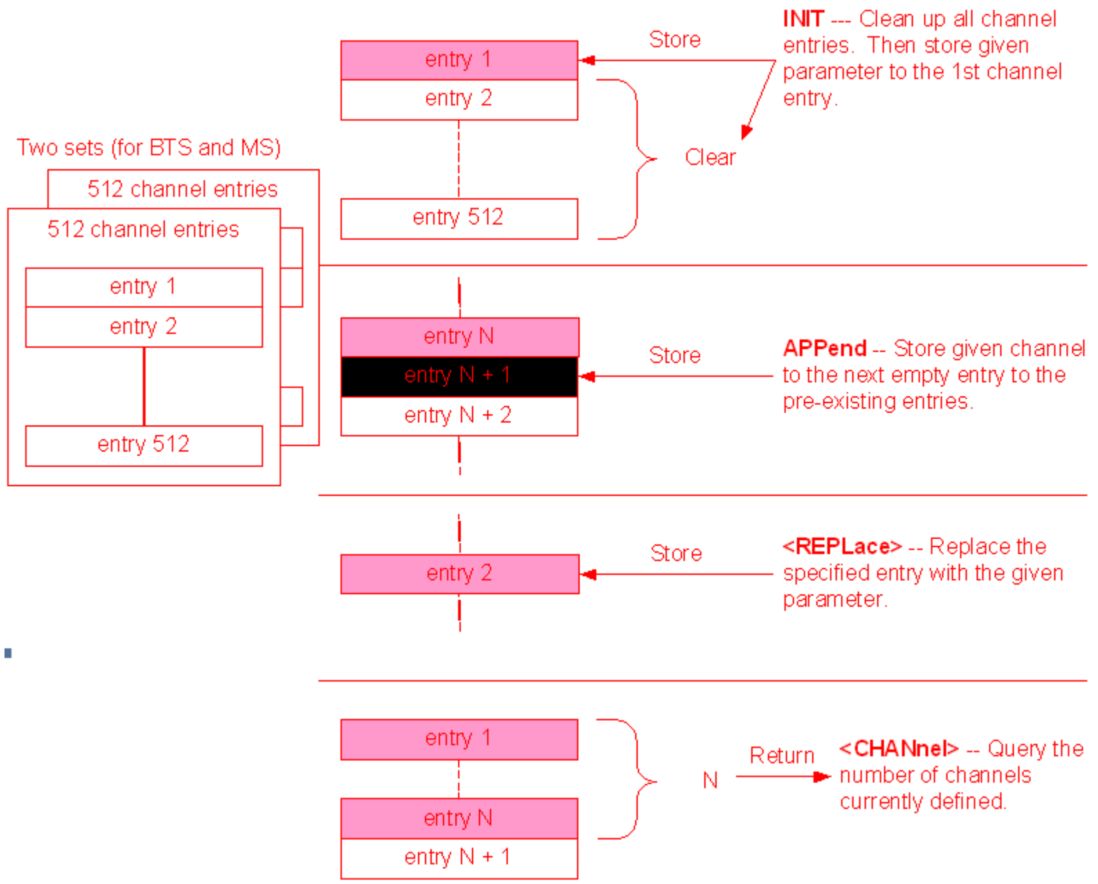
AUTO – Select this feature to set the symbol boundary detection to the automatic mode. Various code channels are measured and the most appropriate code channel is selected as the reference channel.

Custom

CUSTom – Select this feature to specify a customized list of active channels using a remote command. All specified channels are considered as active.

The following commands handle the list of custom predefined channels for MS.

- INIT – Cleans up all channel entries. Then stores given parameter to the 1st channel entry. See "Initialize List (Remote Command Only)" on page 1834.
- APPend – Stores the given channel to the next empty entry of the pre-existing entries. See "Append List (Remote Command Only)" on page 1836.
- REPLace - Replaces the specified entry with the given parameter. See "Replace List (Remote Command Only)" on page 1837.
- CHANnel – Queries the information of the channel specified by the entry id. See "Query List (Remote Query Only)" on page 1839.
- NCHannel - Queries the number of channels currently defined. See "Number of Entries (Remote Query Only)" on page 1841.



Initialize List (Remote Command Only)

Initializes the current custom active channel list. This creates a new entry with the given parameter.

1st parameter:

<symbol_rate>	Specifies symbol rate of the channel

2nd parameter:

<code_num>	Specifies spreading code of the channel

3rd parameter:

IPH	Specifies the channel is on the I-axis
QPH	Specifies the channel Is on the Q-axis

Remote Command	[:SENSe]:CWCDma:RHO:SBOundary:LIST:MS:INIT <symbol_rate>, <code_num>, IPH | QPH

Example	In order to predefine the following channels: - DPCCH (C8(0):Q) - DPDCH (C6(16):I) CWCD:RHO:SBO:LIST:MS:INIT 15000,0,QPH CWCD:RHO:SBO:LIST:MS:APP 60000,16,IPH CWCD:RHO:SBO:LIST:NCH:MS? 2 CWCD:RHO:SBO:LIST:MS:CHAN? 1 15000,0,QPH CWCD:RHO:SBO:LIST:MS:CHAN? 2 60000,16,IPH
Notes	(1) This command is effective if [:SENSe]:RADio:DEVice is set to MS and [:SENSe]:CWCDma:RHO:SBOundary:MS is set to CUSTom (2) symbol_rate = 1920000 is available if HSDPA/HSUPA Enable is On (3) The maximum number of entries is 512 One of the following error messages is logged if the given parameter is invalid. (If an error is reported, the SCPI command is rejected and the instrument's settings do not change) (1) "Missing Parameter" This error is reported if the number of parameters is less than 3 For example, :SENSe:CWCDma:RHO:SBOundary:LIST:MS:INIT 15000, 0 <- 3rd parameter is missing (2) "Illegal parameter value" This error is reported if parameter type is invalid or if enum value is invalid For example, :SENSe:CWCDma:RHO:SBOundary:LIST:MS:INIT 15000, ON, QPH <- 2nd parameter must be integer :SENSe:CWCDma:RHO:SBOundary:LIST:MS:INIT 15001, 0, QPH <- 1st parameter value (Symbol Rate) is not allowed Only the values given in the Range field are valid for the Symbol Rate. You may specify these in numeric form, but they are interpreted as an enumeration and the error results if the value does not translate to one in the list (3) "Data out of range" This error is reported if parameter value is out of range For example, :SENSe:CWCDma:RHO:SBOundary:LIST:MS:INIT 15000, 256, QPH <- 2nd parameter is out of range (4) "Setting Conflict" This error is reported if the given code channel overlaps another code channel in modulation Accuracy For example, if a user sends the following two commands, the second command causes the error message because C7(0):Q overlaps C8(0):Q :SENSe:CWCDma:RHO:SBOundary:LIST:MS:INIT 15000, 0, QPH <- OK :SENSe:CWCDma:RHO:SBOundary:LIST:MS:APPend 30000, 0, QPH <- C7(0):Q overlaps C8(0):Q
State Saved	Saved in instrument state

Range	symbol_rate = 15000 | 30000 | 60000 | 120000 | 240000 | 480000 | 960000 | 19200000 0<= code_num <= 255 if symbol_rate = 15000 0<= code_num <= 127 if symbol_rate = 30000 0<= code_num <= 63 if symbol_rate = 60000 0<= code_num <= 31 if symbol_rate = 120000 0<= code_num <= 15 if symbol_rate = 240000 0<= code_num <= 7 if symbol_rate = 480000 0<= code_num <= 3 if symbol_rate = 960000 0<= code_num <= 1 if symbol_rate = 1920000

Append List (Remote Command Only)

Appends the entry to the custom active channel list.

1st parameter:

<symbol_rate>	Specifies symbol rate of the channel.

2nd parameter:

<code_num>	Specifies spreading code of the channel.

3rd parameter:

IPH	Specifies the channel is on the I-axis
QPH	Specifies the channel Is on the Q-axis

Remote Command	`[:SENSe]:CWCDma:RHO:SBOundary:LIST:MS:APPend <symbol_rate>, <code_num>, IPH | QPH`
Example	In order to predefine the following channels: - DPCCH (C8(0):Q) - DPDCH (C6(16):I) CWCD:RHO:SBO:LIST:MS:INIT 15000,0,QPH CWCD:RHO:SBO:LIST:MS:APP 60000,16,IPH CWCD:RHO:SBO:LIST:NCH:MS? 2 CWCD:RHO:SBO:LIST:MS:CHAN? 1 15000,0,QPH CWCD:RHO:SBO:LIST:MS:CHAN? 2 60000,16,IPH
Notes	(1) This command is effective if [:SENSe]:RADio:DEVice is set to MS and [:SENSe]:CWCDma:RHO:SBOundary:MS is set to CUSTom (2) symbol_rate = 1920000 is available if HSDPA/HSUPA Enable is On

	(3) The maximum number of entries is 512 One of the following error messages is logged if the given parameter is invalid. (If an error is reported, the SCPI command is rejected and the instrument's settings do not change) (1) "Missing Parameter" This error is reported if the number of parameters is less than 3 For example, :SENSe:CWCDma:RHO:SBOundary:LIST:MS:APPend 15000, 0 <- 3rd parameter is missing. (2) "Illegal parameter value" This error is reported if parameter type is invalid or if enum value is invalid For example, :SENSe:CWCDma:RHO:SBOundary:LIST:MS:APPend 15000, ON, QPH <- 2nd parameter must be integer :SENSe:CWCDma:RHO:SBOundary:LIST:MS:APPend 15001, 0, QPH <- 1st parameter value (Symbol Rate) is not allowed Only the values given in the Range field are valid for the Symbol Rate. You may specify these in numeric form, but they are interpreted as an enumeration and the error results if the value does not translate to one in the list (3) "Data out of range" This error is reported if parameter value is out of range For example, :SENSe:CWCDma:RHO:SBOundary:LIST:MS:APPend 15000, 256, QPH <- 2nd parameter is out of range (4) "Setting Conflict" This error is reported if the given code channel overlaps another code channel in modulation accuracy For example, if a user sends the following two commands, the second command causes the error message because C7(0):Q overlaps C8(0):Q :SENSe:CWCDma:RHO:SBOundary:LIST:MS:INIT 15000, 0, QPH <- OK :SENSe:CWCDma:RHO:SBOundary:LIST:MS:APPend 30000, 0, QPH <- C7(0):Q overlaps C8(0):Q
State Saved	Saved in instrument state
Range	symbol_rate = 15000 | 30000 | 60000 | 120000 | 240000 | 480000 | 960000 | 19200000 0<= code_num <= 255 if symbol_rate = 15000 0<= code_num <= 127 if symbol_rate = 30000 0<= code_num <= 63 if symbol_rate = 60000 0<= code_num <= 31 if symbol_rate = 120000 0<= code_num <= 15 if symbol_rate = 240000 0<= code_num <= 7 if symbol_rate = 480000 0<= code_num <= 3 if symbol_rate = 960000 0<= code_num <= 1 if symbol_rate = 1920000

Replace List (Remote Command Only)

Replaces an entry in the custom active channel list.

1st parameter:

<entry_id>	Specifies entry ID of the channel to replace

2nd parameter:

<symbol_rate>	Specifies symbol rate of the channel

3rd parameter:

<code_num>	Specifies spreading code of the channel

4th parameter:

IPH	Specifies the channel is on the I-axis
QPH	Specifies the channel Is on the Q-axis

Remote Command	`[:SENSe]:CWCDma:RHO:SBOundary:LIST:MS:REPLace <entry_id>,<symbol_rate>, <code_num>, IPH | QPH`
Example	In order to predefine the following channels: - DPCCH (C8(0):Q) - DPDCH (C6(16):I) Send the following sequence: CWCD:RHO:SBO:LIST:MS:INIT 15000,0,QPH CWCD:RHO:SBO:LIST:MS:APP 60000,16,IPH CWCD:RHO:SBO:LIST:NCH:MS? 2 And, replace 2nd entry. CWCD:RHO:SBO:LIST:MS:REPL 2,60000,17,QPH CWCD:RHO:SBO:LIST:MS:CHAN? 1 15000,0,QPH CWCD:RHO:SBOundary:LIST:MS:CHANnel? 2 60000,17,IPH
Notes	(1) This command is effective if [:SENSe]:RADio:DEVice is set to MS and [:SENSe]:CWCDma:RHO:SBOundary:MS is set to CUSTom (2) symbol_rate = 1920000 is available if HSDPA/HSUPA Enable is On (3) The maximum number of entries is 512 One of the following error messages is logged if the given parameter is invalid. (If an error is reported, the SCPI command is rejected and the instrument's settings do not change (1) “Missing Parameter” This error is reported if the number of parameters is less than 4 For example, :SENSe:CWCDma:RHO:SBOundary:LIST:MS:REPLace 1,15000, 0 <- 4th parameter is missing (2) “Illegal parameter value” This error is reported if parameter type is invalid or if enum value is invalid For example,

	:SENSe:CWCDma:RHO:SBOundary:LIST:MS: REPLace 1,15000, ON, QPH <- 3rd parameter must be integer :SENSe:CWCDma:RHO:SBOundary:LIST:MS:REPLace 1,15001, 0, QPH <- 2nd parameter value (Symbol Rate) is not allowed Only the values given in the Range field are valid for the Symbol Rate. You may specify these in numeric form, but they are interpreted as an enumeration and the error results if the value does not translate to one in the list (3) "Data out of range" This error is reported if parameter value is out of range. For example, :SENSe:CWCDma:RHO:SBOundary:LIST:MS:APPend 15000, 256, QPH <- 3rd parameter is out of range. (4) "Setting Conflict" This error is reported if the given code channel overlaps another code channel in modulation accuracy For example, if a user sends the following two commands, the second command causes the error message because C7(0):Q overlaps C8(0):Q :SENSe:CWCDma:RHO:SBOundary:LIST:MS:INIT 15000, 0, QPH <- OK :SENSe:CWCDma:RHO:SBOundary:LIST:MS: REPLace 1,30000, 0, QPH <- C7(0):Q overlaps C8(0):Q (5) The entry ID out of range 1 <= entry_id <= The number of entries which is currently appended
State Saved	Saved in instrument state
Range	The entry ID must be: 1 <= entry_id <= The number of entries which is currently appended. symbol_rate = 15000 | 30000 | 60000 | 120000 | 240000 | 480000 | 960000 | 19200000 0<= code_num <= 255 if symbol_rate = 15000 0<= code_num <= 127 if symbol_rate = 30000 0<= code_num <= 63 if symbol_rate = 60000 0<= code_num <= 31 if symbol_rate = 120000 0<= code_num <= 15 if symbol_rate = 240000 0<= code_num <= 7 if symbol_rate = 480000 0<= code_num <= 3 if symbol_rate = 960000 0<= code_num <= 1 if symbol_rate = 1920000

Query List (Remote Query Only)

This command returns the entry of the custom active channel list.

1st parameter:

<entry_id>	Specifies entry ID of the channel to query

Remote Command	`[:SENSe]:CWCDma:RHO:SBOundary:LIST:MS:CHANnel? <entry_id>`

Example	To predefine the following channels: - DPCCH (C8(0):Q) - DPDCH (C6(16):I) Send command sequence::CWCD:RHO:SBO:LIST:MS:INIT 15000, 0, QPH :CWCD:RHO:SBO:LIST:MS:APP 60000,16,IPH CWCD:RHO:SBO:LIST:NCH:MS? 2 CWCD:RHO:SBO:LIST:MS:CHAN? 1 15000, 0, QPH CWCD:RHO:SBO:LIST:MS:CHAN? 2 60000, 16, IPH
Notes	(1) This command is effective if [:SENSe]:RADio:DEVice is set to MS and [:SENSe]:CWCDma:RHO:SBOundary:MS is set to CUSTom (2) symbol_rate = 1920000 is available if HSDPA/HSUPA Enable is On (3) The maximum number of entries is 512 Default value of the parameter By default, one channel is defined. (DPCCH C8(0):Q) In order to query the default entry, specify 1 for <entry_id>: :SENSe:CWCDma:RHO:SBOundary:LIST:MS:CHANnel? 1 The instrument returns an array of three values: 15000, 0, QPH The <entry_id> parameter is always required for the query The range of the parameter is from 1 to the total number of channels you have defined. For example, if you have defined two channels, you can query them as follows: :SENSe:CWCDma:RHO:SBOundary:LIST:MS:CHANnel? 1 :SENSe:CWCDma:RHO:SBOundary:LIST:MS:CHANnel? 2 If you want to know the number of channels you have defined, send the following query command: :SENSe:CWCDma:RHO:SBOundary:LIST:NCHannels:MS? The following error message is logged if the given parameter is invalid: If an error is reported, the SCPI command is rejected and the instrument's settings do not change <entry_id> out of range The entry ID must be: 1 <= entry_id <= The number of entries which is currently appended
Preset	15000, 0, QPH
State Saved	Saved in instrument state
Range	The entry ID must be: 1 <= entry_id <= The number of entries which is currently appended

Number of Entries (Remote Query Only)

Returns the number of entries in the custom predefined active channel list MS. This command is query only.

Remote Command	`[:SENSe]:CWCDma:RHO:SBOundary:LIST:MS:NCHannels?`
Example	`:CWCD:RHO:SBO:LIST:MS:NCH?`
Notes	This command is effective when [:SENSe]:RADio:DEVice is set to MS and [:SENSe]:CWCDma:RHO:SBOundary:MS is set to CUSTom This command is a query-only command
Preset	1
State Saved	No

Remote Command	`[:SENSe]:CWCDma:RHO:SBOundary:MS AUTO | CUSTom` `[:SENSe]:CWCDma:RHO:SBOundary:MS?`
Example	`:CWCD:RHO:SBO:MS CUST` `:CWCD:RHO:SBO:MS?`
Notes	This parameter is effective when [:SENSe]:RADio:DEVice is set to MS
Preset	AUTO
State Saved	Saved in instrument state
Range	Auto | Custom

Sync Start Slot (Remote Command Only)

Specifies the slot number to measure as the first slot. You can then use any trigger, even Free Run to get the measurement result beginning with the specified slot number. For example, if the Sync Start Slot state is set to On and the start slot number is 0, then the synchronization always starts from slot number 0 regardless of the trigger type and its delay.

If Sync Start Slot state is set to Off, the measurement performs synchronization at any slot found immediately after the trigger timing.

Remote Command	`[:SENSe]:CWCDma:RHO:SSLot:NUMBer <integer>`
	`[:SENSe]:CWCDma:RHO:SSLot:NUMBer?`
	`[:SENSe]:CWCDma:RHO:SSLot[:STATe] OFF | ON | 0 | 1`
	`[:SENSe]:CWCDma:RHO:SSLot[:STATe]?`

Example	`:CWCD:RHO:SSL:NUMB 5`
	`:CWCD:RHO:SSL:NUMB?`
	`:CWCD:RHO:SSL:STAT ON`

	:CWCD:RHO:SSL:STAT?
Notes	Turn first slot number detection mode on or off.
Preset	0
State Saved	Saved in instrument state.
Range	0 to 14
Min/Max	0/14

Transient Period Exclude (Remote Command Only)

Selects either to include or to exclude the transient period. The transient period is specified in the 3GPP standard TS 34.121, as 25us before each slot boundary and 25 us after each slot boundary. The 3GPP standard requires that the transient period is not included for the power measurement.

This command is available only when the device is MS.

Remote Command	[:SENSe]:CWCDma:RHO:SWEep:TIME:TRANsient INCLude | EXCLude [:SENSe]:CWCDma:RHO:SWEep:TIME:TRANsient?
Example	:CWCD:RHO:SWE:TIME:TRAN INCL :CWCD:RHO:SWE:TIME:TRAN?
Preset	INCLude
State Saved	Saved in instrument state.

Spectrum (Remote Command Only)

Sets spectrum to either normal or inverted for demodulation related measurements. If set to INVert, the upper and lower spectrums are swapped.

The Invert function conjugates the spectrum, which is equivalent to taking the negative of the quadrature component in demodulation. The correct setting (Normal or Invert) depends on whether the signal at the input of the instrument has a high or low side mix.

Remote Command	[:SENSe]:CWCDma:RHO:SPECtrum INVert | NORMal [:SENSe]:CWCDma:RHO:SPECtrum?
Example	:CWCD:RHO:SPEC INV :CWCD:RHO:SPEC?
Preset	NORMal
State Saved	Saved in instrument state.

EVM Result I/Q Offset (Remote Command Only)

Toggles the I/Q origin offset function between Std (standard) and Exclude.

- Std: The measurement results for EVM and Rho take into account the I/Q origin offset.
- Exclude: The measurement results for EVM and Rho do not take into account the I/Q origin offset.

Remote Command	`:CALCulate:CWCDma:RHO:IQOFfset:INCLude OFF | ON | 0 | 1` `:CALCulate:CWCDma:RHO:IQOFfset:INCLude?`
Example	`:CALC:CWCD:RHO:IQOF:INCL ON` `:CALC:CWCD:RHO:IQOF:INCL?`
Preset	ON
State Saved	Saved in instrument state.

Active Set Threshold (Remote Command Only)

Toggles the active channel identification function between Auto and Man. If set to Auto, the active channels are determined automatically by the internal algorithm. If set to Man, the active channel identification is determined by a user definable threshold ranging from 0.00 dB to -100.00 dB.

Remote Command	`:CALCulate:CWCDma:RHO:ASET:THReshold <rel_ampl>`
	`:CALCulate:CWCDma:RHO:ASET:THReshold?`
	`:CALCulate:CWCDma:RHO:ASET:THReshold:AUTO OFF | ON | 0 | 1`
	`:CALCulate:CWCDma:RHO:ASET:THReshold:AUTO?`

Example	`:CALC:CWCD:RHO:ASET:THR -20.0`
	`:CALC:CWCD:RHO:ASET:THR?`
	`:CALC:CWCD:RHO:ASET:THR:AUTO ON`
	`:CALC:CWCD:RHO:ASET:THR:AUTO?`

Notes	This command is effective when [:SENSe]:CWCDma:RHO:SBOundary[:BTS] is set to AUTO. (For MS, this command is always effective.) Turn the automatic mode On or Off, for the active channel identification function. – OFF – The active channel identification for each code channel is determined by a value set by CALCulate:CWCDma:RHO:ASET:THReshold. – ON – The active channels are determined automatically by the internal algorithm.

Preset	0.0
State Saved	Saved in instrument state.
Min/Max	-100.0/0.0

Chip Rate (Remote Command Only)

Sets the chip rate.

Remote Command	`[:SENSe]:CWCDma:RHO:CRATe <freq>` `[:SENSe]:CWCDma:RHO:CRATe?`
Example	`:CWCD:RHO:CRAT 3900000` `:CWCD:RHO:CRAT?`
Preset	3.84 MHz
State Saved	Saved in instrument state.
Min/Max	3.456 MHz/4.224 MHz

DTX/Burst Detect (Remote Command Only)

For downlink signals, detects the power burst for either “CM” (Compressed Mode) or “DTX”. In the case of “Compressed Mode”, both I and Q symbol power are set to Off. In the case of “DTX”, either I or Q symbol power, or both, can be set to Off.

For uplink signals, this function detects the HS-DPCCH burst, the subframe of which does not align with the DPCCH slot boundary.

Remote Command	`:CALCulate:CWCDma:RHO:DTXBurst 0 | 1 | OFF | ON` `:CALCulate:CWCDma:RHO:DTXBurst?`
Example	`:CALC:CWCD:RHO:DTXB ON` `:CALC:CWCD:RHO:DTXB?`
Notes	If the HSDPA/HSUPA option is enabled, this parameter is active and effective for both uplink and downlink. If the HSDPA/HSUPA option is disabled, this parameter is active and effective only for downlink.
Preset	OFF
State Saved	Saved in instrument state.

PICH Code Number (Remote Command Only)

Specifies the code number for PICH, which contains the DTX (no transmission) part. PICH has 300 bits in 1 radio frame, but the last 12 bits are not transmitted. Then, PICH needs special handling to measure code domain power. The PICH Code Number enables you to specify which code channel should be set as PICH.

Remote Command	`[:SENSe]:CWCDma:RHO:PICH:SPRead <integer>` `[:SENSe]:CWCDma:RHO:PICH:SPRead?`
Example	`:CWCD:RHO:PICH:SPR 16` `:CWCD:RHO:PICH:SPR?`
Notes	(1) If PICH Code Number and MICH Code Number are the same, the channel is considered as PICH. (2) This parameter is active for BTS. (3) This parameter is meaningful only if the Symbol Boundary setting is Auto.
Preset	16
State Saved	Saved in instrument state.
Min/Max	0/255

MICH Code Number (Remote Command Only)

Specifies the code number for MICH (MBMS Indicator channel), which contains the DTX (no transmission) part. MICH has 300 bits in 1 radio frame, but the last 6 symbols (12 bits) are not transmitted. Therefore, MICH needs special handling to measure code domain power. The MICH Code Number specifies which code channel should be considered as MICH.

Since MICH is an optional channel, the parameter has a BAF setting (On|Off).

NOTE

Active ID auto-detection is performed. However, the result can be 7.5ksps channel if MICH's two consecutive demod bits are the same. If this occurs, these 7.5ksps channels are automatically set to be 15ksps channels.

Remote Command	`[:SENSe]:CWCDma:RHO:MICH:SPRead <integer>`
	`[:SENSe]:CWCDma:RHO:MICH:SPRead?`
	`[:SENSe]:CWCDma:RHO:MICH:STATe OFF | ON | 0 | 1`
	`[:SENSe]:CWCDma:RHO:MICH:STATe?`

Example	`:CWCD:RHO:MICH:SPR 4`
	`:CWCD:RHO:MICH:SPR?`
	`:CWCD:RHO:MICH:STAT ON`

	:CWCD:RHO:MICH:STAT?
Notes	(1) If the PICH Code Number and MICH Code Number are the same, the channel is considered as PICH. (2) This parameter is active for BTS. (3) This parameter is meaningful only if Symbol Boundary setting is Auto. This parameter enables or disables MICH code number setting.
Preset	2
State Saved	Saved in instrument state.
Min/Max	2/255

Timing Estimation (Remote Command Only)

Selects between channel-by-channel and global timing estimation functions for MMSE.

- Channel-by-Channel: The code channels are estimated using individual timing. This function takes longer.
- Global: The individual code channels are estimated using global timing. This function takes less time.

Remote Command	[:SENSe]:CWCDma:RHO:MCEStimator:TIMing CHANnel | GLOBal [:SENSe]:CWCDma:RHO:MCEStimator:TIMing?
Example	:CWCD:RHO:MCES:TIM CHAN :CWCD:RHO:MCES:TIM?
Preset	GLOBal
State Saved	Saved in instrument state.

Multi Channel Estimator (Remote Command Only)

Allows you to toggle the multi channel estimator function for MMSE between On and Off.

- On: The individual code channels are aligned to the pilot channel to improve the phase error (whether each code phase is aligned or not). This takes a longer time.
- Off: The phase information is computed from one coded signal only. (The phase of each code channel needs to be aligned to the pilot channel.) This operation is briefer.

Remote Command	[:SENSe]:CWCDma:RHO:MCEStimator OFF | ON | 0 | 1

	[:SENSe]:CWCDma:RHO:MCEStimator?
Example	:CWCD:RHO:MCES ON :CWCD:RHO:MCES?
Preset	OFF
State Saved	Saved in instrument state.

Frequency Error Tolerance Range (Remote Command Only)

Specifies the frequency error tolerance range as one of the following:

– Normal- provides a more stringent range of frequency tolerance, which is useful when you want to accurately demodulate signals of higher complexity. For example, when composite channels are modulated on the same signal, the modulation is complex, and frequency error is critical to correct demodulate. In the case of demodulating complex signals, set to 'Normal'

– Wide- provides a wider, and less stringent range of frequency error tolerance.

This parameter is valid only when the device type is MS (Uplink).

Remote Command	[:SENSe]:CWCDma:RHO:FERRor:TRANge WIDE | NORMal [:SENSe]:CWCDma:RHO:FERRor:TRANge?
Example	:CWCD:RHO:FERR:TRAN WIDE :CWCD:RHO:FERR:TRAN?
Preset	NORMal
State Saved	Saved in instrument state.

3.14.8.11 QPSK EVM Related Setting Commands

The following commands and queries relate to the QPSK EVM measurement:

– "Measurement Enable/Disable (Remote Command Only)" on page 1848

– "QPSK EVM Calculation Length (Remote Command Only)" on page 1848

– "QPSK EVM Calculation Offset (Remote Command Only)" on page 1848

– "QPSK EVM Result Selection (Remote Command Only)" on page 1849

– "EVM Result I/Q Offset (QPSK EVM) (Remote Command Only)" on page 1849

– "Chip Rate (QPSK EVM) (Remote Command Only)" on page 1849

Measurement Enable/Disable (Remote Command Only)

Allows you to enable or disable QPSK EVM measurement. Note that the Rho measurement and the QPSK EVM measurement cannot be enabled at the same time.

Remote Command	`[:SENSe]:CWCDma:EVMQpsk[:ENABle] OFF | ON | 0 | 1` `[:SENSe]:CWCDma:EVMQpsk[:ENABle]?`
Example	`:CWCD:EVMQ ON` `:CWCD:EVMQ?`
Couplings	Enabling the QPSK EVM measurement disables the Rho measurement if it is enabled.
Preset	OFF
State Saved	Saved in instrument state.
Range	On|Off

QPSK EVM Calculation Length (Remote Command Only)

Sets calculation length of QPSK EVM measurement.

Remote Command	`[:SENSe]:CWCDma:EVMQpsk:SWEep:LENGth <time>` `[:SENSe]:CWCDma:EVMQpsk:SWEep:LENGth?`
Example	`:CWCD:EVMQ:SWE:LENG 1ms` `:CWCD:EVMQ:SWE:LENG?`
Preset	1.333334ms
State Saved	Saved in instrument state.
Min/Max	66.667us/2.666667ms

QPSK EVM Calculation Offset (Remote Command Only)

Sets calculation offset of QPSK EVM measurement. The first part of a step can be affected by a frequency hopping. Specified length of the first portion is discarded if non-zero value is set.

Remote Command	`[:SENSe]:CWCDma:EVMQpsk:SWEep:OFFSet <time>` `[:SENSe]:CWCDma:EVMQpsk:SWEep:OFFSet?`
Example	`:CWCD:EVMQ:SWE:OFFS 100us` `:CWCD:EVMQ:SWE:OFFS?`

Preset	0.0
State Saved	Saved in instrument state.
Min/Max	0.0/22.155533ms

QPSK EVM Result Selection (Remote Command Only)

Sets the composition of QPSK EVM result block in scalar results. If an item is disabled (off), the item is not shown and not contained in remote results.

The number and the order of this list correspond to QPSK EVM result block in remote result (n = 1).

Remote Command	`[:SENSe]:CWCDma:EVMQpsk:RESult ON | OFF | 0 | 1,…` `[:SENSe]:CWCDma:EVMQpsk:RESult?`
Example	`:CWCD:EVMQ:RES 1,0,0,0,0,0` `:CWCD:EVMQ:RES?`
Preset	1,1,1,1,1,1
State Saved	Saved in instrument state.

EVM Result I/Q Offset (QPSK EVM) (Remote Command Only)

Toggles the I/Q origin offset function between Std (standard) and Exclude.

- Std: The measurement results for EVM take into account the I/Q origin offset.
- Exclude: The measurement results for EVM do not take into account the I/Q origin offset.

Remote Command	`:CALCulate:CWCDma:EVMQpsk:IQOFfset:INCLude OFF | ON | 0 | 1` `:CALCulate:CWCDma:EVMQpsk:IQOFfset:INCLude?`
Example	`:CALC:CWCD:EVMQ:IQOF:INCL ON` `:CALC:CWCD:EVMQ:IQOF:INCL?`
Preset	ON
State Saved	Saved in instrument state.

Chip Rate (QPSK EVM) (Remote Command Only)

Sets the chip rate.

Remote Command	`[:SENSe]:CWCDma:EVMQpsk:CRATe <freq>` `[:SENSe]:CWCDma:EVMQpsk:CRATe?`
Example	`:CWCD:EVMQ:CRAT 3900000` `:CWCD:EVMQ:CRAT?`
Preset	3.84 MHz
State Saved	Saved in instrument state.
Min/Max	3.456 MHz/4.224 MHz

3.14.8.12 ACP Related Setting Commands

The following commands and queries relate to the ACP measurement:

- "Measurement Enable/Disable (Remote Command Only)" on page 1850
- "ACP Calculation Length (Remote Command Only)" on page 1850
- "ACP Calculation Offset (Remote Command Only)" on page 1851
- "ACP Result Selection (Remote Command Only)" on page 1851
- "FFT Length (Remote Command Only)" on page 1852

Measurement Enable/Disable (Remote Command Only)

Allows you to enable or disable ACP measurement.

Remote Command	`[:SENSe]:CWCDma:ACPower[:ENABle] OFF | ON | 0 | 1` `[:SENSe]:CWCDma:ACPower[:ENABle]?`
Example	`:CWCD:ACP OFF` `:CWCD:ACP?`
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

ACP Calculation Length (Remote Command Only)

Sets calculation length of ACP measurement.

Remote	`[:SENSe]:CWCDma:ACPower:SWEep:LENGth <time>`

Command	[:SENSe]:CWCDma:ACPower:SWEep:LENGth?
Example	:CWCD:ACP:SWE:LENG 1ms :CWCD:ACP:SWE:LENG?
Preset	91.023us
State Saved	Saved in instrument state.
Min/Max	22.756us/8.738134ms

ACP Calculation Offset (Remote Command Only)

Sets calculation offset of ACP measurement. The first part of a step can be affected by a frequency hopping. Specified length of the first portion is discarded if non-zero value is set.

Remote Command	[:SENSe]:CWCDma:ACPower:SWEep:OFFSet <time> [:SENSe]:CWCDma:ACPower:SWEep:OFFSet?
Example	:CWCD:ACP:SWE:OFFS 100us :CWCD:ACP:SWE:OFFS?
Preset	0.0
State Saved	Saved in instrument state.
Min/Max	0.0/22.199444ms

ACP Result Selection (Remote Command Only)

Sets the composition of ACP result block in scalar results. If an item is disabled (off), the item is not shown and not contained in remote results.

The number and the order of this list correspond to ACP result block in remote result (n = 1).

Remote Command	[:SENSe]:CWCDma:ACPower:RESult ON | OFF | 0 | 1,… [:SENSe]:CWCDma:ACPower:RESult?
Example	:CWCD:ACP:RES 1,0,0,0,0 :CWCD:ACP:RES?
Preset	1,1,1,1,1,0,0,0,0
State Saved	Saved in instrument state.

FFT Length (Remote Command Only)

Sets the FFT length.

Remote Command	[:SENSe]:CWCDma:ACPower:FFT:LENGth <integer> [:SENSe]:CWCDma:ACPower:FFT:LENGth?
Example	:CWCD:ACP:FFT:LENG 1024 :CWCD:ACP:FFT:LENG?
Notes	This function is available when Meas Method is SINGle or LIST.
Preset	4096
State Saved	Saved in instrument state.
Min/Max	256/131072

3.14.8.13 Meas Preset (Remote Command Only)

Restores all measurement parameters to their default values.

Remote Command	:CONFigure:CWCDma
Example	:CONF:CWCD

3.14.9 Sweep

The Sweep key contains controls which allow you to control the sweep and measurement functions of the analyzer, such as the sweep or measurement time and whether in Single sweep/measure or Continuous sweep/measure mode.

3.14.9.1 Sweep/Control

This tab accesses controls that enable you to operate the Sweep and Control functions of the analyzer.

Sweep/Measure

Allows you to toggle between Continuous and Single sweep or measurement operation. The single/continuous state is Meas Global so the setting will affect all measurements.

The front-panel key **Single/Cont** performs this exact same function

See "More Information" on page 1853

Remote Command	`:INITiate:CONTinuous OFF | ON | 0 | 1` `:INITiate:CONTinuous?`

Example	Puts the analyzer in Single measurement operation.
	`:INIT:CONT 0`
	Puts the analyzer in Single measurement operation.
	`:INIT:CONT OFF`
	Puts the analyzer in Continuous measurement operation.
	`:INIT:CONT 1`
	Puts the analyzer in Continuous measurement operation
	`:INIT:CONT ON`

Preset	ON (Note that SYST:PRESet sets INIT:CONT to ON but *RST sets INIT:CONT to OFF)
State Saved	Saved in instrument state
Annunciation	The Single/Continuous icon in the Meas Bar changes depending on the setting. A line with an arrow is single, a loop with an arrow is Continuous.
Backwards Compatibility Notes	See the description of this control in the Swept SA measurement

More Information

With Avg/Hold Num (in the Meas Setup menu) set to Off or set to On with a value of 1, a sweep is taken after the trigger condition is met; and the analyzer continues to take new sweeps after the current sweep has completed and the trigger condition is again met. However, with Avg/Hold Num set to On with a value >1, multiple sweeps (data acquisitions) are taken for the measurement. The trigger condition must be met prior to each sweep. The sweep is not stopped when the average count k equals the number N set for Avg/Hold Num is reached, but the number k stops incrementing. A measurement average usually applies to all traces, marker results, and numeric results. But sometimes it only applies to the numeric results.

If the analyzer is in Single measurement, pressing the **Cont/Single** toggle control does not change k and does not cause the sweep to be reset; the only action is to put the analyzer into Continuous measurement operation.

If it is already in continuous sweep:

– the INIT:CONT 1 command has no effect

– the INIT:CONT 0 command will place the analyzer in Single Sweep but will have no effect on the current sequence until k = N, at which point the current sequence will stop and the instrument will go to the idle state.

See "Restart " on page 1854 control description for details on the INIT:IMMediate (Restart) function.

If you are already in single sweep, the `INIT:CONT OFF` command has no effect.

If you are already in Single Sweep, then pressing the **Cont/Single** toggle control in the middle of a sweep does not restart the sweep or sequence. Similarly, pressing the **Cont/Single** toggle control does not restart the sweep or sequence if the sweep is not in the idle state (for example, if you are taking a very slow sweep, or the analyzer is waiting for a trigger). Even though pressing the **Cont/Single** toggle control in the middle of a sweep does not restart the sweep, sending INIT:IMMediate does reset it.

Restart

The Restart function restarts the current sweep, or measurement, or set of averaged/held sweeps or measurements. If you are Paused, pressing Restart does a Resume.

The front-panel key **Restart** performs this exact same function

The Restart function is accessed in several ways:

– Pressing the Restart key

– Sending the remote command INIT:IMMediate

– Sending the remote command INIT:RESTart

See "More Information" on page 1855

Remote Command	`:INITiate[:IMMediate]` `:INITiate:RESTart`
Example	`:INIT:IMM` `:INIT:REST`
Notes	:INITiate:RESTart and :INITiate:IMMediate perform exactly the same function.
Couplings	Resets average/hold count k. For the first sweep overwrites all active (update=on) traces with new current data. For application modes, it resets other parameters as required by the measurement.
Status Bits/OPC dependencies	This is an Overlapped command. The STATus:OPERation register bits 0 through 8 are cleared. The STATus:QUEStionable register bit 9 (INTegrity sum) is cleared.

	The SWEEPING bit is set. The MEASURING bit is set.
Backwards Compatibility Notes	For Spectrum Analysis mode in ESA and PSA, the Restart hardkey and the INITiate:RESTart command restart trace averages (displayed average count reset to 1) for a trace in Clear Write, but did not restart Max Hold and Min Hold. In the X-Series, the Restart hardkey and the INITiate:RESTart command restart not only Trace Average, but Max Hold and Min Hold traces as well. For wireless comms modes in ESA and PSA, the Restart hardkey and the INITiate:RESTart command restart every measurement, which includes all traces and numeric results. There is no change to this operation.

More Information

The **Restart** function first aborts the current sweep or measurement as quickly as possible. It then resets the sweep and trigger systems, sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the analyzer is in the process of aligning when a Restart is executed, the alignment finishes before the restart function is performed.

Even when set for Single operation, multiple sweeps may be taken when Restart is pressed (for example, when averaging/holding is on). Thus when we say that Restart "restarts a measurement," we may mean:

- It restarts the current sweep
- It restarts the current measurement
- It restarts the current set of sweeps if any trace is in Trace Average, Max Hold or Min Hold
- It restarts the current set of measurements if Averaging, or Max Hold, or Min Hold is on for the measurement
- depending on the current settings.

With Average/Hold Number (in Meas Setup menu) set to 1, or Averaging off, or no trace in Trace Average or Hold, a single sweep is equivalent to a single measurement. A single sweep is taken after the trigger condition is met; and the analyzer stops sweeping once that sweep has completed. However, with Average/Hold Number >1 and at least one trace set to Trace Average, Max Hold, or Min Hold (SA Measurement) or Averaging on (most other measurements), multiple sweeps/data acquisitions are taken for a single measurement. The trigger condition must be met prior to each sweep. The sweep is stopped when the average count k equals the number N set for Average/Hold Number. A measurement average usually applies to all traces, marker results, and numeric results; but sometimes it only applies to the numeric results.

Once the full set of sweeps has been taken, the analyzer will go to the idle state. To take one more sweep without resetting the average count, increment the average count by 1, by pressing the step up key while Average/Hold Number is the active function, or sending the remote command CALC:AVER:TCON UP.

Pause/Resume

Pauses a measurement after the current data acquisition is complete.

When Paused, the label on the control changes to Resume. Pressing Resume un-pauses the measurement. When you are Paused, pressing **Restart** does a Resume.

Remote Command	`:INITiate:PAUSe` `:INITiate:RESume`
Example	`:INIT:PAUS` `:INIT:RES`
Dependencies	Not displayed in Modes that do not support Pausing.
Annotation	Only on control

Abort (Remote Command Only)

This command is used to stop the current measurement. It aborts the current measurement as quickly as possible, resets the sweep and trigger systems, and puts the measurement into an "idle" state. If the analyzer is in the process of aligning when ABORt is sent, the alignment finishes before the abort function is performed. So ABORt does not abort an alignment.

If the analyzer is set for Continuous measurement, it sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the analyzer is set for Single measurement, it remains in the "idle" state until an :INIT:IMM command is received.

Remote Command	`:ABORt`
Example	`:ABOR`
Notes	If :INITiate:CONTinuous is ON, then a new continuous measurement will start immediately, with sweep (data acquisition) occurring once the trigger condition has been met. If :INITiate:CONTinuous is OFF, then :INITiate:IMMediate is used to start a single measurement, with sweep (data acquisition) occurring once the trigger condition has been met.
Dependencies	For continuous measurement, ABORt is equivalent to the Restart key. Not all measurements support the abort command.

Status Bits/OPC dependencies	The STATus:OPERation register bits 0 through 8 are cleared. The STATus:QUEStionable register bit 9 (INTegrity sum) is cleared. Since all the bits that feed into OPC are cleared by the ABORt, the ABORt will cause the *OPC query to return true.

3.14.10 Trace

Trace functions are not supported in the List Power Step Measurement.

3.15 List Power Step Measurement Commands

The following commands and queries can be used to retrieve the measurement results:

:CONFigure:LPSTep

:CONFigure:LPSTep:NDEFault

:INITiate:LPSTep

:FETCh:LPSTep[n]?

:MEASure:LPSTep[n]?

:READ:LPSTep[n]?

Remote Command Results for List Power Step

For the queries listed above, the results returned depend on the value of n, as follows.

n	Results Returned
not specified, or 1	Returns the following scalar results: 1. **Sample Interval** is a floating point number representing the time between samples when using the trace queries (n=2) 2. **Mean Power** is the mean power (in dBm). This is the power across the entire trace. If averaging is on, the power is for the latest acquisition 3. **Mean Power Averaged** is the power (in dBm) for N averages, if averaging is on. This is the power across the entire trace. If averaging is on, the power is for the latest acquisition. If averaging is off, the value of the mean power averaged is the same as the value of the mean power 4. **Sweep Points** is the number of data points in the swept signal. This number is useful when performing a query on the signal (i.e. when n=2) 5. **Peak-to-Mean** ratio has units of dB. This is the ratio of the maximum signal level to the mean power. Valid values are only obtained with averaging turned off. If averaging is on, the peaktomean ratio is calculated using the highest peak value, rather than the displayed average peak value 6. **Maximum value** is the maximum of the most recently acquired data (in dBm) 7. **Minimum value** is the minimum of the most recently acquired data (in dBm)
2	Returns trace point values of the entire captured signal envelope trace data. These data points are floating point numbers representing the power of the signal (in dBm). There are N data points, where N is the sweep points. The period between the samples is defined by the sample interval.

3.15.1 Calculate Results (Remote Query Only)

Return power results of the selected sweep. The calculated period is specified with Calculation Time Setup.

Remote Command	:CALCulate:LPSTep:LIST[1]|2|...|50? [RMS] | MAXimum | MINimum
Example	:CALC:LPST:LIST2? MAX
Notes	Query only

For obtaining results efficiently, it is recommended to query this result when analyzer is not sweeping. It is generally advisable to be in Single Sweep

Example Sequence:

`:INIT:CONT 0`

Set Parameter

`:INIT`

`*OPC?`

`:CALC:LPST:LIST?`

3.15.2 Views

Allows you to select the desired measurement view from the following selections:

- MLISt – "Measurement List " on page 1860
- PARameter – "Parameter List " on page 1860
- RESult - "Result Metrics " on page 1860
- RFENvelope See "RF Envelope View" on page 1889

If you have modified the current View, using the "View Editor" on page 128, an asterisk appears next to that View in the radio button panel. You can save the modified View as a User View (see "Save Layout as New View" on page 1890).

Remote Command	`:DISPlay:LPSTep:VIEW[:SELect] MLISt | PARameter | RESult | RFENvelope` `:DISPlay:LPSTep:VIEW[:SELect]?`
Example	`:DISP:LPST:VIEW RES` `:DISP:LPST:VIEW?`
Preset	`RESult`
State Saved	Saved in instrument state
Range	Measurement List|Parameter List|Result Metrics|RF Envelope

3.15.2.1 RF Envelope View

Windows: "RF Envelop Graph" on page 1861, "Metrics" on page 1861,

3.15.3 Windows

There are five windows available in this measurement.

Window Number List

Window	Number
Measurement List	1
Parameter List	2
Result Metrics	3
RF Envelope	4
Metrics	5

3.15.3.1 Measurement List

This window shows the results of currently enabled measurements.

If "Show All Items" on the Display menu is enabled , all available measurements and results are displayed. When a measurement is disabled, the measurement name and results for the disabled measurement are grayed out.

Example	`:DISP:LPST:VIEW MLIS`

3.15.3.2 Parameter List

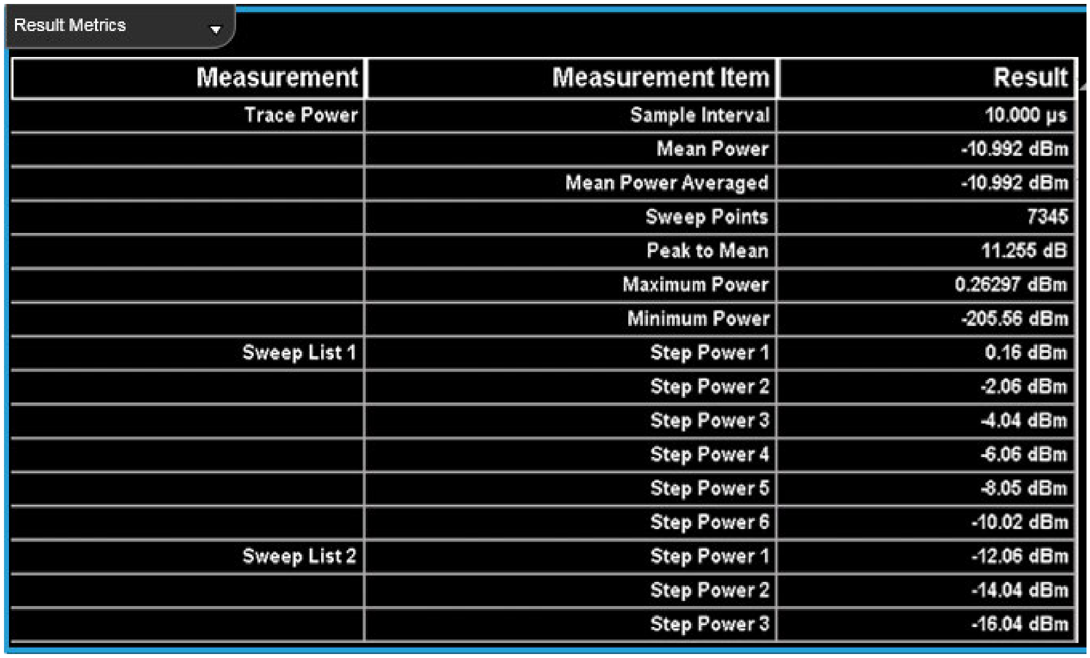
This window shows the name, remote commands and values of all available commands for the current measurement. You can verify and change values in the table by using front-panel keys, or a mouse and keyboard.

Example	`:DISP:LPST:VIEW PAR`

3.15.3.3 Result Metrics

This window displays measurement results in the same order as they are returned by the remote results (n=1) query.

Example	`:DISP:LPST:VIEW RES`


Result Metrics

Measurement	Measurement Item	Result
Trace Power	Sample Interval	10.000 μs
	Mean Power	-10.992 dBm
	Mean Power Averaged	-10.992 dBm
	Sweep Points	7345
	Peak to Mean	11.255 dB
	Maximum Power	0.26297 dBm
	Minimum Power	-205.56 dBm
Sweep List 1	Step Power 1	0.16 dBm
	Step Power 2	-2.06 dBm
	Step Power 3	-4.04 dBm
	Step Power 4	-6.06 dBm
	Step Power 5	-8.05 dBm
	Step Power 6	-10.02 dBm
Sweep List 2	Step Power 1	-12.06 dBm
	Step Power 2	-14.04 dBm
	Step Power 3	-16.04 dBm

RF Envelop Graph

This window shows a time-domain magnitude trace that is connected to multiple gated sweeps by setting of List Setup parameters. The gray vertical bars show the calculation period of related power results.

Example	`:DISP:LPST:VIEW RFEN`

The Graph window appears in the following View:

View	Size	Position
RF Envelope	Two-thirds, Full width	Top

Corresponding Trace	yellow – n=2

Metrics

The Metrics window appears in the following View:

View	Size	Position
RF Envelope	One-thirds, Full width	Bottom

Name	Corresponding Results	Display Format
Meas Power (Entire Trace)	n=1, 2nd item Meas power across the entire trace in dBm	XX.XX dBm
Pk-to-Mean	n=1, 5th item The ratio of the maximum signal level to the mean power in dB.	XX.XX dB
Current Data Max Point	n=1, 6th item Maximum value of the most recently acquired data in dBm	XX.XX dBm
Current Data Min Point	n=1, 7th item Minimum value of the most recently acquired data in dBm	XX.XX dBm

3.15.4 Amplitude

The Amplitude front-panel key activates the Amplitude menu and selects Reference Value as the active function.

3.15.4.1 Y Scale

The Y Scale Tab contains controls that pertain to the Y axis parameters of the measurement. These parameters control how data on the vertical (Y) axis is displayed and control instrument settings that affect the vertical axis.

Ref Value

Sets the value for the absolute power reference. The reference line is at the top, center, or bottom of the graticule, depending on the value of the Ref Position function.

Remote Command	`:DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:RLEVel <real>` `:DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:RLEVel?`
Example	`:DISP:LPST:VIEW:WIND:TRAC:Y:RLEV 2.0` `:DISP:LPST:VIEW:WIND:TRAC:Y:RLEV?`
Couplings	When Auto Scaling is On (default), this value is automatically determined by the measurement result.

	When you set a value manually, Auto Scaling changes to Off. Attenuation is not coupled to Ref Value.
Preset	10.00 dBm
State Saved	Saved in instrument state
Min/Max	-250.00 dBm / 250.00 dBm
Annotation	Ref <value> top left of graph

Scale/Div

For measurements that support a logarithmic Y-Axis, Scale/Div sets the height of one division of the graticule in the current Y-Axis unit.

Scale/Div also determines the displayed amplitude range in the log plot graph. Since there are usually 10 vertical graticule division on the display, the total amplitude range of the graph is typically 10x this amount. For example, if Scale/Div is 10 dB, then the total range of the graph is 100 dB.

Remote Command	`:DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:PDIVision <rel_ampl>` `:DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:PDIVision?`
Example	`:DISP:LPST:VIEW:WIND:TRAC:Y:PDIV 10dB` `:DISP:LPST:VIEW:WIND:TRAC:Y:PDIV?`
Couplings	When the Auto Scaling is On, this value is automatically determined by the measurement result. When you set a value manually, Auto Scaling automatically changes to Off.
Preset	10.00 dB / Div
State Saved	Saved in instrument state
Min	0.10 dB
Max	20 dB
Annotation	<value> dB/ left upper of graph

Ref Position

Positions the reference level at the top, center, or bottom of the Y Scale display. Changing the reference position does not change the reference level value.

Remote Command	`:DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:RPOSition TOP | CENTer | BOTTom` `:DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:RPOSition?`
Example	`:DISP:LPST:VIEW:WIND:TRAC:Y:RPOS CENT` `:DISP:LPST:VIEW:WIND:TRAC:Y:RPOS?`

Preset	TOP
State Saved	Saved in instrument state.
Range	Top|Center|Bottom
Annotation	The greater than (>) and less than (<) symbols are displayed on both sides of the graph to indicate the Reference Position

Auto Scaling

Toggles the Auto Scaling function between On and Off.

Remote Command	`:DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:COUPle 0 | 1 | OFF | ON` `:DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:COUPle?`
Example	`:DISP:LPST:VIEW:WIND:TRAC:Y:COUP OFF` `:DISP:LPST:VIEW:WIND:TRAC:Y:COUP?`
Couplings	When Auto Scaling is On, and the Restart front-panel key is pressed, this function automatically sets the scale per division to 10 dB and determines the reference values based on the measurement results. When you set a value to either Scale/Div or Ref Value manually, Auto Scaling automatically changes to Off.
Preset	1
State Saved	Saved in instrument state.
Range	On|Off

3.15.4.2 Range (Non-attenuator models)

This tab is only available for Keysight's modular signal analyzers and certain other Keysight products. Examples include:

- VXT
- E7760
- M9391A
- M9393A

This tab also does not appear in UXM. In UXM, all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

State Saved	No

Range

Represents the amplitude of the largest sinusoidal signal that could be present within the IF without being clipped by the ADC. For signals with high peak-to-average ratios, the range may need to exceed the rms signal power by a significant amount to avoid clipping.

This is a measurement global setting.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe <real>` `[:SENSe]:POWer[:RF]:RANGe?`
Example	`:POW:RANG 10 dBm` `:POW:RANG?`
Notes	The MIN and MAX values are affected by the External Gain parameters, and by the **Center Frequency** The hardware compensates for frequency response and alters the Range setting
Preset	0 dBm
State Saved	Yes
Min	-100
Max	100
Annotation	Meas Bar

Adjust Range for Min Clipping

Sets the combination of attenuation and gain based on the current measured signal level so that clipping will be at a minimum.

This is an "immediate action" function, that is, it executes once, when the key is pressed.

This key does not appear in measurements that do not support this functionality.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate`
Notes	Executing Adjust Range for Min Clipping initiates the measurement
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760

Pre-Adjust for Min Clipping

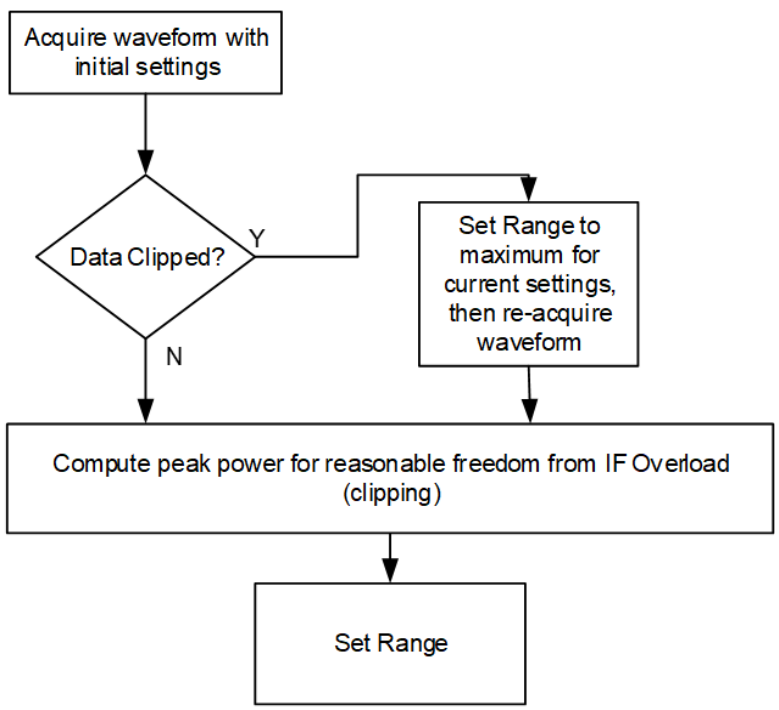
If this function is `ON`, it applies the adjustment described under Adjust Range For Min Clipping each time a measurement restarts. Therefore, in Continuous measurement mode, it only executes before the first measurement.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation OFF | ON | ELECtrical | COMBined`

	[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation?
Notes	Because there is no attenuator control available in these models, the control displays only ON and OFF choices. However, for SCPI compatibility with other platforms, all three parameters (ELECtrical, COMBined, and ON) are honored and all are mapped to ELECtrical, so if any of these three parameters is sent, a subsequent query will return ELEC
Dependencies	This control does not appear in the Swept SA and Monitor Spectrum measurements This control appears in all measurements in E7760
Preset	OFF for Swept SA measurement; ON for all other measurements that support **Pre-Adjust for Min Clipping**
State Saved	Saved in instrument state

Adjustment Algorithm

The algorithm for the adjustment is documented below:



Peak-to-Average Ratio

Used with "Range (Non-attenuator models)" on page 1864 to optimize the level control in the instrument. The value is the ratio, in dB, of the peak power to the average power of the signal to be measured. A ratio of 0 should be used for sinusoidal signals; for 802.11g OFDM signals use 9 dB.

All Applications (Modes) show the current value of Peak-to-Average ratio on the control. However, some applications do not permit changing the value. In these situations, the control is grayed-out.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:PARatio <real>` `[:SENSe]:POWer[:RF]:RANGe:PARatio?`
Example	`:POW:RANG:PAR 12 dB`
Notes	In some Applications (Modes) this parameter is read-only; meaning the value will appear on the control and query via SCPI, but is not changeable. In such applications the control is grayed-out. Attempting to change the value via SCPI will be ignored but no error message will be generated
Dependencies	This control does not appear in Spectrum Analyzer Mode
Preset	10 dB VXT Models M9410A/11A: 0 dB
State Saved	Saved in instrument state
Min	0 dB
Max	20 dB VXT Models M9410A/11A: 50 dB

Mixer Lvl Offset

This is an advanced setting to adjust target Range at the input mixer, which in turn affects the signal level in the instrument's IF. This setting can be used when additional optimization is needed after setting "Peak-to-Average Ratio" on page 1866. Positive values of offset optimize noise performance over distortion, negative values optimize distortion performance over noise.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet <real>` `[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet?`
Example	`:POW:RANG:MIX:OFFS -5 dB`
Preset	0 dB
State Saved	Saved in instrument state
Min	-35 dB VXT Models M9410A/11A: -34 dB
Max	30 dB

3.15.4.3 Signal Path

Contains controls that pertain to the routing of the signal through the frontend of the instrument.

In general, this tab only appears in instruments whose hardware supports this signal routing. For example, this tab does not appear in many of the modular instrument products, including VXT Models M9420/21A. It also does not appear in UXM.

This tab *does* appear in VXT Models M9410A/11A because the Software Preselection control is in this tab, and VXT Models M9410A/11A implement a version of Software Preselection.

Presel Center

Pressing this control adjusts the centering of the preselector filter to optimize the amplitude accuracy at the frequency of the selected marker. If the selected marker is not on when **Presel Center** is pressed, the instrument turns on the selected marker, performs a peak search, and then performs centering on the marker's center frequency. If the selected marker is already on and between the start and stop frequencies of the instrument, the instrument performs the preselector calibration on that marker's frequency. If the selected marker is already on, but outside the frequency range between Start Freq and Stop Freq, the instrument first performs a peak search, and then performs centering on the marker's center frequency.

The value displayed on "Preselector Adjust" on page 1869 will change to reflect the new preselector tuning.

A number of considerations should be observed to ensure proper operation. See "Proper Preselector Operation" on page 1869.

Remote Command	`[:SENSe]:POWer[:RF]:PCENter`
Example	`:POW:PCEN`
Notes	Note that the rules outlined above under the control description apply for the remote command as well as the key. The result of the command is dependent on marker position, etc. Any message shown by the control press is also shown in response to the remote command
Dependencies	Does not appear in CXA-m Does not appear in VXT Models M9410A/11A Grayed-out if the microwave preselector is off – If the selected marker's frequency is below Band 1, an advisory message is generated "Preselector not used in this frequency range" and no action is taken – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz – Blank in models that do not include a preselector, such as option 503. If the remote command is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View
Couplings	The active marker position determines where the centering will be attempted If the instrument is in a measurement such as averaging when centering is initiated, the act of centering the preselector restarts averaging, but the first average trace will not be taken until the centering is completed The offset applied to do the centering reads out on the "Preselector Adjust" on page 1869 control
Status Bits/OPC dependencies	When centering the preselector, `*OPC` will not return true until the process is complete and a subsequent measurement has completed, nor will results be returned to `:READ` or `:MEASure` queries The Measuring bit should remain set while this command is operating and should not go false until the subsequent sweep/measurement has completed

Proper Preselector Operation

A number of considerations should be observed to ensure proper operation:

1 If the selected marker is off, the instrument turns on a marker, performs a peak search, and adjusts the preselector using the selected marker's frequency. It uses the "highest peak" peak search method unqualified by threshold or excursion, so that there is no chance of a 'no peak found' error. It continues with that peak, even if it is the peak of just noise. Therefore, for this operation to work properly, there should be a signal on screen in a preselected range for the peak search to find

2 If the selected marker is already on, the instrument attempts the centering at that marker's frequency. There is no preselector for signals below about 3.6 GHz, so if the marker is on a signal below 3.6 GHz, no centering will be attempted and an advisory message generated

3 In some models, the preselector can be bypassed. If it is bypassed, no centering will be attempted in that range and a message will be generated

Preselector Adjust

Allows you to manually adjust the preselector filter frequency to optimize its response to the signal of interest. This function is only available when "Presel Center" on page 1868is available.

For general purpose signal analysis, using **Presel Center** is recommended. Centering the filter minimizes the impact of long-term preselector drift. **Preselector Adjust** can be used instead to manually optimize the preselector. One application of manual optimization would be to peak the preselector response, which both optimizes the signal-to-noise ratio and minimizes amplitude variations due to small (short-term) preselector drifting.

When **Presel Center** is performed, the offset applied to do the centering becomes the new value of **Preselector Adjust**.

Remote Command	`[:SENSe]:POWer[:RF]:PADJust <freq>` `[:SENSe]:POWer[:RF]:PADJust?`
Example	`:POW:PADJ 100KHz` `:POW:PADJ?`
Notes	The value on the control reads out to 0.1 MHz resolution
Dependencies	– Does not appear in CXA-m – Does not appear in VXT Models M9410A/11A – Grayed-out if microwave preselector is off – Grayed-out if entirely in Band 0, that is, if Stop Freq is below about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if Start Freq is above 50 GHz

	– Blank in models that do not include a preselector, such as option 503. If the SCPI is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the Spectrogram View
Preset	0 MHz
State Saved	The **Preselector Adjust** value set by "Presel Center" on page 1868, or by manually adjusting **Preselector Adjust** It is not saved in instrument state, and does not survive a Preset or power cycle
Min	-500 MHz
Max	500 MHz
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PADJust` `[:SENSe]:POWer[:RF]:MMW:PADJust`

Notes	PSA had multiple preselectors, and you could select which preselector to adjust. Since the X-Series has only one mm/uW preselector, the preselector selection control is no longer available. However, to provide backward compatibility, we accept the legacy remote commands The command form has no effect, the query always returns `MWAVe`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:PADJust:PRESelector MWAVe | MMWave | EXTernal` `[:SENSe]:POWer[:RF]:PADJust:PRESelector?`

Internal Preamp

Accesses a menu of controls for the internal preamps. Turning on the preamp gives a better noise figure, but a poorer inter-modulation distortion (TOI) to noise floor dynamic range. You can optimize this setting for your particular measurement.

The instrument takes the preamp gain into account as it sweeps. If you sweep outside of the range of the preamp, the instrument will also account for that. The displayed result always reflects the correct gain.

For some measurements, when the preamp is on and any part of the displayed frequency range is below the lowest frequency for which the preamp has specifications, a warning condition message appears in the status line. For example, for a preamp with a 9 kHz lowest specified frequency: "Preamp: Accy unspec'd below 9 kHz".

Selection	Example	Note
Off	`:POW:GAIN OFF`	
Low Band	`:POW:GAIN ON` `:POW:GAIN:BAND LOW`	Sets the internal preamp to use only the low band. The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Low Band selection in the dropdown

Selection	Example	Note
Full Range	:POW:GAIN ON :POW:GAIN:BAND FULL	Sets the internal preamp to use its full range. The low band (0-3.6 GHz, 0-3.4 GHz, 0-3GHz, depending on the model) is supplied by the low band preamp and the frequencies above low band are supplied by the high band preamp The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Full Range selection in the dropdown. If the high band option is not installed the Full Range selection does not appear

Remote Command	`[:SENSe]:POWer[:RF]:GAIN:BAND LOW | FULL`
	`[:SENSe]:POWer[:RF]:GAIN:BAND?`
	`[:SENSe]:POWer[:RF]:GAIN[:STATe] OFF | ON | 0 | 1`
	`[:SENSe]:POWer[:RF]:GAIN[:STATe]?`

Example	`:POW:GAIN:BAND LOW`
	`:POW:GAIN:BAND?`
	`:POW:GAIN OFF`
	`:POW:GAIN?`

Dependencies	Preamp is not available on all hardware platforms. If the preamp is not present or is unlicensed, the control is not shown Does not appear in VXT Models M9410A/11A/15A If `:POW:GAIN:BAND FULL` is sent when a low band preamp is available, the preamp band parameter is set to `LOW` instead of `FULL`, and an "Option not installed" message is generated The preamp is not available when the electronic/soft attenuator is enabled
Preset	`LOW` `OFF`
State Saved	Saved in instrument state
Annotation	When the USB Preamp is not connected to USB, the Preamp annotation in the Meas Bar says "Off" if the preamp is off and displays the frequency range of the low band or full range preamp depending on the setting. For example, if the Preamp is set to Low Band and the Low Band is 3.6 GHz the annotation says "3.6 GHz". If it is a 13.6 GHz preamp and it is set to Full Range the annotation says "13.6 GHz" When the USB Preamp is connected to USB, the Preamp annotation says "Preamp: USB" if the internal preamp is off or "Preamp: USB, Int" if the internal preamp is on (only for measurements that support the USB preamp)

LNA

Lets you turn the Low Noise Amplifier (LNA) on or off.

The LNA is an additional preamplifier that provides superior DANL and frequency range compared to the Internal Preamp. The LNA provides lower system noise figure, especially at frequencies above 100 MHz, and can be operated up to the full range of 50 GHz instruments.

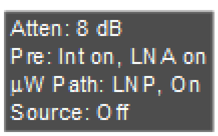
For best possible sensitivity, the LNA can be turned on together with the "Internal Preamp" on page 1870, although if you operate both preamps together, note that the TOI (distortion) specifications are impacted. The sensitivity improvement of this combination is substantial when operating in high band (frequencies above 3.6 GHz).

See "More Information" on page 1872

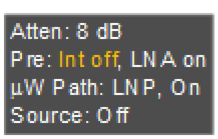
Remote Command	`[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe] OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe]?`
Example	`:POW:GAIN:LNA ON`
Dependencies	Requires option LNA Option LNA is not required by VXT model M9415A Does not appear in VXT models M9420A/21A/10A/11A May not appear in some measurements
Preset	`OFF`
State Saved	Saved in State

More Information

When the LNA is installed, the preamp annotation changes to show the state of both the LNA and the Internal Preamp. Below is an example:



Note that when operating entirely in the low band (below about 3.6 GHz), if the LNA is on, the Internal Preamp is switched off (even if you have its switch set to ON). This is because the noise performance is actually degraded in low band if both preamps are on. In this case, the annotation reflects the actual state of the two preamps, but the Internal Preamp annotation displays in amber, to warn you that the actual state of the Internal Preamp does not match the **Internal Preamp** switch control display:



µW Path Control

Options for this control include **µW Preselector Bypass** (Option MPB), **Low Noise Path** (Option LNP) and **Full Bypass Enable** in the High Band path circuits.

When the µW Preselector is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. When **Low Noise Path Enable** is selected, the instrument automatically bypasses certain circuitry in the high frequency bands that can contribute to noise, when it is appropriate based on other instrument settings.

For most applications, the preset state is **Standard Path**, which provides the best remote-control throughput, minimizes acoustic noise from switching and minimizes the risk of wear in the hardware switches, particularly in remote test scenarios where both low band and high band setups will follow in rapid succession. In this path, the bypass of the low band/high band switch and microwave preamp is never activated, which can cause some noise degradation but preserves the life of the bypass switch.

For applications that utilize the wideband IF paths, the preset state is **µW Preselector Bypas**s, if option MPB is present. This is because, when using a wideband IF such as the 140 MHz IF, the µW Preselector's bandwidth can be narrower than the available IF bandwidth, causing degraded amplitude flatness and phase linearity, so it is desirable to bypass the preselector in the default case.

You may choose **Low Noise Path Enable** for a lower noise floor, especially in the 21-26.5 GHz region, though without improving many measures of dynamic range, and without giving the best possible noise floor. The preamp, if purchased and used, gives better noise floor than does **Low Noise Path Enable**, but the preamp's compression threshold and third-order intercept are much poorer than that of **Low Noise Path Enable**.

A fourth choice is **Full Bypass Enable**, which combines **µW Preselector Bypass** and **Low Noise Path Enable**. Because this can bypass most of the circuitry between the input and the first mixer, care should be taken when using this setting to avoid damaging the mixer. **Full Bypass Enable** is only available if both options LNP and MPB are present, as well as option FBP.

Path	Example	Note
Standard Path	`:POW:MW:PATH STD`	Normal setting for most measurements. µW Preselector in circuit, Low Noise Path disabled
Low Noise Path Enable	`:POW:MW:PATH LNP`	See "Low Noise Path Enable" on page 1877
µW Preselector Bypass	`:POW:MW:PATH MPB`	See "µW Preselector Bypass" on page 1879
Full Bypass Enable	`:POW:MW:PATH FULL`	See "Full Bypass Enable" on page 1880

Remote Command	`[:SENSe]:POWer[:RF]:MW:PATH STD | LNPath | MPBypass | FULL`

	`[:SENSe]:POWer[:RF]:MW:PATH?`

Example	`:POW:MW:PATH LNP`
	Enables the Low Noise path
	`:POW:MW:PATH?`

Notes	If "Presel Center" on page 1868 is performed, the instrument will momentarily switch to the Standard Path, regardless of the setting of **µW Path Control** The DC Block will always be switched in when the low noise path is switched in, to protect succeeding circuitry from DC. Note that this does not mean "when the low noise path is enabled" but when, based on the Low Noise Path rules, the path is actually switched in. This can happen when the selection is **Low Noise Path Enable** or **Full Bypass Enable.** In the case where the DC Block is switched in the instrument is now AC coupled. However, if you selected DC coupling, the UI would still behave as though it were DC coupled, including all annunciation, warnings, status bits, and responses to SCPI queries. This is because, based on other settings, the instrument could switch out the low noise path at any time and hence go back to being DC coupled Alignment switching ignores the settings in this menu, and restores them when finished
Dependencies	Does not appear in CXA-m Does not appear in VXT Models M9410A/11A Does not appear in BBIQ and External Mixing The **Low Noise Path Enable** selection does not appear unless Option LNP is present and licensed The **µW Preselector Bypass** selection does not appear unless Option MPB is present and licensed The **Full Bypass Enable** selection does not appear unless options LNP and MPB are both present as well as option FBP In any of these cases, if the required options are not present and the SCPI command is sent, error -241, "Hardware missing; Option not installed" is generated **Low Noise Path Enable** and **Full Bypass Enable** are grayed-out if the current measurement does not support them **Low Noise Path Enable** and **Full Bypass Enable** are not supported in Avionics and MMR Modes. In any of these cases (that is, the feature is not supported in either measurement or mode), if the SCPI command is sent, the following error is generated: -221, "Setting Conflict; Feature not supported for this measurement"
Preset	All except modes specified below: `STD` IQ Analyzer, VXA, Pulse and Avionics mode: – MPB option present and licensed: `MPB` – MPB option not present and licensed: `STD`
State Saved	Save in instrument state
Range	Standard Path|Low Noise Path Enable|µW Presel Bypass|Full Bypass Enable
Annotation	In the Meas Bar, if the Standard path is chosen, it says: µW Path: Standard If Low Noise Path is enabled but the LNP switch is not thrown, it shows: µW Path: LNP,Off If the Low Noise Path is enabled and the LNP switch IS thrown, it shows: µW Path: LNP,On

If the preselctor is bypassed, it says:

µW Path: Bypass

If Full Bypass Enable is selected but the LNP switch is not thrown, it shows:

µW Path: FByp,Off

If Full Bypass Enable is selected and the LNP switch IS thrown, it shows:

µW Path: FByp,On

µW Path Control Auto [Mode: VMA, WLAN, NR5G, CQM]

In VMA, WLAN, 5G NR, CQM modes, an Auto/Man switch is added to **µW Path Control**:

This allows the function to automatically switch based on certain Auto Rules as shown below:

VMA Mode

Measurement	When µW Path Control is in Auto:
Digital Demod	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Custom OFDM	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Presel Bypass
SEM	Always Presel Bypass
Spurious Emissions	Always Standard Path

WLAN Mode

Measurement	When µW Path Control is in Auto:
Modulation Analysis	Always Presel Bypass

Measurement	When µW Path Control is in Auto:
Spectral Flatness	Always Presel Bypasss
Power vs Time	Always Presel Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Always Presel Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Always Presel Bypass
SEM	1. For 11be 320M, when 'Enabled Wideband IF for FFT' is OFF or 'Sweep Type Rule' is Best Dynamic Range, auto µW path is standard. 2. For other cases, auto µW path is presel bypass if presel bypass is enabled, auto µW path is standard if presel bypass is not enabled.
Spurious Emissions	Always Standard Path

5G NR Mode

Measurement	When µW Path Control is in Auto:
Modulation Analysis	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and "Allow Full Bypass in Auto" is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and "Allow Full Bypass in Auto" is On), otherwise choose Preselector Bypass
Channel Power	Always Standard Path
Occupied BW	Always Standard Path
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Standard Path
SEM	Always Standard Path
Spurious Emissions	Always Standard Path
Transmit On|Off Power	Use Standard Path unless tuned frequency > 3.6 GHz and Info BW > 15 MHz, in which case choose Preselector Bypass

Channel Quality Mode

Measurement	When µW Path Control is in Auto:
Group Delay	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and "Allow Full Bypass in Auto" is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in

Measurement	When µW Path Control is in Auto:
	which case choose Preselector Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass

Remote Command	`[:SENSe]:POWer[:RF]:MW:PATH:AUTO ON | OFF | 1 | 0` `[:SENSe]:POWer[:RF]:MW:PATH:AUTO?`
Example	`:POW:MW:PATH:AUTO ON` `:POW:MW:PATH:AUTO?`
Dependencies	Only appears in VMA, WLAN, 5G NR and CQM modes
Couplings	See the tables above
Preset	ON
Range	ON|OFF

Low Noise Path Enable

You may select **Low Noise Path Enable**, which gives a lower noise floor under some circumstances, particularly when operating in the 21-26.5 GHz region. With the Low Noise Path enabled, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

– The instrument is not in the Low Band, meaning:

– the start frequency is above 3.5 GHz and

– the stop frequency is above 3.6 GHz

– the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Low Noise Path Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Low Noise Path Enable** is selected in the user interface. The only time the Low Noise Path is used is when **Low Noise Path Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

For measurements that use IQ acquisition, the low noise path is used when **Center Frequency** is in High Band (> 3.6 GHz) and no preamp is in use. In other words, the rules above are modified to use only the center frequency to qualify which path to switch in. This is not the case for FFTs in the Swept SA measurement; they use the same rules as swept measurements.

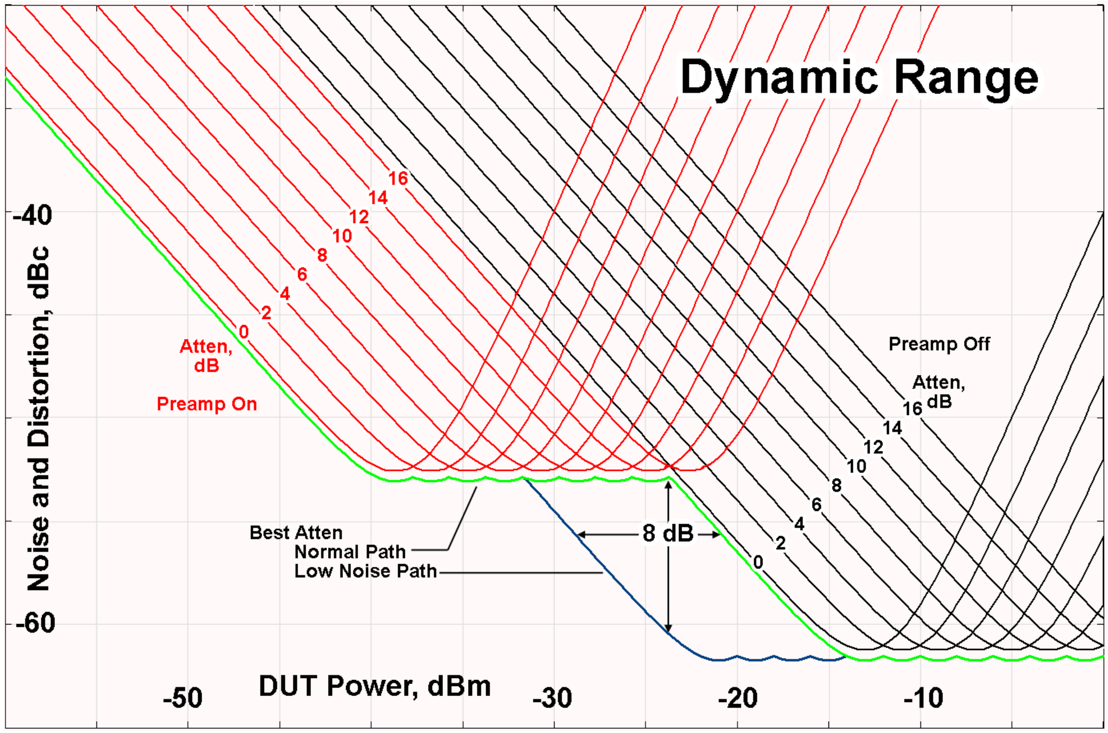
Note that the Low Noise Path, while giving improved DANL, has the disadvantage of decreased TOI performance and decreased gain compression performance relative to the standard path.

Note also that the bypass switch is a mechanical switch and has finite life, so if the **Low Noise Path Enable** is selected, it is possible to cause frequent cycling of this switch by frequently changing instrument settings such that the above conditions hold true only some of the time. A user making tests of this nature should consider opting for the **Standard Path**, which will never throw the bypass switch, at the expense of some degraded noise performance.

The low noise path is useful for situations where the signal level is so low that the instrument performance is dominated by noise even with 0 dB attenuation, but still high enough that the preamp option would have excessive third-order intermodulation or compression. The preamp, if purchased and used, gives better noise floor than does the “Low Noise Path.” However, its compression threshold and third-order intercept are much poorer than that of the non-preamp path.

There are some applications, typically for signals around –30 dBm, for which the third-order dynamic range of the standard path is good enough, but the noise floor is not low enough even with 0 dB input attenuation. When the third-order dynamic range of the preamp path is too little and the noise floor of the standard path is too high, the Low Noise Path can provide the best dynamic range

The graph below illustrates the concept. It shows, in red, the performance of an instrument at different attenuation settings, both with the preamp on and off, in a measurement that is affected by both instrument noise and instrument TOI. The green shows the best available dynamic range, offset by 0.5 dB for clarity. The blue shows how the best available dynamic range improves for moderate signal levels with the low noise path switched in. In this illustration, the preamp improves the noise floor by 15 dB while degrading the third-order intercept by 30 dB, and the low noise path reduces loss by 8 dB. The attenuator step size is 2 dB.



There are other times where selecting the low noise path improves performance, too. Compression-limited measurements such as finding the nulls in a pulsed-RF spectrum can profit from the low noise path in a way similar to the TOI-limited measurement illustrated. Accuracy can be improved when the low noise path allows the optimum attenuation to increase from a small amount like 0, 2 or 4 dB to a larger amount, giving better return loss at the instrument input. Harmonic measurements, such as second and third harmonic levels, are much improved using the low noise path because of the superiority of that path for harmonic (though not intermodulation) distortion performance.

µW Preselector Bypass

Toggles the preselector bypass switch for band 1 and higher. When the microwave presel is on, the signal path is preselected. When the microwave preselector is off, the signal path is not preselected. The preselected path is the normal path for the instrument.

The preselector is a tunable bandpass filter which prevents signals away from the frequency of interest from combining in the mixer to generate in-band spurious signals (images). The consequences of using a preselector filter are its limited bandwidth, the amplitude and phase ripple in its passband, and any amplitude and phase instability due to center frequency drift.

Option MPB or pre-selector bypass provides an unpreselected input mixer path for certain X-Series signal analyzers with frequency ranges above 3.6 GHz. This signal path allows a wider bandwidth and less amplitude variability, which is an advantage when doing modulation analysis and broadband signal analysis. The disadvantage is that, without the preselector, image signals will be displayed. Another disadvantage of bypassing the preselector is increased LO emission levels at the front panel input port.

Image responses are separated from the real signal by twice the 1st IF. For IF Paths of 10 MHz and 25 MHz, the 1st IF is 322.5 MHz, so the image response and the real signal will be separated by 645 MHz. The 1st IF will be different for other IF Path settings. When viewing a real signal and its corresponding image response in internal mixing, the image response will be to the left of the real signal.

Also, the image response and the real signal typically have the same amplitude and exhibit the same shape factor.

However, if Option FS1, Fast Sweep Capability, is enabled, the image response in the Swept SA measurement appears lower in amplitude and has a much wider shape factor compared to the real signal.

Full Bypass Enable

With **Full Bypass Enable** selected, the microwave preselector is bypassed. In addition, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

- The instrument is not in the Low Band, meaning:
- the start frequency is above 3.5 GHz and
- the stop frequency is above 3.6 GHz.
- the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. The only time the Low Noise Path is used is when **Full Bypass Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

CAUTION

When **Full Bypass Enable** is selected, and "Attenuation" on page 1747 is set to 0 dB, there will be a direct AC connection between the input and the first converter when the Low Noise Path switches in (when Start Freq >3.6 GHz and the Preamp is either not licensed, set to Low Band, or Off). This puts the first converter at high risk to be damaged by high AC power. Consequently, whenever **Full Bypass Enable** is selected, a warning message appears in the status bar:

Full Bypass Enabled, maximum safe input power reduced

Microwave Preselector Bypass Backwards Compatibility

Example	`:POW:MW:PRES OFF` Bypasses the microwave preselector
Notes	Included for Microwave Preselector Bypass backwards compatibility The `ON` parameter sets the `STD` path (`:POW:MW:PATH STD`) The `OFF` parameter sets path `MPB` (`:POW:MW:PATH MPB`)
Preset	`ON`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe] ON | OFF | 0 | 1` `[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe]?`

Frequency Extender Preselection Bypass

Frequency Extender Preselection Bypass only applies to the high frequency path of the Frequency Extender and only if the Frequency Extender allows it. For example, the V3050A high frequency path is 50 – 110 GHz and does allow control of the preselector bypass.

When the Frequency Extender's preselection is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. For bandwidths greater than 2.5 [GHz], it is recommended that the signal bypass the Frequency Extender Preselector since the max bandwidth of the Preselector can be as narrow as 2.5 [GHz].

For most applications, the preset state is `OFF`, which gives the best remote-control throughput, minimizes acoustic noise from switching, minimizes out of band spurs, and minimizes the risk of wear in the hardware switches.

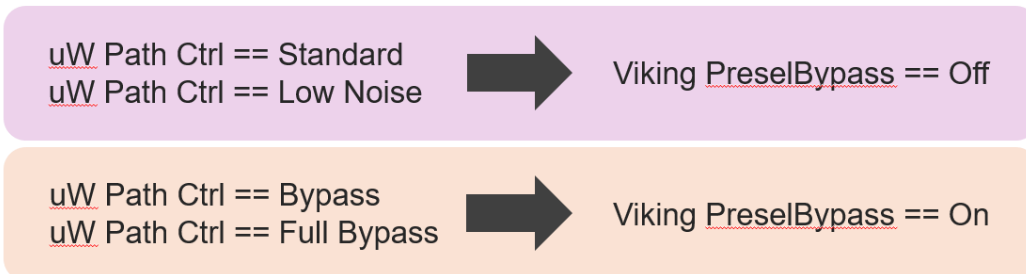
Coupling with Microwave Preselector Control

The control of whether to apply or bypass the Frequency Extender's preselection is dependent on the Microwave Path Control setting.

The coupling between the Microwave Path Control and Frequency Extender Preselector Bypass is described below.

UW PATH CTRL	UW PRESELECTOR	VIKING PRESELECTOR
Standard Path	On	**On**
Low Noise Path Enable	On	**On**
uW Presel Bypass	Off	**Off**
Full Bypass Enable	Off	**Off**

In other words…



For the Frequency Extender Preselector Bypass to take effect, it requires a Frequency Extender device (such as V3050A) be connected and External RF (ERFIN) selected as the input.

The Frequency Extender Preselector is applied or bypassed depending on the Microwave Path Control setting only when the acquisition is above 50 [GHz]. Hence, it will be bypassed only when the acquisition is above 50 [GHz].

Preselector and Bandwidth Conflict

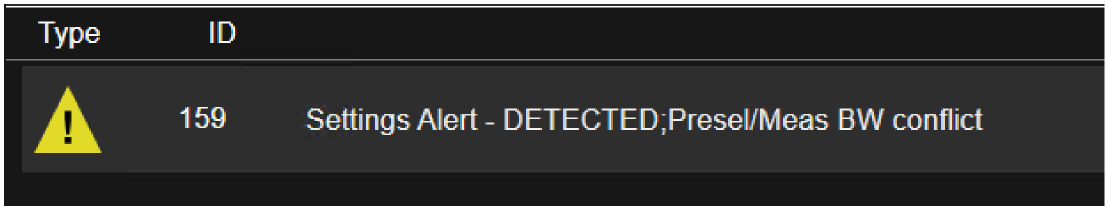
When the Frequency Extender Preselector is applied and the signal bandwidth is greater than 2.5 [GHz], then a settings alert message will show to warn the user that the signal may be distorted due to the limitation of the Frequency Extender Preselector bandwidth.

An example of the settings alert message is shown below.

Settings Alert message in the Status Bar at the bottom of the display.

Settings Alert message in the error queue

.



Software Preselection

Software Preselection is provided in some instruments, either to compensate for issues with provided hardware preselection or to provide the preselection function when there is no hardware preselector.

N9041B

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 50 GHz, software preselection must be used to suppress and separate images above 50 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

In the N9041B, Software Preselection only applies for frequencies above 50 GHz, therefore it is only used for RF Input 2. Even if it is turned on, it will not be used for other inputs and never for frequencies below 50 GHz. This is why the label of this control contains the parenthetical note "(>~50 GHz)".

Note that in the N9041B, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

N9042B+V3050A

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 88 GHz, software preselection must be used to suppress and separate images above 88 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

For N9042B+V3050A, Software Preselection only applies for frequencies above 88 GHz, therefore it is only used for External RF. Even if it is turned on, it will not be used for other inputs and never for frequencies below 88 GHz. This is why the label of this control contains the parenthetical note "(>~88 GHz)".

Note that for N9042B+V3050A, in Swept SA, Software Preselection will work even if the measurement is using an FFT sweep type. In measurements other than Swept SA, Software Preselection will not be used if the measurement is using an FFT sweep type.

VXT models M9410A/11A

Software Preselection is used to provide the preselection function, as there is no hardware preselector in these models. Two background traces are taken and compared point by point, and the point with the lowest amplitude from the two traces is used. This provides a method to reduce spurs that are internally generated within the VXT, but the user should note the following when using Software Preselection:

- There is some speed cost due to the need to take multiple captures
- Taking the point with the lowest amplitude in each trace will make the average noise level lower at all points that do not have a spur. This can reduce the accuracy of the measurement of noise and noise-like signals.

Because of the difficulty in identifying spurs manually, you are encouraged to leave Software Preselection ON at all times in VXT models M9410A/11A. If you turn it off in order to speed up your measurement or improve noise accuracy, be aware of unwanted onscreen spurs.

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel:STATe 0 | 1 | ON | OFF` `[:SENSe]:POWer[:RF]:SWPresel:STAT?`
Example	`:POW:SWPR:STAT 1` `:POW:SWPR:STAT?`
Dependencies	Only appears in N9041B, N9042B+V2050A, and VXT models M9410A/11A. Does not appear in all measurements
Couplings	Sweep Time is affected by SW Preselection. Also Auto Tune supports SW Preselection, so set SW Preselection state and then do Auto Tune
Preset	N9041B: OFF N9042B+V3050A: ON M9410A/11A: ON
State Saved	Saved in instrument state

SW Preselection Type

Specifies the algorithm used for software preselection.

Two hidden sweeps are taken in succession. The second sweep is offset in LO frequency by 2*IF/N. For each point in each trace, the smaller amplitude from the two traces is taken and placed in that point in the selected trace. The Peak detector is auto-selected to improve the image suppression effectiveness. Responses of each trace that lie on top of one another will remain and are valid signals. Other signals are images and are suppressed. The action of taking the smaller of the two traces will make the average noise level lower in all points that do not have an image, thus reducing the accuracy of the measurement of noise and noise-like signals.

- NORMal - mathematically removes all image and multiple responses of signals present at the input
- ADVanced - any trace processing (such as “max hold” or trace averaging) is performed on the points of both candidate traces before the “select minimum” operation occurs. This form of processing works better for non-stationary signals, such as pulsed-RF signals

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel NORMal | ADVanced` `[:SENSe]:POWer[:RF]:SWPResel?`
Example	`:POW:SWPR NORM` `:POW:SWPR?`
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed-out. Its grayout message is “Unavailable unless SW Presel enabled”
Preset	N9041B: ADVanced N9042B+V3050A: NORMal
State Saved	Saved in instrument state

SW Preselection BW

Specifies the effective bandwidth to be used for Software Preselection.

The choices are:

- NORMal – when making Swept measurements, a software preselection algorithm is used which takes up to 4 background acquisitions, then post-processes the result. This algorithm can remove images from signals with an occupied bandwidth up to around 3 GHz. (Default/Preset setting). When making FFT measurements, this algorithm is not used, instead the same algorithm is used as for NARRow (below)
- NARRow– a software preselection algorithm is used which takes two background acquisitions, then post-processes the result to detect and remove images from wideband signals with occupied bandwidths up to 2 GHz. This increases the risk of images failing to be rejected, but improves the measurement speed

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel:BW NORMal | NARRow` `[:SENSe]:POWer[:RF]:SWPResel:BW?`
Example	`:POW:SWPR:BW NARR`
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method When "Software Preselection" on page 1883 is Disabled, this control is grayed out. Its grayout message is “Unavailable unless SW Presel enabled” For N9042B+V3050A the parameter is SCPI only and always set to NARRow when Software

	Preselection is enabled
Preset	N9041B: `NORMal` N9042B+V3050A: `NARRow`
State Saved	Saved in instrument state

High Freq Prefilter

Lets you set the state of Prefilter for Center Frequencies above 1310 MHz.

In VXT Models M9410A/11A, the Receiver RF path has a bank of filters that come after the RF Attenuator in the signal path. Since this bank of filters precedes the mixer they are known as the “Prefilter” bank. Their purpose is to eliminate unwanted in-band mixing products by filtering out all but the desired frequencies before the signals get to the mixer. There are 13 prefilter bands to cover the frequencies between 9 kHz and 6000 MHz. The Prefilter provides the necessary rejection of the unwanted signal.

Remote Command	`[:SENSe]:<measurement>:PFILter[:STATe] ON | OFF | 1 | 0` `[:SENSe]:<measurement>:PFILter[:STATe]?`

Example	For example, to enable High Freq Prefilter in IQ Analyzer Mode:
	For the Complex Spectrum Measurement:
	`:SPEC:PFIL ON`
	For the IQ Waveform Measurement:
	`:WAV:PFIL ON`
	`:`

Dependencies	This control only appears in VXT models M9410A/11A with center frequency above 1310 MHz
Preset	See “Prefilter Presets” below
State Saved	Saved in instrument state

Prefilter Presets

Meas	Mode	Preset
SPEC	BASIC	OFF
WAV	BASIC, WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
MON	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
RHO	WCDMA	OFF
CDP	WCDMA	OFF
PCON	WCDMA	OFF
EVMQ	WCDMA	OFF
CHP	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF

Meas	Mode	Preset
OBW	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
ACP	WCDMA, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
SEM	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PST	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PVT	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF
EVM	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF
FLAT	WLAN	OFF
EVMM	WLAN	OFF
CEVM	LTEAFDD, LTEATDD	OFF
PAVT	5GNR, VMA	OFF
DDEM	VMA	OFF
OFDM	VMA	OFF
SAN	SA	ON
HARM	SA	ON

3.15.5 BW

BW is not supported in the WCDMA List Power Step Measurement.

3.15.6 Display

The Display Menu lets you configure display items for the current Mode, Measurement View or Window.

3.15.6.1 Meas Display

The Meas Display tab contains controls for setting up the display for the current Measurement, View or Window.

Show All Items

Allows you to specify display settings of the Measurement List view. In default (OFF), the current status of enabled measurements, items, limit settings and pass fail states are displayed.

Preset	OFF
State Saved	Saved in instrument state.
Range	On|Off

Index

Allows you to specify an index of array for editing the value of specified index. This control only appears when a list type of SCPI is selected on Parameter List view. Maximum number of this index corresponds to the length of selected SCPI.

Value

Allows you to edit the value of selected SCPI on Parameter List view.

Result Type

Allows you to choose type of power displayed in the Result Metrics view.

Remote Command	`:DISPlay:LPSTep:VIEW:RESType RMS | MAXimum | MINimum` `:DISPlay:LPSTep:VIEW:RESType?`
Example	`:DISP:LPST:VIEW:REST MAX` `:DISP:LPST:VIEW:REST?`
Preset	RMS
State Saved	Saved in instrument state.
Range	RMS|Maximum|Minimum

3.15.6.2 View

Contains controls for selecting the current **View**, and for editing User Views.

Views

Allows you to select the desired measurement view from the following selections:

- MLISt – "Measurement List " on page 1860
- PARameter – "Parameter List " on page 1860
- RESult - "Result Metrics " on page 1860
- RFENvelope See "RF Envelope View" on page 1889

If you have modified the current View, using the "View Editor" on page 128, an asterisk appears next to that View in the radio button panel. You can save the modified View as a User View (see "Save Layout as New View" on page 1890).

Remote Command	:DISPlay:LPSTep:VIEW[:SELect] MLISt | PARameter | RESult | RFENvelope :DISPlay:LPSTep:VIEW[:SELect]?
Example	:DISP:LPST:VIEW RES :DISP:LPST:VIEW?
Preset	RESult
State Saved	Saved in instrument state
Range	Measurement List|Parameter List|Result Metrics|RF Envelope

RF Envelope View

Windows: "RF Envelop Graph" on page 1861, "Metrics" on page 1861,

User View

Lets you choose a View from the saved User Views for the current measurement. This panel only appears if a User View exists for the current measurement.

Remote Command	:DISPlay:VIEW:ADVanced:SELect <alphanumeric> :DISPlay:VIEW:ADVanced:SELect?
Example	Select Baseband as the current View :DISP:VIEW:ADV:SEL “Baseband”
Notes	You must be in the measurement whose View you are trying to set to send the command. You can only set Views for the current measurement using this command For predefined views, the parameter is derived from the view name that is shown in the View list in the user interface. For example, if you are trying to select the Trace Zoom view in the Swept SA measurement, you send: :DISP:VIEW:ADV:SEL "Trace Zoom" because “Trace Zoom” is the name of the View as seen in the Mode/Meas dialog or in the Display, View menu You *cannot* use the legacy View parameter (which in this case would be TZOom) with :DISP:VIEW:ADV:SEL <alphanumeric> is case insensitive; you can specify mixed case, however the name will be evaluated on a single case. Thus, both of the following forms work: :DISP:VIEW:ADV:SEL "Trace Zoom" :DISP:VIEW:ADV:SEL "TRACE ZOOM" If the specified view is not a valid View, the query returns the error message “-224, Illegal parameter value; View with the name <alphanumeric> does not exist” If the display is disabled (via :DISP:ENAB OFF) then the error message “-221, Settings conflict; View SCPI cannot be used while Display is disabled” is generated

Backwards Compatibility SCPI	The legacy node `:DISPlay:VIEW[:SELect]` is retained for backwards compatibility, but it only supports predefined views

Restore Layout to Default

Restores the Layout to the default for Basic.

Modified Views are very temporary; if you exit the current measurement they are discarded, and they are not saved in State. To retain this View for later use, and to be able to return easily to your original Basic View, you can save your edited View as a "User View".

Save Layout as New View

Saves your new View as a User View. An alpha keyboard appears, which lets you name your new View; the default is the old View name plus a number.

Remote Command	`:DISPlay:VIEW:ADVanced:NAME <alphanumeric>`
Example	`:DISP:VIEW:ADV:NAME "Baseband"` Creates a new View named `Baseband` from the current View, and selects it as the current View
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If `<alphanumeric>` name already exists as a View, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; User View SCPI cannot be used while Display is disabled" is generated

Re-Save User View

You can re-edit a User View; if you make changes, then an asterisk will appear next to the User View's name. You can then tap **Re-Save User View** to save it back to its existing name, or **Save Layout as New View** to add another, new User View.

This is a front panel function only, there is no remote command available to perform this function. To do this remotely, you must first perform **Save Layout as New View**, then delete the old User View and rename the new one with the name of the View you just deleted.

Rename User View

You can rename the current View by giving it a new unique name. Only User Views can be renamed, if the current View is a Predefined View, an error occurs.

Remote Command	`:DISPlay:VIEW:ADVanced:REName <alphanumeric>`
Example	`:DISP:VIEW:ADV:REN "Baseband"`
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the `<alphanumeric>` specifying the new name is already present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot rename a Predefined View" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete User View

You can delete the current View if it is a User View. The default view becomes the current view for the Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:DELete`
Example	`:DISP:VIEW:ADV:DEL`
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the `<alphanumeric>` is not present in the list of View names, the error message "-224, Illegal parameter value; View <alphanumeric> does not exist" is generated If the current View is a Predefined View, the error message "-224, Illegal parameter value; Cannot delete a Predefined View" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated

Delete All User Views

Deletes all previously saved User Views. The default view becomes the current view for the Measurement if a User View was the current view when this command was executed.

Remote Command	`:DISPlay:VIEW:ADVanced:DELete:ALL`
Example	`:DISP:VIEW:ADV:DEL:ALL`
Notes	Disabled if there are no User Views

View Editor Remote Commands

The following remote commands help you manage Views and User Views. Note that the SCPI node for User Views handles both Predefined and User Views. The legacy nodes, :DISPlay:VIEW[:SELect] and :DISPlay:VIEW:NSEL, are retained for backwards compatibility, but they only support predefined views.

View Listing Query

Returns a string containing a comma-separated list of names for *all* the Views, including User Views, available for the current Measurement.

Remote Command	:DISPlay:VIEW:ADVanced:CATalog?
Example	:DISP:VIEW:ADV:CAT?
Notes	Returns a quoted string of the available Views for the current measurement, separated by commas. The list includes names for *all* the Views, including User Views, available for the current Measurement Example: "Normal,Trace Zoom,Spectrogram,Baseband,myView1,yourView1" No distinction is made between Predefined and User Views If you switch measurements with the display disabled (via :DISP:ENAB OFF), then query the list of available Views, the result is undefined

User View Listing Query

Returns a string containing a comma-separated list of names for *only* the User Views available for the current Measurement.

Remote Command	:DISPlay:VIEW:ADVanced:USER:CATalog?
Example	:DISP:VIEW:ADV:USER:CAT?
Notes	Returns a quoted string of the available User Views for the current measurement, separated by commas. Example: "Baseband,myView1,yourView1" If you switch measurements with the display disabled (see "Display Enable (Remote Command Only)" on page 1894), then query the list of available Views, the result is undefined

3.15.6.3 Annotation

Contains controls for setting up the annotation for the current Mode or Measurement.

Graticule

Turns the display graticule On or Off for all windows with graticules in all measurements in the current Mode. Also turns the graticule Y-Axis annotation on and off.

Remote Command	`:DISPlay:GRATicule[:STATe] OFF | ON | 0 | 1` `:DISPlay:GRATicule[:STATe]?`
Example	`:DISP:GRAT OFF`
Notes	The graticule is the set of horizontal and vertical lines that make up the grid/divisions for the X-Axis and Y-Axis
Preset	`ON`
State Saved	Saved in instrument state

Backwards Compatibility SCPI	`:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe] OFF | ON | 0 | 1`
	`:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe]?`
	This command is accepted for backwards compatibility with older instruments, but the `WINDow`, `TRACe` and `GRID` parameters are ignored

Screen Annotation

Controls the display of the annunciation and annotation around the graticule, including any annotation on lines (such as the display line, the threshold line, etc.) and the Y-Axis annotation, for all windows with screen annotation in all measurements in the current Mode.

This does *not* include marker annotation (or the N dB result). When `OFF`, the graticule expands to fill the entire graticule area, leaving only the 1.5% gap above the graticule, as described in the **Trace** section.

Remote Command	`:DISPlay:ANNotation:SCReen[:STATe] OFF | ON | 0 | 1` `:DISPlay:ANNotation:SCReen[:STATe]?`
Example	`:DISP:ANN:SCR OFF`
Dependencies	Grayed-out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Trace Annotation

Turns on and off the labels on the traces, showing their detector (or their Math Mode) as described in the **Trace** section, for all windows in all measurements in the current Mode for which Trace Annotation on/off is supported.

If Trace Math is being performed on a trace, then the Trace Math annotation replaces the detector annotation.

For measurements that support limit lines, this key also turns on and off the labels on the Limit Lines. The label is the Limit number annotation and Limit Comment displayed on the graph. If the length of the comment is greater than 20 characters, the first 8 characters and the last 8 characters are displayed, joined with **…**.

Remote Command	`:DISPlay:ANNotation:TRACe[:STATe] ON | OFF | 1 | 0` `:DISPlay:ANNotation:TRACe[:STATe]?`
Example	`:DISP:ANN:TRAC OFF`
Preset	`OFF`
State Saved	Saved in instrument state

Control Annotation

Turns on and off the display of values on the Active Function controls for all measurements in the current Mode. This is a security feature.

Remote Command	`:DISPlay:ACTivefunc[:STATe] ON | OFF | 1 | 0` `:DISPlay:ACTivefunc[:STATe]?`
Example	`:DISP:ACT OFF`
Dependencies	Grayed out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Meas Bar

Turns the Measurement Bar at the top of the screen on and off for all measurements in the current Mode. When `OFF`, the graticule area expands to fill the area formerly occupied by the Measurement Bar.

Remote Command	`:DISPlay:ANNotation:MBAR[:STATe] OFF | ON | 0 | 1` `:DISPlay:ANNotation:MBAR[:STATe]?`
Example	`:DISP:ANN:MBAR OFF`
Dependencies	Grayed out and forced to `OFF` when **System Display Settings**, **Annotation** is `OFF`
Preset	`ON` This remains `OFF` through a Preset when **System Display Settings**, **Annotation** is set to `OFF`
State Saved	Saved in instrument state

Display Enable (Remote Command Only)

Turns the display on/off, including the display drive circuitry. The backlight stays lit to confirm that the instrument is on. The display enable setting is mode global. Theare three reasons for turning the display off:

1. To increase speed as much as possible by freeing the instrument from having to update the display
2. To reduce emissions from the display, drive circuitry
3. For security purposes

If you have turned off the display:

– and you are in local operation, the display can be turned back on by pressing any key or by sending `:SYSTem:DEFaults MISC` or `:DISPlay:ENABle ON` (neither `*RST` nor :SYSTem:PRESet enable the display)

– and you are in remote operation, the display can be turned back on by pressing the **Local** or **Esc** keys, or by sending `:SYSTem:DEFaults MISC` or `:DISPlay:ENABle ON` (neither `*RST` nor `:SYSTem:PRESet` enable the display)

– and you are using either the `:SYSTem:KLOCk` command or GPIB local lockout, then *no* front-panel key press will turn the display back on. You must turn it back on remotely.

If the display is `OFF`, many SCPI commands related to User Views and Multiscreen functionality do not work, and return the error messages “-221, Settings conflict; Screen SCPI cannot be used when Display is disabled” or “221, Settings conflict; View SCPI cannot be used while Display is disabled”. These commands include:

Name	Command
Select User View	`:DISPlay:VIEW:ADVanced:SELect`
Rename User View	`:DISPlay:VIEW:ADVanced:REName`
Delete User View	`:DISPlay:VIEW:ADVanced:DELete`
Create User View	`:DISPlay:VIEW:ADVanced:NAME`
Select Screen	`:INSTrument:SCReen:SELect`
Delete Screen	`:INSTrument:SCReen:DELete`
Delete All But This Screen	`:INSTrument:SCReen:DELete:ALL`
Add Screen	`:INSTrument:SCReen:CREate`
Rename Screen	`:INSTrument:SCReen:REName`
Sequencer On/Off	`:SYSTem:SEQuencer`

Remote Command	`:DISPlay:ENABle OFF | ON | 0 | 1` `:DISPlay:ENABle?`
Example	`:DISP:ENAB OFF`
Couplings	`:DISP:ENAB OFF` turns Backlight `OFF` and `:DISP:ENAB ON` turns Backlight `ON`, but changing Backlight settings does *not* change the state of `:DISP:ENAB`
Preset	`ON` Set by `:SYST:DEF MISC`, but not affected by `*RST` or `:SYSTem:PRESet`

State Saved	Not saved in instrument state
Backwards Compatibility Notes	`:SYST:PRES` no longer turns on `:DISPlay:ENABle` as it did in legacy analyzers

3.15.7 Freq

The Freq key opens the Frequency menu, which contains controls that allow you to control the Frequency and Channel parameters of the instrument.

Some features in the Frequency menu are the same for all measurements in the current Mode – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset. For example, the Center Freq setting is the same for all measurements - it does not change as you change measurements.

3.15.7.1 Settings

The Settings Tab contains controls that pertain to the X axis parameters of the measurement. These parameters control how data on the vertical (X) axis is displayed and control instrument settings that affect the horizontal axis.

Center Frequency

Sets the frequency that corresponds to the horizontal center of the graticule. While adjusting the Center Frequency the Span is held constant.

The center frequency setting is the same for all measurements within a mode, that is, it is Meas Global. Some modes are also able to share a Mode Global center frequency value. If this is the case, the Mode will have a **Global** tab in its **Meas Setup** menu.

The **Center Freq** function sets (and queries) the Center Frequency for the currently selected input. If your analyzer has multiple inputs, and you select another input, the Center Freq changes to the value for that input. SCPI commands are available to directly set the Center Freq for a specific input.

Center Freq is remembered as you go from input to input. Thus you can set a Center Freq of 10 GHz with the RF Input selected, change to BBIQ and set a Center Freq of 20 MHz, then switch to External Mixing and set a Center Freq of 60 GHz, and when you go back to the RF Input the Center Freq will go back to 10 GHz; back to BBIQ and it is 20 MHz; back to External Mixing and it is 60 GHz.

See "RF Center Freq" on page 1899

See "Ext Mix Center Freq" on page 1899

See "I/Q Center Freq" on page 1900

See "Center Frequency Presets" on page 1897

Remote Command	`[:SENSe]:FREQuency:CENTer <freq>` `[:SENSe]:FREQuency:CENTer?`

Example	Sets the Center Frequency to 50 MHz
	`:FREQ:CENT 50 MHz`
	Increments the Center Frequency by the value of CF Step
	`:FREQ:CENT UP`
	Returns the current value of Center Frequency
	`:FREQ:CENT?`

Notes	This command sets the RF, External Mixing or I/Q Center Frequency depending on the selected input. For RF input it is equivalent to FREQ:RF:CENT For I/Q input it is equivalent to FREQ:IQ:CENT For External Mixer it is equivalent to FREQ:EMIX:CENT Preset and Max values are dependent on Hardware Options (5xx) If no terminator (e.g. MHz) is sent the terminator Hz is used. If a terminator with unit other than Frequency is used, an invalid suffix error message is generated.
Preset	Depends on instrument maximum frequency, mode, measurement, and selected input. See "Center Frequency Presets" on page 1897 and "RF Center Freq" on page 1899 and "Ext Mix Center Freq" on page 1899 and "I/Q Center Freq" on page 1900.
State Saved	Saved in instrument state
Min	Depends on instrument maximum frequency, mode, measurement, and selected input.. See "Center Frequency Presets" on page 1897 and "RF Center Freq" on page 1899 and "Ext Mix Center Freq" on page 1899 and "I/Q Center Freq" on page 1900.
Max	Depends on instrument maximum frequency, mode, measurement, and selected input.. See "Center Frequency Presets" on page 1897 and "RF Center Freq" on page 1899 and "Ext Mix Center Freq" on page 1899 and "I/Q Center Freq" on page 1900.
Status Bits/OPC Dependencies	Non-overlapped

Center Frequency Presets

The following table provides the Center Frequency Presets for the Spectrum Analyzer mode, and the Max Freq, for the various frequency options:

Freq Option	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
503 (all but CXA)	1.805 GHz	3.6 GHz	3.7 GHz
503	1.505 GHz	3.0 GHz	3.08 GHz

(CXA)			
507 (all but CXA)	3.505 GHz	7.0 GHz	7.1 GHz
507 (CXA)	3.755 GHz	7.5 GHz	7.58 GHz
508 (all but MXE)	1.805 GHz	3.6 GHz	8.5 GHz
508 (MXE)	4.205 GHz	8.4 GHz	8.5 GHz
513	6.805 GHz	13.6 GHz	13.8 GHz
526 (all but CXA and MXE)	13.255 GHz	26.5 GHz	27.0 GHz*
526 (CXA)	13.255 GHz	26.5 GHz	26.55 GHz
526 (MXE)	1.805 GHz	3.6 GHz	27.0 GHz
532	16.005 GHz	32.0 GHz	32.5 GHz
543	21.505 GHz	43.0 GHz	TBD
544	22.005 GHz	44.0 GHz	44.5 GHz
550	25.005 GHz	50.0 GHz	52 GHz

*For option 526, the Max CF in RTSA is 26.999999995 GHz.

Input 2:

Model	CF after Mode Preset	Stop Freq after Mode Preset	Max Freq (can't tune above)
CXA opt C75	0.7505 GHz	1.5 GHz	1.58 GHz
MXE	505 MHz	1 GHz	1.000025 GHz

Tracking Generator Frequency Limits (CXA only):

Tracking Generator Option	Min Freq (clips to this freq when turn TG on and can’t tune below while TG on)	If above this Freq, Stop Freq clipped to this Freq when TG turned on	Max Freq (can't tune above) while TG on
T03	9 kHz	3.0 GHz	3.08 GHz
T06	9 kHz	6.0 GHz	6.05 GHz

RF Center Freq

SCPI command for specifying the RF Center Frequency. This command will set the Center Frequency to be used when the RF input is selected, even if the RF input is not the input that is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:RF:CENTer <freq>` `[:SENSe]:FREQuency:RF:CENTer?`
Example	`:FREQ:RF:CENT 30 MHz` `:FREQ:RF:CENT?`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode.
Dependencies	If the electronic/soft attenuator is enabled, any attempt to set Center Frequency such that the Stop Frequency would be >3.6 GHz fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning.
Preset	See table above
State Saved	Saved in instrument state.
Min	-79.999995 MHz
Max	See table above. Basically instrument maximum frequency - 5 Hz.

Ext Mix Center Freq

SCPI command for specifying the External Mixer Center Frequency. This command will set the Center Frequency to be used when the External Mixer is selected, even if the External Mixer input is not the input which is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:EMIXer:CENTer <freq>` `[:SENSe]:FREQuency:EMIXer:CENTer?`
Example	`:FREQ:EMIX:CENT 60 GHz` `:FREQ:EMIX:CENT?`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode
Couplings	When returning to External Mixing after having been switched to one of the other inputs (e.g., RF), you will come back into the settings that you had when you left External Mixing. So you will come back to the band you were in with the Center Frequency that you had. However, Span is not an input-dependent parameter, therefore you will bring the span over from the other input. Therefore, the analyzer comes back with the span from the previous input, limited as necessary by the current mixer setup
Preset	When a Mode Preset is performed while in External Mixing, the Start frequency of the current Mode is set to the nominal Min Freq of the lowest harmonic range in the Harmonic Table for the current mixer setup. Similarly, the Stop frequency of the current Mode is set to the nominal Max

	Freq of the highest harmonic range in the Harmonic Table. The Center Freq thus presets to the point arithmetically equidistant from these two frequencies NOTE: If the current measurement has a limited Span available to it, and cannot achieve the Span shown in the table (Span=Stop Freq – Start Freq), the analyzer uses the maximum Span the measurement allows, and still sets the Center Freq to the midpoint of the Start and Stop Freq values in the Harmonic Table When Restore Input/Output Defaults is performed, the mixer presets to the 11970A, whose Start and Stop frequencies are 26.5 and 40 GHz respectively. The center of these two frequencies is 33.25 GHz Therefore, after a Restore Input/Output Defaults, if you go into External Mixing and do a Mode Preset while in the Spectrum Analyzer Mode, the resulting Center Freq is 33.25 GHz
State Saved	Saved in instrument state
Min	The minimum frequency in the currently selected mixer band + 5 Hz
Max	The maximum frequency in the currently selected mixer band - 5 Hz

I/Q Center Freq

SCPI command for specifying the I/Q Center Frequency. This command will set the Center Frequency to be used when the I/Q input is selected, even if the I/Q input is not the input which is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Remote Command	`[:SENSe]:FREQuency:IQ:CENTer <freq>` `[:SENSe]:FREQuency:IQ:CENTer?`
Example	`:FREQ:IQ:CENT 30 MHz`
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode
Preset	0 Hz
State Saved	Saved in instrument state
Min	-40.049995 MHz
Max	40.049995 MHz

CF Step

Changes the step size for the center frequency and start and stop frequency functions. Once a step size has been selected and the center frequency function is active, the step keys (and the UP|DOWN parameters for Center Frequency from remote commands) change the center frequency by the step-size value. The step size function is useful for finding harmonics and sidebands beyond the current frequency span of the analyzer.

Note that the start and stop frequencies also step by the CF Step value.

Remote Command	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement] <freq>`
	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement]?`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:FREQuency:CENTer:STEP:AUTO?`

Example	`:FREQ:CENT:STEP 500 MHz`
	Increases the current center frequency value by 500 MHz
	`:FREQ:CENT UP`
	`:FREQ:CENT:STEP?`
	`:FREQ:CENT:STEP:AUTO ON`
	`:FREQ:CENT:STEP:AUTO?`

Notes	Preset and Max values are depending on Hardware Options (503, 507, 508, 513, 526)
Notes	Preset and Max values are dependent on Hardware Options (5xx)
Dependencies	Span, RBW, Center frequency If the electronic/soft attenuator is enabled, any attempt to change the value of the center frequency >3.6 GHz by pressing the Up-arrow key, fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning.
Couplings	When auto-coupled in a non-zero span, the center frequency step size is set to 10% of the span. When auto-coupled in zero span, the center frequency step size is set to the equivalent -3 dB RBW value.
Preset	Auto
State Saved	Saved in instrument state
Min	– (the maximum frequency of the instrument). That is, 27 GHz max freq instrument has a CF step range of +/- 27 GHz. Note that this is the maximum frequency given the current settings of the instrument, so in External Mixing, for example, it is the maximum frequency of the current mixer band.
Max	The maximum frequency of the instrument. That is, 27 GHz max freq instrument has a CF step range of +/- 27 GHz. Note that this is the maximum frequency given the current settings of the instrument, so in External Mixing, for example, it is the maximum frequency of the current mixer band.
Status Bits/OPC dependencies	non-overlapped

3.15.8 Marker

Marker is not supported in the WCDMA List Power Step Measurement.

3.15.9 Meas Setup

The Meas Setup menu panel contains functions for setting up the measurement parameters.

3.15.9.1 Radio

The Radio tab contains controls to select the Radio Device, and enable or disable HSPA/HSPA+ options.

Radio Device

Allows you to specify the device to be used.

Remote Command	`[:SENSe]:RADio:STANdard:DEVice BTS | MS` `[:SENSe]:RADio:STANdard:DEVice?`
Example	`:RAD:STAN:DEV MS` `:RAD:STAN:DEV?`
Preset	BTS
State Saved	Saved in instrument state.
Range	BTS | MS
Backwards Compatibility SCPI	`[:SENSe]:RADio:DEVice`

HSPA Enable

Allows you to turn on or off the HSDPA/HSUPA option enable. This selection is necessary because some of the auto detection functions that expect an HSPA signal are less tolerant when the signal is noisy or distorted. When the HSPA signal is not expected, turn HSPA Enable off.

Remote Command	`[:SENSe]:RADio:CONFigure:HSDPa[:STATe] 0 | 1 | OFF | ON` `[:SENSe]:RADio:CONFigure:HSDPa[:STATe]?`
Example	`:RAD:CONF:HSDP 0` `:RAD:CONF:HSDP?`
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

HSPA+ Enable

Allows you to turn on or off the HSPA+ option enable. This selection is necessary because some of the auto detection functions that expect an HSPA+ signal are less tolerant when the signal is noisy or distorted. When the HSPA+ signal is not expected, turn HSPA+ Enable off.

Remote Command	`[:SENSe]:RADio:CONFigure:EHSPa[:STATe] OFF | ON | 0 | 1` `[:SENSe]:RADio:CONFigure:EHSPa[:STATe]?`
Example	`:RAD:CONF:EHSP 0` `:RAD:CONF:EHSP?`
Notes	When HSPA enable is OFF, HSPA+ function is disabled too.
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

3.15.9.2 Global

The controls in this menu apply to all Modes in the instrument.

Some controls (e.g., Global center Freq) allow you to switch certain Meas Global parameters to a Mode Global state. These switches apply to all Modes that support global settings. For example, no matter what Mode you are in when you set the “Global Center Frequency” switch to on, it applies to all Modes that support Global Settings.

Other controls (e.g., Extend Low Band) are actually set in this menu but apply to all Modes.

Global Center Freq

The software maintains a Mode Global value called “Global Center Freq”.

When the **Global Center Freq** control is switched to **On** in any mode, the current mode’s center frequency is copied into the Global Center Frequency, and from then on all modes that support global settings use the Global Center Frequency. So you can switch between any of these modes and the Center Freq will remain unchanged.

Adjusting the Center Freq of any mode which supports Global Settings, while **Global Center Freq** is **On**, will modify the Global Center Frequency.

When **Global Center Freq** is turned **Off**, the Center Freq of the current mode is unchanged, but now the Center Freq of each mode is once again independent.

When **Mode Preset** is pressed while **Global Center Freq** is **On**, the Global Center Freq is preset to the preset Center Freq of the current mode.

This function is reset to Off when the Restore Defaults control is pressed in the Global Settings menu, or when **System**, **Restore Defaults**, **All Modes** is pressed.

Remote Command	`:INSTrument:COUPle:FREQuency:CENTer ALL | NONE` `:INSTrument:COUPle:FREQuency:CENTer?`
Example	`:INST:COUP:FREQ:CENT ALL` `:INST:COUP:FREQ:CENT?`
Preset	Set to Off on Global Settings, Restore Defaults and System, Restore Defaults, All Modes
Range	On|Off

Remote Command	`:GLOBal:FREQuency:CENTer[:STATe] 1 | 0 | ON | OFF` `:GLOBal:FREQuency:CENTer[:STATe]?`
Preset	Off

Restore Defaults

This control resets all of the functions in the Global Settings menu to Off. This also occurs when **System**, **Restore Defaults**, **All Modes** is pressed.

Remote Command	`:INSTrument:COUPle:DEFault`
Example	`:INST:COUP:DEF`
Backwards Compatibility SCPI	`:GLOBal:DEFault`

3.15.9.3 Avg/Hold Num (Remote Command Only)

Sets the number of data acquisitions that will be averaged. After the specified number of average counts, the average mode (termination control) setting determines the average action.

Remote Command	`[:SENSe]:LPSTep:AVERage:COUNt <integer>`
	`[:SENSe]:LPSTep:AVERage:COUNt?`
	`[:SENSe]:LPSTep:AVERage[:STATe] OFF | ON | 0 | 1`
	`[:SENSe]:LPSTep:AVERage[:STATe]?`

Example	`:LPST:AVER:COUN 3` `:LPST:AVER:COUN?`

	:LPST:AVER ON :LPST:AVER?
Couplings	When this value is changed, Avg State is set to On.
Preset	10
State Saved	Saved in instrument state.
Min/Max	1/20001

3.15.9.4 Average Mode (Remote Command Only)

Select the type of termination control used to averaging. This determines the averaging action after the specified number of data acquisitions (average count) is reached.

Remote Command	[:SENSe]:LPSTep:AVERage:TCONtrol EXPonential | REPeat [:SENSe]:LPSTep:AVERage:TCONtrol?
Example	:LPST:AVER:TCON REP :LPST:AVER:TCON?
Notes	EXPonential - When Measure is set at Cont, data acquisitions will continue indefinitely. After N averages, exponential averaging is used with a weighting factor of N (the displayed average count stops at N). Exponential averaging weights new data more than old data, which allows tracking of slow-changing signals. The weighting factor N is set using the Averages, Avg Bursts parameter. REPeat - When Measure is set at Cont, data acquisitions will continue indefinitely. After N averages is reached, all previous result data is cleared and the average count is set back to 1. This is equivalent to being in Measure Single and pressing the Restart key when the Single measurement finishes.
Preset	EXPonential
State Saved	Saved in instrument state.

3.15.9.5 Average Type (Remote Command Only)

Specifies the type of trace and result averaging to use.

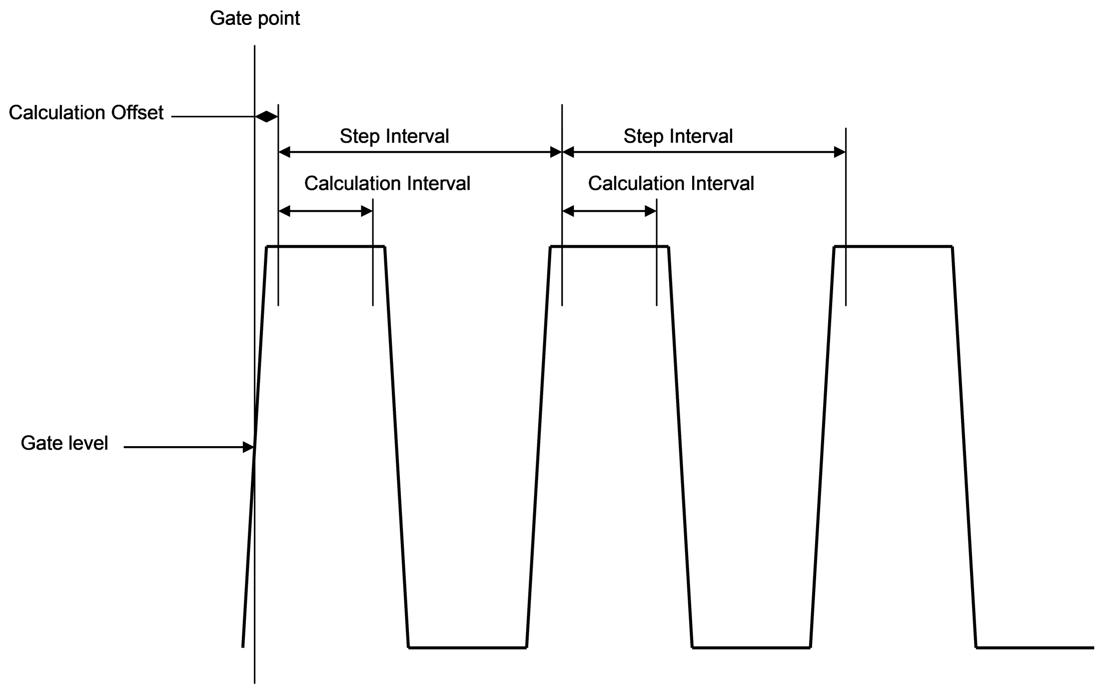
This parameter is valid only for Measure Trace.

Remote Command	[:SENSe]:LPSTep:AVERage:TYPE LOG | RMS [:SENSe]:LPSTep:AVERage:TYPE?
Example	:LPST:AVER:TYPE LOG :LPST:AVER:TYPE?
Notes	LOG - simulates the traditional spectrum analyzer type of averaging by averaging the log of the power. RMS - true power averaging that is equivalent to taking the RMS value of the voltage. It is the most

	accurate type of averaging.
Preset	RMS
State Saved	Saved in instrument state.

3.15.9.6 Calculation Time Setup (Remote Command Only)

Allows you to specify the period to be calculated for the swept trace.



Step Interval (Remote Command Only)

Step Interval is a real number in seconds. It defines the beginning of the next field of trace elements to be calculated. This is relative to the beginning of the previous field.

Remote Command	`[:SENSe]:LPSTep:SWEep:STEP:TIME <time>` `[:SENSe]:LPSTep:SWEep:STEP:TIME`
Example	`:LPST:SWE:STEP:TIME 0.001` `:LPST:SWE:STEP:TIME?`
Preset	500 us
State Saved	Saved in instrument state.
Min/Max	1 ns/1s

Calculation Offset (Remote Command Only)

Calculation Offset is a real number in seconds. It specifies the amount of data points at the beginning of the gated sweep that will be ignored before the calculation process starts.

Remote Command	`[:SENSe]:LPSTep:LIST:SWEep:STEP:OFFSet <time>, …` `[:SENSe]:LPSTep:LIST:SWEep:STEP:OFFSet?`
Example	`:LPST:LIST:SWE:STEP:OFFS 0.00005,0.00005` `:LPST:LIST:SWE:STEP:OFFS?`
Preset	0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0
State Saved	Saved in instrument state.
Min/Max	0 s/1 s

Calculation Interval (Remote Command Only)

Calculation Interval is a real number in seconds. It defines how much data points will be calculated into one value.

Remote Command	`[:SENSe]:LPSTep:SWEep:STEP:LENGth <time>` `[:SENSe]:LPSTep:SWEep:STEP:LENGth?`
Example	`:LPST:SWE:STEP:LENG 0.00004` `:LPST:SWE:STEP:LENG?`
Preset	250 us
State Saved	Saved in instrument state.
Min/Max	1 ns/1 s

3.15.9.7 List Setup (Remote Command Only)

Number of Steps (Remote Command Only)

Allows you to set the number of periods to be calculated in a sweep.

Remote Command	`[:SENSe]:LPSTep:LIST:STEP <integer>, …` `[:SENSe]:LPSTep:LIST:STEP?`

Example	`:LPST:LIST:STEP 10, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10` `:LPST:LIST:STEP?`
Preset	1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1
State Saved	Saved in instrument state.
Min/Max	1/100

Sweep State (Remote Command Only)

The command defines a list of state at which the sweep is made.

<table>
<tr><td>Remote Command</td><td><code>[:SENSe]:LPSTep:LIST:STATe ON | OFF | 1 | 0, …</code>
<code>[:SENSe]:LPSTep:LIST:STATe?</code></td></tr>
<tr><td>Example</td><td><code>:LPST:LIST:STAT 1, 1, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0</code>
<code>:LPST:LIST:STAT?</code></td></tr>
<tr><td>Notes</td><td>The state of the first list doesn’t change to OFF|0.</td></tr>
<tr><td>Preset</td><td>1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0</td></tr>
<tr><td>State Saved</td><td>Saved in instrument state.</td></tr>
</table>

Sweep Frequency (Remote Command Only)

The command defines a list of center frequencies at which the sweep is made.

Remote Command	`[:SENSe]:LPSTep:LIST:FREQuency <freq>, …` `[:SENSe]:LPSTep:LIST:FREQuency?`
Example	`:LPST:LIST:FREQ 1e9, 2e9, 3e9` `:LPST:LIST:FREQ?`
Notes	The ‘Center Frequency’ setting under “Freq / Channel’ front panel key or [:SENSe]:FREQuency:CENTer overwrites the first frequency in this list. Any values less than 3.6GHz can be set. Note that when Sweep E-ATT has a cycle consisting of n values, then the same Sweep Frequency should be repeated n times. [Example of the combination of Sweep Frequency and E-ATT] N=1 (No cycle) Sweep Frequency 1GHz, 1.5GHz, 2GHz, 2.5GHz, 3GHz, 3.5GHz Sweep E-ATT 20, 20, 20, 20, 20, 20

	N=3 cycle Sweep Frequency 1GHz, 1GHz, 1GHz, 2GHz, 2GHz, 2GHz, 3GHz, 3GHz, 3GHz Sweep E-ATT 20, 0, 20, 20, 0, 20, 20, 0, 20 N=5 cycle Sweep Frequency 1GHz, 1GHz, 1GHz, 1GHz, 1GHz, 2GHz, 2GHz, 2GHz, 2GHz, 2GHz Sweep E-ATT 20, 0, 20, 20, 0, 20, 0, 20, 20, 0 N=10 cycle Sweep Frequency 1GHz, 1GHz, 1GHz, 1GHz, 1GHz, 1GHz, 1GHz, 1GHz, 1GHz, 1GHz, 2GHz, 2GHz, 2GHz, 2GHz, 2GHz, 2GHz, 2GHz, 2GHz, 2GHz, 2GHz Sweep E-ATT 20, 0, 20, 0, 0, 20, 20, 20, 20, 0, 20, 0, 20, 0, 0, 20, 20, 20, 20, 0
Preset	WCDMA: 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9, 1e9 GSM: 935.2MHz, , 935.2MHz, , 935.2MHz, 935.2MHz, 935.2MHz, 935.2MHz, 935.2MHz
State Saved	Saved in instrument state.
Min/Max	-79.999995 MHz/3.6 GHz

Sweep Time (Remote Command Only)

This command defines a list of sweep time settings at which the sweep is made.

Remote Command	`[:SENSe]:LPSTep:LIST:TIME <time>, …` `[:SENSe]:LPSTep:LIST:TIME?`
Example	`:LPST:LIST:TIME 10e-4, 10e-4` `:LPST:LIST:TIME?`
Preset	10ms, 10ms
Min/Max	1us/0.5s

Sweep E-ATT (Remote Command Only)

This command defines a list of electric attenuator settings at which the sweep is made. The value must be 0 or 20.

Remote Command	`[:SENSe]:LPSTep:LIST:EATTen <rel_ampl>, …` `[:SENSe]:LPSTep:LIST:EATTen`
Example	`:LPST:LIST:EATT 20,0,20,0,20,0,20,0` `:LPST:LIST:EATT?`
Notes	Either 20dB or 0 dB can be set for each value. When Sweep E-ATT has a cycle consisting of n values, then the same Sweep Frequency should be repeated n times. See examples in Notes of Sweep Frequency.
Preset	20dB, 0dB, 20dB, 0dB
State Saved	Saved in instrument state.
Min/Max	0/20

Gate Source (Remote Command Only)

This command defines a list of gate source settings at which the sweep is made.

Remote Command	`[:SENSe]:LPSTep:LIST:GATE:SOURce IMMediate | EXTernal1 | EXTernal2 | RFBurst | FRAMe, …` `[:SENSe]:LPSTep:LIST:GATE:SOURce?`
Example	`:LPST:LIST:GATE:SOUR RFB,IMM,RFB,IMM` `:LPST:LIST:GATE:SOUR?`
Notes	One or any two types of Gate Sources can be set. When two sources are set, in accordance with the Ns cycle, each combination must include one source and the other repeated Ns-1 times. [Example] No cycle RFB, RFB, RFB,RFB,,, Ns=2 cycle EXT, IMM, EXT, IMM, EXT, IMM, EXT, IMM EXT1, EXT2, EXT1, EXT2, EXT1, EXT2, EXT1, EXT2 Ns=5 cycle RFB, IMM, IMM, IMM, IMM, RFB, IMM, IMM, IMM, IMM
Preset	IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM, IMM
State Saved	Saved in instrument state.

Gate Recovery Time (Remote Command Only)

It defines the recovery time until next sweep starts.

Remote Command	`[:SENSe]:LPSTep:LIST:GATE:RTIMe <time>, …` `[:SENSe]:LPSTep:LIST:GATE:RTIMe?`
Example	`:LPST:LIST:GATE:RTIM 2e-6, 1e-3` `:LPST:LIST:GATE:RTIM?`
Notes	One or any two values can be set. When two values are set, in accordance with the Nr cycle, each combination must include one value repeated Nr-1 times and one another value. [Example] No cycle 2u, 2u, 2u, 2u, 2u, 2u,,, Nr=3 cycle 2u, 2u, 500u, 2u, 2u, 500u, 2u, 2u, 500u Nr=6 cycle 10u, 10u, 10u, 10u, 10u, 100u, 10u, 10u, 10u, 10u, 10u, 100u
Preset	0.5ms, 0.5ms
State Saved	Saved in instrument state.
Min/Max	2us/500 ms

3.15.9.8 IF Gain (Remote Command Only)

Sets the IF Gain function to Auto, Low Gain or High Gain. These settings affect sensitivity and IF overloads.

Remote Command	`[:SENSe]:LPSTep:IF:GAIN[:STATe] AUTOrange | LOW | HIGH`
	`[:SENSe]:LPSTep:IF:GAIN[:STATe]?`
	`[:SENSe]:LPSTep:IF:GAIN:AUTO[:STATe] ON | OFF | 1 | 0`
	`[:SENSe]:LPSTep:IF:GAIN:AUTO[:STATe]?`

Example	`:LPST:IF:GAIN HIGH`
	`:LPST:IF:GAIN?`
	`:LPST:IF:GAIN:AUTO ON`
	`:LPST:IF:GAIN:AUTO?`

Notes	AUTO – slower follows signals LOW – best for large signals

	HIGH – best noise level
Dependencies	This SCPI command is not supported in VXT, M9393A, M9391A or UXM
Preset	AUTOrange
State Saved	Saved in instrument state.
Range	Autorange|Low|High

3.15.9.9 Meas Preset (Remote Command Only)

Restores all the measurement parameters to their default values.

For details, see “Meas Preset” under the “Meas Setup” section of the W-CDMA or GSM/EDGE Measurement Application User’s & Programmer’s Reference, or the corresponding section of the online Help.

Remote Command	`:CONFigure:LPSTep`
Example	`:CONF:LPST`

3.15.10 Sweep

The Sweep key contains controls which allow you to control the sweep and measurement functions of the analyzer, such as the sweep or measurement time and whether in Single sweep/measure or Continuous sweep/measure mode.

3.15.10.1 Sweep/Control

This tab accesses controls that enable you to operate the Sweep and Control functions of the analyzer.

Sweep/Measure

Allows you to toggle between Continuous and Single sweep or measurement operation. The single/continuous state is Meas Global so the setting will affect all measurements.

The front-panel key **Single/Cont** performs this exact same function

See "More Information" on page 1913

Remote Command	`:INITiate:CONTinuous OFF | ON | 0 | 1` `:INITiate:CONTinuous?`

Example	Puts the analyzer in Single measurement operation.
	`:INIT:CONT 0`
	Puts the analyzer in Single measurement operation.
	`:INIT:CONT OFF`
	Puts the analyzer in Continuous measurement operation.
	`:INIT:CONT 1`
	Puts the analyzer in Continuous measurement operation.
	`:INIT:CONT ON`

Preset	ON (Note that SYST:PRESet sets INIT:CONT to ON but *RST sets INIT:CONT to OFF)
State Saved	Saved in instrument state
Annunciation	The Single/Continuous icon in the Meas Bar changes depending on the setting. A line with an arrow is single, a loop with an arrow is Continuous.
Backwards Compatibility Notes	See the description of this control in the Swept SA measurement

More Information

With Avg/Hold Num (in the Meas Setup menu) set to Off or set to On with a value of 1, a sweep is taken after the trigger condition is met; and the analyzer continues to take new sweeps after the current sweep has completed and the trigger condition is again met. However, with Avg/Hold Num set to On with a value >1, multiple sweeps (data acquisitions) are taken for the measurement. The trigger condition must be met prior to each sweep. The sweep is not stopped when the average count k equals the number N set for Avg/Hold Num is reached, but the number k stops incrementing. A measurement average usually applies to all traces, marker results, and numeric results. But sometimes it only applies to the numeric results.

If the analyzer is in Single measurement, pressing the **Cont/Single** toggle control does not change k and does not cause the sweep to be reset; the only action is to put the analyzer into Continuous measurement operation.

If it is already in continuous sweep:

- the INIT:CONT 1 command has no effect
- the INIT:CONT 0 command will place the analyzer in Single Sweep but will have no effect on the current sequence until k = N, at which point the current sequence will stop and the instrument will go to the idle state.

See "Restart " on page 1914 control description for details on the INIT:IMMediate (Restart) function.

If you are already in single sweep, the `INIT:CONT OFF` command has no effect.

If you are already in Single Sweep, then pressing the **Cont/Single** toggle control in the middle of a sweep does not restart the sweep or sequence. Similarly, pressing the **Cont/Single** toggle control does not restart the sweep or sequence if the sweep is not in the idle state (for example, if you are taking a very slow sweep, or the analyzer is waiting for a trigger). Even though pressing the **Cont/Single** toggle control in the middle of a sweep does not restart the sweep, sending INIT:IMMediate does reset it.

Restart

The Restart function restarts the current sweep, or measurement, or set of averaged/held sweeps or measurements. If you are Paused, pressing Restart does a Resume.

The front-panel key **Restart** performs this exact same function

The Restart function is accessed in several ways:

- Pressing the Restart key
- Sending the remote command INIT:IMMediate
- Sending the remote command INIT:RESTart

See "More Information" on page 1915

Remote Command	`:INITiate[:IMMediate]` `:INITiate:RESTart`
Example	`:INIT:IMM` `:INIT:REST`
Notes	:INITiate:RESTart and :INITiate:IMMediate perform exactly the same function.
Couplings	Resets average/hold count k. For the first sweep overwrites all active (update=on) traces with new current data. For application modes, it resets other parameters as required by the measurement.
Status Bits/OPC dependencies	This is an Overlapped command. The STATus:OPERation register bits 0 through 8 are cleared. The STATus:QUEStionable register bit 9 (INTegrity sum) is cleared. The SWEEPING bit is set. The MEASURING bit is set.
Backwards Compatibility Notes	For Spectrum Analysis mode in ESA and PSA, the **Restart** hardkey and the INITiate:RESTart command restart trace averages (displayed average count reset to 1) for a trace in **Clear Write**, but did not restart Max Hold and Min Hold. In the X-Series, the **Restart** hardkey and the INITiate:RESTart command restart not only Trace Average, but Max Hold and Min Hold traces as well. For wireless comms modes in ESA and PSA, the **Restart** hardkey and the INITiate:RESTart command

restart every measurement, which includes all traces and numeric results. There is no change to this operation.

More Information

The **Restart** function first aborts the current sweep or measurement as quickly as possible. It then resets the sweep and trigger systems, sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the analyzer is in the process of aligning when a Restart is executed, the alignment finishes before the restart function is performed.

Even when set for Single operation, multiple sweeps may be taken when Restart is pressed (for example, when averaging/holding is on). Thus when we say that Restart "restarts a measurement," we may mean:

- It restarts the current sweep
- It restarts the current measurement
- It restarts the current set of sweeps if any trace is in Trace Average, Max Hold or Min Hold
- It restarts the current set of measurements if Averaging, or Max Hold, or Min Hold is on for the measurement
- depending on the current settings.

With Average/Hold Number (in Meas Setup menu) set to 1, or Averaging off, or no trace in Trace Average or Hold, a single sweep is equivalent to a single measurement. A single sweep is taken after the trigger condition is met; and the analyzer stops sweeping once that sweep has completed. However, with Average/Hold Number >1 and at least one trace set to Trace Average, Max Hold, or Min Hold (SA Measurement) or Averaging on (most other measurements), multiple sweeps/data acquisitions are taken for a single measurement. The trigger condition must be met prior to each sweep. The sweep is stopped when the average count k equals the number N set for Average/Hold Number. A measurement average usually applies to all traces, marker results, and numeric results; but sometimes it only applies to the numeric results.

Once the full set of sweeps has been taken, the analyzer will go to the idle state. To take one more sweep without resetting the average count, increment the average count by 1, by pressing the step up key while Average/Hold Number is the active function, or sending the remote command CALC:AVER:TCON UP.

Pause/Resume

Pauses a measurement after the current data acquisition is complete.

When Paused, the label on the control changes to Resume. Pressing Resume un-pauses the measurement. When you are Paused, pressing **Restart** does a Resume.

Remote Command	`:INITiate:PAUSe` `:INITiate:RESume`
Example	`:INIT:PAUS` `:INIT:RES`
Dependencies	Not displayed in Modes that do not support Pausing.
Annotation	Only on control

Abort (Remote Command Only)

This command is used to stop the current measurement. It aborts the current measurement as quickly as possible, resets the sweep and trigger systems, and puts the measurement into an "idle" state. If the analyzer is in the process of aligning when ABORt is sent, the alignment finishes before the abort function is performed. So ABORt does not abort an alignment.

If the analyzer is set for Continuous measurement, it sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the analyzer is set for Single measurement, it remains in the "idle" state until an :INIT:IMM command is received.

Remote Command	`:ABORt`
Example	`:ABOR`
Notes	If :INITiate:CONTinuous is ON, then a new continuous measurement will start immediately, with sweep (data acquisition) occurring once the trigger condition has been met. If :INITiate:CONTinuous is OFF, then :INITiate:IMMediate is used to start a single measurement, with sweep (data acquisition) occurring once the trigger condition has been met.
Dependencies	For continuous measurement, ABORt is equivalent to the Restart key. Not all measurements support the abort command.
Status Bits/OPC dependencies	The STATus:OPERation register bits 0 through 8 are cleared. The STATus:QUEStionable register bit 9 (INTegrity sum) is cleared. Since all the bits that feed into OPC are cleared by the ABORt, the ABORt will cause the *OPC query to return true.

3.15.10.2 X Scale

This tab accesses controls that enable you to set the horizontal scale parameters.

Ref Value

Enables you to set the display X reference value.

Remote Command	Form used in the Burst Power and List Power Step measurement:
	`:DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:RLEVel <time>`
	`:DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:RLEVel?`

Example	`:DISP:LPST:VIEW:WIND:TRAC:X:RLEV 1` `:DISP:LPST:VIEW:WIND:TRAC:X:RLEV?`
Couplings	If X Auto Scaling is On, this value is automatically determined by the measurement result. When you set a value manually, X Auto Scaling automatically changes to Off.
Preset	0.000 s
State Saved	Saved in instrument state.
Min/Max	-1.0 s / 10.0s
Annotation	<value> s bottom left of graph

Scale/Div

Enables you to set the display X scale/division value.

Remote Command	`:DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:PDIVision <time>` `:DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:PDIVision?`
Example	`:DISP:LPST:VIEW:WIND:TRAC:X:PDIV 1ms` `:DISP:LPST:VIEW:WIND:TRAC:X:PDIV?`
Couplings	If X Auto Scaling is On, this value is automatically determined by the measurement result. When you set a value manually, X Auto Scaling automatically changes to Off.
Preset	1.000 ms
State Saved	Saved in instrument state.
Min	1.00 ns
Max	1.0 s

Ref Position

Sets the reference position for the X axis to Left, Center or Right.

Remote Command	`:DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:RPOSition LEFT | CENTer | RIGHt`

	:DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:RPOSition?
Example	:DISP:LPST:VIEW:WIND:TRAC:X:RPOS LEFT :DISP:LPST:VIEW:WIND:TRAC:X:RPOS?
Preset	LEFT
State Saved	Yes Saved in instrument state.
Range	Left|Center|Right

Auto Scaling

Toggles the scale coupling function between On and Off.

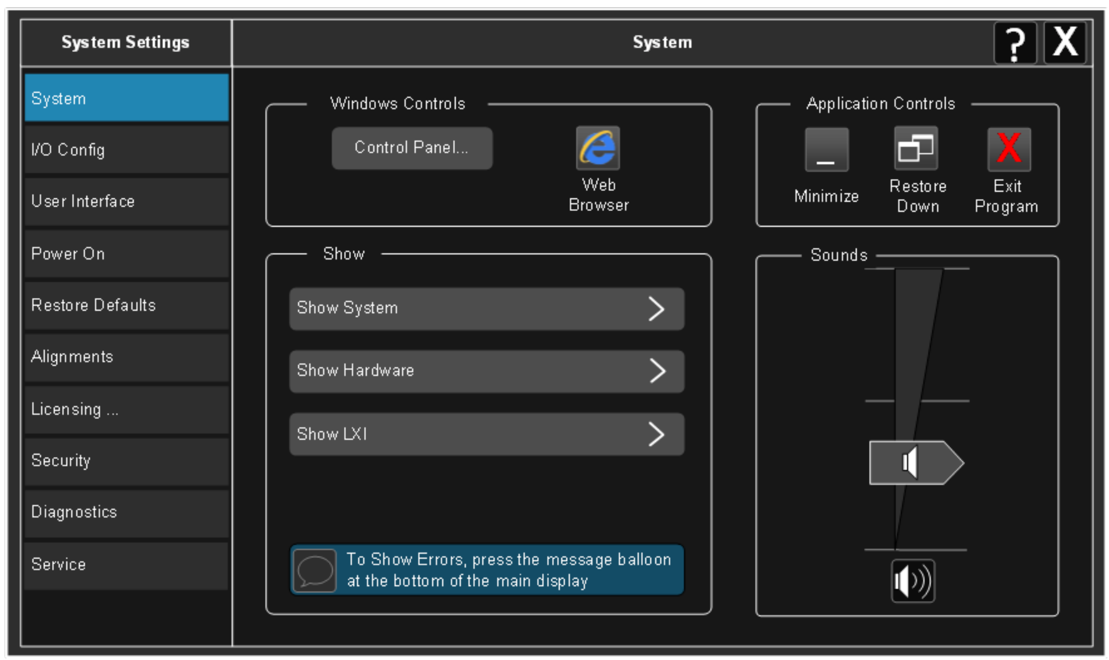
Remote Command	:DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:COUPle 0 | 1 | OFF | ON :DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:COUPle?
Example	:DISP:LPST:VIEW:WIND:TRAC:X:COUP ON :DISP:LPST:VIEW:WIND:TRAC:X:COUP?
Couplings	When Auto Scaling is On and the Restart front-panel key is pressed, this function automatically determines the scale per division and reference values based on the measurement results. When you set a value to either Scale/Div or Ref Value manually, Auto Scaling automatically changes to Off.
Preset	ON
State Saved	Saved in instrument state.
Range	On|Off

3.15.11 Trace

Trace is not supported in the WCDMA List Power Step Measurement.

4 System

The **System** hardkey and the “gear” icon both open the **System Settings** dialog, which allows you to access various configuration menus and dialogs. The line of tabs down the left side let you choose various pages for configuring your instrument.



Notes	No remote command for this key specifically

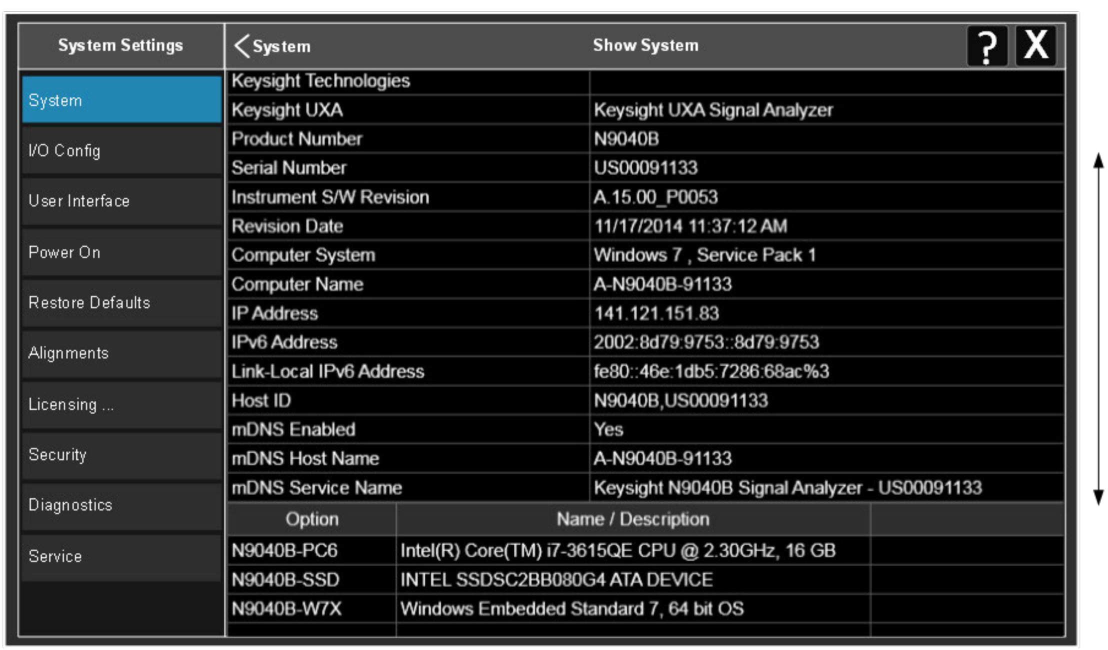
4.1 System

Allows access to several general system functions including three **Show** screens for viewing system parameters. Several such **Show** screens are available on this and other **System** menu pages. They can also be accessed with the following SCPI command described here.

Remote Command	`:SYSTem:SHOW OFF | ERRor | SYSTem | HARDware | LXI | HWSTatistics | ALIGnment | SOFTware | CAPPlication` `:SYSTem:SHOW?`
Example	`:SYST:SHOW SYST`
Notes	This command displays (or exits) the various System information screens
Preset	`OFF`
State Saved	No
Range	`OFF| ERRor | SYSTem | HARDware | LXI | HWSTatistics | ALIGNment | SOFTware | CAPPlication`

4.1.1 Show System

This screen is divided into three groups: product descriptive information, options tied to the hardware, and software products. Swipe up and down on this screen with your finger to scroll the display and see more information.



Example	`:SYST:SHOW SYST`

Backwards Compatibility Notes	The hardware statistics that are displayed in the PSA Show System screen have been moved to a dedicated Show Hardware Statistics screen in the Service Menu

4.1.1.1 Show System contents (Remote Command Only)

A remote command to obtain the contents of the **Show System** screen (the entire contents, not just the currently displayed page).

Remote Command	`:SYSTem:CONFigure[:SYSTem]?`
Example	`:SYST:CONF?`
Notes	The output is an IEEE Block format of the Show System contents. Each line is separated with a new-line character

4.1.1.2 Computer System description (Remote Command Only)

Returns the Computer System description, which consists of the operating system and patch level as reported by operating system.

Remote Command	`:SYSTem:CSYStem?`
Example	`:SYST:CSYS?`
Notes	The return value is the Computer System name and service pack level

4.1.2 Show Hardware

Used to view details of the installed hardware. This information can be used to determine versions of hardware assemblies and field programmable devices, in the advent of future upgrades or potential repair needs.

The screen is divided into two groups: product descriptive information and hardware information. The hardware information is listed in a table format.

Example	`:SYST:SHOW HARD`

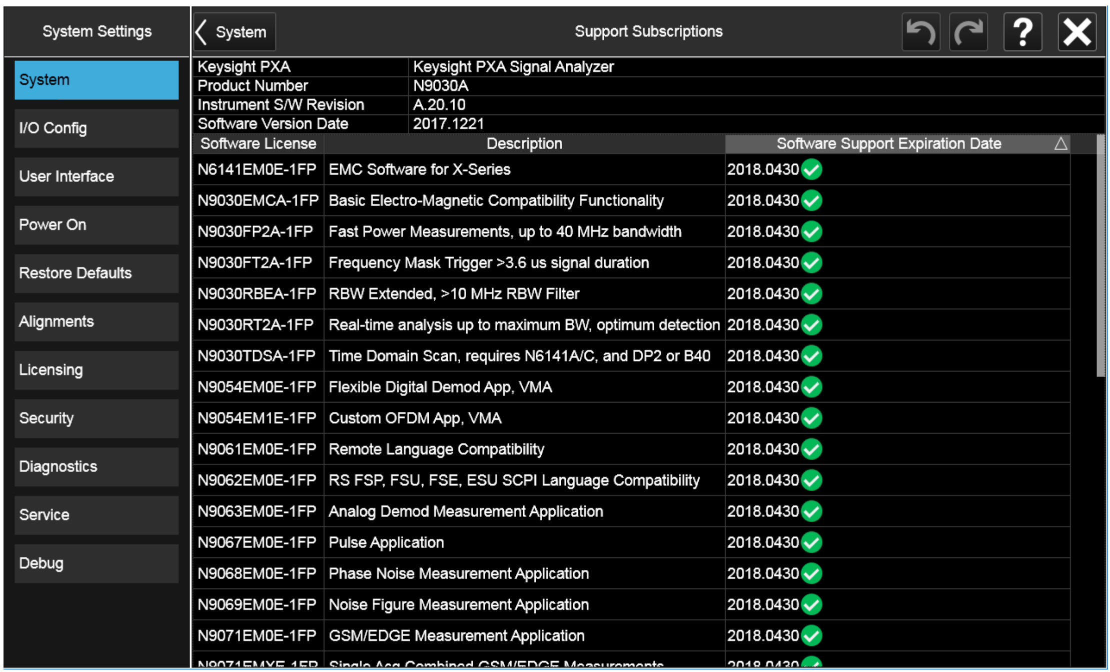
4.1.3 Show LXI

Displays the product number, serial number, firmware revision, computer name, IP address, Host ID, LXI Class, LXI Version, MAC Address, and the Auto-MDIX Capability.

Example	`:SYST:SHOW LXI`

4.1.4 Show Support Subscriptions

Displays the software support subscription information for the licenses you have available on the instrument. It shows the software license, description, software support expiration date (format is `YYYY.MMDD`), and the software support status. The Software Version Date (format is `YYYY.MMDD`) shown in the header indicates the date required to access the latest software enhancements included in this version of the software. If any license has a software support expiration date earlier than the Software Version Date, then there may be enhancements available that the license does not enable.



Example	`:SYST:SHOW SSINformation`

4.1.5 Show Support ID

Displays the Support ID for each license available for the instrument. It shows the software license, descriptions, software support expiration date, and the Support ID for that license.

Each license has a copy icon, which copies just the Support ID for that license to the Windows clipboard. This is useful to avoid typing mistakes when entering the Support ID into another program or web site.

The “Copy all to clipboard ...” button copies all the data in Comma-Separated Values (CSV) format to the Windows clipboard.

Example	`:SYST:SHOW SID`

4.1.6 Control Panel...

Opens the Windows Control Panel. The **Control Panel** is used to configure certain elements of Windows that are not configured through the Multitouch UI System menus.

NOTE	This feature is not available if option SF1 is installed.

Control Panel is a separate Windows application, so to return to the Instrument Application, you may either:

– Exit by tapping on the red **X** in the upper right hand corner

– Use **Alt+Tab**: press and hold the **Alt** key and press and release the **Tab** key until the Instrument logo is showing in the window in the center of the screen, then release the **Alt** key

Notes	No remote command for this key

4.1.7 Web Browser

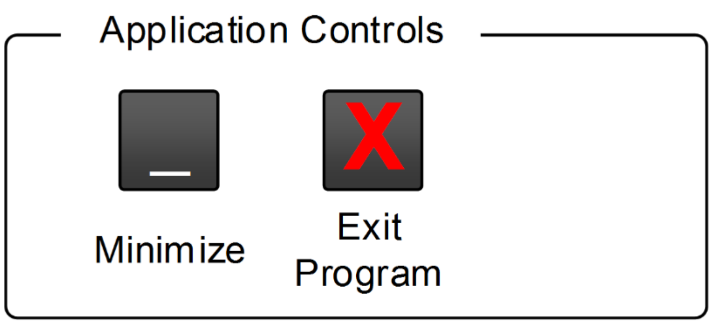
Launches the system's default **Web Browser**. Usually, the default is Microsoft Internet Explorer. A mouse and external keyboard are highly desirable for using

Internet Explorer. Close Internet Explorer to return focus to the Instrument Application (or use Alt-Tab).

NOTE This feature is not available if option SF1 is installed.

4.1.8 Application Controls

Lets you Minimize or Exit the application.



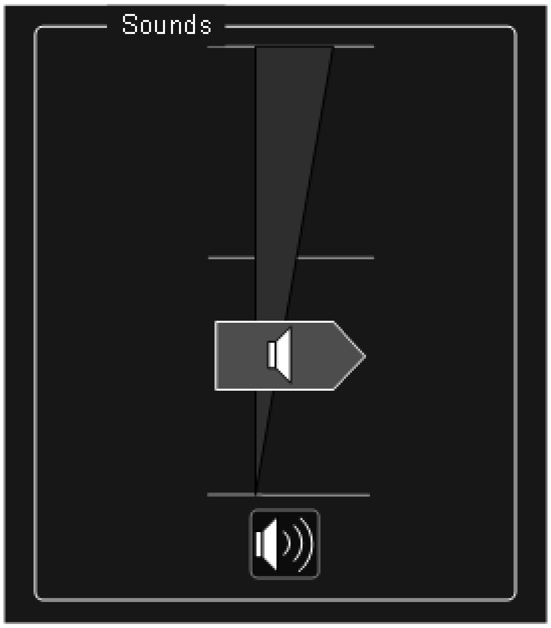
Pressing Exit Program displays a prompt asking if you are sure you want to close the program. If you choose OK, the entire analyzer application will shut down, and you will lose any unsaved trace or measurement data.

Notes	No equivalent remote command for this key

4.1.9 Sounds

Lets you adjust the speaker volume using the slider, or Mute/Unmute the speaker by tapping the Speaker icon.

Moving the slider up and down changes the speaker volume. It unmutes the speaker if muted.



Icon when muted

4.2 I/O Config

Activates a menu for identifying and changing the I/O configuration for remote control. Controls in this menu allow configuration of the I/O ports used for SCPI remote control over GPIB and LAN.

The SCPI LAN parameters are set using the I/O Config menu, but configuration of the LAN settings themselves is performed using the Windows Control Panel (DHCP, Gateway, Subnet Mask, etc.).

The USB port is also available for remote control, but requires no configuration.

4.2.1 GPIB

Activates a menu for configuring the GPIB I/O port.

Dependencies	This control is not available on the M9391A, M9393A, UXM or E7760

4.2.1.1 GPIB Address

Select the GPIB remote address.

Remote Command	`:SYSTem:COMMunicate:GPIB[1][:SELF]:ADDRess <integer>` `:SYSTem:COMMunicate:GPIB[1][:SELF]:ADDRess?`
Example	`:SYST:COMM:GPIB:ADDR 17`
Notes	Changing the Address on the GPIB port requires all further communication to use the new address
Dependencies	This control is not available on the M9391A, M9393A, or E7760
Preset	This is unaffected by Preset but is set to 18 on a “Restore System Defaults->Misc”
State Saved	No
Min	0
Max	30

4.2.1.2 GPIB Controller

Sets the GPIB port into controller or device mode. In the normal state, **GPIB Controller** is disabled, which allows the instrument to be controlled by a remote computer. When **GPIB Controller** is enabled, the instrument can run software applications that use the instrument's computer as a GPIB controller; controlling devices connected to the instrument's GPIB port.

NOTE: When GPIB Controller is enabled, the analyzer application itself cannot be controlled over GPIB. In this case it can easily be controlled via LAN or USB. The

GPIB port cannot be a controller and device at the same time. Only one controller can be active on the GPIB bus at any given time. If the instrument is the controller, an external PC cannot be a controller.

To control the instrument from the software that is performing GPIB controller operation, you can use an internal TCP/IP connection to the analyzer application. Use the address `TCPIP0:localhost:inst0:INSTR` to send SCPI commands to the analyzer application.

Remote Command	`:SYSTem:COMMunicate:GPIB[1][:SELF]:CONTroller[:ENABle] ON | OFF | 0 | 1` `:SYSTem:COMMunicate:GPIB[1][:SELF]:CONTroller[:ENABle]?`

Example	`:SYST:COMM:GPIB:CONT ON`
	Sets GPIB port to Controller
	`:SYST:COMM:GPIB:CONT OFF`
	Sets GPIB port to Device

Notes	When the instrument becomes the Controller, Bit 0 in the Standard Event Status Register is set (and when the instrument relinquishes Controller capability bit 0 is cleared in the Standard Event Status Register)
Dependencies	This control is not available on the M9391A, M9393A, or E7760
Preset	This is unaffected by Preset but is set to `OFF` (Disabled) on a “Restore System Defaults->Misc”
State Saved	No
Range	Disabled|Enabled

4.2.2 SCPI LAN

Activates a menu for identifying and changing the SCPI over a LAN configuration. There are a number of different ways to send SCPI remote commands to the instrument over LAN. It can be a problem to have multiple users simultaneously accessing the instrument over the LAN. These controls limit that somewhat by disabling the telnet, socket, and/or SICL capability.

NOTE **When multiple instances of the application are running, Telnet port 5023, socket port 5025, SICL server inst0 and HiSLIP server Device 0 will be assigned to the first instance; Telnet port 5123, socket port 5125, SICL server inst1 and HiSLIP server Device 1 will be assigned to the second instance; Telnet port 5223, socket port 5225, SICL server inst2 and HiSLIP server Device 2 will be assigned to the third instance; Telnet port 5323, socket port 5325, SICL server inst3 and HiSLIP server Device 3 will be assigned to the fourth instance.**

– "SCPI Telnet" on page 1928
– "SCPI Socket" on page 1928
– "SICL Server" on page 1929
– "HiSLIP Server" on page 1930
– "Verbose SCPI On/Off" on page 1930
– "SCPI Socket Control Port (Remote Command Only)" on page 1932

4.2.2.1 SCPI Telnet

Turns the SCPI LAN telnet capability On or Off, allowing you to limit SCPI access over LAN through telnet.

Remote Command	`:SYSTem:COMMunicate:LAN:SCPI:TELNet:ENABle OFF | ON | 0 | 1` `:SYSTem:COMMunicate:LAN:SCPI:TELNet:ENABle?`
Example	`:SYST:COMM:LAN:SCPI:TELN:ENAB OFF`
Preset	This is unaffected by **Preset** but is set to ON by **Restore System Defaults->Misc** Secure Instrument Communications configuration setting is ON,: if not set up or specified
State Saved	No
Range	OFF|ON

4.2.2.2 SCPI Socket

Turns the capability to establish Socket LAN sessions ON or OFF, to limit SCPI access over LAN through socket sessions.

Connection String & Copy Button

In the SCPI LAN dialog, to the right of the **SCPI Socket**ON/OFF control, the full SCPI connection string is displayed. Pressing the **Copy** button to the right of the string copies the displayed connection string to the Windows clipboard.

Remote Command	`:SYSTem:COMMunicate:LAN:SCPI:SOCKet:ENABle OFF | ON | 0 | 1` `:SYSTem:COMMunicate:LAN:SCPI:SOCKet:ENABle?`
Example	`:SYST:COMM:LAN:SCPI:SOCK:ENAB OFF`
Dependencies	If the Secure Instrument Communications configuration has disabled this connection, local changes are not allowed, and an attempt to do so results in error -221,“Disabled by Secure Instrument Communications configuration”
Preset	This is unaffected by **Preset** but is set to ON by **Restore System Defaults->Misc** If not set up or specified, the Secure Instrument Communications configuration setting: is ON

State Saved	No
Range	OFF|ON

4.2.2.3 SICL Server

Turns the **SICL Server** capability ON or OFF, to limit SCPI access over LAN through the SICL server. (SICL IEEE 488.2 protocol.)

Parameter	Description	Setting
Maximum Connections	The maximum number of connections that can be accessed simultaneously	5
Instrument Name	The name (same as the remote SICL address) of your instrument	inst0
Instrument Logical Unit	The unique integer assigned to your instrumentwhen using SICL LAN	8
Emulated GPIB Name	The name (same as the remote SICL address) of the device used when communicating with your instrument	gpib7
Emulated GPIB Logical Unit	The unique integer assigned to your device when it is being controlled using SICL LAN	8
Emulated GPIB Address	The emulated GPIB address assigned to your transmitter tester when it is a SICL server (the same as your GPIB address)	18

Connection String & Copy Button

In the SCPI LAN dialog, to the right of the **SICL Server**ON/OFF control, the full connection string is displayed. Pressing the **Copy** button to the right of the string copies the displayed connection string to the Windows clipboard.

Remote Command	`:SYSTem:COMMunicate:LAN:SCPI:SICL:ENABle OFF | ON | 0 | 1` `:SYSTem:COMMunicate:LAN:SCPI:SICL:ENABle?`
Example	`:SYST:COMM:LAN:SCPI:SICL:ENAB OFF`
Dependencies	This control is not available on the M9391A or M9393A or UXM If the Secure Instrument Communications configuration has disabled this connection, local changes are not allowed, and an attempt to do so results in error -221,“Disabled by Secure Instrument Communications configuration”
Preset	This is unaffected by **Preset**, but is set to ON by **Restore System Defaults->Misc** Secure Instrument Communications configuration setting: is ON if not set up or specified
State Saved	No
Range	OFF|ON

4.2.2.4 HiSLIP Server

Turns the **HiSLIP Server** capability `ON` or `OFF`, to limit SCPI access over LAN through the HiSLIP server.

HiSLIP stands for High Speed LAN Instrument Protocol, and is part of the IVI-6.1 specification.

Example of a VISA connection string used to connect to the HiSLIP Server on an X-Series Spectrum Analyzer:

`TCPIP0::a-n9030a-93016::hislip0::INSTR`

In the example above, `hislip0` is the HiSLIP device name that VISA users must include in HiSLIP VISA Address strings. Your HiSLIP device name may differ,depending on your VISA settings.

Connection String & Copy Button

In the SCPI LAN dialog, to the right of the **HiSLIP Server**`ON/OFF` control, the full connection string is displayed. Pressing the **Copy** button to the right of the string copies the displayed connection string to the Windows clipboard.

Remote Command	`:SYSTem:COMMunicate:LAN:SCPI:HISLip:ENABle OFF | ON | 0 | 1` `:SYSTem:COMMunicate:LAN:SCPI:HISLip:ENABle?`
Example	`:SYST:COMM:LAN:SCPI:HISL:ENAB OFF`
Preset	This is unaffected by **Preset**, but is set to `ON` by **Restore System Defaults->Misc** Secure Instrument Communications configuration setting: is `ON` if not set up or specified
State Saved	No
Range	`OFF|ON`

4.2.2.5 Verbose SCPI On/Off

When you turn **Verbose SCPI**`ON`, additional information is returned when you send the `:SYSTem:ERRor?` query. The additional information consists of the characters that stimulated the error. This can aid you in debugging your test programs by indicating where in the parsing of a SCPI command the instrument encountered an invalid command or query.

Specifically, with **Verbose SCPI** `ON`, the `:SYSTem:ERRor?` query is expanded to show the SCPI data received, with the indicator `<Err>` at the point in the stream that the error occurred.

Verbose SCPI has no effect on the **Show Errors** screen or front panel Message Line; and only changes the response to the `:SYST:ERR?` query.

See the example below, where the invalid command `:SENS:BOGUS` is sent:

Normal response to `:SYST:ERR?` (using the Telnet window):

```
SCPI> SENS:BOGUS
SCPI> SYST:ERR?
-113,"Undefined header"
```

Now after turning on **Verbose SCPI**:

```
SCPI> SYST:BOGUS
SCPI> SYST:ERR?
-113,"Undefined header;SYST:BOGUS<Err>"
```

Remote Command	`:SYSTem:ERRor:VERBose OFF | ON | 0 | 1` `:SYSTem:ERRor:VERBose?`
Example	`:SYST:ERR:VERB ON`
Preset	This is unaffected by **Preset** but is set to `OFF` by **Restore System Defaults->Misc**
State Saved	No
Range	`OFF|ON`

4.2.2.6 Device Clear on Disconnect

When using HiSLIP (High Speed LAN Instrument Protocol), Telnet, or Sockets, a communication session with the instrument is opened when you connect, and closed when you disconnect. This differs from other connections such as GPIB, USB and VXI-11 connections, which are never actually closed but stay open as long as the instrument is running.

When a session is closed, a Device Clear function is generated, which affects the entire instrument, not just the current connection. So when using HiSLIP, Telnet, or Sockets, unexpected Device Clears may occur, which can disrupt measurements in ways that GPIB and VXI-11 “sessions” do not.

Device Clear on Disconnect enables these auto-generated Device Clears for Telnet, Socket, and HiSLIP sessions. For backwards compatibility, they will not be generated unless you explicitly enable them.

There is no change in VXI-11, USB, or GPIB session behavior. These sessions do not close when you disconnect, have never generated Device Clear events, and still do not generate Device Clear events, regardless of the setting of this switch.

Remote Command	`:SYSTem:COMMunicate:LAN:SCPI:EOSession:DCLEar:ENABle 0 | 1 | ON | OFF` `:SYSTem:COMMunicate:LAN:SCPI:EOSession:DCLEar:ENABle?`
Example	`:SYST:COMM:LAN:SCPI:EOS:DCLE:ENAB ON`
Preset	This is unaffected by **Preset** but is set to `OFF` by **Restore System Defaults->Misc**
State Saved	No
Range	`OFF|ON`

4.2.2.7 SCPI Socket Control Port (Remote Command Only)

Returns the TCP/IP port number of the control socket associated with the SCPI socket session. This query enables you to obtain the unique port number to open when a device clear is to be sent to the instrument. Every time a connection is made to the SCPI socket, the instrument creates a peer control socket. The port number for this socket is random. You must use this command to obtain the port number of the control socket. To force a device clear on this socket, open the port and send the string "DCL\n" to the instrument.

If this SCPI command is sent to a non SCPI Socket interface, then 0 is returned.

Remote Command	`:SYSTem:COMMunicate:LAN:SCPI:SOCKet:CONTrol?`
Example	`:SYST:COMM:LAN:SCPI:SOCK:CONT?`
Preset	This is unaffected by **Preset** or **Restore System Defaults->Misc**
State Saved	No
Range	0 to 65534
Min	0
Max	65534
Backwards Compatibility SCPI	`:SYSTem:COMMunicate:TCPip:CONTrol?`

4.2.2.8 SCPI Instrument Port (Remote Command Only)

Some MIMO applications need to be able to determine the port to use to communicate with the instrument. This query returns the port number to use for communications.

Remote Command	`:SYSTem:COMMunicate:LAN:INSTrument:PORT?`

4.2.3 Web Password Reset

The embedded web server contains certain capabilities that are password protected; modifying the LAN configuration of the instrument, and access to web pages that can change the settings of the instrument. The default password from the factory is '`measure4u`' (without the quotes). The control provided here is the means to set the web password as desired, or to reset the password to the factory default.

Selecting **Web Password Reset** displays a control for resetting the password as desired, or to the factory default. The built-in alpha keyboard appears. You may change the password from the factory default of "`measure4u`".

You can cancel this entry by pressing the **Cancel (ESC)** front-panel key.

Dependencies	This control is not available on the M9391A or M9393A or UXM

4.2.4 LXI

Accesses various LXI configuration properties.

Dependencies	This control is not available on the M9391A or M9393A or UXM

4.2.4.1 LAN Reset

Resets the LAN connection. This sets parameters as follows, and restarts the LAN operation:

DHCP	Enabled
Automatic IP Address	Enabled
ICMP Ping Responder	Enabled
Web Password	keysight
Dynamic DNS	Enabled
mDNS and DNS-SD	Enabled
Dynamic Link Local Addressing	Enabled
Auto Negotiation	Enabled

There is no SCPI command for this function.

4.2.4.2 Device Identification (Remote Command Only)

Enabling LXI device identification places the LXI Status Indicator in the 'Identify' state. Disabling LXI device identification places the LXI Status Indicator in the 'No Fault' state. The LXI Status indicator is in the upper left region of the instrument's graphical user interface.

For the EXT-C (E6607C), the controlling test software can use this capability to instruct the operator that the instrument is under remote operation. For example, the test software can enable identification to indicate the instrument is in use, and disable identification when the test procedure is finished.

Remote Command	`:LXI:IDENtify[:STATe] OFF | ON | 0 | 1` `:LXI:IDENtify[:STATe]?`
Example	`:LXI:IDEN ON`
Preset	Not part of **Preset**, but reset to `OFF` by **Restore System Defaults All**
State Saved	No
Range	`OFF|ON`

4.2.5 System IDN Response

Allows you to specify a response to the *IDN? query, return the instrument to the FACTory response if you have changed it, or, if your test software is expecting the *IDN response to indicate Agilent Technologies, configure the instrument to respond with Agilent as the manufacturer.

The current *IDN response is displayed at the top of the panel, followed by the **System IDN Response** and **User IDN** controls.

4.2.5.1 System IDN Response

To choose the factory-set response, select FACTory. To specify your own response, select USER. You can enter your desired response using the next control (**User IDN**).

If your test software expects the response to indicate Agilent Technologies as the Manufacturer, you can configure this response by selecting AGILent.

Remote Command	:SYSTem:IDN:CONFigure FACTory | AGILent | USER For option details, see "More Information" on page 1934 :SYSTem:IDN:CONFigure?
Example	:SYST:IDN:CONF FACT
Notes	This affects the response returned by all Modes of the instrument, unless the current Mode has also specified a custom response, in which case the current Mode's custom IDN response takes precedence over the System's, but only while that Mode is the current Mode Survives shutdown and restart of the software and therefore survives a power cycle
Preset	The *IDN response is reset to FACTory by **Restore Misc Defaults** or **Restore System Defaults All** and survives subsequent running of the software

More Information

Here are details of the options available for the System *IDN response:

Factory

SCPI example: :SYST:IDN:CONF FACT

Selects the factory default configuration of *IDN?, which indicates the Manufacturer as Keysight Technologies. For example,

"Keysight Technologies,N9040B,MY00012345,A.15.00"

where the fields are manufacturer, model number, serial number, firmware revision.

Note: In products that run multiple instances of the X-Series Application, all instances use the *same* factory System IDN response.

Agilent

SCPI example: `:SYST:IDN:CONF AGIL`

Starting with software version x.14.50, the `*IDN?` response in the Factory configuration will indicate the Manufacturer as Keysight Technologies. If your test software is expecting the response to indicate Agilent Technologies, you can configure the response with this menu selection or SCPI command.

For example:

`“Agilent Technologies,N9020A,MY00012345,A.05.01”`

Note: In products that run multiple instances of the X-Series Application, all instances use the *same* Agilent System IDN response.

User

SCPI example: `:SYST:IDN:CONF USER`

Selects your customized configuration of `*IDN?`

Enter your desired response using the User IDN control.

4.2.5.2 User IDN

Allows you to specify your own response to the `*IDN?` query. You may enter your desired response with the Alpha Editor or a plugin PC keyboard. Once the value is entered select `USER` under System IDN Response.

When you select this control, the active function becomes the current User string and is highlighted, so typing replaces it. If instead you wish to edit the existing string press the left or right arrow to go to the beginning or the end.

If you enter a null string (for example, by clearing the User String while editing and then pressing Done) the instrument automatically reverts to the `FACTory` setting.

NOTE: In products that run multiple instances of the X-Series Application, all instances use the *same* User System IDN response.

Remote Command	`:SYSTem:IDN <string>` `:SYSTem:IDN?`
Notes	The format of the `<string>` must be four fields each separated by a comma, example: `:SYST:IDN “XYZ Corp,Model 12,012345,A.01.01”` The four fields are `<manufacturer>`, `<model number>`, `<serial number>`, `<firmware revision>`. The fields are comma-delimited, so text within a field cannot contain a comma This affects the response given in all Modes of the instrument, unless the current Mode has also specified a custom response, in which case the current Mode’s custom IDN response takes precedence over the System’s, but only while that Mode is the current Mode

	Survives shutdown and restart of the software and therefore survives a power cycle Null string as parameter restores the `FACTory` setting, example: `:SYST:IDN ""`
Preset	This is unaffected by **Preset** but is set to the original `FACTory` setting by **Restore System Defaults->Misc**

4.2.5.3 SYSTem:PERSona (Remote Commands Only)

The `:SYSTem:PERSona` command set permits setting of individual fields of the `*IDN?` Response.

– "SYSTem:PERSona:DEFault" on page 1936
– "SYSTem:PERSona:MANufacturer" on page 1936
– "SYSTem:PERSona:MANufacturer:DEFault" on page 1937
– "SYSTem:PERSona:MODel" on page 1937
– "SYSTem:PERSona:MODel:DEFault" on page 1937

SYSTem:PERSona:DEFault

Resets the `*IDN` response to the instrument default.

Remote Command	`:SYSTem:PERSona:DEFault` `:SYSTem:PERSona:DEFault?`

Notes	The query `:SYST:PERS:DEF?` returns the default value of `*IDN?` even if the current setting of `*IDN?` is the non-default value. The query return value is a `<string>`
	`:SYST:PERS:DEF`
	is equivalent to:
	`SYSTem:IDN “”`
	SYSTem:IDN:CONF DEF

SYSTem:PERSona:MANufacturer

Sets the `MANufacturer` field of the `*IDN?` response. The field is the first field of the `*IDN?` response.

Remote Command	`:SYSTem:PERSona:MANufacturer <string>` `:SYSTem:PERSona:MANufacturer?`
Notes	When setting the `MANufacturer` field, the current IDN response string is modified to replace the manufacturer field with the string specified by the command. If the resulting IDN response matches one of the predefined responses (`:SYST:IDN:CONF FACT | AGIL`), then the `:SYST:IDN:CONF` is

	set to the corresponding value. If the IDN response with the new manufacturer field is not one of the predefined values, then `:SYST:IDN:CONF` will be set to `USER` and `:SYST:IDN` will be set to the new IDN response string The query returns the current value of the `*IDN?` Manufacturer field

SYSTem:PERSona:MANufacturer:DEFault

Resets the `MANufacturer` field of the `*IDN?` response to the default value.

Remote Command	`:SYSTem:PERSona:MANufacturer:DEFault` `:SYSTem:PERSona:MANufacturer:DEFault?`
Notes	The returns the default `MANufacturer` Field value of `*IDN?` even if the current setting of `*IDN?` is the non-default value. The return value is a <string>

SYSTem:PERSona:MODel

Sets the `MODel` field of the `*IDN?` response. This is the second field of the `*IDN?` response.

Remote Command	`:SYSTem:PERSona:MODel <string>` `:SYSTem:PERSona:MODel?`
Notes	When setting the `MODel` field, the current IDN response string is modified to replace the model field with the string specified by the command. If the resulting IDN response matches one of the predefined responses (`:SYST:IDN:CONF FACT | AGIL`), then `:SYST:IDN:CONF` is set to the corresponding value. If the IDN response with the new model field is not one of the predefined values, then `:SYST:IDN:CONF` will be set to `USER` and `:SYST:IDN` will be set to the new IDN response string The query returns the current value of the `*IDN?MODel` field

SYSTem:PERSona:MODel:DEFault

Resets the `MODel` field of the `*IDN?` response to the default value.

Remote Command	`:SYSTem:PERSona:MODel:DEFault` `:SYSTem:PERSona:MODel:DEFault?`
Notes	The query returns the default `MODel` Field value of `*IDN?` even if the current setting of `*IDN?` is the non-default value. The return value is a `<string>`

4.2.6 Restore I/O Config Defaults

Causes the group of settings associated with the **I/O Config** menu to be reset to their default values. This also happens on **Restore Misc Defaults**, which has a SCPI command.

When **Restore I/O Config Defaults** is selected, a message appears saying:

```
This will reset all of the I/O Config variables to their default state,
including the GPIB address and SCPI LAN settings
```

```
It will not affect Alignment data or settings
```

```
This action cannot be undone. Do you want to proceed?
```

The message provides **OK** and **Cancel** buttons for you to affirm or cancel the operation.

4.2.7 Query USB Connection (Remote Command Only)

Enables you to determine the speed of the USB connection.

Remote Command	`:SYSTem:COMMunicate:USB:CONNection?`
Example	`:SYST:COMM:USB:CONN?`
Notes	`NONE` – Indicates no USB connection has been made `LSPeed` – Indicates a USB low speed connection (1.5 Mbps) Note that this is reserved for future use, the T+M488 protocol is not supported on low speed connections `HSPeed` – Indicates that a USB high speed connection (480 Mbps) has been negotiated `FSPeed` – Indicates that a USB full speed connection (12 Mbps) has been negotiated
Dependencies	This control is not available in E7760
State Saved	No
Range	`NONE|LSPeed|HSPeed|FSPeed`

4.2.8 USB Connection Status (Remote Command Only)

Enables you to determine the current status of the USB connection.

Remote Command	`:SYSTem:COMMunicate:USB:STATus?`
Example	`:SYST:COMM:USB:STAT?`
Notes	`SUSPended` – Indicates that the USB bus is currently in its suspended state. The bus is in the suspended state when: – The bus is not connected to any controller – The controller is currently powered off – The controller has explicitly placed the USB device into the suspended state When in the suspended state, no USB activity, including start of frame packets are received `ACTive` – Indicates that the USB device is in the active state. When the device is in the active state, it is receiving periodic start of frames but it isn't necessarily receiving or transmitting data
Dependencies	This control is not available in E7760

State Saved	No
Range	SUSPended|ACTive

4.2.9 USB Packet Count (Remote Command Only)

Enables you to determine the number of packets received and transmitted on the USB bus.

Remote Command	:SYSTem:COMMunicate:USB:PACKets?
Example	:SYST:COMM:USB:PACK?
Notes	Two integers are returned: 1. The number of packets received since application invocation 2. The number of packets transmitted since application invocation If no packets have been received or transmitted, the response is 0,0 The packet count is initialized to 0,0 when the instrument application is started
Dependencies	This control is not available in E7760
State Saved	No

4.2.10 Lock Remote I/O Session (Remote Command only)

An instrument can support multiple remote I/O sessions at the same time. However, you cannot *simultaneously* send remote commands from multiple sessions to the same instrument. The results in such a case are undefined.

Care must be taken so that only *one* session actively controls the instrument at a time. Other sessions must wait until the active session finishes the instrument control.

To help achieve this cooperative instrument sharing, the following remote commands are provided:

– "Lock Remote I/O Request (Remote Command only)" on page 1941
– "Unlock Remote I/O Session (Remote Command only)" on page 1942
– "Remote I/O Session Lock Name (Remote Command only)" on page 1942
– "Remote I/O Session Lock Owner (Remote Command only)" on page 1942

Example of Lock Usage

1 Each session tries to obtain a lock by sending a :SYSTem:LOCK:REQuest? query

This query can be sent simultaneously from multiple sessions

2. Only one session will be granted. The granted session receives `1` in response to its query
3. The granted session actively controls the instrument

   Meanwhile, other sessions must wait, and must periodically send `:SYSTem:LOCK:REQuest?` queries, trying to obtain the lock
4. When the active session finishes its task, it releases the lock by sending a `:SYSTem:LOCK:RELease` command
5. Now the lock has become available, so when one of the waiting sessions sends a `:SYSTem:LOCK:REQuest?` query, it receives `1` in response, granting the lock to that session

By repeating steps 3, 4, and 5 above, multiple sessions can share the same instrument in a cooperative fashion.

NOTE

A session can query its own unique session name by sending a `:SYSTem:LOCK:NAME?` query. This session name is determined by the instrument.

A session also can query the name of the currently granted session by sending a `:SYSTem:LOCK:OWNer?` query.

NOTE

Remote I/O interfaces are grouped in two types: single-session interface and multi-session interface. Both types of interface can be used for cooperative instrument sharing.

The recommended interface is LAN HiSLIP.

Interface	Single-session	Multi-Session
GPIB	ü	
USB-488	ü	
LAN VXI-11 (SICL)	ü	
LAN Socket		ü
LAN HiSLIP		ü
LAN Telnet		ü

If using a single-session interface, care must be taken to ensure only one client uses the single-session interface.

In particular, LAN VXI-11 (SICL) interface is a single-session interface, even though multiple clients could simultaneously connect to this interface. Such multiple VXI-11 clients share the same session context; the same status registers and the same error queue. Even a SCPI query response can be received by another client. Furthermore, the lock obtained by `:SYSTem:LOCK:REQuest?` is shared among all VXI-11 clients, allowing all of them to actively control the instrument.

If a LAN VXI-11 (SICL) interface must be used by multiple clients for a cooperative instrument sharing, then VISA locking *must* be used, *in addition to* Remote I/O Session Lock.

4.2.10.1 Lock Remote I/O Request (Remote Command only)

You can lock the SCPI control of the instrument to the I/O Interface and Session by sending a `:SYSTem:LOCK:REQuest?` query. This permits cooperative sharing of the instrument between multiple computers, or multiple sessions from the same computer.

Remote Command	`:SYSTem:LOCK:REQuest?`
Example	`:SYST:LOCK:REQ?`
Notes	Returns 1 if the lock request is granted, or 0 if the request is denied Lock requests on an individual interface and session can be nested and each request will increase an internal lock count by 1. For every granted request, you will need to send `:SYST:LOCK:REL` to decrement the internal lock count to fully relinquish the lock When the instrument is locked, Bit 0 is set in the Operation Instrument status register Disconnecting the individual interface and session releases the lock if the lock is granted to the interface and session A Device Clear over any interface and session releases the lock, regardless of the interface and session which obtained the lock The following queries are permitted over any interface and session, even if an interface has the instrument locked: – `*IDN?` – `*OPT?` – `*STB?` – `*ESR?` – `:SYSTem:DATE?` – `:SYSTem:TIME?` – `:SYSTem:PON:TIME?` – Queries in the :STATus subsystem – Queries in the :SYSTem:ERRor subsystem – Queries in the :SYSTem:LKEY subsystem – Queries in the :SYSTem:LOCK subsystem – Queries in the :SYSTem:METRics subsystem – Queries in the :SYSTem:MODule subsystem

	All other commands and queries result in the error: -203,"Command protected; Instrument locked by another I/O session"
State Saved	Not part of Save/Recall

4.2.10.2 Unlock Remote I/O Session (Remote Command only)

You can unlock the SCPI control of the current I/O Interface and Session by sending `:SYSTem:LOCK:RELease`. Lock requests on an individual interface and session can be nested, and each request increases an internal lock count by 1. For every granted request, you will need to perform a release. The lock is not relinquished until the internal lock count reaches 0.

Remote Command	`:SYSTem:LOCK:RELease`
Example	`:SYST:LOCK:REL`
Notes	When the instrument is unlocked, Bit 0 is cleared in the Operation Instrument status register

4.2.10.3 Remote I/O Session Lock Name (Remote Command only)

Use this query to obtain the name of the current I/O Interface and Session.

Remote Command	`:SYSTem:LOCK:NAME?`
Example	`:SYST:LOCK:NAME?`
Notes	The information returned is a string of the format: `<I/O Interface>[/<IP address>/<Session ID>]` Where `IP address` and `Session ID` are only provided for interfaces that provide multiple sessions Single Session interfaces (GPIB, USB-488, and LAN VXI-11) only list interface name `Session ID` is an internally generated identifier. It is not guaranteed to be consistent across instrument software versions (the identifier is subject to change when the software of the instrument is updated). The absolute value of `Session ID` is not significant, but the identifier will be consistent for a given software version, and can be relied upon for lock owner logic comparisons

4.2.10.4 Remote I/O Session Lock Owner (Remote Command only)

Use this query to determine which I/O Interface and Session has the SCPI locked.

If no interface and session has the SCPI locked, then the return value is `NONE`.

Remote Command	`:SYSTem:LOCK:OWNer?`
Example	`:SYST:LOCK:OWN?`
Notes	The information returned is a string of the format:

<I/O Interface>[/<IP address>/<Session ID>]

Where IP address and Session ID are only provided for interfaces that provide multiple sessions

Single Session interfaces (GPIB, USB-488, and LAN VXI-11) only list interface name

Session ID is an internally generated identifier. It is not guaranteed to be consistent across instrument software versions (the identifier is subject to change when the software of the instrument is updated). The absolute value of Session ID is not significant, but the identifier will be consistent for a given software version, and can be relied upon for lock owner logic comparisons

If no interface and session has the SCPI locked, then the return value is NONE

4.2.11 Multiple Network Interface Card Configuration (Remote Commands Only)

Systems that have multiple Network Interface Cards (NICs) require additional configuration information. The following keys can be added to the XApps configuration file:

- PrimaryNICIpv4 – IP address value is a string with the exact IP V4 format. Required field in IP v4 networks.
- PrimaryNICIpv6 – IP address value is a string with the exact IP V6 format. Required field in IP v6 networks.

These commands do not apply to instruments that have only one NIC. The commands apply to all modular deployments that have a controller with multiple NICs.

To configure and query these configuration options, the following remote commands are provided:

- "Multiple Network Adapters Enabled (Remote Command Only)" on page 1943
- "Config IPV4 Address (Remote Command Only)" on page 1944
- "Config IPV6 Address (Remote Command Only)" on page 1944
- "List All Physical Network Adapter IP Addresses (Remote Command Only)" on page 1945

4.2.11.1 Multiple Network Adapters Enabled (Remote Command Only)

Remote Command	:SYSTem:COMMunicate:LAN:MULTiple:NIC:ENABled?
Example	:SYSTem:COMMunicate:LAN:MULTiple:NIC:ENABled?
Notes	Applies to Instruments that have multiple Network Adapters. When more than one network adapter is present in the system, and they are **Enabled** (that is, they have a valid IP Address), this query returns: – 1, if more than one NIC enabled

	– 0, if only one or No NICs are enabled
State Saved	No

4.2.11.2 Config IPV4 Address (Remote Command Only)

Remote Command	`:SYSTem:COMMunicate:LAN:IPV4:CONFig <ipaddress>` `:SYSTem:COMMunicate:LAN:IPV4:CONFig?`
Example	`:SYSTem:COMMunicate:LAN:IPV4:CONFig "192.168.1.146"` `:SYSTem:COMMunicate:LAN:IPV4:CONFig?`
Notes	Applies to instruments that have multiple Network Adapters. When more than one network adapter is present in the system, you must specify in the instrument config file the IP address to use to enable Remoting channel bindings. If this is not provided, Remoting connections are likely to fail on systems where multiple NICs are enabled This command can set the valid IPV4 address, passed in as string in the config file Query returns IPV4 address as string. If config file is missing, "" (empty string) is returned Or the IP Address in IP V4 format Configuring IPV4 value requires a restart of the instrument software, to ensure that servers use the configured IP address
State Saved	No

4.2.11.3 Config IPV6 Address (Remote Command Only)

Remote Command	`:SYSTem:COMMunicate:LAN:IPV6:CONFig <ipaddress>` `:SYSTem:COMMunicate:LAN:IPV6:CONFig?`
Example	`:SYSTem:COMMunicate:LAN:IPV6:CONFig "2001:0d-b8:85a3:0000:0000:8a2e:0370:7334"` `:SYSTem:COMMunicate:LAN:IPV6:CONFig?`
Notes	Applies to instruments that have multiple Network Adapters. When more than one network adapter is present in the system, you must specify in the instrument config file the IP address to use to enable Remoting channel bindings. If this is not provided, Remoting connections are likely to fail on systems where multiple NICs are enabled This command can set the valid IPV6 address, passed in as string in the config file Query returns IPV6 address as string. If config file is missing, "" (empty string) is returned Or the IP Address in IP v6 format Configuring IPV6 value requires a restart of the instrument software, to ensure servers use the configured IP address
State Saved	No

4.2.11.4 List All Physical Network Adapter IP Addresses (Remote Command Only)

Remote Command	`:SYSTem:COMMunicate:LAN:PHYSical:IPADdress:LIST?`
Example	`:SYSTem:COMMunicate:LAN:PHYSical:IPADdress:LIST?` `“192.168.1.146,2001:0db8:85a3:0000:0000:8a2e:0370:7334”`
Notes	Returns the IP Addresses of the physical network adapters found in the PC/Instrument
State Saved	No

4.3 User Interface

Configures functions specific to the User Interface, such as the menu panel orientation and the display color theme.

4.3.1 Menu Panel Position

Allows the Menu Panel to be positioned on the `RIGHt` or `LEFT` side of the display.

Remote Command	`:SYSTem:DISPlay:MPPosition RIGHt | LEFT` `:SYSTem:DISPlay:MPPosition?`
Example	`:SYST:DISP:MPP LEFT`
Preset	This is unaffected by **Preset** but is set to `RIGHt` by **Restore User Interface Defaults** or **Restore System Defaults->All**
State Saved	Power On Persistent (survives shutdown and restart)

4.3.2 Menu Panel Tabs

Allows the **Menu Panel Tabs** to be positioned on the `RIGHt` or `LEFT` side of the menu panel.

Remote Command	`:SYSTem:DISPlay:MPTab RIGHt | LEFT` `:SYSTem:DISPlay:MPTab?`
Example	`:SYST:DISP:MPT LEFT`
Preset	This is unaffected by **Preset** but is set to `RIGHt` by **Restore User Interface Defaults** or **Restore System Defaults->All**
State Saved	Power On Persistent (survives shutdown and restart)

4.3.3 Annotations Local Settings/All Off

Overrides the annotation settings for all measurement in all modes and turns them all off. This provides the security based "annotation off" function of previous instruments; hence it uses the legacy SCPI command.

When this control is set to **All Off**, the **Screen Annotation, Meas Bar, Trace Annotation,** and **Control Annotation** controls under the **Display, Annotation** menu are grayed out and forced to `OFF` for all measurements in all modes. When **Local Settings** is selected, you can set the local annotation settings on a measurement by measurement basis.

Remote Command	`:DISPlay:WINDow[1]:ANNotation[:ALL] OFF | ON | 0 | 1`

	:DISPlay:WINDow[1]:ANNotation[:ALL]?
Example	:DISP:WIND:ANN OFF
Preset	This is unaffected by **Preset** but is set to ON on by **Restore User Interface Defaults**, **Restore Misc Defaults** or **Restore System Defaults->All**
State Saved	Power On Persistent (survives shutdown and restart)
Backwards Compatibility Notes	The WINDow parameter and optional subopcode is included for backwards compatibility but ignored – all windows are equally affected

4.3.4 Display Theme

Allows you to change the **Display Theme**. This is similar to the Themes selection under Page Setup and Save Screen Image.

The two available themes are:

- FILLed: this is the normal theme using filled objects
- OUTLine: this theme uses color, but does not use fill for most areas on the display. It is ideal for images that need to be printed on inkjet printers. Although setting **Display Theme** to OUTLine does not affect screen image saves or prints, it does show you exactly how screen images will look when using the OUTLine theme under **Save Screen Image**, and how prints will look when using the OUTLine theme under **Page Setup**.

NOTE: Although the OUTLine theme eliminates most of the filled area, some objects remain filled. In particular, the selected marker remains filled with the green marker color, in order to distinguish it from the other markers. This is important, as it is the selected marker whose readout appears in the upper right corner of the display.

Remote Command	:DISPlay:THEMe TDColor | TDMonochrome | FCOLor | FMONochrome | FILLed | OUTLine :DISPlay:THEMe?
Example	:SYST:DISP:THEM OUTL sets the display style to OUTLine
Notes	To permit code compatibility with A-model X-Series Signal Analyzer instruments, the command parameters from the A-models are mapped as follows: – TDColor and TDMonochrome are both mapped to FILLed (exact full color representation of what is on the screen) – FCOLor and FMONochrome are both mapped to OUTLine (uses color for traces and other items, but most filled areas are white) There is no Monochrome theme in the B-model instruments, so the monochrome commands for the A-

	model instruments yield color themes The query of `:DISPlay:THEMe?` always returns `FILLed` or `OUTLine`. It never returns `FCOLor`, `FMONochrome`, `TDColor`, or `TDMonochrome`
Preset	This is unaffected by **Preset** but is set to `FILLed` by **Restore User Interface Defaults**, **Restore Misc Defaults** or **Restore System Defaults->All**
State Saved	Power On Persistent (survives shutdown and restart)

4.3.5 Backlight

Turns the display **Backlight** on and off. This setting may interact with settings under the Windows **Power** menu.

When the backlight is `OFF`, pressing ESC, TAB, SPACE, ENTER, UP, DOWN, LEFT, RIGHT, DEL, BKSP, CTRL, or ALT turns the backlight `ON` without affecting the application. Pressing any other key turns backlight `ON`, and could potentially perform the action as well.

Remote Command	`:DISPlay:BACKlight ON | OFF` `:DISPlay:BACKlight?`

Example	`:DISP:BACK ON`
	Turns backlight `ON`
	`:DISP:BACK OFF`
	Turns backlight `OFF`

Preset	Pressing any key turns the backlight back `ON`, as does **Restore User Interface Defaults**, **Restore Misc Defaults** or **Restore System Defaults->All**
State Saved	Not saved in State

4.3.6 Backlight Intensity

Allows the **Backlight Intensity** to be controlled from the UI settings panel.

Remote Command	`:SYSTem:DISPlay:BACKlight:INTensity <integer>` `:SYSTem:DISPlay:BACKlight:INTensity?`
Example	`:SYST:DISP:BACK:INT 67`
Preset	100
State Saved	Power On Persistent (survives shutdown and restart)
Range	0-100

4.3.7 Hints

Hints are descriptions that provide additional information for a control. You can set **Hints** to be enabled or disabled.

Remote Command	`:SYSTem:DISPlay:HINTs[:STATe] OFF | ON | 0 | 1` `:SYSTem:DISPlay:HINTs?`
Example	`:SYST:DISP:HINT OFF`
Preset	This is unaffected by **Preset** but is set to ON by **Restore User Interface Defaults** or **Restore System Defaults->All**
State Saved	Power On Persistent (survives shutdown and restart)

4.3.8 Numeric Entry Auto Open

Configures whether the **Numeric Entry** Panel will appear immediately when an active function control is activated (Auto Open `ON`), or be deferred until you touch it again or begin to enter a value (Auto Open `OFF`). When configured for Auto Open `OFF` (the default), adjusting the value with the front panel Up/Down keys or the RPG hides the **Numeric Entry** Panel.

Remote Command	`:SYSTem:DISPlay:NEPimmediate ON | OFF | 1 | 0` `:SYSTem:DISPlay:NEPimmediate?`
Example	`:SYST:DISP:NEP OFF`
Preset	This is unaffected by **Preset** but is set to ON by **Restore User Interface Defaults** or **Restore System Defaults->All**
State Saved	Power On Persistent (survives shutdown and restart)

4.3.9 Touch On/Off

Turns the touch functionality on and off on the display. If `OFF`, you can turn it back on using the front panel **Touch On/Off** key, or by using a mouse to toggle this control.

Preset	Always starts up ON Unaffected by **Preset** but is turned ON by **Restore User Interface Defaults** or **Restore System Defaults->All**
State Saved	Not saved in state, not affected by **Preset**, not Power On Persistent (does not survive shutdown and restart)

4.3.10 Control Size

Configures the size of the controls in the user interface. This can be used to make screen dumps from a large screen instrument match those from a smaller screen instrument, to make the controls more readable on a large-screen instrument, or to display more information on a smaller screen instrument.

Remote Command	`:DISPlay:UINTerface:CSIZe SMALl | LARGe` `:DISPlay:UINTerface:CSIZe?`
Example	`:DISP:UINT:CSIZ LARG`
Preset	This is unaffected by **Preset** but is set to `SMALl` by **Restore User Interface Defaults** or **Restore System Defaults->All**
State Saved	Power On Persistent (survives shutdown and restart)

4.3.11 Quick Save Mode

When **Quick Save Mode** is `NORMal` (the default setting), the instrument does an immediate save of a new file of the same type and to the same directory as the previous **Save** action. When **Quick Save Mode** is in the `PROMpt` state, instead of immediately performing a **Save**, the Alpha Keyboard appears with the proposed auto-filename in the entry area. You can then press **Enter** to accept the auto filename, or edit the name then press **Enter**. This allows you to easily save a file with a custom file name.

Remote Command	`:MMEMory:STORe:QSAVe NORMal | PROMpt` `:MMEMory:STORe:QSAVe?`
Example	`:MMEM:STOR:QSAV PROM`
Preset	This is unaffected by **Preset** but is set to `NORMal` by **Restore User Interface Defaults** or **Restore System Defaults->All**
State Saved	Power On Persistent (survives shutdown and restart)

4.3.12 Screen Tabs Left/Right

This switch, when in the `RIGHt` position, makes the screen tabs start on the right and build across to the left, thus minimizing the finger travel over to the screen tab when there is only one screen.

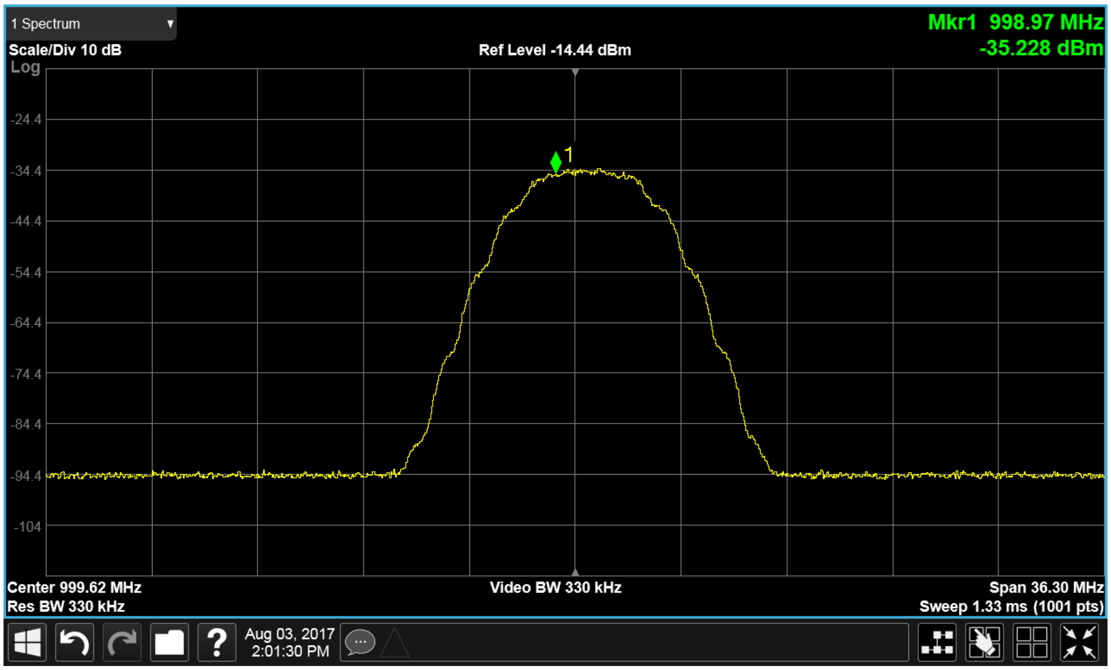
The default is `LEFT`.

Remote Command	`:DISPlay:UINTerface:STAB RIGHt | LEFT` `:INSTrument:SCReen:STAB?`
Example	`:DISP:UINT:STAB RIGH`

Preset	This is unaffected by **Preset** but is set to `LEFT` by **Restore User Interface Defaults** or **Restore System Defaults->All**
State Saved	Power On Persistent (survives shutdown and restart)

4.3.13 Hide Screen Tabs in Full Screen

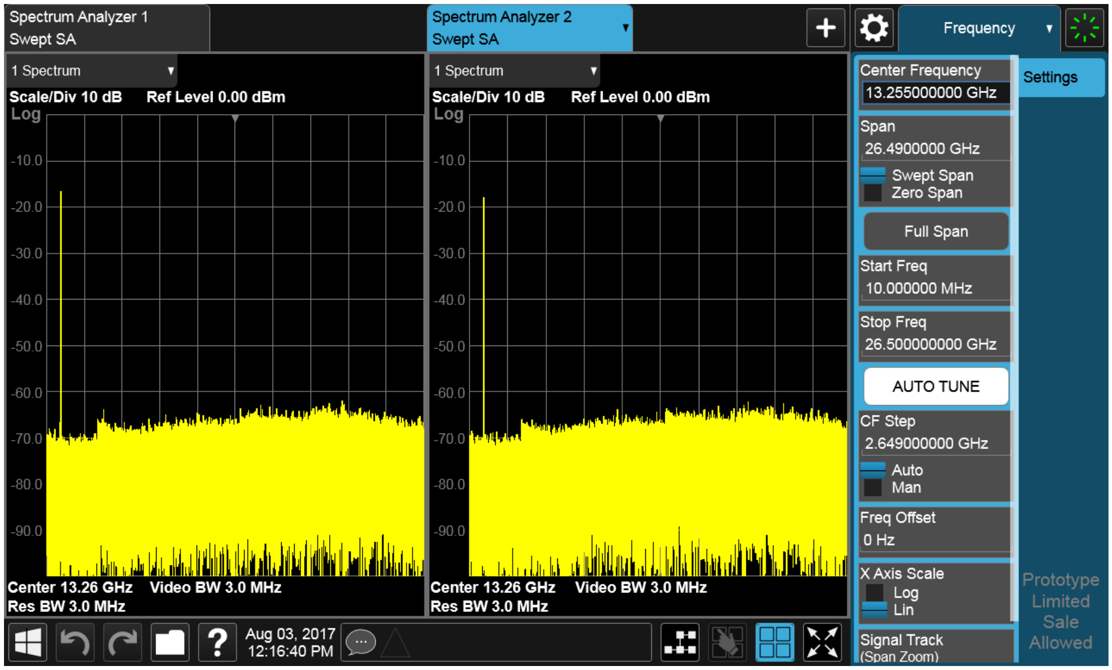
This switch, when in the `ON` position, causes the Screen Tabs to be hidden when in Full Screen view, thus maximizing the display area available for results. By also turning off the Meas Bar (in the **Display, Annotation** menu), you can maximize the available area for results, as shown below:



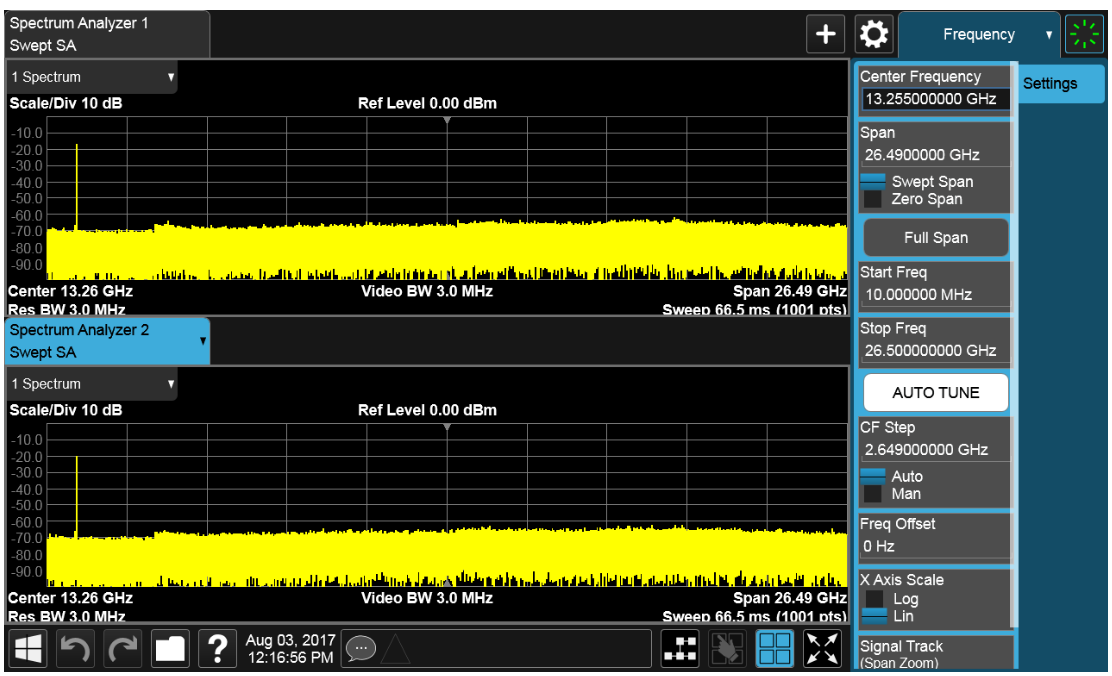
Remote Command	`:DISPlay:UINTerface:HTABs ON | OFF | 1 | 0` `:DISPlay:UINTerface:HTABs?`
Example	`:DISP:UINT:HTAB ON` Hide the tabs in full screen
Preset	This is unaffected by **Preset** but is set to `OFF` by **Restore User Interface Defaults** or **Restore System Defaults->All**
State Saved	Power On Persistent (survives shutdown and restart)

4.3.14 2-Screen Orientation

When you add a second Screen using the "+" control on the Screen Tabs bar, normally the screen is added to the right of the first screen. However, sometimes it is better to add the new screen below the first screen rather than to the right, as shown below.



New screen added to the right (horizontal orientation)



New screen added below (vertical orientation)

The **2-Screen Orientation** switch allows you to choose between these two orientations for 2-Screen configurations. The default is the `HORizontal` configuration, two Screens side-by-side.

Remote Command	:INSTrument:SCReen:ORIentation VERTical | HORizontal
Example	:INST:SCR:ORI VERT Set the 2 screens to be above/below each other
Preset	HOR This is unaffected by **Preset** but is set to HORizontal by **Restore User Interface Defaults** or **Restore System Defaults->All**

4.3.15 Clock Format

Allows the **Clock Format** to be switched between 12-Hour Format (HR12) and 24-Hour Format (HR24).

Remote Command	:SYSTem:DISPlay:CFORmat HR12 | HR24 :SYSTem:DISPlay:CFORmat?
Example	:SYST:DISP:CFOR HR12
Preset	HR12
State Saved	Power On Persistent (survives shutdown and restart)
Range	12-Hour | 24-Hour

4.3.16 Language

Accesses the selection of **Language** displayed on the menus and controls. ENGLish is the default.

All Measurement Applications that share common controls will display the localized controls.

The description on the control labels is bounded by the control size. Any given language will have labels in that language that are shorter or longer than the equivalent label in English. Any localized text on the controls that does not fit the label size remains in English. Thus for any given menu, controls may be displayed in English *and* the selected language.

– Labels that are acronyms, engineering, or technology specific terms may remain in English.

– All Application and Measurement names remain in English.

– All data in exported files remain in English.

– The Diagnostic and Service menus in the System Subsystem remain in English.

– The Windows operating system must remain in English. Changing the **Region and Language** settings in the Windows Control Panel is not supported.

External keyboards in English are supported. Localized external keyboards are not supported. When the language selected is not English, a message is displayed to explain that any external keyboard must remain in English.

Other aspects of the Graphical User Interface remain in English. The Remote User Interface (SCPI) remains in English.

Remote Command	`:SYSTem:DISPlay:LANGuage ENGLish | RUSSian` `:SYSTem:DISPlay:LANGuage?`

Example	`:SYST:DISP:LANG ENGL`
	`:SYST:DISP:LANG RUSS`
	Requires Option AKT

Preset	This is unaffected by **Preset** but is set to `ENGLish` by **Restore User Interface Defaults,Restore Misc Defaults** or **Restore System Defaults->All**

4.3.17 Restore User Interface Defaults

Causes the group of settings associated with the **User Interface** menu to be reset to their default values. This also happens on **Restore Misc Defaults**.

When **User Interface** is selected, a message appears saying:

```
This will reset all of the User Interface variables to their default state,
including the menu panel location, display theme, and language.
It will not affect Alignment data or settings.
This action cannot be undone. Do you want to proceed?
```

The message provides **OK** and **Cancel** buttons for you to affirm or cancel the operation.

Example	`:SYST:DEF UINT`

4.3.18 User Interface Type (Remote only command)

Use this query to determine if the instrument is running the Multi-Touch user interface or Softkey user interface. This is an easy way to distinguish between A-models (Softkey) instruments and Touch UI (Multi-Touch) instruments.

Remote Command	`:DISPlay:UINTerface:TYPE?`
Example	`:DISP:UINT:TYPE?`
Notes	The query returns `MULTITOUCH` for instruments with the Multi-Touch UI or `SOFTKEY` for instruments with the Softkey UI

4.4 Power On

Enables you to select how the instrument should power on.

NOTE: In products that run multiple instances of the X-Series Application, the same Power On type is shared between all the instances.

Dependencies	This menu is not available on the M9391A or M9393A

4.4.1 Power On State

Enables you to select whether the instrument powers up in a default state, or some other state. The options are:

- `MODE` and Input/Output Defaults
- `USER` Preset
- `LAST` State

Remote Command	`:SYSTem:PON:TYPE MODE | USER | LAST` `:SYSTem:PON:TYPE?`

Example	`:SYST:PON:TYPE MODE`
	`:SYST:PON:TYPE USER`
	`:SYST:PON:TYPE LAST`

Preset	This is unaffected by **Preset** but is set to `MODE` by **Restore System Defaults->All**
State Saved	No
Backwards Compatibility SCPI	`:SYSTem:PON:TYPE PRESet` the `PRESet` parameter is supported for backward compatibility only, and behaves the same as `MODE`

Mode and Input/Output Defaults

When the instrument is powered-on in `MODE` and Input/Output Defaults, it performs a **Restore Mode Defaults** to all modes in the instrument and also performs a **Restore Input/Output Defaults**.

Persistent parameters (such as Amplitude Correction tables or Limit tables) are not affected at power-on, even though they are normally cleared by **Restore Input/Output Defaults** and/or **Restore Mode Defaults**.

User Preset

Sets **Power On State** to `USER` Preset. When the instrument is powered on in User Preset, it will **User Preset** each mode and switch to the "Power On Application" on page 1957. Power On User Preset does not affect any settings other than those set by a normal **User Preset**.

Backward Compatibility Note: Power On: User Preset causes the instrument to power up in the "Power On Application" on page 1957, *not* the last mode the instrument was in prior to shutdown. Also, Power On: User Preset will **User Preset** all modes. This does not exactly match legacy behavior.

NOTE: In products that run multiple instances of the X-Series Application, the same User Preset is shared between all the instances.

NOTE: An instrument could never power up for the first time in USER Preset.

Last State

Sets **Power On State** to `LAST`. When the instrument is powered on, it will put all modes in the last state they were in prior to when the instrument was put into Power Standby, and it will start up in the mode it was last in prior to powering off the instrument. The saving of the active mode prior to shutdown happens behind the scenes when a controlled shutdown is requested, either via the front panel **Standby** key, or the remote command `:SYSTem:PDOWn`. The non-active modes are saved as they are deactivated and recalled by Power On: Last State.

Power On: Last State only works if you completed a controlled shutdown prior to powering on in `LAST`. If a controlled shutdown is not completed when in Power On: Last State, the instrument will power up in the last active mode, but it may not power up in the active mode’s last state. If an invalid mode state is detected, a **Mode Preset** will occur. To control the shutdown under remote control, use `:SYSTem:PDOWn`.

Backwards Compatibility Note: It is no longer possible to power-up the instrument in the last mode the instrument was running with that mode in the preset state. (ESA/PSA SYST:PRESET:TYPE MODE with SYST:PON:PRESET) You can power-on the instrument in the last mode the instrument was running in its last state (`:SYST:PON:TYPE LAST`), or you can specify the mode to power-up in its preset state (`:SYST:PON:MODE <mode>`).

NOTE: In products that run multiple instances of the X-Series Application, each instance has a unique Last State.

NOTE: An instrument can never power up for the first time in `LAST`.

If line power to the instrument is interrupted, for example by pulling the line cord plug or by switching off power to a test rack, Power On Last State may not work properly. For proper operation, Power On Last State depends on your shutting down the instrument using the **Standby** key or the `:SYSTem:PDOWn` SCPI command. This ensures the last state of each mode is saved and can be recalled during a power up.

4.4.2 Power On Application

Accesses a menu that lists the available Modes, and lets you select which Mode is to be the **Power On Application**. Whichever application is selected runs at power on when the Power On Type is set to "`MODE` and Input/Output Defaults".

NOTE: In products that run multiple instances of the X-Series Application, the same Power On Application is shared between all the instances.

Remote Command	`:SYSTem:PON:MODE <mode>`
	where `<mode>` is an item from the same set that can be sent using the `:INSTrument[:SELect]` command
	`:SYSTem:PON:MODE?`

Example	`:SYST:PON:MODE SA`
Notes	The list of possible modes (and remote parameters) to choose from is dependent on which modes are installed in the instrument
Preset	This is unaffected by **Preset** but is set by **Restore System Defaults->All** to `SA`, except in the cases noted below: – For N8973B, N8974B, N8975B, or N8976B: `NFIG` – For E7760: `BASIC`
State Saved	No

4.4.3 FPGA Configuration

This dialog lets you choose which FPGA image you want loaded into the instrument.

Depending on your hardware configuration, your instrument may contain a Field Programmable Gate Array (FPGA) which handles much of the processing for some of the mathematically intensive features, such as Time Domain Scan (option TDS) and Enhanced Sweep Speed (option FS2). The FPGA is not big enough to hold the functionality for both options, so you have to decide which FPGA program you want loaded.

When licenses allow for both FPGA image versions to be available, and you have not explicitly chosen an FPGA image version, then when the firmware is updated the Time Domain Scan version will be loaded. In the absence of all licenses, the Enhanced Sweep Speed version will be loaded. Once you have explicitly chosen an

FPGA image version, using the FPGA Configuration dialog, any future firmware updates will continue to load the chosen version as long as it is licensed.

Example: loading the Time Domain Scan FPGA image, removing the TDS license, and then updating the firmware will result in the Enhanced Sweep Speed version being loaded.

When multiple capabilities are licensed, the FPGA Configuration presents a dialog which tells you that there is insufficient space to fit all the licensed capabilities, and asks you to choose one of the FPGA programs (images).

If you remove licenses, it is possible to end up with an unlicensed capability loaded in the FPGA while a licensed capability is not loaded. In this case, the dialog will not present the Preference group and will show a message about unlicensed/licensed capabilities. You can dismiss the dialog if the licensed capability isn't currently needed and you don't want to take the time to load the licensed FPGA image. However, this dialog will continue to pop-up each time the instrument is restarted.

Behavior when the Enhanced Sweep Speed FPGA Image is Loaded

When the Enhanced Sweep Speed version of the FPGA image is loaded, sweep behavior still depends on the licenses:

- FS2 gives full FPGA enhanced sweep speed
- FS1 gives software implemented enhanced sweep speed
- Neither FS1 nor FS2 – no enhanced sweep speed
- Both FS1 and FS2 – same as FS2, the full FPGA enhanced sweep speed

If the EMI Receiver application and TDS option are licensed and the Enhanced Sweep Speed FPGA image is loaded, then you will not have the proper FPGA image loaded to fully support the EMI Receiver application. In particular, the Frequency Scan measurement cannot use the Scan Type of "Time Domain Scan" (this is the normally the default Scan Type for instruments with the TDS option). Instead, the EMI Receiver Application will behave as if the TDS option is not licensed.

Behavior when the Time Domain Scan FPGA Image is loaded

When the Time Domain Scan version of the FPGA image is loaded, The EMI Receiver application will work as expected with the TDS option licensed, but the FS2 capability will silently revert back to FS1 behavior.

Switching Between Enhanced Sweep Speed and Time Domain Scan FPGA Images

You can't have both full TDS and FS2 images at the same time, so to switch to the other image you must go through the process of reloading the FPGA by choosing the desired image with the Selected FPGA control and pressing Load FPGA or issuing the "Load FPGA" SCPI command below with the proper parameter.

Incorrect FPGA Configuration

If the EMI Receiver application, TDS, or FS2 license is removed while the FPGA image for that license is loaded, the instrument ends up in an incorrect configuration since the loaded FPGA image version has support for unlicensed functionality that is not accessible and does not support the currently licensed functionality. It will still function, but when the instrument recognizes this situation at startup, it will automatically enter the FPGA Configuration dialog. The only selections available will be the licensed ones, but you can choose to dismiss the dialog and continue with the current FPGA image version if you do not want to take the time to load the correct FPGA image. The dialog will continue to be presented at each startup until the correct FPGA image is loaded.

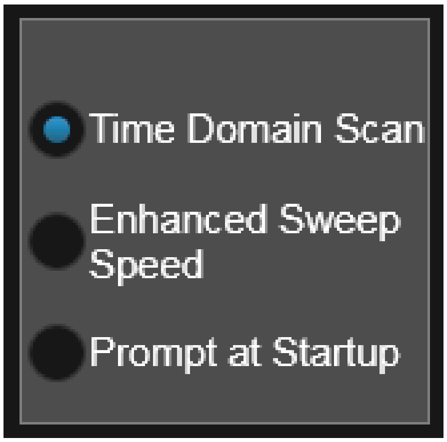
FPGA Updates When Firmware Installs

The FPGA image and X-Series firmware are tightly coupled, so whenever the firmware is updated, the FPGA image is also checked and updated if needed. The rules for choosing between Time Domain Scan and Enhanced Sweep Speed versions of the FPGA image are as:

1. Always use Time Domain Scan FPGA image for MXE
2. If neither the EMC Application nor TDS nor FS2 are licensed, the Enhanced Sweep Speed FPGA image is loaded
3. If EMC Application and TDS are licensed and FS2 is not licensed, the Time Domain Scan FPGA image is loaded
4. If EMC Application and TDS are not licensed and FS2 is licensed, the Enhanced Sweep Speed FPGA image is loaded
5. If all are licensed
   a. If the FPGA Configuration Preference is Time Domain Scan, the Time Domain Scan FPGA image is loaded
   b. If the FPGA Configuration Preference is Enhanced Sweep Speed, the Enhanced Sweep Speed FPGA image is loaded
   c. If FPGA Configuration Preference is Prompt
      a. If the last FPGA Configuration Load was Time Domain Scan, the Time Domain Scan FPGA image is loaded
      b. If the last FPGA Configuration Load was Enhanced Sweep Speed, the Enhanced Sweep Speed FPGA image is loaded
      c. If no FPGA has been explicitly loaded, the Time Domain Scan FPGA image is loaded

4.4.3.1 FPGA Load Preference

You may choose one image or the other from the radio buttons at the top of the dialog:



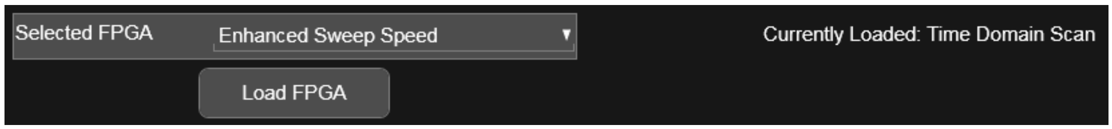
If you select the image that is already loaded, you will not be prompted again. If you select a different one, the Selected FPGA control changes to that one and you must then press the **Load FPGA** control to load the other image.

When installing new firmware, the **FPGA Load Preference** setting is used to load the preferred FPGA image version if more than one version is available. Selecting **Prompt at Startup**.causes you to be prompted at each startup to select the desired version of the FPGA image.

Remote Command	`:SYSTem:PON:FPGA:PREFerence TDS | FS2 | PROMpt`
Example	`:SYST:PON:FPGA:PREF TDS` `:SYST:PON:FPGA:PREF?`
Notes	– `TDS` = Load the Time Domain Scan version of the FPGA image – `FS2` = Load the Enhanced Sweep Speed version of the FPGA image – `PROMpt` = Prompt at each startup, show the FPGA Configuration dialog. The user can choose to continue with the currently loaded FPGA image version or load a different version This SCPI is always available, but if the hardware does not support multiple FPGA image choices, the value will always be: – `NA` = Not available for this hardware Also when not supported, any attempt to change away from `NA` results in the error -224, “Illegal parameter value”
Dependencies	Dialogs and menus available only when EMC Application, `TDS` and `FS2` are all licensed
Preset	`PROMpt` Not affected by **Mode Preset** but set to `PROMpt` by **Restore System Defaults > All** or **Power On**

4.4.3.2 Load FPGA

Depending on the "FPGA Load Preference" on page 1960 selection, there may be a mismatch between the desired FPGA image, and the one that is currently loaded. In that case the **Load FPGA** control at the bottom of the dialog will not be grayed-out, and you must press it in order to actually load the desired FPGA image. The image that is currently loaded is shown on the right:



If you have a mismatch, but don't actually load the other image, the **FPGA Load Preference** will be remembered, but the image you had before will remain until you return to this dialog and press **Load FPGA**, or until the next time the instrument firmware is updated.

If you press **Load FPGA**, the X-series software exits, the FPGA update program runs, and the instrument reboots. After rebooting, the new image will be loaded in the FPGA.

NOTE This can take 15 minutes or more.

CAUTION If power is lost during the FPGA load process, the FPGA can become corrupted, in which case the only solution is to return it to Keysight for servicing.

Remote Command	`:SYSTem:PON:FPGA:LOAD TDS | FS2`
Example	`:SYST:PON:FPGA:LOAD TDS` `:SYST:PON:FPGA:LOAD?`
Notes	If the specified FPGA image version is the one already loaded, then the command does nothing. If the FPGA image needs to change, the analyzer software exits (terminating the SCPI session) and the FPGA update utility is launched. Once the FPGA has updated, the instrument will reboot This SCPI is always available, but if the hardware does not support multiple FPGA image choices, the value returned will always be: `NA` = Not available for this hardware Also when not supported, any attempt to change away from `NA` results in the error -224, “Illegal parameter value”
Dependencies	Available only when there are multiple versions of the FPGA image that could be loaded Selection limited to licensed features: – `TDS` selection requires the EMC Application and the TDS hardware option – `FS2` requires the FS2 hardware option The UI is blanked when there is only one licensed selection and that selection is already loaded. Sending the SCPI for an unlicensed selection results in error:

	-224, “Illegal parameter value; <option> is not licensed”
Preset	None. Not affected by **Mode Preset** or any **Restore Defaults**

4.4.4 Restore Power On Defaults

This selection causes the **Power On** settings to be reset to their default values.

When this button is pressed, a message appears saying:

This will reset Power On State and Power On Application to their default state.

It will not affect Alignment data or settings.

This action cannot be undone. Do you want to proceed?

The message provides **OK** and **Cancel** buttons for you to affirm or cancel the operation.

Example	`:SYST:DEF PON`

4.4.5 Configure Applications – Desktop application

The **Configure Applications** utility runs from the instrument’s desktop. You must close the Instrument Application before running **Configure Applications.**

This utility can be used to:

– select applications for preload

– determine how many applications can fit in memory at one time

– specify the order of the Modes in the Mode menu.

The utility consists of a window with instructions, a set of **Select Application** checkboxes, a “fuel bar” style memory gauge, and keys that help you set up your configuration.

NOTE **In products that run multiple instances of the X-Series Application, the same Configure Applications Utility is shared between all the instances.**

For more information, see the following topics:

– "Preloading Applications" on page 1963

– "Access to Configure Applications utility" on page 1963

– "Virtual memory usage" on page 1964

Example	`:SYST:SHOW CAPP` Displays the Config Applications screen

Preloading Applications

During runtime, if a Mode that is not preloaded is selected using the **Mode** menu or by sending SCPI commands, there will be a pause while the Application is loaded. During this pause a message that says "`Loading application, please wait …`" is displayed. Once loaded, the application stays loaded, so the next time you select it during a session, there is no delay.

Preloading enables you to "preload" at startup, to eliminate the runtime delay. Preloading an application causes it to be loaded into the instrument's memory when the analyzer program starts up. If you do this, the delay will increase the time it takes to start up the analyzer program, but this may be preferable to having to wait the first time you select an application. Note that, once an application is loaded into memory, it cannot be unloaded without exiting and restarting the analyzer program.

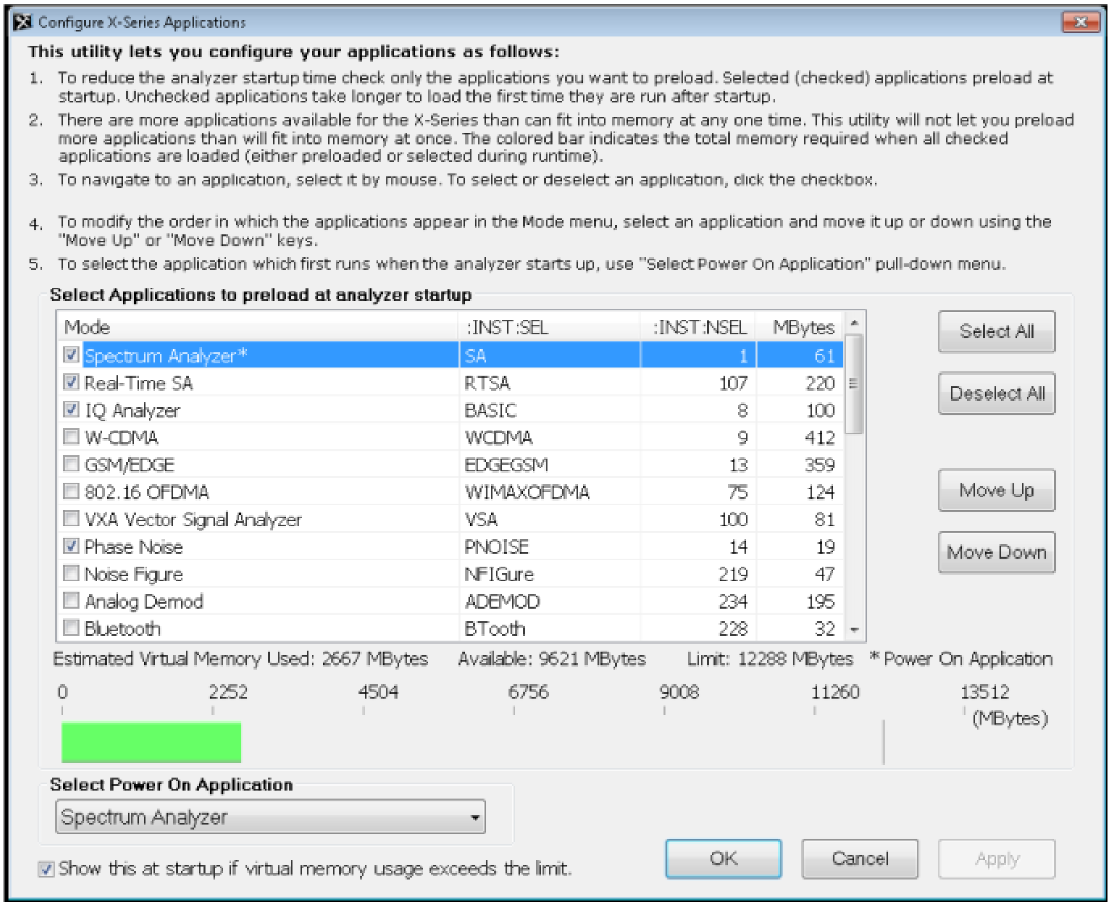
Note that there are more applications available for the X-Series than can fit into Windows Virtual Memory. By allowing you to choose which licensed applications to load at startup, the **Configure Applications** utility allows you to make optimal use of the instrument memory.

Access to Configure Applications utility

A version of the utility runs the first time you power up the instrument after purchasing it from Keysight. The utility automatically configures preloads so that as many licensed applications as possible are preloaded while keeping the total estimated virtual memory usage below the limit. This auto-configuration only takes place at the very first run, and after analyzer software upgrades.

At any time, you can manually start the **Configure Applications** utility by closing the analyzer application and double-tapping the **Configure Applications** icon on the desktop.

The utility's main dialog looks like this:



Instructions are provided below and on the utility. Use the utility to find a configuration that works best for you, and then restart the analyzer program.

Select All	Marks all applications in the selection list. This allows you to enable all applications licensed on the instrument for pre-loading, or is a convenience for selecting all applications in one operation and then letting you deselect individual applications
Deselect All	Clears the marks from all applications in the selection list, except the Power On application. The Power On application cannot be eliminated from the pre-load list
Move Up Move Down	The application list is the order that applications appear in the Mode Menu. These keys enables you to shift the selected application up or down in the list, thus moving the selected application earlier or later in the Mode Menu
Select Power On Application	This is the same as the “Power On Application” selection on the Power On page of the System Settings dialog

Virtual memory usage

There are more applications available for the X-Series than can fit into memory at any one time, so the **Configure Applications** utility includes a memory tracker that serves two purposes:

1. It will not let you preload more applications than will fit into memory at once.

2. You can determine how many of your favorite applications can reside in memory at one time.

The utility provides a graphical representation of the amount of memory (note that the amount of memory shown here is *virtual* memory, which is a limitation imposed by the operating system, not by the amount of physical memory you have in your instrument). You select applications to preload by checking the boxes on the left. Checked applications preload at startup. The colored fuel bar indicates the total memory required when all the checked applications are loaded (either preloaded or selected during runtime).

Here is what the fuel bar colors mean:

– RED: the applications you have selected cannot all fit into the instrument's memory. You must deselect applications until the fuel bar turns yellow.

– YELLOW: the applications you have selected can all fit into the instrument's memory, but there is less than 10% of the memory left, probably not enough to load any other applications, either via preload or by selecting a Mode while the instrument is running..

– GREEN: The indicator is green when <90% of the memory limit is consumed. This means the applications you have selected can all fit into the instrument's memory with room to spare. You will likely be able to load one or more other applications without running out of memory.

All apps that are part of the Sequencer Mode (GSM/EDGE, WCDMA, CDMA2K and 1xEVDO) will be preloaded (if licensed) if Sequence Analyzer is selected to be preloaded.

4.4.6 Configure Applications - Instrument boot-up

When the Instrument Application startsa dialog box similar to the one you see when you run Configure Applications is displayed, allowing you to choose which licensed applications are to be loaded. This dialog is only displayed if the memory required to pre-load all of the licensed applications exceeds the virtual memory available.

4.4.7 Configure Applications - Remote Commands

The following topics provide details on using remote commands to configure the list of applications you want to load into the instrument memory, or query the virtual memory utilization for your applications.

– "Configuration list (Remote Command Only)" on page 1966

– "Configuration Memory Available (Remote Command Only)" on page 1966

- "Configuration Memory Total (Remote Command Only)" on page 1966
- "Configuration Memory Used (Remote Command Only)" on page 1966
- "Configuration Application Memory (Remote Command Only)" on page 1967

4.4.7.1 Configuration list (Remote Command Only)

Used to set or query the list of applications to be loaded in-memory.

Remote Command	`:SYSTem:PON:APPLication:LLISt <string of INSTrument:SELect names>` `:SYSTem:PON:APPLication:LLISt?`
Example	`:SYST:PON:APPL:LLIS "SA,BASIC,WCDMA"`
Notes	`<string of INSTrument:SELect names>` contains items that are valid options for the `:INSTrument:SELect` command The order of the `<INSTrument:SELect names>` specifies the order in which the applications are loaded into memory, and the order that they appear in the **Mode** menu Error message -225 "Out of Memory" is reported when more applications are listed than can reside in virtual memory. When this occurs, the existing applications load list is unchanged
Preset	Not affected by Preset
State Saved	Not saved in instrument state

4.4.7.2 Configuration Memory Available (Remote Command Only)

Used to query the amount of Virtual Memory remaining.

Remote Command	`:SYSTem:PON:APPLication:VMEMory[:AVAilable]?`
Example	`:SYST:PON:APPL:VMEM?`
Preset	Not affected by Preset

4.4.7.3 Configuration Memory Total (Remote Command Only)

Used to query the limit of Virtual Memory allowed for applications.

Remote Command	`:SYSTem:PON:APPLication:VMEMory:TOTal?`
Example	`:SYST:PON:APPL:VMEM:TOT?`
Preset	Not affected by Preset

4.4.7.4 Configuration Memory Used (Remote Command Only)

Queries of the amount of Virtual Memory used by all measurement applications.

Remote Command	`:SYSTem:PON:APPLication:VMEMory:USED?`
Example	`:SYST:PON:APPL:VMEM:USED?`
Preset	Not affected by Preset

4.4.7.5 Configuration Application Memory (Remote Command Only)

Queries the amount of Virtual Memory a particular application consumes.

Remote Command	`:SYSTem:PON:APPLication:VMEMory:USED:NAME? <INSTrument:SELect name>`
Example	`:SYST:PON:APPL:VMEM:USED:NAME? CDMA2K`
Notes	`<INSTrument:SELect name>` is an item from the same set used by the `:INSTrument:SELect` command If the name provided is invalid, 0 (zero) is returned
Preset	Not affected by Preset

4.5 Restore Defaults

Provides initialization of system setting groups, including the option to set the entire instrument back to a factory default state.

NOTE: In products that run multiple instances of the X-Series Application, all instances have the same factory default states for **Restore Defaults**.

Remote Command	`:SYSTem:DEFault [ALL] | ALIGn | INPut | MISC | MODes | PON | UINTerface | SCReen`
Example	`:SYST:DEF`
State Saved	No

4.5.1 Input/Output

Input/Output Preset resets the group of settings and data associated with the **Input/Output** front-panel key to their default values. These settings are not affected by a **Mode Preset** because they are generally associated with connections to the instrument, which you will probably not want to reset every time you press **Mode Preset**.

By using **Input/Output** Preset and **Restore Mode Defaults**, a full preset of the current mode will be performed, with the caveat that since **Input/Output** Preset is a global function, it will affect *all* modes.

This is the same as the **Input/Output Preset** button in the **Preset** dropdown and the **Input/Output** menu.

When **Input/Output** is selected, a message appears saying:

```
This will reset all of the Input/Output variables to their default state,
including which input is selected, all Amplitude Correction settings and data,
all External Mixing settings, all Frequency Reference settings and all Output
settings

It will not affect Alignment data or settings

This action cannot be undone. Do you want to proceed?
```

The dialog includes **OK** and **Cancel** controls, for you to affirm or cancel the operation.

Example	`:SYST:DEF INP`

4.5.2 I/O Config

Causes the group of settings associated with the **I/O Config** menu to be reset to their default values. This also happens on **Restore Misc Defaults**, which has a SCPI command, although **I/O Config** does not.

When **I/O Config** is selected, a message appears saying:

`This will reset all of the I/O Config variables to their default state, including the GPIB address and SCPI LAN settings`

`It will not affect Alignment data or settings`

`This action cannot be undone. Do you want to proceed?`

The dialog includes **OK** and **Cancel** controls, for you to affirm or cancel the operation.

Dependencies	This control is not available on the M9391A or M9393A

4.5.3 User Interface

Causes the group of settings associated with the **User Interface** menu to be reset to their default values. This also happens on a**Restore Misc Defaults**.

When **User Interface** is selected, a message appears saying:

`This will reset all of the User Interface variables to their default state, including the menu panel location, display theme, and language`

`It will not affect Alignment data or settings`

`This action cannot be undone. Do you want to proceed?`

The dialog includes **OK** and **Cancel** controls, for you to affirm or cancel the operation.

Example	`:SYST:DEF UINT`

4.5.4 Power On

Causes the **Power On** settings to be reset to their default values.

The Power On settings are **Power On State** and **Power On Application**.

When **Power On** is selected, a message appears saying:

`This will reset Power On State and Power On Application to their default state`

`It will not affect Alignment data or settings`

`This action cannot be undone. Do you want to proceed?`

The dialog includes **OK** and **Cancel** controls, for you to affirm or cancel the operation.

Example	`:SYST:DEF PON`
Dependencies	This control is not available on the M9391A or M9393A

4.5.5 Alignments

Causes the **Alignments** system settings to be reset to their default values. This does not affect any Alignment data stored in the system.

After performing this function, it may impact the auto-alignment time of the instrument until a new alignment baseline has been established.

When **Alignments** is selected, a message appears saying:

`This will reset all of the settings for the Alignment system to their default values`

`No alignment data will be erased`

`This action cannot be undone. Do you want to proceed?`

The dialog includes **OK** and **Cancel** controls, for you to affirm or cancel the operation.

Example	`:SYST:DEF ALIG`

4.5.6 Misc

Causes miscellaneous system settings to be reset to their default values.

CAUTION **This function resets the GPIB address to 18.**

When **Misc** is selected, a message appears saying:

`This will reset miscellaneous system settings to their default values. This includes settings for I/O Config (GPIB and SCPI LAN), the User Interface, the Save/Recall system, and the Preset type`

`It will not affect Alignment data or settings`

`This action cannot be undone. Do you want to proceed?`

The dialog includes **OK** and **Cancel** controls, for you to affirm or cancel the operation.

This Miscellaneous group contains settings that are *not* part of the other Restore System Defaults groups. These include:

– All settings on the **I/O Config** page of the **System Settings** dialog

– All settings in the following table:

Miscellaneous Setting	Default Value
The SYST:PRES:TYPE	MODE
Auto File Name Number	000
Save Type	State
State Save To	Register 1
Screen Save To	SCREEN000.png
Save/Recall Shortcuts	Deleted
Display Theme	Filled
Backlight	ON
System Annotation	Local Settings
Language	English

Miscellaneous Setting	Default Value
DISP:ENABle	ON
Full Screen	Off

Example	`:SYST:DEF MISC`

4.5.7 All

Comprehensively resets **All** instrument settings to their factory default values. It resets all of the **System Settings** groups, performs **Restore Mode Defaults** for all modes in the instrument, and switches back to the power-on mode. It does not affect the User Preset file, or any user saved files.

When **All** is selected, a message appears saying:

`This will reset all of the settings in the instrument to their factory default values, including the state of all Modes and Screens, the GPIB settings, the Alignment settings, and the Power On Mode`

`It will not affect Alignment data or settings`

`This action cannot be undone. We recommend canceling this operation and restoring settings individually (I/O Config, User Interface, Alignments, etc.) instead`

`Do you want to proceed?`

The dialog includes **OK** and **Cancel** controls, for you to affirm or cancel the operation.

NOTE If you are using a Keysight USB External Mixer, then you will need to perform **Refresh USB Mixer Connection** after Restoring All Defaults.

Example	`:SYST:DEF ALL`
Notes	If using a Keysight USB External Mixer, perform **Refresh USB Mixer Connection** (SCPI command `:MIX:BAND USB`) following **Restore All Defaults**
Couplings	**All** causes the currently running measurement to be aborted, and sets all modes to a consistent state, so it is unnecessary to couple any settings

Example	`:SYST:PRES:PERS`
Notes	`:SYST:PRES:PERS` is exactly the same as `:SYST:DEF ALL`
Backwards Compatibility SCPI	`:SYSTem:PRESet:PERSistent`

4.6 Alignments

Accesses the alignment system of the instrument. You can control the automatic alignments, view alignment statistics and manually perform alignments.

The current setting of the alignment system is displayed in the Meas Bar along the top of the display. For conditions that may cause specifications to be impacted, this annotation will be in amber.

4.6.1 Auto Align

Lets you configure the automatic background alignments and the alerts from the automatic alignment system.

Dependencies	Does not appear in VXT

4.6.1.1 Auto Align

Configures the method the automatic background alignment will use when it runs.

Automatic background alignments are run periodically between measurement acquisitions. The instrument's software determines when alignments are to be performed to maintain warranted operation. The recommended setting for Auto Align is Normal.

Auto Align execution *cannot* be aborted with the **Cancel (ESC)** key. To interrupt **Auto Align** execution, select **Auto Align Off**.

Remote Command	`:CALibration:AUTO ON | LIGHt | PARTial | OFF`
	For option details, see "Auto Align Options" on page 1973 below
	`:CALibration:AUTO?`

Example	`:CAL:AUTO ON`
Notes	While Auto Align is executing, bit 0 of Status Operation register is set
Couplings	Auto Align is set to Off if Restore Align Data is invoked
Preset	This is unaffected by **Preset** but is set to ON by **Restore System Defaults->Align**
State Saved	No
Annotation	In the Meas Bar: – Normal with "All But RF" off: Auto (white) – Normal with "All But RF" on: Auto/No RF (amber) – Partial: Partial (amber) – Off: Off (amber)

Status Bits/OPC dependencies	When **Auto Align** is executing, Bit 0 in the Status Operational register is set An interfering signal at the RF Input may prevent automatic alignment of the RF subsystem. If this occurs, the Error Condition message "Align RF skipped" is reported, the Status Questionable Calibration bit 11 is set, and the alignment proceeds. When a subsequent alignment of the RF subsystem succeeds, either by the next cycle of automatic alignment or from an Align Now, RF, the Error Condition and Status Questionable Calibration bit 11 are cleared
Backwards Compatibility SCPI	`:CALibration:AUTO ALERt` Parameter `ALERt` is for backwards compatibility only, and is mapped to `PARTial`

Auto Align Options

Normal (ON)

SCPI example `:CAL:AUTO ON`

Auto Align, **Normal** turns on the automatic alignment of all measurement systems. This selection maintains the instrument in warranted operation across varying temperature and over time.

If the condition "Align Now All required" is set, transitioning to **Auto Align**, **Normal** performs the required alignments, clears the "Align Now All required" condition, then continues with further alignments as required to maintain the instrument adequately aligned for warranted operation.

When **Auto Align**, **Normal** is selected, the **Auto Align Off** time is set to zero, and the Meas Bar indicates Align: Auto (in white) or Align: Auto/No RF (in amber). The amber color reminds you that you are responsible for maintaining the RF alignment of the instrument.

Alignment processing as a result of the transition to **Normal** is executed sequentially. Thus, `*OPC?` or `*WAI` following `:CAL:AUTO ON` will return when the alignment processing is complete.

Light

SCPI example `:CAL:AUTO LIGH`

Auto Align, **Light** turns on the automatic alignment of all measurement systems. The **Auto Align**, **Light** selection allows considerably more drift in amplitude accuracy in order to allow much less frequent measurement interruptions to perform alignments. The temperature changes required to trigger each alignment are increased by a factor of three. Alignments also expire from time as well as temperature. In a stable thermal environment, the alignments occur one-ninth as often as in Normal. With these less frequent alignments, all accuracy specifications (those expressed with ±x dB tolerances) change by nominally a factor of 1.4.

If the condition "Align Now, All required" is set, transitioning to **Auto Align**, **Light** performs the required alignments, clears the "Align Now, All required" condition, and continues with further alignments as required to maintain the instrument adequately aligned for warranted operation.

Alignment processing as a result of the transition to **Light** is executed sequentially. Thus, `*OPC?` or `*WAI` following `:CAL:AUTO LIGHT` will return when the alignment processing is complete.

When **Auto Align**, **Light** is selected, the **Auto Align Off** time is set to zero, and the Settings Panel indicates Align: Light.

Partial

SCPI example `:CAL:AUTO PART`

Auto Align, **Partial** disables the full automatic alignment and the maintenance of warranted operation for the benefit of improved measurement throughput. Accuracy is retained for the Resolution Bandwidth filters and the IF Passband, which is critical to FFT accuracy, demodulation, and many measurement applications. With Auto Align set to Partial, you are now responsible for maintaining warranted operation by updating the alignments when they expire. The Auto Align, Alert mechanism will notify you when alignments have expired. One solution to expired alignments is to perform the Align All, Now operation. Another is to return the Auto Align selection to Normal.

Auto Align, **Partial** is recommended for measurements where the throughput is so important that a few percent of improvement is more valued than an increase in the accuracy errors of a few tenths of a decibel. One good application of **Auto Align**, **Partial** would be an automated environment where the alignments can be called during overhead time when the device-under-test is exchanged.

When **Auto Align**, **Partial**, is selected the elapsed time counter begins for **Auto Align Off** time, and the Settings Panel indicates Align: Partial in an amber color. The amber color reminds you that you are responsible for maintaining the warranted operation of the instrument.

Off

SCPI example `:CAL:AUTO OFF`

Auto Align, **Off** disables automatic alignment and the maintenance of warranted operation, for the benefit of maximum measurement throughput. With **Auto Align** set to **Off**, you are now responsible for maintaining warranted operation by updating the alignments when they expire. The Auto Align, Alert mechanism will notify you when alignments have expired. One solution to expired alignments is to perform the **Align All**, **Now** operation. Another is to return the **Auto Align** selection to **Normal**.

The **Auto Align Off** setting is rarely the best choice, because **Partial** gives almost the same improvement in throughput while maintaining the warranted performance for a much longer time. The choice is intended for unusual circumstances, such as the measurement of radar pulses where you might want the revisit time to be as consistent as possible.

When **Auto Align**, **Off** is selected, the **Auto Align Off** time is initialized and the elapsed time counter begins, and the Settings Panel indicates Align: Off in an amber color. The amber color reminds you that you are responsible for maintaining the warranted operation of the instrument.

4.6.1.2 All but RF

Configures automatic alignment to include or exclude the RF subsystem. (Eliminating the automatic alignment of the RF subsystem prevents the input impedance from changing. The normal input impedance of 50 ohms can change to an open circuit when alignments are being used. Some devices under test do not behave acceptably under such circumstances, for example by showing instability.)

When **All but RF** is `ON`, the operator is responsible for performing an **Align Now RF** when RF-related alignments expire. The Auto Align, Alert mechanism will notify you to perform an **Align Now All** when the combination of time and temperature variation is exceeded.

When **All But RF** is `ON`, the Settings Panel indicates Align: Auto/No RF (in amber). The amber color reminds you that you are responsible for maintaining the RF alignment of the instrument.

Remote Command	`:CALibration:AUTO:MODE ALL | NRF` `:CALibration:AUTO:MODE?`
Example	`:CAL:AUTO:MODE NRF`
Preset	This is unaffected by **Preset** but is set to `ALL` on **Restore System Defaults->Align**
State Saved	No

4.6.1.3 Alert

The instrument signals an **Alert** when conditions exist such that you will need to perform a full alignment (for example, **Align Now All**). Alert can be configured in one of four settings:

Setting	Option
Time & Temperature	`TTEMperature`
24 hours	`DAY`
7 days	`WEEK`
None	`NONE`

With **Auto Align** set to **Normal**, the configuration of **Alert** is not relevant, because the instrument's software maintains the instrument in warranted operation.

A confirmation is required when a selection other than `TTEMperature` is chosen. This prevents accidental deactivation of alerts. When setting **Alert** from the front panel to any value but `TTEMperature`, confirmation is required to transition into this setting of Alert. The confirmation dialog is:

```
This will suppress alerts from the Alignment system, which would notify you when
an Alignment is required to maintain warranted operation. Without the alerts you
will be responsible for performing an Align Now All at appropriate intervals to
maintain warranted operation
```

```
Do you want to proceed?
```

The dialog includes **OK** and **Cancel** controls, for you to affirm or cancel the operation.

No confirmation is required when **Alert** is configured through a remote command.

For more information see "Time & Temperature" on page 1976

Remote Command	`:CALibration:AUTO:ALERt TTEMperature | DAY | WEEK | NONE` `:CALibration:AUTO:ALERt?`
Example	`:CAL:AUTO:ALER TTEM`
Preset	This is unaffected by Preset but is set to `TTEMperature` on a "Restore Alignment Defaults
State Saved	No
Status Bits/OPC dependencies	When an alert is generated, the condition message "Align Now All required" appears in the Status Bar, and bit 14 is set in the Status Questionable Calibration register

The settings for **Alert** are detailed below.

Time & Temperature

SCPI example `CAL:AUTO:ALER TTEM`

The instrument signals an alert when alignments expire due to the combination of the passage of time and changes in temperature. The alert is the Error Condition message "Align Now All required". If this choice for Alert is selected, the absence of an alert means that the instrument alignment is sufficiently up-to-date to maintain warranted accuracy.

24 hours

SCPI example `CAL:AUTO:ALER DAY`

The instrument signals an alert after a time span of 24 hours since the last successful full alignment (for example, **Align Now All** or completion of a full **Auto Align**). You may want to select this option in an environment where the temperature is stable on a daily basis, at a small risk of accuracy errors in excess of the warranted specifications. The alert is the Error Condition message "Align Now All required".

7 days

SCPI example `CAL:AUTO:ALER WEEK`

The instrument signals an alert after a time span of 168 hours since the last successful full alignment (for example, **Align Now All** or completion of a full **Auto Align**). You may want to select this option in an environment where the temperature is stable on a weekly basis, at a modest risk of accuracy degradations in excess of warranted performance. The alert is the Error Condition message “Align Now All required”.

None

SCPI example `CAL:AUTO:ALER NONE`

The instrument does not signal an alert. This is provided for rare occasions where you are making a long measurement that cannot tolerate **Auto Align** interruptions, and must have the ability to capture a screen image at the end of the measurement without an alert posted to the display. Keysight does not recommend using this selection in any other circumstances, because of the risk of accuracy performance drifting well beyond expected levels without the operator being informed.

4.6.1.4 Execute Expired Alignments (Remote Command Only)

Alignments can be Expired in the situation where **Auto Align** is `PARTial` or `OFF`. This feature runs the alignments that have expired. This is different than performing **Align All, Now**. **Align All, Now** performs an alignment of all subsystems regardless of whether they are needed or not, whereas **Execute Expired Alignments** aligns only the individual subsystems that have become due.

Remote Command	`:CALibration:EXPired?`
Example	`:CAL:EXP?`
Notes	`:CALibration:EXPired?` returns 0 if successful, or 1 if failed

4.6.2 Align Now

Accesses alignment processes that are immediate action operations. They perform complete operations and run until they are complete.

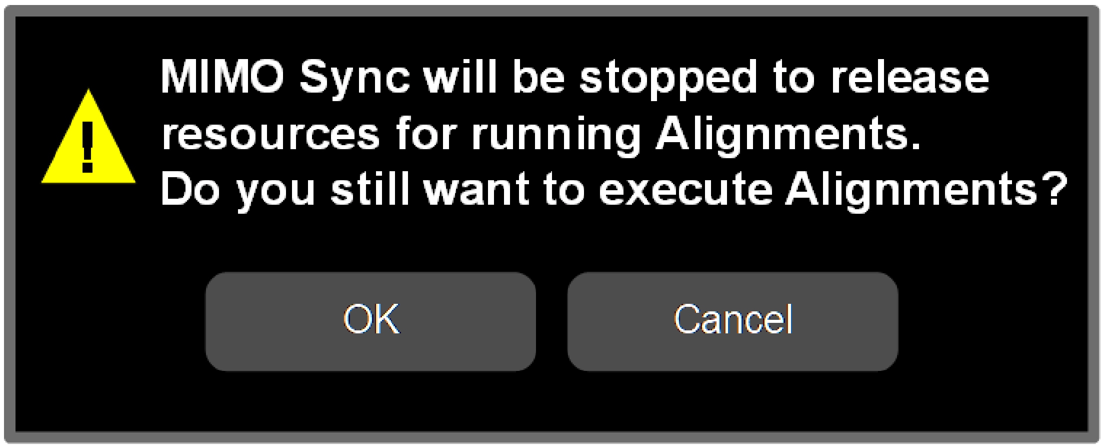
Executing immediate alignments from SCPI can be problematic due to the length of time required for the alignments to complete. Alignment commands are by their nature sequential, meaning they must complete before any other SCPI commands can be processed. In many cases the alignment itself will take longer than the typical SCPI timeout value. Furthermore status cannot be easily queried while a sequential command is running.

For this reason, overlapped versions of the **Align Now** commands are provided. When using these No-Operation-Pending (`NPENDing`) commands, the SCPI thread will not be blocked (will be released immediately), so that you can use `:STATus:OPERation:CONDition?` to query the alignment status bit and use `:STATus:QUEStionable:CALibration:CONDition?` to check the alignment results. As an example, `:CALibration[:ALL]:NPENding` is the overlapped replacement for `:CALibration[:ALL]`.

While the alignment is executing, the coming NOP calibration will be ignored, and error message “SettingConflict, Alignment is in process.” will be posted. Also, any other operations to the instrument will be pended and postponed until the alignment is completed. The operations include: Preset, Initiate a new measurement, Device clear and so on. Accordingly, changing parameters will not take effect although the UI is updated immediately. To avoid unexpected timeouts and results, these operations are not recommended during any such alignments.

NOTE

The Alignments will not be performed if the MIMO Sync is running. As the MIMO and Alignments require the same hardware resource. If the instrument is in MIMO Sync and you press a button to execute Alignments, a pop-up window appears as below. Click **OK** to stop MIMO and execute Alignments.



If the instrument is in MIMO sync, and you send a SCPI command to run Alignments, the align process will not be executed and a warning will be generated . To execute Alignments, you must first stop MIMO via SCPI (or manually).

4.6.2.1 Align Now All

In PXE, the key label is **Align Now All (plus RF Presel 20 Hz – 3.6 GHz)**

Immediately executes an alignment of all subsystems. The instrument stops any measurement currently underway, performs the alignment, then restarts the measurement from the beginning (similar to pressing the **Restart** key).

If an interfering user signal is present at the RF Input, the alignment is performed on all subsystems except the RF. After completion, the Error Condition message “Align RF skipped” is generated. In addition the Error Condition message “Align Now, RF required” is generated, and bits 11 and 12 are set in the Status Questionable Calibration register.

The query form of the remote commands (`:CALibration[:ALL]?` or `*CAL?`) invokes the alignment of all subsystems and returns a success or failure value. An interfering user signal is not grounds for failure; if the alignment was able to succeed on all portions but unable to align the RF because of an interfering signal, the resultant will be the success value.

Successful completion of **Align Now All** will clear the “Align Now All required” Error Condition, and clear bit 14 in the Status Questionable Calibration register. It will also begin the elapsed time counter for Last Align Now All Time, and capture the Last Align Now All Temperature.

If the Align RF subsystem succeeded in aligning (no interfering signal present), the elapsed time counter begins for Last Align Now, RF Time, and the temperature is captured for the Last Align Now, RF Temperature. In addition the Error Conditions “Align RF skipped” are cleared, the Error Condition “Align Now, RF required” is cleared, and bits 11 and 12 are cleared in the Status Questionable Calibration register

Align Now All can be interrupted, by pressing the **Cancel (ESC)** front-panel key, or remotely with Device Clear followed by the `:ABORt` SCPI command. When this occurs, the Error Condition message “Align Now All required” is generated, and bit 14 is set in the Status Questionable Condition register. This is because new alignment data may be employed for an individual subsystem, but not a cohesive set of data for all subsystems.

In many cases, you might find it more convenient to change alignments to **Normal**, instead of executing **Align Now All**. When the Auto Align process transitions to **Normal**, the instrument will immediately start to update only the alignments that have expired, thus efficiently restoring the alignment process.

Remote Command	`:CALibration[:ALL]` `:CALibration[:ALL]?`
Example	`:CAL`
Notes	:CALibration[:ALL]? returns 0 if successful, or 1 if failed :CALibration[:ALL]? is the same as *CAL? While **Align Now All** is performing the alignment, the Calibrating bit (Bit 0 in the Status Operation register) is set. Completion, or termination, will clear Bit 0 in the Status Operation register This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the `:ABORt` command Successful completion will clear bit 14 in the Status Questionable Calibration register An interfering user signal is not grounds for failure of **Align Now All**. However, Bits 11 and 12 are set in the Status Questionable Calibration register to indicate Align Now, RF is required An interfering user-supplied signal will result in the instrument requiring an Align Now, RF with the interfering signal removed
Couplings	Initializes the time for the Last Align Now All Time Records the temperature for the Last Align Now All Temperature If Align RF component succeeded, initializes the time for the Last Align Now, RF Time If Align RF component succeeded, records the temperature for the Last Align Now, RF Temperature
Status Bits/OPC dependencies	Bits 11, 12, or 14 may be set in the Status Questionable Calibration register

Remote Command	`*CAL?`
Example	`*CAL?`
Notes	Returns 0 if successful, or 1 if failed `:CALibration[:ALL]?` is exactly the same as `*CAL?`, including all conditions, status register bits, and couplings See additional remarks described with `:CALibration[:ALL]?`

Remote Command	`:CALibration[:ALL]:NPENding`
Example	`:CAL:NPEN`
Notes	`:CALibration[:ALL]:NPENding` is the same as `:CALibration[:ALL]`, including all conditions, status register bits, except this SCPI command *does not block* the SCPI session, so you should use status register bits to query whether the calibration is successfully completed or not Typical usage is: 1. `:CALibration:ALL:NPENding` (Start a calibration) 2. `:STATus:OPERation:CONDition?` (Check if the calibration is completed or not, If bit 0 is set, then the system is doing calibration, you should repeat this SCPI query until the bit is cleared) 3. `:STATus:QUEStionable:CALibration:CONDition?` (Check if there are any errors/-failures in previous calibration procedure

4.6.2.2 Align Now All but RF

In PXE, the key label is **Align Now All but RF (not including RF Presel)**

Immediately executes an alignment of all subsystems except the RF subsystem. The instrument will stop any measurement currently underway, perform the alignment, and then restart the measurement from the beginning (similar to pressing the **Restart** key). This can be used to align portions of the instrument that are not impacted by an interfering user input signal.

This operation might be chosen instead of **All** if you do not want the device under test to experience a large change in input impedance, such as a temporary open circuit at the instrument input.

The query form of the remote commands (`:CALibration:NRF?`) invokes the alignment and returns a success or failure value.

Successful completion of **Align Now All but RF** clears the “Align Now All required” Error Condition, and clears Bit 14 in the Status Questionable Calibration register. If “Align Now All required” was in effect prior to executing **All but RF**, the Error Condition message “Align Now RF required” is generated and Bit 12 in the Status Questionable Calibration register is set. It will also begin the elapsed time counter for Last Align Now All Time, and capture the Last Align Now All Temperature.

Align Now All but RF can be interrupted, by pressing the **Cancel (ESC)** front-panel key, or remotely with Device Clear followed by the `:ABORt` SCPI command. When this occurs, the Error Condition message "Align Now All required" is generated, and Bit 14 is set in the Status Questionable Condition register. This is because new alignment data may be used for an individual subsystem, but not a full new set of data for all subsystems.

Remote Command	`:CALibration:NRF` `:CALibration:NRF?`
Example	`:CAL:NRF`
Notes	Returns 0 if successful, or 1 if failed While **Align Now All but RF** is performing the alignment, Bit 0 in the Status Operation register is set. Completion, or termination, will clear Bit 0 in the Status Operation register This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the `:ABORt` command Successful completion clears Bit 14 in the Status Questionable Calibration register and sets Bit 12 if invoked with "Align Now All required"
Couplings	Initializes the time for the Last Align Now All Time Records the temperature for the Last Align Now All Temperature
Status Bits/OPC dependencies	Bits 12 or 14 may be set in the Status Questionable Calibration register

Remote Command	`:CALibration:NRF:NPENding`
Example	`:CAL:NRF:NPEN`
Notes	`:CALibration:NRF:NPENding` is the same as `:CALibration:NRF`, including all conditions, status register bits, except that this SCPI command *does not block* the SCPI session, so you should use status register bits to query whether the calibration is successfully completed or not Typical usage is: 1. `:CALibration:NRF:NPENding` (start the All but RF calibration) 2. `:STATus:OPERation:CONDition?` (If bit 0 is set, then the system is doing calibration, you should do re-query until this bit is cleared) 3. `:STATus:QUEStionable:CALibration:CONDition?` (to check if there are any errors/-failures in previous calibration procedure)

4.6.2.3 Align Now RF

In PXE, the key label is **Align Now RF Only**

Immediately executes an alignment of the RF subsystem. The instrument stops any measurement currently underway, performs the alignment, then restarts the measurement from the beginning (similar to pressing the **Restart** key).

This operation might be desirable if the alignments had been set to not include RF alignments, or if previous RF alignments could not complete because of interference which has since been removed.

If an interfering user signal is present at the RF Input, the alignment will terminate and generate the Error Condition message “Align RF skipped”, and Error Condition “Align Now, RF required”. In addition, bits 11 and 12 will be set in the Status Questionable Calibration register.

The query form of the remote commands (`:CALibration:RF?`) invokes the alignment of the RF subsystem and returns a success or failure value. An interfering user signal is grounds for failure.

Successful completion of **Align Now RF** begins the elapsed time counter for Last Align Now, RF Time, and capture the Last Align Now, RF Temperature.

Align Now RF can be interrupted, by pressing the **Cancel (ESC)** front-panel key, or remotely with Device Clear followed by the `:ABORt` SCPI command. When this occurs, the Error Condition message “Align Now, RF required” is generated, and Bit 12 is set in the Status Questionable Condition register. None of the new alignment data is used.

Remote Command	`:CALibration:RF` `:CALibration:RF?`
Example	`:CAL:RF`
Notes	Returns 0 if successful, or 1 if failed (including interfering user signal) While **Align Now RF** is performing the alignment, Bit 0 in the Status Operation register is set. Completion, or termination, clears Bit 0 in the Status Operation register This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the `:ABORt` command Successful completion clears the Error Conditions “Align RF skipped” and the Error Conditions “Align RF failed” and “Align Now, RF required”, and clears Bits 3, 11, and 12 in the Status Questionable Calibration register A failure encountered during alignment generates the Error Condition message “Align RF failed” and sets Bit 3 in the Status Questionable Calibration register An interfering user signal will result in Bits 11 and 12 being set in the Status Questionable Calibration register, to indicate Align Now, RF is required An interfering user supplied signal results in the instrument requiring **Align Now RF** with the interfering signal removed
Couplings	Initializes the time for the Last Align Now, RF Time Records the temperature for the Last Align Now, RF Temperature
Status Bits/OPC dependencies	Bits 11, 12, or 14 may be set in the Status Questionable Calibration register

Remote Command	`:CALibration:RF:NPENding`

Example	`:CAL:RF:NPEN`
Notes	`:CALibration:RF:NPENding` is the same as `:CALibration:RF`, including all conditions, status register bits, except that this SCPI command *does not block* the SCPI session, so you should use status register bits to query whether the calibration is successfully completed or not Typical usage is: 1. `:CALibration:RF:NPENding` (Start a RF calibration) 2. `:STATus:OPERation:CONDition?` (If Bit 0 is set, then the system is doing calibration, you should do re-query until this bit is cleared) 3. `:STATus:QUEStionable:CALibration:CONDition?` (to check if there are any errors/-failures in previous calibration procedure)

4.6.2.4 Align Now External Mixer

Immediately executes an alignment of the External Mixer that is plugged into the USB port. The instrument stops any measurement currently underway, performs the alignment, then restarts the measurement from the beginning (similar to pressing the **Restart** key). As this alignment calibrates the LO power to the mixer, this is considered an LO alignment; and failure is classified as an LO alignment failure.

The query (`:CALibration:EMIXer?`) invokes the alignment of the External Mixer and returns a success or failure value.

Remote Command	`:CALibration:EMIXer` `:CALibration:EMIXer?`
Example	`:CAL:EMIX`
Notes	Returns 0 if successful, or 1 if failed While **Align Now External Mixer** is performing the alignment, Bit 0 in the Status Operation register is set. Completion, or termination, clears Bit 0 in the Status Operation register This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the `:ABORt` command A failure encountered during alignment generate the Error Condition message “Align LO failed” and sets Bit 5 in the Status Questionable Calibration register. Successful completion clears the “Align LO failed” message and Bit 5 in the Status Questionable Calibration register
Dependencies	This control does not appear unless option EXM is present and is grayed-out, unless a USB mixer is plugged in to the USB
Status Bits/OPC dependencies	Bit3 may be set in the Status Questionable Calibration Extended Failure register

4.6.2.5 Align Source

Accesses source alignment processes that are immediate action operations. They perform complete operations and run until they are complete.

The instrument stops any sequence of the source, performs the alignment, then restarts the sequence from the beginning.

Note: This alignment corrects slow-rate drift, which does not impair specifications for time periods shorter than one week. Thus, it is required to perform this alignment on a weekly basis to maintain specifications. This alignment typically takes >2 minutes to complete.

There is no alert available for the source alignment. Operators are responsible for checking temperature shift since the last **Align Now Source** to determine whether the source alignment needs to be executed.

Remote Command	`:CALibration:INTernal:SOURce[:ALL]` `:CALibration:INTernal:SOURce[:ALL]?`
Example	`:CAL:INT:SOUR`
Notes	`:CAL:INT:SOUR?` Initiates an Alignment and returns 0 if successful, or 1 if failed
Dependencies	Only appears in VXT models M9410A/11A
Couplings	Initializes the time for the Last Align Source Now, All Time Records the temperature for the Last Align Source Now, All Temperature

Remote Command	`:CALibration:INTernal:SOURce[:ALL]:NPENding`
Example	`:CAL:INT:SOUR:NPEN`
Notes	`:CALibration:INTernal:SOURce[:ALL]:NPENding` is the same as `:CALibration:INTernal:SOURce[:ALL]`, including all conditions and status register bits, except that this SCPI command *does not block* the SCPI session, so you should use status register bits to query whether the calibration is successfully completed or not Typical usage is: 1. `:CALibration:INTernal:SOURce:NPENding` (start an internal source calibration) 2. `:STATus:OPERation:CONDition?` (Check if the calibration is completed or not, If Bit 0 is set, then the system is doing calibration. Repeat this query until the bit is cleared) 3. `:STATus:QUEStionable:CALibration:EXTended:FAILure:CONDition?` (Check if Bit 14 is set or not. If this bit is set, that means there are some errors in previous internal source calibration)
Dependencies	Only appears in VXT models M9410A/11A.

4.6.2.6 Align Analyzer

Accesses analyzer alignment processes that are immediate action operations. They perform complete operations and run until they are complete.

NOTE **This alignment corrects slow-rate drift, which does not impair specifications for time periods shorter than one week. Thus, it is required to perform this alignment on a weekly basis to maintain specifications. This alignment typically takes >2** minutes to complete.

There is no alert available for the analyzer alignment. Operators are responsible for checking temperature shift since the last Align Now, Align Analyzer, to determine whether the receiver alignment needs to be executed.

Remote Command	`:CALibration:INTernal:RECeiver[:ALL]` `:CALibration:INTernal:RECeiver[:ALL]?`
Example	`:CAL:INT:REC`
Notes	`:CAL:INT:REC?` Initiates an Alignment and returns 0 if successful, or 1 if failed
Dependencies	Only appears in VXT models M9410A/11A
Couplings	Initializes the time for the Last Align Receiver Now, All Time Records the temperature for the Last Align Receiver Now, All Temperature

4.6.2.7 Align Fast

Accesses fast alignment processes, which are immediate action operations and perform complete operations, running until they are complete.

Remote Command	`:CALibration:INTernal:FAST[:ALL]` `:CALibration:INTernal:FAST[:ALL]?`
Example	`:CAL:INT:FAST`
Notes	`:CAL:INT:FAST?` Initiates an Alignment and returns 0 if successful, or 1 if failed
Dependencies	Only appears in VXT models M9410A/11A

4.6.2.8 Align LO Leakage

Accesses LO Leakage alignment processes, which are immediate action operations and perform complete operations, running until they are complete.

Remote Command	`:CALibration:INTernal:LOLeakage` `:CALibration:INTernal:LOLeakage?`
Example	`:CAL:INT:LOL`
Notes	`:CAL:INT:LOL?` Initiates an Alignment and returns 0 if successful, or 1 if failed
Dependencies	Only appears in VXT models M9410A/11A

4.6.2.9 Align IF Cable

Accesses IF Cable alignment processes, which are immediate action operations and perform complete operations, running until they are complete.

This alignment aligns the IF cabling to the remote heads.

Remote Command	`:CALibration:INTernal:RRHead:IFCable` `:CALibration:INTernal:RRHead:IFCable?`
Example	`:CAL:INT:RRH:IFC`
Notes	The query initiates an Alignment and returns 0 if successful, or 1 if failed
Dependencies	Only appears when M1741A or M1749A or M1740A is associated with VXT models
Backwards Compatibility SCPI	`:CALibration:INTernal:IFCable` `:CALibration:INTernal:IFCable?`

4.6.2.10 Align LO Clock

This is an immediate action operation, which runs until complete.

Synchronizes RRH Lo Clocks.

Remote Command	`:CALibration:INTernal:RRHead:LOSync` `:CALibration:INTernal:RRHead:LOSync?`
Example	`:CAL:INT:RRH:LOS?`
Notes	The query initiates an Alignment and returns 0 if successful, or 1 if failed
Dependencies	Only appears when M1741A or M1749A is associated with VXT models
Backwards Compatibility SCPI	`:CALibration:INTernal:LOSync` `:CALibration:INTernal:LOSync?`

4.6.2.11 Align RRH Amplitude

This is an immediate action operation, which runs until complete.

Aligns the Amplitude of Remote Radio Head. This operation may take quite a long time to run.

CAUTION Be sure to connect 50 ohm terminations to Head Tx/Rx 1 and 2 ports.

Remote Command	`:CALibration:INTernal:RRHead:AMPLitude` `:CALibration:INTernal:RRHead:AMPLitude?`
Example	`:CAL:INT:RRH:AMPL?`

Notes	`:CAL:INT:RRH:AMPL?` Initiates an Alignment and returns 0 if successful, or 1 if failed
Dependencies	Only appears when M1741A or M1749A is associated with VXT models
Backwards Compatibility SCPI	`:CALibration:INTernal:RRHAmp` `:CALibration:INTernal:RRHAmp?`

4.6.2.12 Align Now All but RF Preselector

Only available in models with the RF Preselector, such as the N9048B. It is identical to the "Align Now All" on page 1978 (plus RF Presel) function, except that the RF Preselector is only partially aligned. Only the System Gain, Mechanical attenuator and Electronic attenuator alignments on the RF Preselector path are aligned. The purpose of these alignments is to improve the RF Preselector path amplitude variation compared to the bypass path.

Remote Command	`:CALibration:NRFPselector` `:CALibration:NRFPselector?`
Example	`:CAL:NRFP`
Dependencies	Only appears in N9048B. Sending the SCPI command or query in other models generates an error
Status Bits/OPC dependencies	Bits 12 or 14 may be set in the Status Questionable Calibration register

4.6.2.13 Align Now RF Presel Only (20 Hz to 3.6 GHz)

Only available in models with the RF Preselector, such as the N9048B. It executes an alignment of the RF Preselector section. The receiver will stop any measurement currently underway, perform the alignment, and then restart the measurement from the beginning (similar to pressing the **Restart** key). *Only* the RF Preselector is aligned; no Align Now All function is performed first.

The query (`:CALibration:RFPSelector:ONLY?`) invokes the alignment of the RF Preselector on both Conducted and Radiated Band, and returns a success or failure value. Successful completion clears the “Align 20 Hz to 3.6 GHz required” Error Condition, and clears Bit 1 and Bit 2 in the Status Questionable Calibration Extended Needed register.

The elapsed time counter will begin for Last Align Now, Conducted Time and Last Align Now Radiated Time and the temperature is captured for Last Align Now, Conducted Temperature and Last Align Now, Radiated Temperature. The alignment can be interrupted by pressing the **Cancel (ESC)** front-panel key or remotely with Device Clear followed by the `:ABORt` SCPI command. When this occurs, the Error Condition “Align 20 Hz to 3.6 GHz required” is set because new alignment data may be employed for an individual subsystem, but not a cohesive set of data for all subsystems.

The "Align 20 Hz to 3.6 GHz required" Error Condition will appear when this alignment has expired. The user is now responsible to perform the Align Now, 20 Hz to 3.6 GHz in order to keep the receiver in warranted operation. This alignment can only be performed by the user, as it is not part of the Auto Align process.

Remote Command	`:CALibration:RFPSelector:ONLY` `:CALibration:RFPSelector:ONLY?`
Example	`:CAL:RFPS:ONLY`
Notes	Query returns 0 if successful, or 1 if failed When Align 20 Hz to 3.6 GHz is performing the alignment, bit 0 in the Status Operation register is set. Completion, or termination, will clear bit 0 in the Status Operation register This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the `:ABORt` command. Successful completion clears Bits 1 and 2 in the Status Questionable Calibration Extended Needed register and Bits 0 and 1 in Status Questionable Calibration Extended Failure register A failure encountered during alignment sets the Error Condition "20 Hz to 3.6 GHz Alignment Failure", sets Bits 1 and 2 in the Status Questionable Calibration Extended Needed register, and Bit 9 in Status Questionable Calibration register
Dependencies	Only appears in N9048B. Sending the SCPI command or query in other models generates an error This key is grayed-out if the instrument is displaying an "Align Now All required" message. If you press the key while it is grayed-out, you will see the informational message, "Align Now All required first"
Couplings	Initializes the time for the Last Align Conducted Now, Conducted Time Initializes the time for the Last Align Radiated Now, Radiated Time Records the temperature for the Last Align Conducted Now, Conducted Temperature Records the temperature for the Last Align Radiated Now, Radiated Temperature
Status Bits/OPC dependencies	Bit 8 or 9 may be set in the Status Questionable Calibration register Bit 1 and 2 may be set in the Status Questionable Calibration Extended Needed register Bit 0 and 1 may be set in the Status Questionable Calibration Extended Failure register

4.6.2.14 Align Selected Freq Ranges

VXT models M9410A/11A provide five alignments: **Align Now** All, **Align Source**, **Align Analyzer**, **Align Fast** and **Align LO Leakage**. Every time you execute one of these alignments, the system performs a full span alignment. To save time, it is possible to limit the range of alignment frequency settings. **Align Selected Freq Ranges** allows you to set the start and stop frequency of an alignment.

The example below shows the steps for processing Align Analyzer on VXT models M9410A, specifying a frequency range from 1.3 GHz to 1.8 GHz, and 2.5 GHz to 3.9 GHz.

- First row: set the Start and Stop Frequency to 1.3 GHz and 1.8 GHz. Enable the first row
- Second row: set the Start and Stop Frequency to 2.5 GHz and 3.9 GHz. Enable

the second row

– Click **Align Analyzer**. A message appears: "Aligning Selected Freq Ranges 1 of 7"

The equivalent SCPI command sequence is:

`:CAL:INT:ASFR ON`

`:CAL:INT:ASFR:FRAN 1.3 GHz, 1.8 GHz, 2.5 GHz, 3.9 GHz`

`:CAL:INT:REC`

Remote Command	`:CALibration:INTernal:ASFRanges[:STATe] ON | OFF | 1 | 0` `:CALibration:INTernal:ASFRanges?`
Example	`:CAL:INT:ASFR ON` `:CAL:INT:ASFR?`
Notes	When **Align Selected Freq Ranges** is ON, the table is displayed for setting up the frequency ranges to be aligned
Dependencies	Only available in: – VXT models M9410A/11A/15A – VXT models M9410A/11A/15A with RRH and/or CIU Only functional for the following alignments: – Align Now All of VXT models M9410A/11A/15A. – Align Source – Align Receiver – Align Fast – Align LO Leakage **Align Selected Freq Ranges** only guarantees the hardware performance within the frequency range
Preset	`OFF`

Enable Extended Freq Range

Allows you to set frequency ranges for VXT models M9410A/11A/15A with Remote Head and/or CIU. When Enable Extended Freq Range is not active, the frequency range is limited by VXT models only.

Remote Command	`:CALibration:INTernal:ASFRanges:EXTend[:STATe] ON | OFF | 1 | 0` `:CALibration:INTernal:ASFRanges:EXTend[:STATe]?`
Example	`:CAL:INT:ASFR:EXT ON` `:CAL:INT:ASFR:EXT?`
Dependencies	Only available in VXT models M9410A/11A/15A with Remote Head and/or CIU

	Only available when **Align Specified Freq Ranges** is ON
Preset	OFF

Frequency Range

Allows you to set the alignment frequency range.

Remote Command	`:CALibration:INTernal:ASFRanges:FRANges <startFreq>,<stopFreq>[,<startFreq>,<stopFreq>][,<startFreq>,<stopFreq>][,<startFreq>,<stopFreq>][,<startFreq>,<stopFreq>]`
Example	`:CAL:INT:ASFR:FRAN 1.3 GHz,1.8 GHz,2.5 GHz,3.9 GHz` `:CAL:INT:ASFR:FRAN?`
Notes	<startFreq>: set the start frequency of an alignment <stopFreq>: set the stop frequency of an alignment To process alignment for a single frequency point, set startFreq = stopFreq
Dependencies	Only appears when **Align Selected Freq Ranges** is ON Error message “Invalid alignment frequency range” will be reported when the start and stop frequency are invalid, such as: 1. Stop frequency - Start frequency < 0 2. the count of start and stop frequency is not even 3. the frequency is out of range, Refer to More Information more than 5 pairs of start and stop frequency are listed
Preset	1.0 GHz, 2.0 GHz

More Information

When "Enable Extended Freq Range" on page 1989 is not active, the frequency range depends on the VXT models. The table below lists the Start and Stop Frequency Range of VXT models M9410A/11A/15A:

Hardware	Options	Min Frequency	Max Frequency
M9410A/11A	F06	330 MHz	6.08 GHz
M9410A/11A	F06 & EP6	330 MHz	6.6 GHz
M9410A/11A	F06 & LFE & EP6	6.5 kHz	6.6 GHz
M9415A	F06	330 MHz	6.6 GHz
M9415A	F08	330 MHz	8.6 GHz
M9415A	F12	330 MHz	12.9 GHz

When **Enable Extended Freq Range** is active, the frequency range depends on the extensions connected to VXT models. The table below lists the Start and Stop Frequency Range of VXT models with Radio Heads/CIU:

Connected with Radio Heads/CIU	Min frequency	Max frequency	IF Frequency range
VXT + CIU	5.9 GHz	12 GHz	1.4 GHz ~ 4.6 GHz
VXT + CIU + RRH	24.25 GHz	43.5 GHz	2.5 GHz ~ 4.5 GHz

NOTE

The Min frequency and Max frequency are also the preset frequencies. It is recommended to keep the preset frequency range for VXT models with extensions. An alignment with the full IF Frequency range will be executed ignoring the specific ranges.

Enable

Enables or disables the selected frequency ranges.

Preset	`OFF`

4.6.2.15 Align External Mixer Path

Immediately executes an alignment of the External Mixer Path inside the VXT model M9415A. External Mixer Path is used when the RF Port is connected to an external Remote Radio Head (RRH). It provides a better performance compared to the normal path. External Mixer Path Alignment covers frequencies from 2.4 GHz to 3.4 GHz of the external mixer path.

NOTE

This alignment corrects slow-rate drift, which does not impair specifications for time periods shorter than one week. Thus, you need only perform this alignment on a weekly basis to maintain specifications. This alignment typically takes >2 minutes to complete.

There is no alert for the External Mixer Path alignment. You are responsible for checking the temperature shift since the last **Align Now, External Mixer Path**, to determine whether the external mixer path alignment needs to be executed.

Remote Command	`:CALibration:INTernal:EMPath` `:CALibration:INTernal:EMPath?`
Example	`:CAL:INT:EMP`
Notes	The query initiates an alignment and returns 0 if successful, or 1 if failed
Dependencies	Only appears in VXT model M9415A when Option MXP is installed
Couplings	Initializes the time for the Last Align External Mixer Path Now, All Time Records the temperature for the Last Align External Mixer Path Now, All Temperature

4.6.2.16 Align Low Band

Accesses Low Band alignment processes that are immediate action operations. They perform complete operations and run until they are complete. Low Band Alignment covers frequencies from 380 MHz to 4.3 GHz of the non-external mixer path.

NOTE **This alignment corrects slow-rate drift, which does not impair specifications for time periods shorter than one week. Thus, you need only perform this alignment on a weekly basis to maintain specifications. This alignment typically takes >2 minutes to complete.**

There is no alert for the Low Band alignment. You are responsible for checking the temperature shift since the last **Align Now, Align Low Band**, to determine whether the Low Band alignment needs to be executed.

Remote Command	`:CALibration:INTernal:LBANd[:ALL]` `:CALibration:INTernal:LBANd[:ALL]?`
Example	`:CAL:INT:LBAN`
Notes	The query initiates an Alignment, and returns 0 if successful, or 1 if failed
Dependencies	Only appears in VXT model M9415A
Couplings	Initializes the time for the Last Align Low Band Now, All Time Records the temperature for the Last Align Low Band Now, All Temperature

4.6.2.17 Align High Band

Accesses High Band alignment processes that are immediate action operations. They perform complete operations and run until they are complete. High Band Alignment covers frequencies from 4.3 GHz to 12 GHz of the non-external mixer path.

NOTE **This alignment corrects slow-rate drift, which does not impair specifications for time periods shorter than one week. Thus, you need only perform this alignment on a weekly basis to maintain specifications. This alignment typically takes >2 minutes to complete.**

There is no alert for the High Band alignment. You are responsible for checking the temperature shift since last **Align Now, Align High Band**, to determine whether the High Band alignment needs to be executed.

Remote Command	`:CALibration:INTernal:HBANd[:ALL]` `:CALibration:INTernal:HBANd[:ALL]?`
Example	`:CAL:INT:HBAN`
Notes	The query initiates an Alignment, and returns 0 if successful, or 1 if failed

Dependencies	Only appears in VXT model M9415A
Couplings	Initializes the external time for the Last Align High Band Now, All Time Records the temperature for the Last Align High Band Now, All Temperature

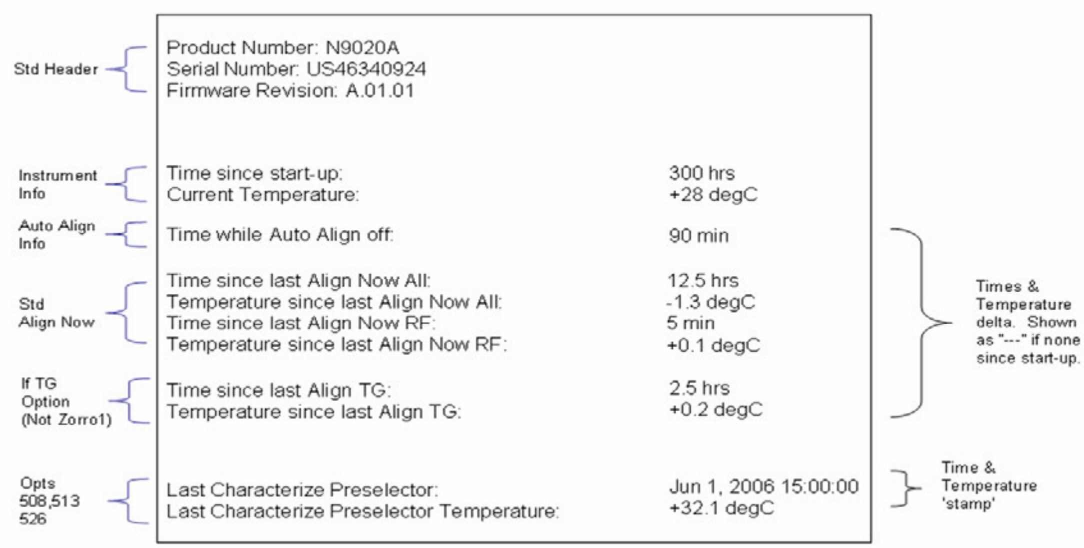
4.6.3 Show Alignment Statistics

Shows alignment information you can use to ensure that the instrument is operating in a specific manner. The **Show Alignment Statistics** screen is where you can view time and temperature information.

Values displayed are only updated when the **Show Alignment Statistics** screen is invoked. They are not updated while the **Show Alignment Statistics** screen is being displayed. The remote commands that access this information obtain current values.

Note that some of these statistics only display if your instrument supports them; for example, Last Source Align Now All Time only shows up in instruments which contain a source which supports auto alignments.

An example of the **Show Alignment Statistics** screen would be similar to:



“Time while Auto Align off” is not available in VXT models M9410A/11A.

A successful **Align Now, RF** sets the Last Align RF temperature to the current temperature, and resets the Last Align RF time. A successful **Align Now All** or **Align Now All but RF** sets the Last Align Now All temperature to the current temperature, and resets the Last Align Now All time. A successful **Align Now All** also resets the Last Align RF items if the RF portion of the **Align Now** succeeded.

Example	`:SYST:SHOW ALIGN`
Notes	The values displayed on the screen are only updated upon entry to the screen, and not updated while the screen is being displayed

The following data-specific queries are available:

Query Time since Startup

Remote Command	`:SYSTem:PON:TIME?`
Example	`:SYST:PON:TIME?`
Notes	Value is the time since the most recent start-up in seconds
State Saved	No

Query Current Temperature

Remote Command	`:CALibration:TEMPerature:CURRent?`
Example	`:CAL:TEMP:CURR?`
Notes	Value is in degrees Centigrade
State Saved	No

Query Time since Last Align Now All

Remote Command	`:CALibration:TIME:LALL?`
Example	`:CAL:TIME:LALL?`
Notes	Value is the elapsed time, in seconds, since the last successful **Align Now All** or **Align Now All but RF** was executed
State Saved	No

Query Temperature of Last Align Now All

Remote Command	`:CALibration:TEMPerature:LALL?`
Example	`:CAL:TEMP:LALL?`
Notes	Value is in degrees Centigrade at which the last successful **Align Now All** or **Align Now All but RF** was executed
State Saved	No

Query Time since Last Align Now Analyzer

Remote Command	`:CALibration:TIME:INTernal:RECeiver?`
Example	`:CAL:TIME:INT:REC?`
Notes	Value is the elapsed time, in hours, since the last successful **Align Now Analyzer**
Dependencies	Only appears in VXT models M9410/11A
State Saved	No

Query Temperature of Last Align Now Analyzer

Remote Command	`:CALibration:TEMPerature:INTernal:RECeiver?`
Example	`:CAL:TEMP:INT:REC?`
Notes	Value is in degrees Centigrade at which the last successful **Align Now Analyzer** was executed
Dependencies	Only appears in VXT models M9410/11A
State Saved	No

Query Time since Last Align Now Source

Remote Command	`:CALibration:TIME:INTernal:SOURce?`
Example	`:CAL:TIME:INT:SOUR?`
Notes	Value is the elapsed time, in hours, since the last successful **Align Now Source**
Dependencies	Only appears in VXT models M9410/11A
State Saved	No

Query Temperature of Last Align Now Source

Remote Command	`:CALibration:TEMPerature:INTernal:SOURce?`
Example	`:CAL:TEMP:INT:SOUR?`
Notes	Value is in degrees Centigrade at which the last successful **Align Now Source** was executed
Dependencies	Only appears in VXT models M9410/11A
State Saved	No

Query Time since Last Align Now Fast

Remote Command	`:CALibration:TIME:INTernal:FAST?`
Example	`:CAL:TIME:INT:FAST?`
Notes	Value is the elapsed time, in hours, since the last successful **Align Now Fast**
Dependencies	Only appears in VXT models M9410/11A
State Saved	No

Query Temperature of Last Align Now Fast

Remote Command	`:CALibration:TEMPerature:INTernal:FAST?`
Example	`:CAL:TEMP:INT:FAST?`
Notes	Value is in degrees Centigrade at which the last successful **Align Now Fast** was executed
Dependencies	Only appears in VXT models M9410/11A
State Saved	No

Query Time since Last Align Now LO Leakage

Remote Command	`:CALibration:TIME:INTernal:LOLeakage?`
Example	`:CAL:TIME:INT:LOL?`
Notes	Value is the elapsed time, in hours, since the last successful **Align Now LO Leakage**
Dependencies	Only appears in VXT models M9410/11A
State Saved	No

Query Temperature of Last Align Now LO Leakage

Remote Command	`:CALibration:TEMPerature:INTernal:LOLeakage?`
Example	`:CAL:TEMP:INT:LOL?`
Notes	Value is in degrees Centigrade at which the last successful **Align Now LO Leakag**e was executed
Dependencies	Only appears in VXT models M9410/11A
State Saved	No

Query Time since Last Align Now IF Cable

Remote Command	`:CALibration:TIME:INTernal:RRHead:IFCable?`
Example	`:CAL:TIME:INT:RRH:IFC?`
Notes	Value is the elapsed time, in hours, since the last successful **Align Now IF Cable**
Dependencies	Only appears when M1741A or M1749A or M1740A is associated with VXT models
State Saved	No
Backwards Compatibility SCPI	`:CALibration:TIME:INTernal:IFCable?`

Query Temperature of Last Align Now IF Cable

Remote Command	`:CALibration:TEMPerature:INTernal:RRHead:IFCable?`
Example	`:CAL:TEMP:INT:RRH:IFC?`
Notes	Value is in degrees Centigrade at which the last successful **Align Now IF Cable** was executed
Dependencies	Only appears when M1741A or M1749A or M1740A is associated with VXT models
State Saved	No
Backwards Compatibility SCPI	`:CALibration:TEMPerature:INTernal:IFCable?`

Query Time since Last Align Lo Clock

Remote Command	`:CALibration:TIME:INTernal:RRHead:LOSync?`
Example	`:CAL:TIME:INT:RRH:LOS?`
Notes	Value is the elapsed time, in hours, since the last successful Align Lo Clock Returns NaN if no Align Lo Clock has ever been performed on the instrument

Dependencies	Only appears when M1741A or M1749A is associated with VXT models
State Saved	No
Backwards Compatibility SCPI	:CALibration:TIME:INTernal:LOSync?

Query Temperature of Last Align Lo Clock

Remote Command	:CALibration:TEMPerature:INTernal:RRHead:LOSync?
Example	:CAL:TEMP:INT:RRH:LOS?
Notes	Value is in degrees Centigrade at which the last successful Align Lo Clock was executed Returns 9.91E+37(NaN) if no Align Lo Clock has ever been performed on the instrument
Dependencies	Only appears when M1741A or M1749A is associated with VXT models
State Saved	No
Backwards Compatibility SCPI	:CALibration:TEMPerature:INTernal:LOSync?

Query Time since Last Align RRH Amplitude

Remote Command	:CALibration:TIME:INTernal:RRHead:AMPLitude?
Example	:CAL:TIME:INT:RRH:AMPL?
Notes	Value is the elapsed time, in hours, since the last successful Align RRH Amplitude Returns NaN if no Align RRH Amplitude has ever been performed on the instrument
Dependencies	Only appears when M1741A or M1749A is associated with VXT models
State Saved	No
Backwards Compatibility SCPI	:CALibration:TIME:INTernal:RRHAmp?

Query Temperature of Last Align RRH Amplitude

Remote Command	:CALibration:TEMPerature:INTernal:RRHead:AMPLitude?
Example	:CAL:TEMP:INT:RRH:AMPL?
Notes	Value is in degrees Centigrade at which the last successful Align RRH Amplitude was executed Returns 9.91E+37(NaN) if no Align RRH Amplitude has ever been performed on the instrument
Dependencies	Only appears when M1741A or M1749A is associated with VXT models
State Saved	No
Backwards Compatibility SCPI	:CALibration:TEMPerature:INTernal:RRHAmp?

Query Time since Last Align Now RF

Remote	:CALibration:TIME:LRF?

Command	
Example	:CAL:TIME:LRF?
Notes	Value is the elapsed time, in seconds, since the last successful **Align Now, RF** was executed, either individually or as a component of **Align Now All**
State Saved	No

Query Temperature of Last Align Now RF

Remote Command	:CALibration:TEMPerature:LRF?
Example	:CAL:TEMP:LRF?
Notes	Value is in degrees Centigrade at which the last successful **Align Now RF** was executed, either individually or as a component of **Align Now All**
State Saved	No

Query Time since Last Align IF

Remote Command	:CALibration:TIME:LIF?
Example	:CAL:TIME:LIF?
Notes	Value is the elapsed time, in seconds, since the last successful **Align IF** was executed
State Saved	No

Query Temperature of Last Align IF

Remote Command	:CALibration:TEMPerature:LIF?
Example	:CAL:TEMP:LIF?
Notes	Value is in degrees Centigrade at which the last successful **Align IF** was executed
State Saved	No

Query Time since Last Characterize Preselector

Remote Command	:CALibration:TIME:LPReselector?
Example	:CAL:TIME:LPR?
Notes	Value is the date and time the last successful **Characterize Preselector** was executed. The date is separated from the time by a space character Returns "" if no **Characterize Preselector** has ever been performed on the instrument
Dependencies	In models that do not include preselectors, this command is not enabled and any attempt to set or query yields an error
State Saved	No

Query Temperature of Last Characterize Preselector

Remote Command	`:CALibration:TEMPerature:LPReselector?`
Example	`:CAL:TEMP:LPR?`
Notes	Value is in degrees Centigrade at which the last successful **Characterize Preselector** was executed
Dependencies	In models that do not include preselectors, this command is not enabled and any attempt to set or query yields an error
State Saved	No

Query Time since Auto Align Off

Remote Command	`:CALibration:AUTO:TIME:OFF?`
Example	`:CAL:AUTO:TIME:OFF?`
Notes	Value is the elapsed time, in seconds, since **Auto Align** has been set to **Off** or **Off with Alert**. The value is 0 if **Auto Align** is `ALL` or `NORF`
State Saved	No

Query Time since Last Align Now 20 Hz - 30 MHz

Remote Command	`:CALibration:TIME:RFPSelector:LCONducted?`
Example	`:CAL:TIME:RFPS:LCON?`
Notes	Values are the date and time the last successful **Align Now, 20 Hz – 30 MHz** was executed. The date is separated from the time by a semi-colon character
State Saved	No

Query Temperature of Last Align Now 20 Hz - 30 MHz

Remote Command	`:CALibration:TEMPerature:RFPSelector:LCONducted?`
Example	`:CAL:TEMP:RFPS:LCON?`
Notes	Value is in degrees Centigrade at which the last successful **Align Now, 20 Hz – 30 MHz** was executed
State Saved	No

Query Time since Last Align Now 30 MHz - 3.6 GHz

Remote Command	`:CALibration:TIME:RFPSelector:LRADiated?`
Example	`:CAL:TIME:RFPS:LRAD?`
Notes	Value is the date and time the last successful **Align Now, 30 MHz – 3.6 GHz** was executed. The date is separated from the time by a semi-colon character
State Saved	No

Query Temperature of Last Align Now 30 MHz - 3.6 MHz

Remote Command	`:CALibration:TEMPerature:RFPSelector:LRADiated?`
Example	`:CAL:TEMP:RFPS:LRAD?`
Notes	Value is in degrees Centigrade at which the last successful **Align Now, 30 MHz – 3.6 GHz** was executed
State Saved	No

Query Next Scheduled Alignment Time

Remote Command	`:CALibration:RFPSelector:SCHeduler:TIME:NEXT?`
	This query returns data using the following format:
	`YYYY/MM/DD; HH:MM:SS`

Example	`:CAL:RFPS:SCH:TIME:NEXT?`
Notes	The next run time will be updated based on the start date/time and recurrence set by the user “date” is representation of the date the task will run in the form of “YYYY/MM/DD” where: – YYYY is the four digit representation of year. (for example, 2009) – MM is the two digit representation of month. (for example, 01 to 12) – DD is the two digit representation of the day. (for example, 01 to 28, 29, 30 or 31 depending on the month and year) “time” is a representation of the time of day the task will run in the form of “HH:MM:SS” where: – HH is the two digit representation of the hour in 24 hour format – MM is the two digit representation of minute – SS is the two digit representation of seconds For model N9038A only
State Saved	No

Query Time since Last Align Now External Mixer Path

Remote Command	`:CALibration:TIME:INTernal:EMPath?`
Example	`:CAL:TIME:INT:EMP?`
Notes	Value is the elapsed time, in hours, since the last successful **Align Now External Mixer Path** Returns NaN if no **Align Now External Mixer Path** has ever been performed on the instrument
Dependencies	Only appears in VXT model M9415A, when Option MXP is installed
State Saved	No

Query Temperature of Last Align Now External Mixer Path

Remote Command	`:CALibration:TEMPerature:INTernal:EMPath?`

Example	`:CAL:TEMP:INT:EMP?`
Notes	Value is in degrees Centigrade at which the last successful **Align Now External Mixer Path** was executed Returns 9.91E+37(NaN)if no **Align External Mixer Path** has ever been performed on the instrument
Dependencies	Only appears in VXT model M9415A, when Option MXP is installed
State Saved	No

Query Time since Last Align Now Low Band

Remote Command	`:CALibration:TIME:INTernal:LBANd?`
Example	`:CAL:TIME:INT:LBAN?`
Notes	Value is the elapsed time, in hours, since the last successful **Align Now Low Band** Returns NaN if no **Align Now Low Band** has ever been performed on the instrument
Dependencies	Only appears in VXT model M9415A
State Saved	No

Query Temperature of Last Align Now Low Band

Remote Command	`:CALibration:TEMPerature:INTernal:LBANd?`
Example	`:CAL:TEMP:INT:LBAN?`
Notes	Value is in degrees Centigrade at which the last successful **Align Now Low Band** was executed Returns 9.91E+37(NaN)if no **Align Now Low Band** has ever been performed on the instrument
Dependencies	Only appears in VXT model M9415A
State Saved	No

Query Time since Last Align Now High Band

Remote Command	`:CALibration:TIME:INTernal:HBAN?`
Example	`:CAL:TIME:INT:HBAN?`
Notes	Value is the elapsed time, in hours, since the last successful **Align Now High Band** Returns NaN if no **Align Now High Band** has ever been performed on the instrument
Dependencies	Only appears in VXT model M9415A
State Saved	No

Query Temperature of Last Align Now High Band

Remote Command	`:CALibration:TEMPerature:INTernal:HBANd?`
Example	`:CAL:TEMP:INT:HBAN?`
Notes	Value is in degrees Centigrade at which the last successful **Align Now High Band** was executed Returns 9.91E+37(NaN)if no **Align Now High Band** has ever been performed on the instrument

Dependencies	Only appears in VXT model M9415A
State Saved	No

4.6.4 Timebase DAC

Allows you to change the setting of the **Timebase DAC** from a factory calibrated setting to your own desired setting.

The display shows the current **Timebase DAC** setting at the top, and gives you a choice of `CALibrated` or `USER` setting. There is also a field for you to enter your desired setting.

Dependencies	Does not appear in VXT

4.6.4.1 Timebase DAC

Allows control of the internal 10 MHz reference oscillator timebase. This may be used to adjust for minor frequency alignment between your signal's reference and the internal frequency reference. This adjustment has no effect if the instrument is operating with an External Frequency Reference.

If the value of the **Timebase DAC** changes (by switching to `CALibrated` from `USER` with **User Value** set to a different value, or in `USER` with a new value entered) an alignment may be necessary. The alignment system will take appropriate action; which will either invoke an alignment or cause an **Alert**.

The `CALibrated` setting sets the **Timebase DAC** to the value established during factory or field calibration. In this case the value displayed at the top of the screen is the calibrated value.

The `USER` setting sets the **Timebase DAC** to the value set on the **User Value** control. In this case the value displayed at the top of the screen is the user value.

Remote Command	`:CALibration:FREQuency:REFerence:MODE CALibrated | USER` `:CALibration:FREQuency:REFerence:MODE?`
Example	`:CAL:FREQ:REF:MODE CAL`
Notes	If the value of the timebase is changed the alignment system automatically performs an alignment or alerts that an alignment is due
Dependencies	This menu is not available on the M9391A or M9393A or UXM
Preset	This is unaffected by **Preset** but is set to `CALibrated` on **Restore System Defaults->Align**
State Saved	No

4.6.4.2 User Value

Allows you to set the **Timebase DAC** to a value other than the value established during the factory or field calibration. The current value of the DAC is displayed at the top of the screen. This will be the Calibrated value if **Timebase DAC** is set to `CALibrated`.

Remote Command	`:CALibration:FREQuency:REFerence:FINE <integer>` `:CALibration:FREQuency:REFerence:FINE?`
Example	`:CAL:FREQ:REF:FINE 8191`
Notes	If the value of the timebase is changed the alignment system automatically performs an alignment or alerts that an alignment is due
Couplings	Setting `:CAL:FREQ:REF:FINE` sets `:CAL:FREQ:REF:MODE USER`
Preset	This is unaffected by **Preset** but is set to the factory setting on **Restore System Defaults->Align**
State Saved	No
Min	0
Max	16383
Backwards Compatibility SCPI	`:CALibration:FREQuency:REFerence:COARse` ESA hardware contained two DAC controls for the Timebase. In X-Series the command `:CALibration:FREQuency:REFerence:FINE` is the method for adjusting the timebase. The `COARse` option is provided as an alias to `FINE`

Remote Command	`:CALibration:FREQuency:REFerence:COARse <integer>` `:CALibration:FREQuency:REFerence:COARse?`
Example	`:CAL:FREQ:REF:COAR 8191`
Notes	This is an alias for `:CAL:FREQ:REF:FINE`. Any change to `COARse` is reflected in `FINE` and *vice-versa*. See `:CAL:FREQ:REF:FINE` for description of functionality
Couplings	Setting `:CAL:FREQ:REF:COAR` sets `:CAL:FREQ:REF:MODE USER`

4.6.5 Advanced

Accesses alignment processes that are immediate action operations that perform operations that run until complete. **Advanced** alignments are performed on an irregular basis, or require additional operator interaction.

Dependencies	This menu is not available on VXT or M9391A or M9393A or UXM

4.6.5.1 Characterize Preselector

The Preselector tuning curve drifts over temperature and time. Recognize that the Amplitude, Presel Center function adjusts the preselector for accurate amplitude measurements at an individual frequency. Characterize Preselector improves the amplitude accuracy by ensuring the Preselector is approximately centered at all frequencies without the use of the Amplitude, Presel Center function. Characterize Preselector can be useful in situations where absolute amplitude accuracy is not of utmost importance, and the throughput savings or convenience of not performing a Presel Center is desired. Presel Center is required prior to any measurement for best (and warranted) amplitude accuracy.

Keysight recommends that the Characterize Preselector operation be performed yearly as part of any calibration, but performing this operation every three months can be worthwhile.

Characterize Preselector immediately executes a characterization of the Preselector, which is a YIG-tuned filter (YTF). The instrument stops any measurement currently underway, performs the characterization, then restarts the measurement from the beginning (similar to pressing the **Restart** key).

The query (`:CALibration:YTF?`) invokes the alignment of the YTF subsystem, and returns a success or failure value.

A failure encountered during alignment generates the Error Condition message “Characterize Preselector failure” and sets Bit 3 in the `STATus:QUEStionable:CALibration:EXTended:FAILure` status register. Successful completion of **Characterize Preselector** clears this Condition. It also begins the elapsed time counter for Last Characterize Preselector Time, and captures the Last Characterize Preselector Temperature.

The last Characterize Preselector Time and Temperature survives across the power cycle, as this operation is performed infrequently.

NOTE: The **Characterize Preselector** function can be interrupted, by pressing the **Cancel (ESC)** front-panel key, or remotely with Device Clear followed by the `:ABORt SCPI` command. None of the new characterization data is then used. However, since the old characterization data is purged at the beginning of the characterization, you now have an uncharacterized preselector. You should re-execute this function and allow it to finish before making any further preselected measurements.

Remote Command	`:CALibration:YTF` `:CALibration:YTF?`
Example	`:CAL:YTF`
Notes	`:CALibration:YTF?` returns 0 if successful, or 1 if failed (including interfering user signal) While **Advanced**, **Characterize Preselector** is performing the alignment, Bit 0 in the Status Operation register is set. Completion, or termination, clears Bit 0 in the Status Operation register

	This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the `:ABORt` command Successful completion clears Bit 9 in the Status Questionable Calibration register A failure encountered during alignment generates the Error Condition message "Characterize Preselector failed" and sets Bit 9 in the Status Questionable Calibration register For Options that support frequencies > 3.6 GHz only
Dependencies	This control does not appear in models that do not contain preselectors. In these models the SCPI command is accepted without error but no action is taken
Couplings	Initializes the time for the Last Characterize Preselector Time Records the temperature for the Last Characterize Preselector Temperature

Remote Command	`:CALibration:YTF:NPENding`
Example	`:CAL:YTF:NPEN`
Notes	`:CALibration:YTF:NPENding` is the same as `:CALibration:YTF`, including all conditions, status register bits, except that this SCPI command *does not block* the SCPI session, so you should use status register bits to query if the calibration is successfully completed or not Typical usage is: 1. `:CALibration:YTF:NPENding` (Start a YTF calibration) 2. `:STATus:OPERation:CONDition?` (Check if the calibration is completed or not, If Bit 0 is set, then the system is doing calibration, and you should repeat this query until the bit is cleared) 3. `:STATus:QUEStionable:CALibration:EXTended:FAILure:CONDition?` (Check whether Bit 2 is set. If this bit is set, that means there are some errors in previous internal source calibration)

4.6.5.2 Characterize Reference Clock

Calibrates the Reference Input Phase with the External Reference Output. This feature is only available when either option DP2 or B40 is present. It requires connecting the 10 MHz OUT to the EXT REF IN port with a BNC cable before running the characterization.

See "Front panel guided calibration sequence" on page 2006

Remote Command	`:CALibration:REFerence:CLOCk?`

Example	`:CAL:REF:CLOC:INIT?`
	connect cable
	`:CAL:REF:CLOC?`
	disconnect cable
	`:CAL:REF:CLOC:END?`

Notes	`:CALibration:REFerence:CLOCk?` returns 0 if successful, or 1 if failed
Dependencies	Option DP2 or B40
Couplings	Initializes the time for the Last Characterize Reference Clock Time Records the temperature for the Last Characterize Reference Clock Temperature. Expected to be run after `:CAL:REF:CLOC:INIT`, and before `:CAL:REF:CLOC:END`

Remote Command	`:CALibration:REFerence:CLOCk:INITialize?`
Example	`:CAL:REF:CLOC:INIT?`
Notes	Returns 0 if successful, or 1 if failed
Dependencies	Option DP2 or B40
Couplings	Expected to be run before sending the `:CAL:REF:CLOC?` query. This will stop the current measurement when it has completed (does not abort the current data acquisition), and prepare the instrument for the expected cabling

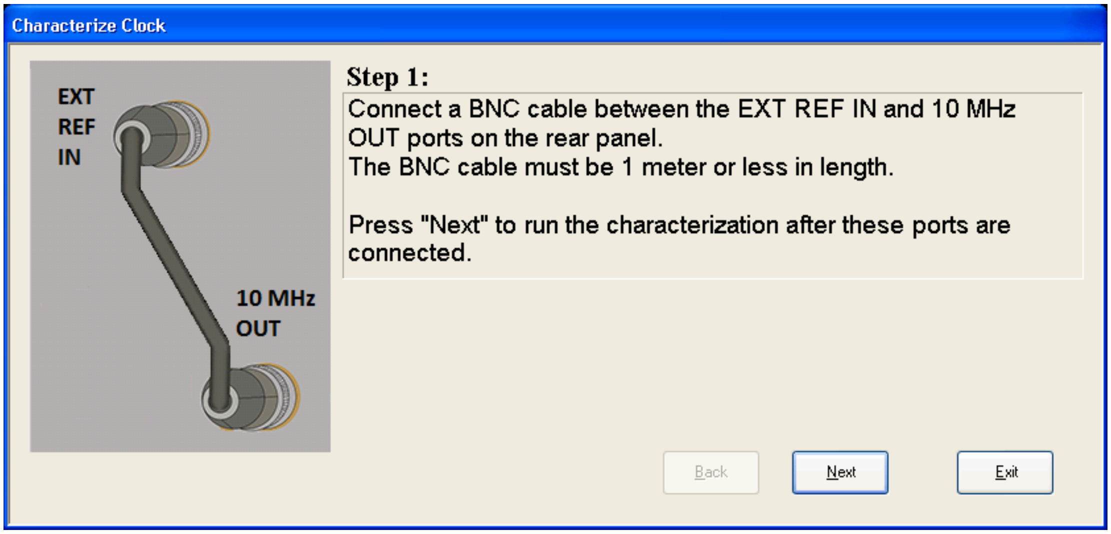
Remote Command	`:CALibration:REFerence:CLOCk:END?`
Example	`:CAL:REF:CLOC:END?`
Notes	Returns 0 if successful, or 1 if failed
Dependencies	Option DP2 or B40
Couplings	Expected to be run after sending the `:CAL:REF:CLOC?` query, and after removing the cable used in that Characterize Reference Clock step. This will resume any queued measurements, and concludes the reference clock characterization

Remote Command	`:CALibration:TIME:REFerence:CLOCk?`
Example	`:CAL:TIME:REFerence:CLOCk?`
Notes	Value is the date and time the last successful Characterize Reference Clock was executed. The date is separated from the time by a space character. Returns “” if Characterize Reference Clock has never been performed on the instrument
Dependencies	Option DP2 or B40
State Saved	No

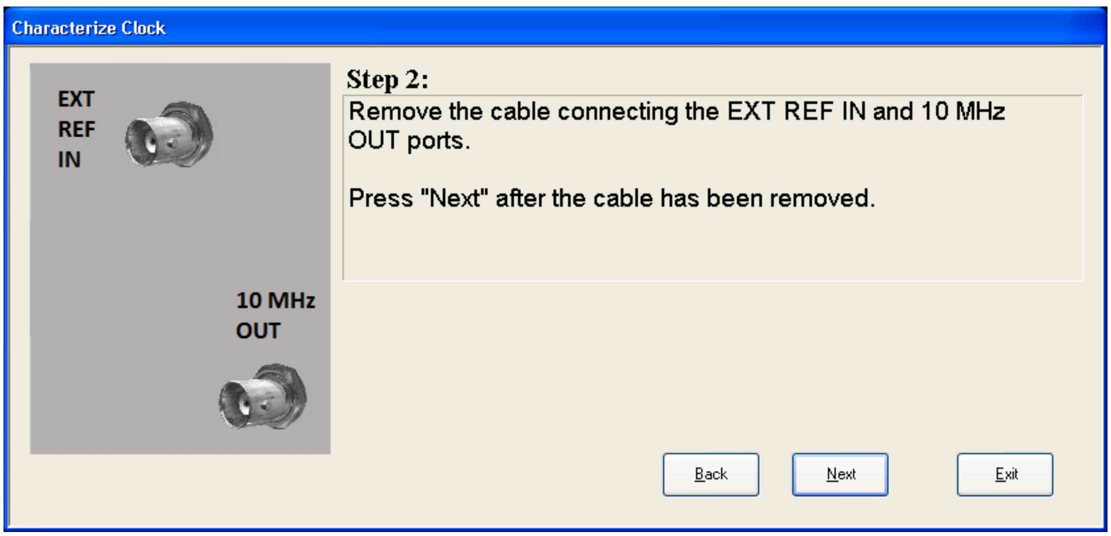
Front panel guided calibration sequence

When selecting **Characterize Reference Clock** via the front panel, the following form is displayed.

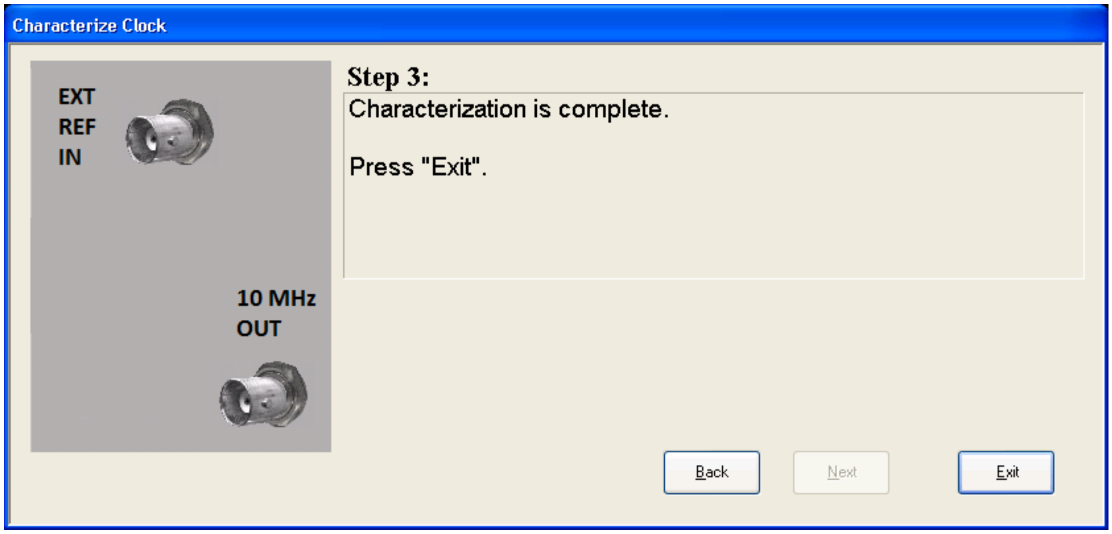
Step 1 of the guided calibration sequence:



Step 2 of the guided calibration sequence:



Step 3 of the guided calibration sequence:



4.6.5.3 Characterize Noise Floor

On instruments with the NF2 license installed, the calibrated Noise Floor used by Noise Floor Extensions should be refreshed periodically. To do this, press **Characterize Noise Floor**. When you press this control, the instrument stops any measurement currently underway, and a dialog appears with an **OK** and **Cancel** button that says:

```
This action will take several minutes to perform. Please disconnect all cables
from the RF input and press Enter to proceed. Press ESC to cancel
```

When you press **Enter** or **OK**, the characterization proceeds. After the characterization, the instrument restarts the measurement from the beginning (similar to pressing the **Restart** key). The characterization takes many minutes to run.

The noise floor model used by Noise Floor Extensions includes an estimation of the temperature behavior of the noise floor, but this is only an estimation. The noise floor changes little with the age of the components. However, even small changes in the estimated level of the noise floor can make large changes in the effective noise floor, because the effective noise floor is the error in the estimation of the noise floor. Keysight recommends that the **Characterize Noise Floor** operation be performed when the instrument is operating at an ambient temperature that is significantly different than the ambient temperature at which this alignment was last run. In addition, Keysight recommends that the **Characterize Noise Floor** operation be performed after the first 500 hours of operation, and once every calendar year.

The noise floor model from the last operation of **Characterize Noise Floor** survives across the power cycle.

NOTE The **Characterize Noise Floor** function can be interrupted, by pressing the **Cancel (ESC)** front-panel key, or remotely with Device Clear followed by the `:ABORt SCPI` command. None of the new characterization data is then used. However, since the old characterization data is purged at the beginning of the characterization, you now have an uncharacterized noise floor. You should re-execute this function and allow it to finish before making any further measurements with NFE. Until you do, the instrument will display a "Characterize Noise Floor required" message and set bit 12 in the Status Questionable Calibration register (`STATus:QUEStionable:CALibration:EXTended:NEEDed`).

Remote Command	`:CALibration:NFLoor` `:CALibration:NFLoor?`
Example	`:CAL:NFL`
Notes	`:CALibration:NFLoor?` returns 0 if successful, or 1 if failed (including interfering user signal) This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the `:ABORt` command
Dependencies	This control does not appear in models that do not contain NF2. In these models the SCPI command is accepted without error but no action is taken
Couplings	Successful completion of **Characterize Noise Floor** begin the elapsed time counter or the Last Characterize Noise Floor Time

Remote Command	`:CALibration:TIME:NFLoor?`
Example	`:CAL:TIME:NFL?`
Notes	Value is the date and time the last successful **Characterize Noise Floor** was executed. The date is separated from the time by a space character Returns "" if no **Characterize Noise Floor** has ever been performed on the instrument
Dependencies	In models that do not include NF2, this command is not enabled and any attempt to set or query yields an error
State Saved	No

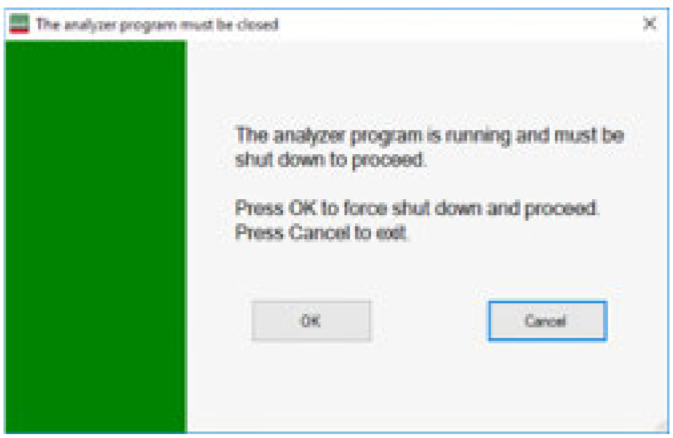
Remote Command	`:CALibration:TEMPerature:NFLoor?`
Example	`:CAL:TEMP:NFL?`
Notes	Value is the temperature of the last successful **Characterize Noise Floor** was executed Returns "" if no **Characterize Noise Floor** has ever been performed on the instrument
Dependencies	In models that do not include NF2, this command is not enabled and any attempt to set or query yields an error
State Saved	No

Remote Command	`:CALibration:TIME:ELAPsed:NFLoor?`
Example	`:CAL:TIME:ELAP:NFL?`

Notes	Value is the elapsed time the instrument was powered-on since the last successful **Characterize Noise Floor** was executed Returns "" if no **Characterize Noise Floor** has ever been performed on the instrument
Dependencies	In models that do not include NF2, this command is not enabled and any attempt to set or query yields an error
State Saved	No

4.6.6 Backup or Restore Align Data...

Opens the utility for backing-up or restoring alignment data. Since this utility cannot be run while the instrument software is running, a prompt tells you to shut down the instrument first:



Press **OK** and the instrument will shut down and open the backup utility.

Alignment data for the instrument resides on the hard drive in a database. Keysight uses high quality hard drives; however it is highly recommended the alignment data be backed-up to storage outside of the instrument. Additionally, for customers who use multiple CPU Assemblies or multiple disk drives, the alignment that pertains to the instrument must be transferred to the resident hard drive after a CPU or hard drive is replaced. This utility facilitates backing-up and restoring the alignment data.

NOTE **This utility allows you to navigate to any location of the Windows file system. If you are backing up alignment data to storage outside of the instrument, then it is assumed that you will use a USB memory device, or Mapped Network Drive.**

Processor Assembly types PC6 and PC7 contain a removable SD memory card. When one of these CPUs is installed, the Backup and Restore Alignment Data wizard defaults to the SD card as the backup location. At every power-on, the software will check to determine if the calibration data on the SD memory card (the backup) is newer than the data in use on the disk. In such situations, before the application is loaded, you are given the opportunity to restore the data from the backup. If you respond **Yes**, the Backup and Restore Alignment Data wizard (see "Alignment Data Wizard (without Flash)" on page 2011) will be invoked to perform the restore.

Processor Assembly types PC6S and PC7S contain an internal flash EEPROM, as well as a removable SD card. When one of these CPUs is installed, the Backup and Restore Alignment Data wizard defaults to the internal flash as the backup location. As with the PC6 and PC7, at every power-on, the software compares the timestamp of the backup on the flash and the timestamp of the alignment data in use on the disk. If the backup on the flash has newer data, you are given the opportunity to restore the data from the backup before the application is loaded. If you respond **Yes**, the Backup and Restore Alignment Data wizard (see "Alignment Data Wizard (with Flash)" on page 2021) will be invoked and will prompt you to restore that backup.

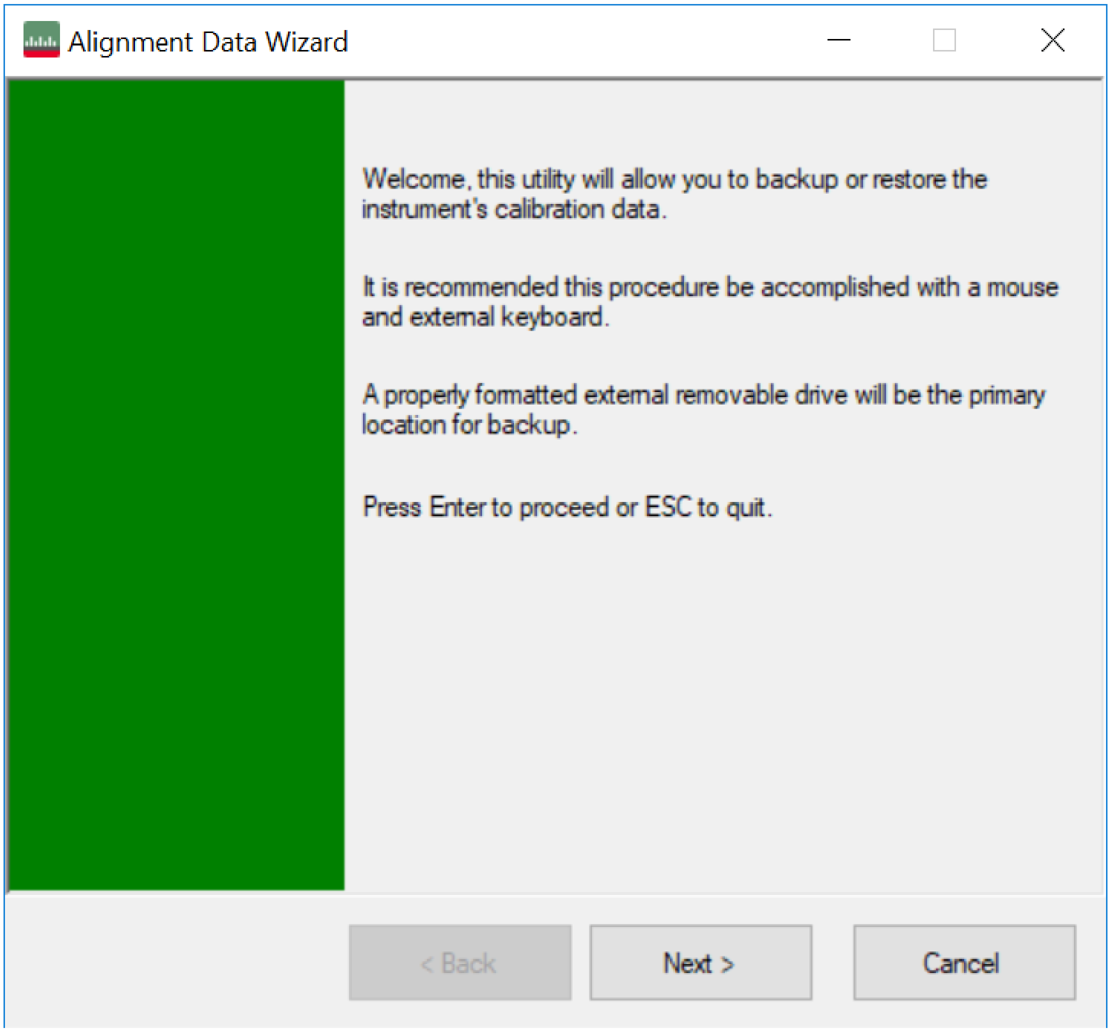
For purposes of these instructions, “alignment data” and “calibration data” are used interchangeably.

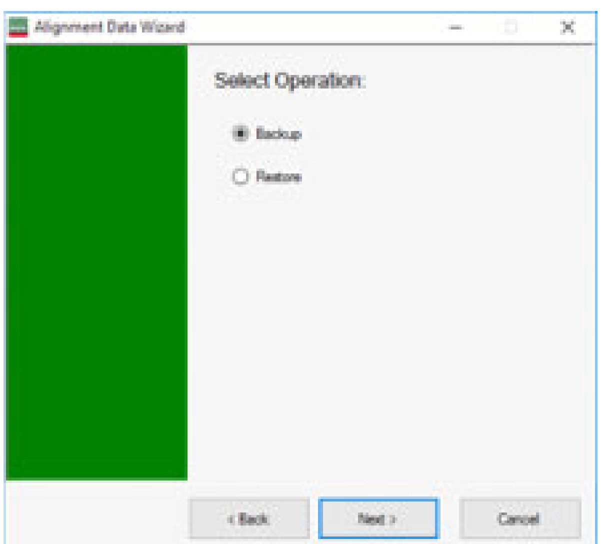
Dependencies	This menu is not available on the M9391A or M9393A or UXM

Remote Command	`:CALibration:DATA:DEFault`
Example	`:CAL:DATA:DEF`
Notes	Restores the alignment data files to their default state
Couplings	Sets **Auto Align** to `OFF`. Sets Bit 14 in the Status Questionable Calibration register. The Error Condition message “Align Now All required” is generated

4.6.6.1 Alignment Data Wizard (without Flash)

Guides you through the operation of backing-up or restoring the alignment data.

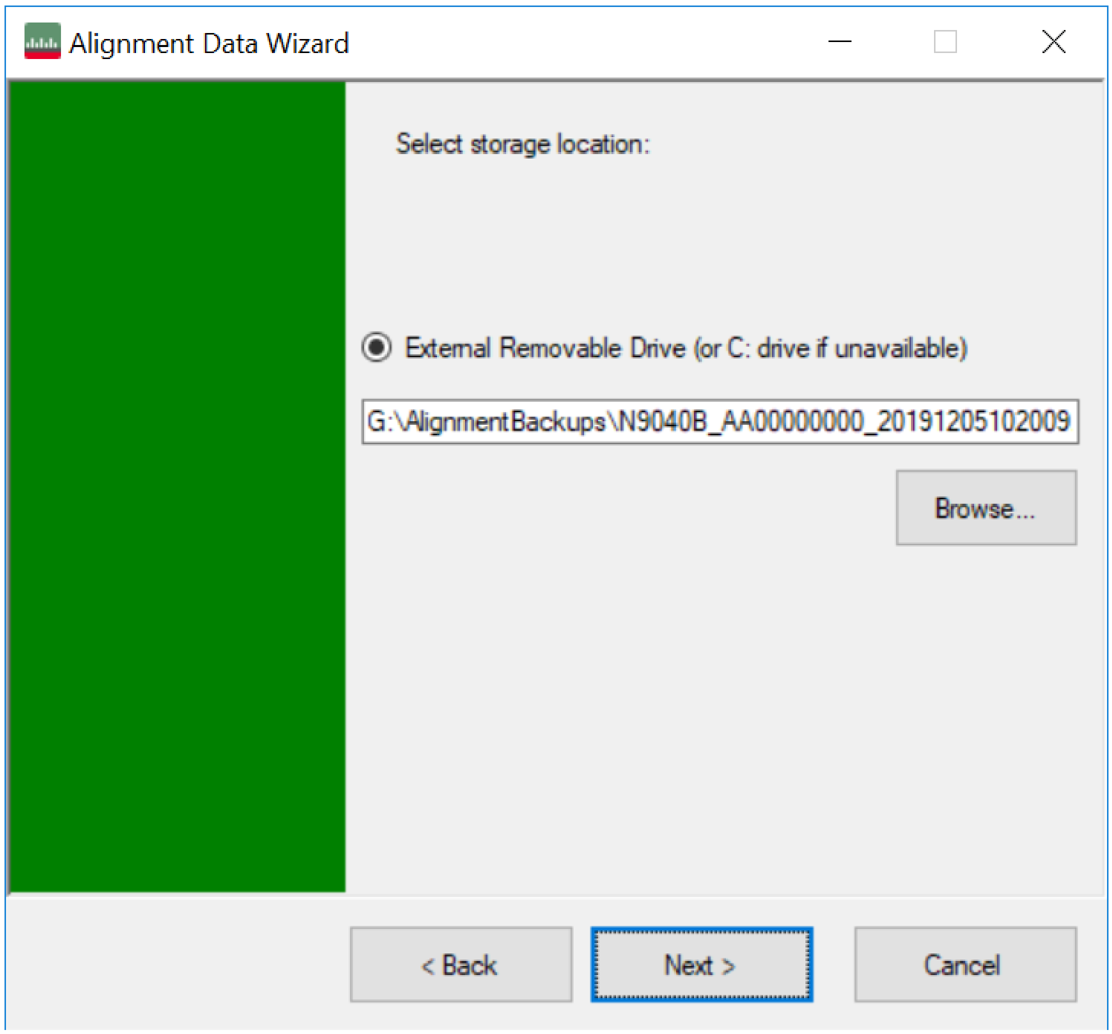

Alignment Data Wizard
Welcome, this utility will allow you to backup or restore the instrument's calibration data.
It is recommended this procedure be accomplished with a mouse and external keyboard.
A properly formatted external removable drive will be the primary location for backup.
Press Enter to proceed or ESC to quit.
< Back
Next >
Cancel


Alignment Data Wizard
Select Operation:
Backup
Restore
< Back
Next >
Cancel

The default backup location for instruments *without* internal flash will be the first drive identified as an external drive (USB or LAN) if such is available; or, if not, the internal D: partition.

The default file name is <model number>_<serial number>_<date in YYYYMMDDHHMMSS>.bkz.

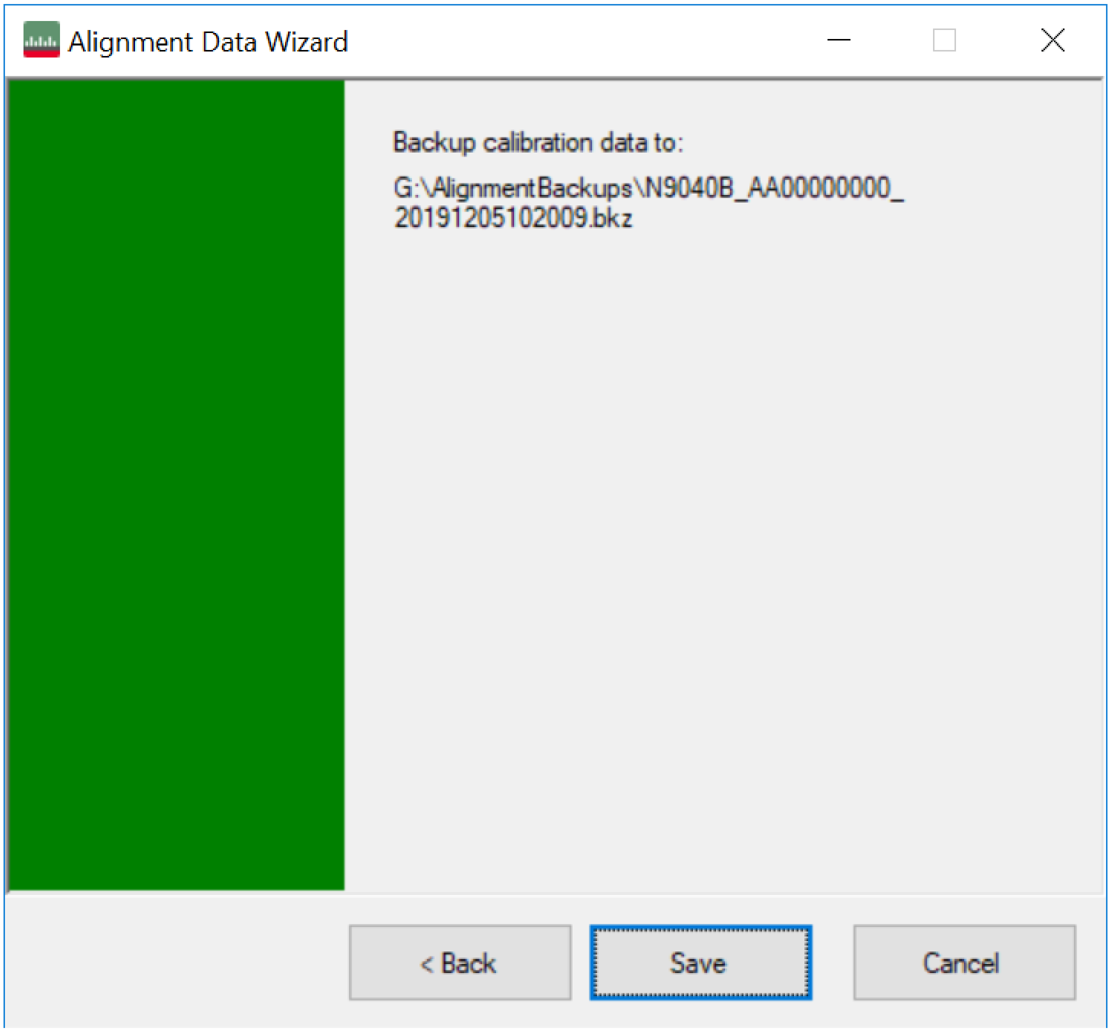
The default file extension for legacy backup files was .bak. The Backup and Restore operations support both the .bak (legacy format) and .bkz formats.

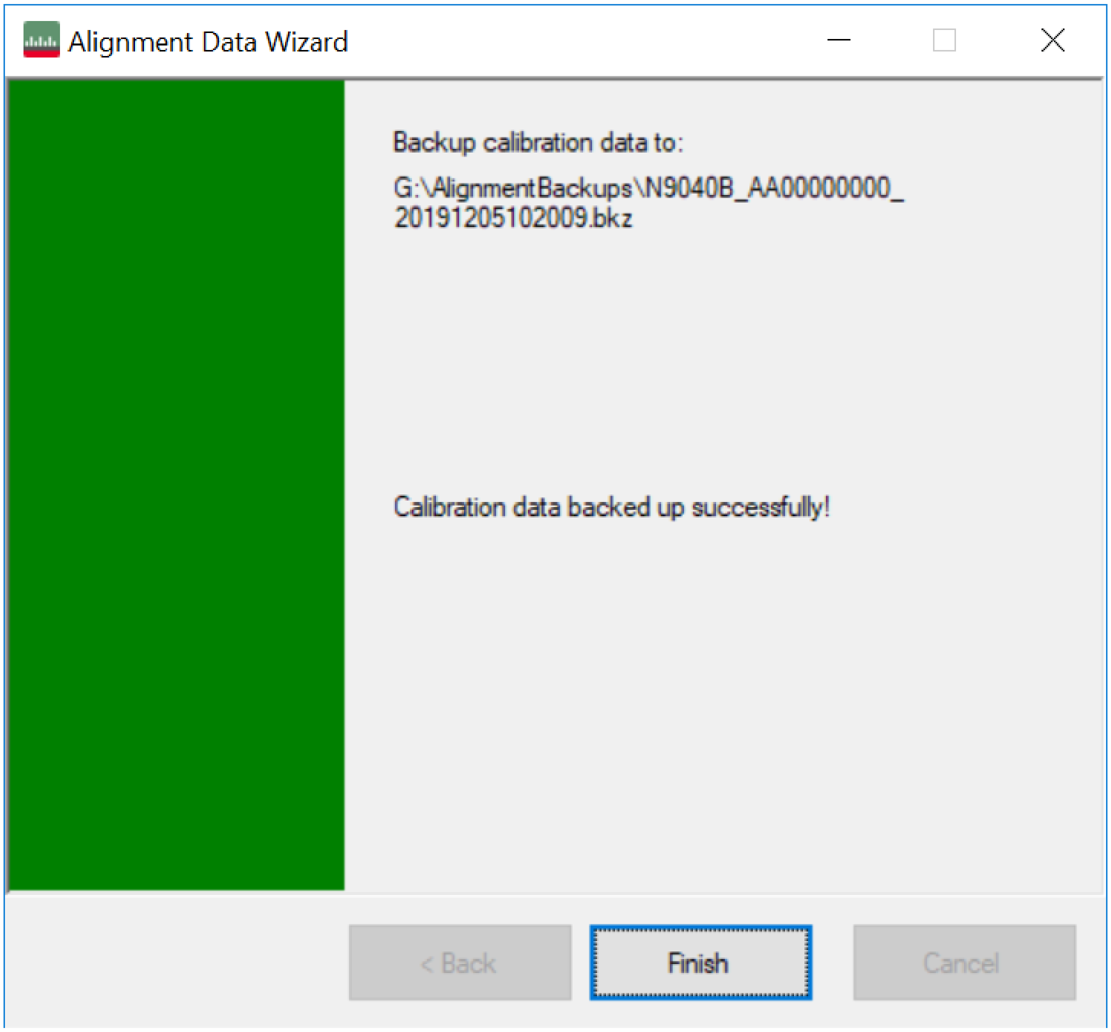


If a USB drive is present, it will be selected by default. The path defaults to the AlignmentBackups folder, and a filename is automatically created, in the form: <model>_<serial number>_<date><time>.bkz

If you wish to enter a customer filename, you can do so with an external keyboard, or by opening the onscreen Alpha keyboard, by pressing the **Keyboard** hardkey on the front panel:

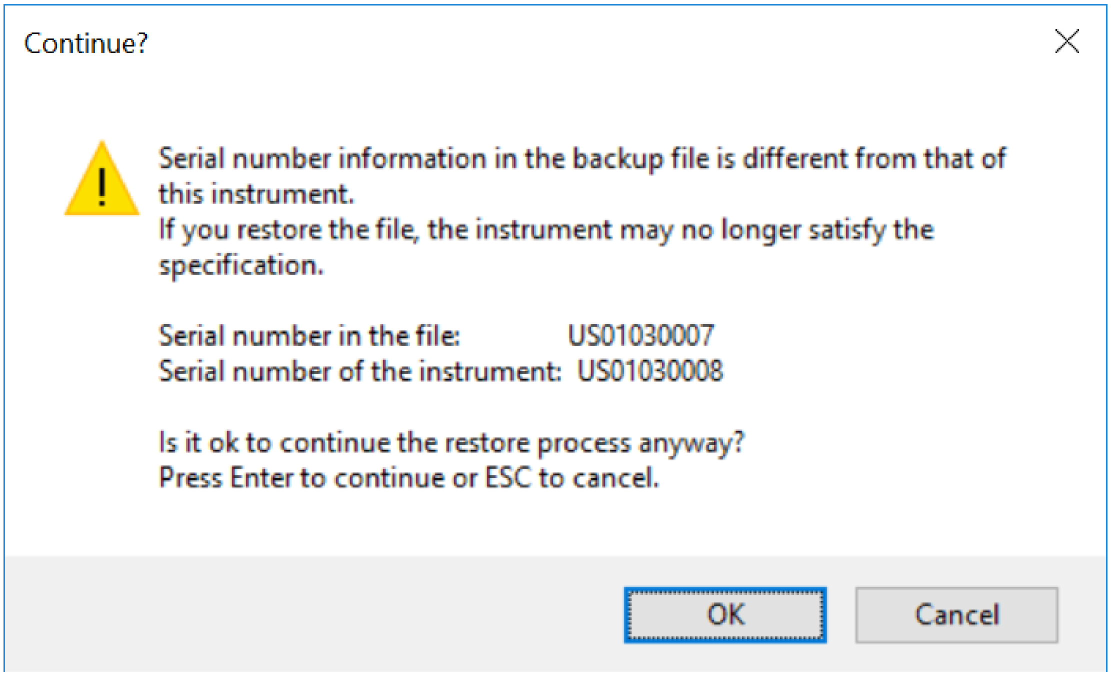
When the **Next >** button is pressed, you will be prompted to create a new folder if the chosen path does not yet exist.



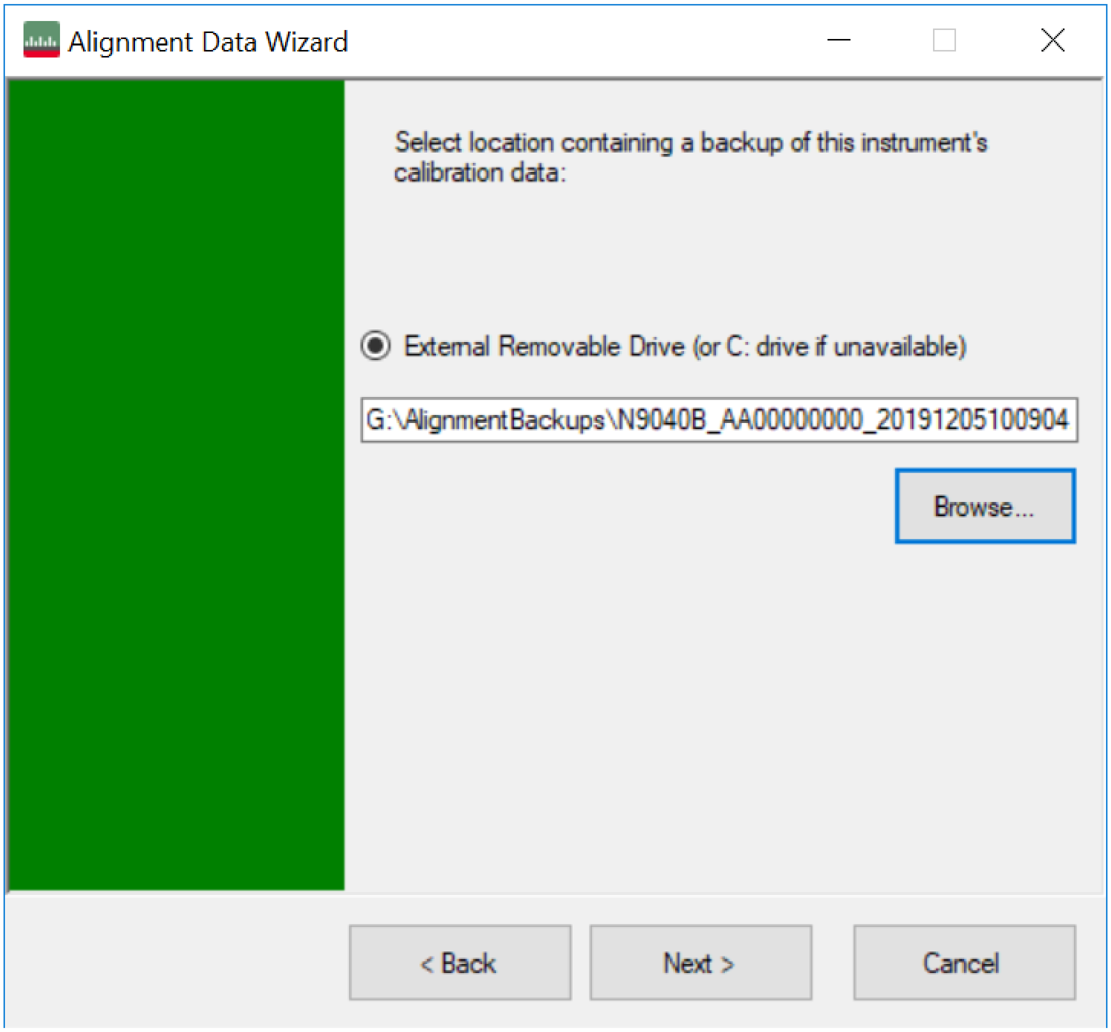


The restore operation checks the validity of the restore file using the database's built-in file validation. If the restore file is corrupt, the existing alignment data will remain in use.

If the serial number information in the backup file being restored is different from that of the instrument, the following message appears (the serial numbers shown are examples):

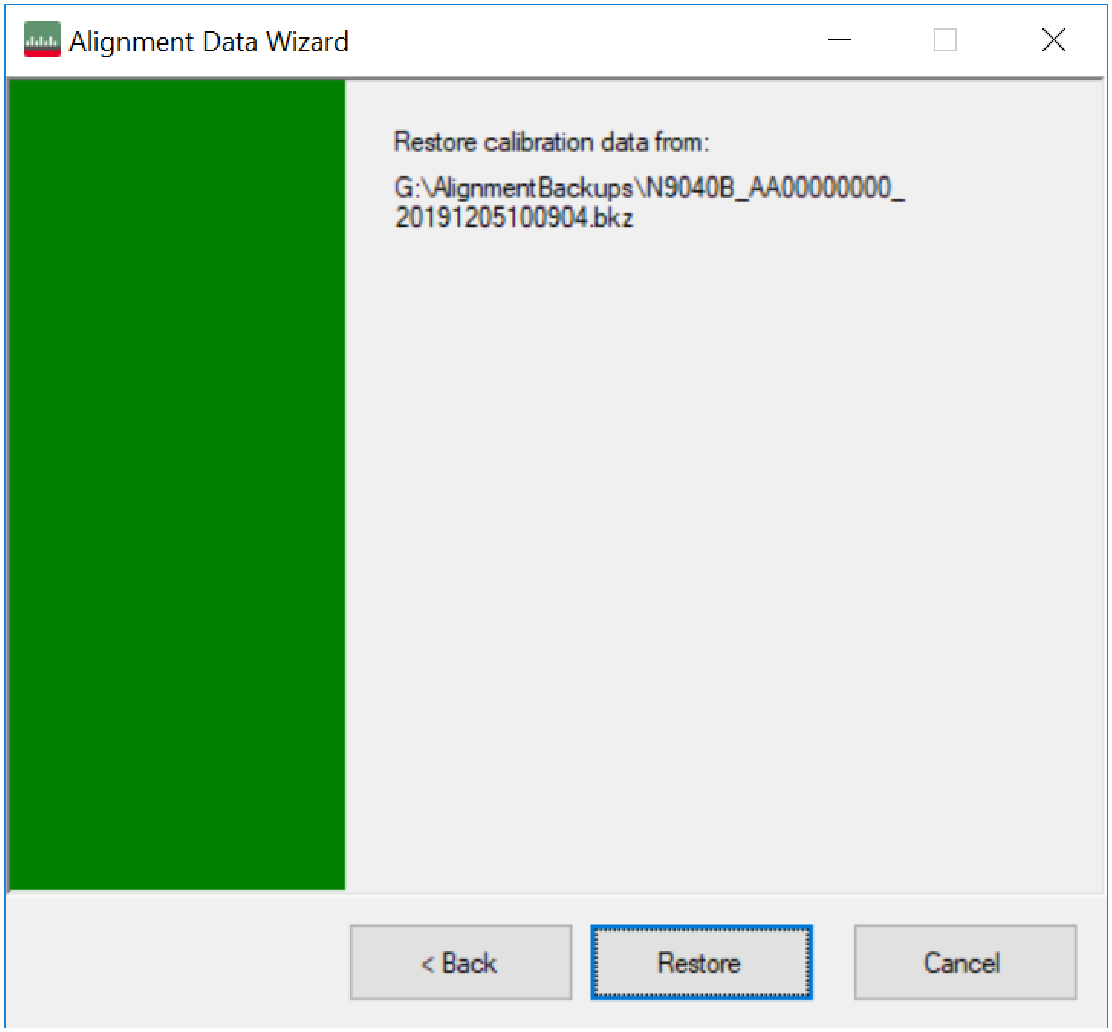


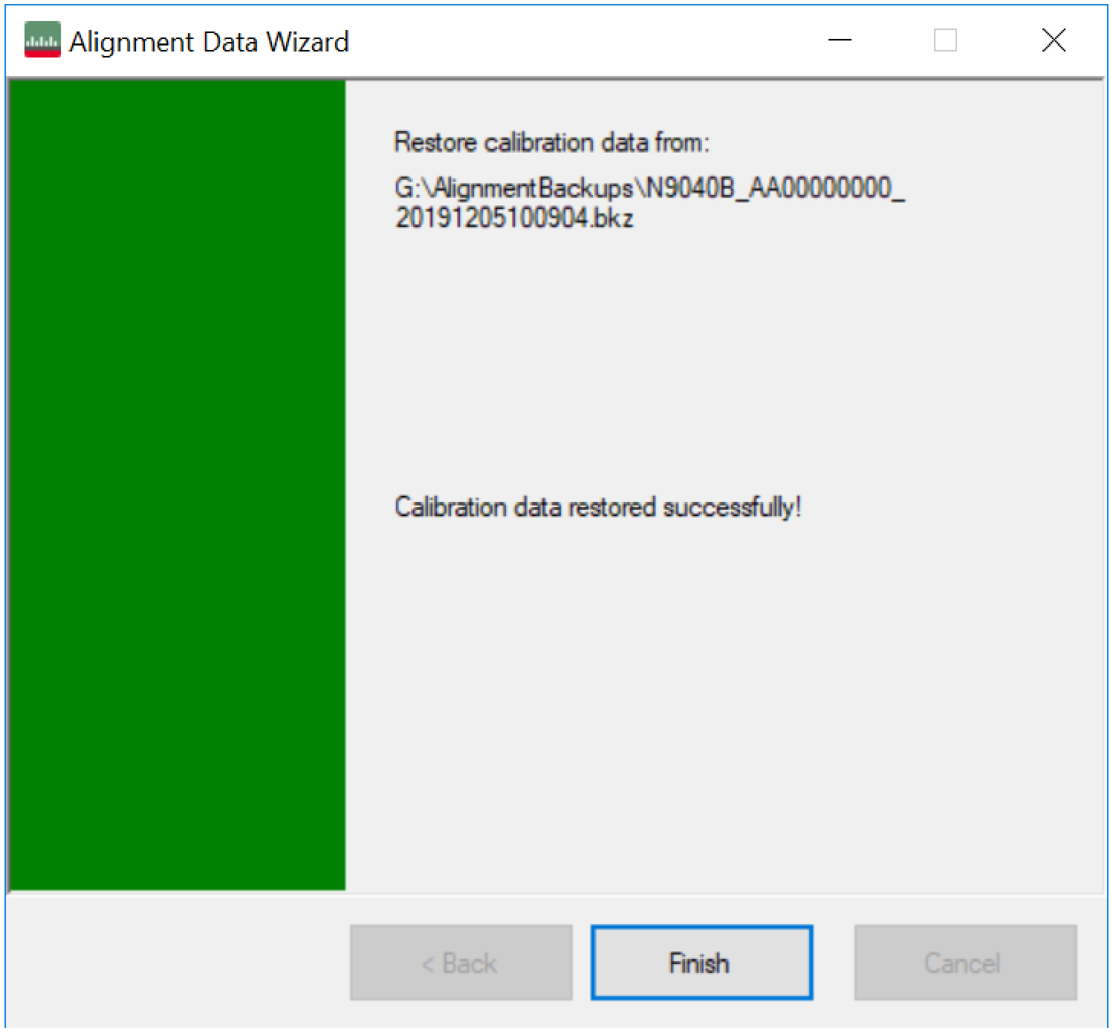
The default restore location for instruments *without* internal flash will be the first drive identified as an external drive (USB or LAN) if such is available; or, if not, the internal D: partition. The default restore file will be the most recent file that matches the default backup file name format: <model number>_<serial number>_<date>.bkz



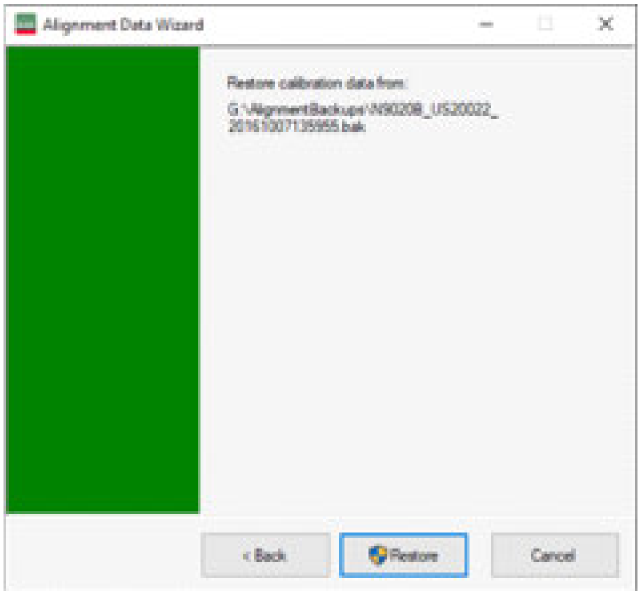
Changing the drive letter also modifies the path displayed in the box below. When this step is first loaded, the drive drop-down menu is populated with connected drives, which provide you with read access.

The path defaults to the `AlignBackups` folder. The most recent backup (`*.bkz` or `*.bak`) file in the folder will also be selected by default.


Alignment Data Wizard
Restore calibration data from:
G:\AlignmentBackups\N9040B_AA00000000_
20191205100904.bkz
< Back
Restore
Cancel



When restoring data in the legacy `.bak` format, Administrator privileges are required. You will be prompted when you attempt a restore (indicated by the UAC Shield on the **Restore** button below).



4.6.6.2 Perform Backup (without Flash) (Remote Command Only)

Invokes an alignment data backup operation to the provided Folder.

NOTE: It is recommended that the Folder provided is outside of the instrument (USB or Mapped Network Drive).

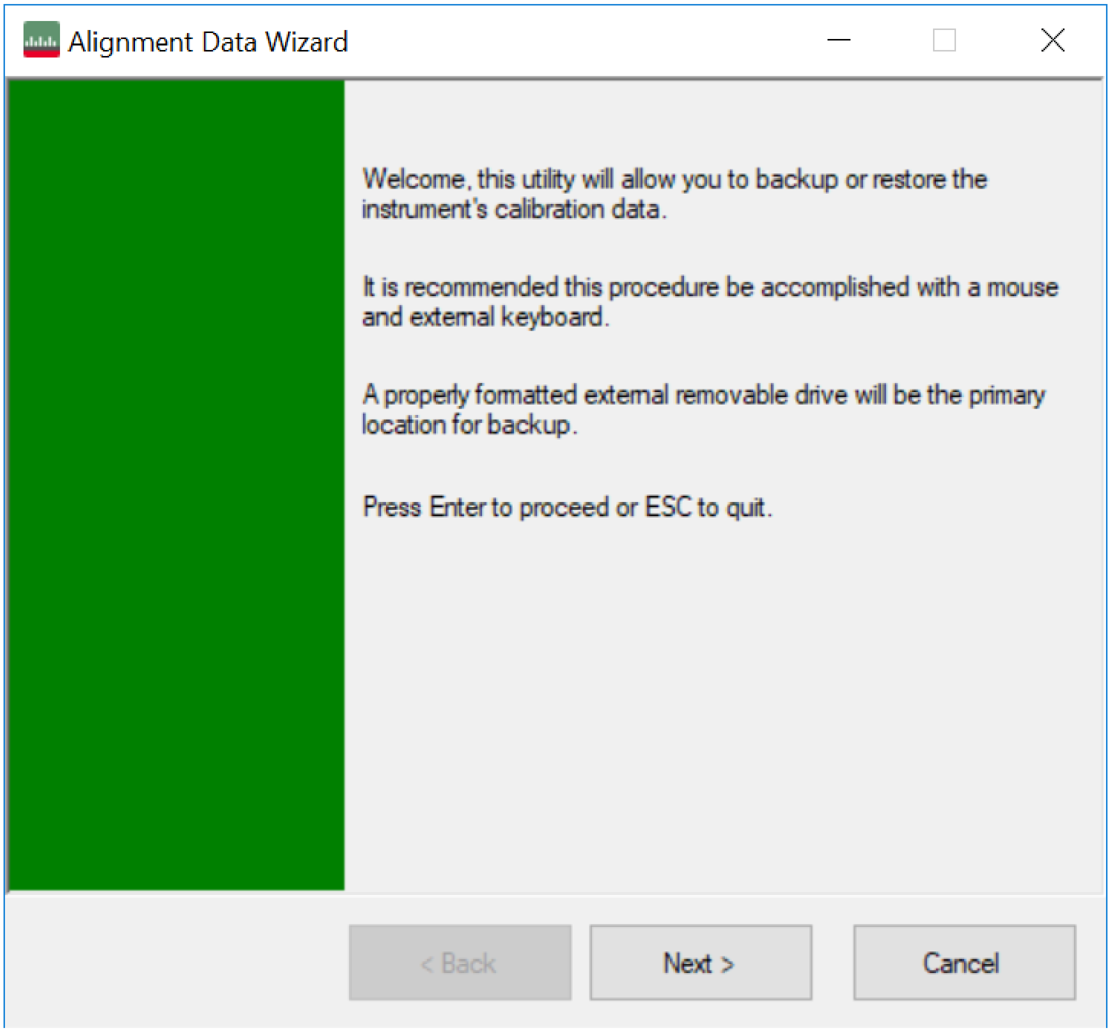
Remote Command	`:CALibration:DATA:BACKup <filename>`
Example	`:CAL:DATA:BACK "F:\AlignDataBackup_N9020A_US00000001_2008140100.bkz"`

4.6.6.3 Perform Restore (With Flash) (Remote Command Only)

Invokes an alignment data restore operation from the internal flash EEPROM.

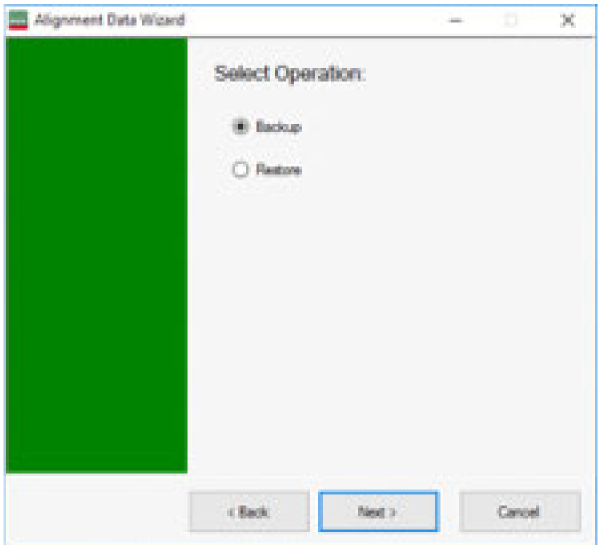
Remote Command	`:CALibration:DATA:INTernal:RESTore`
Example	`:CAL:DATA:INT:REST`

4.6.6.4 Alignment Data Wizard (with Flash)



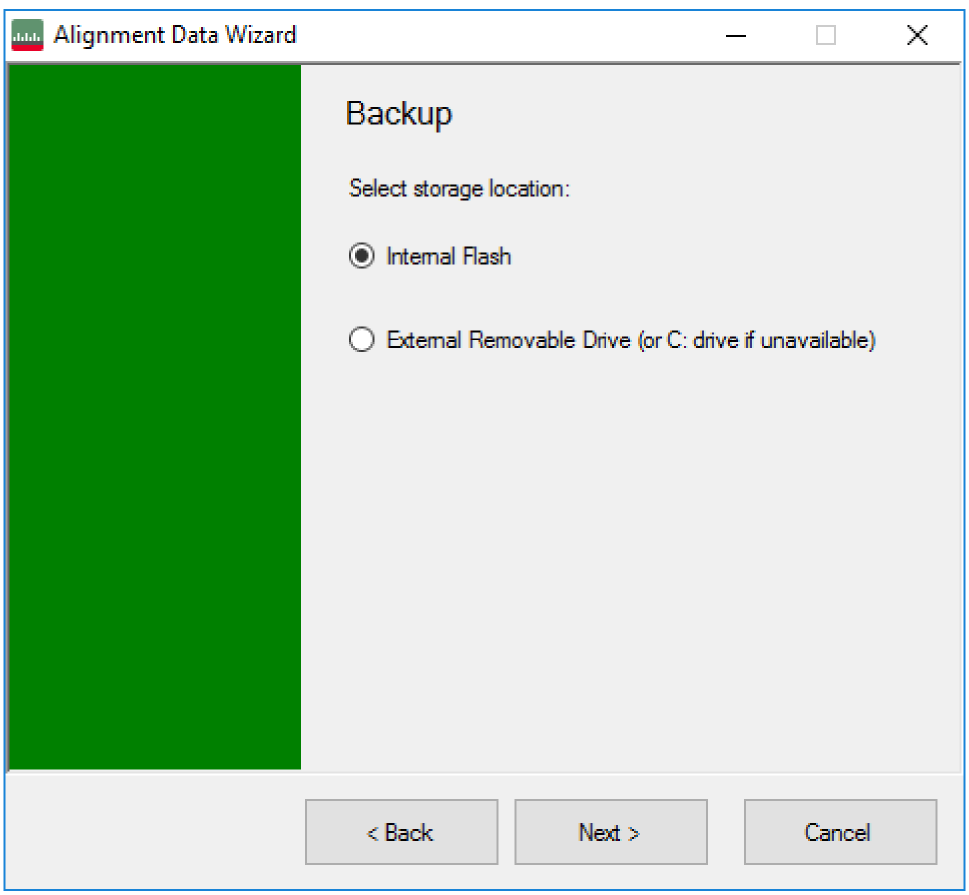
If your instrument has Processor Assembly type PC6S or PC7S (see "Show System" on page 1920) the instrument has an internal flash EEPROM that can store a backup of the alignment data. In this case, the interface to the Alignment Data Wizard is enhanced to accommodate this internal storage. This section details the use of this internal flash. For details on using external storage, see the previous section ("Alignment Data Wizard (without Flash)" on page 2011).

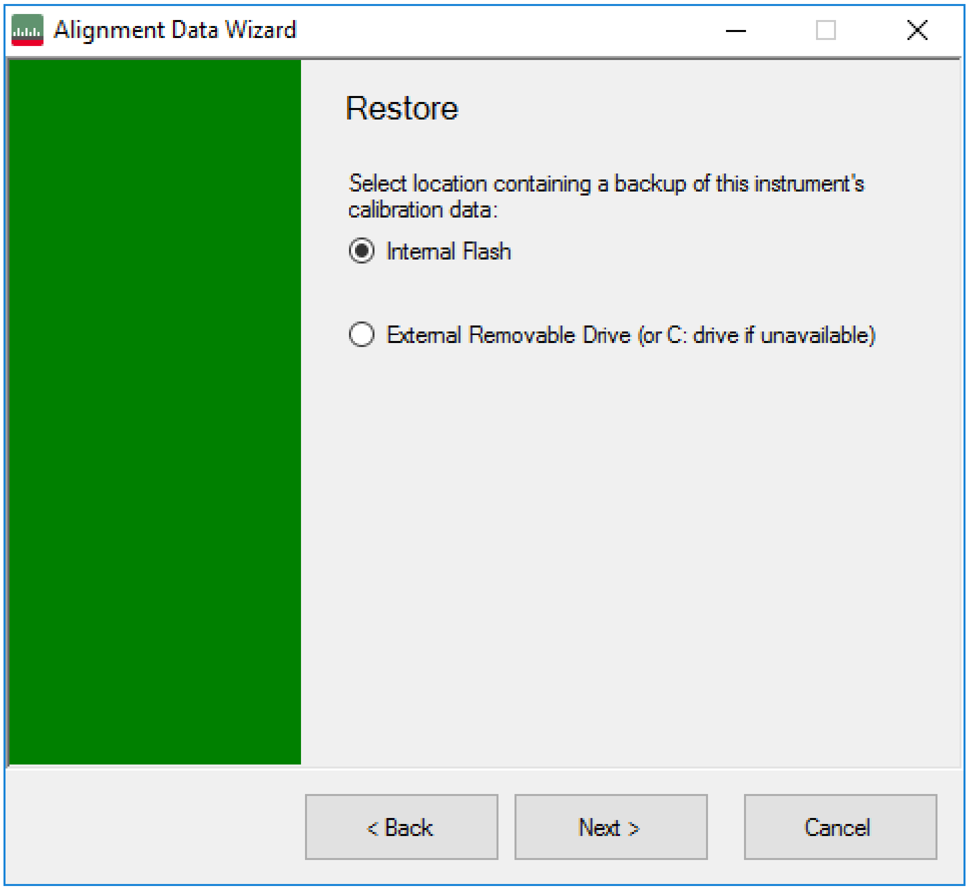
The Alignment Data Wizard guides you through the operations of backing up or restoring alignment data.



Having selected **Backup** or **Restore**, you then select the source or destination for the alignment data. As shown below, you can select either:

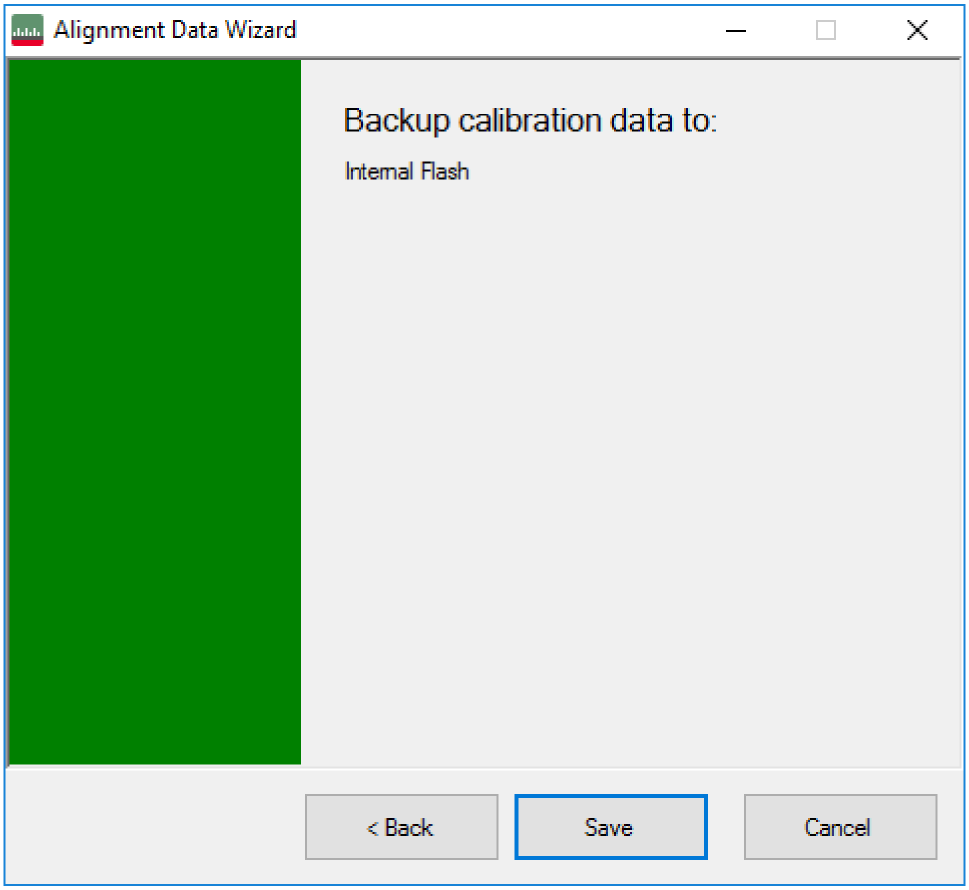
- Internal flash EEPROM, or,
- External Removable Drive (which includes the SD card described in "Backup or Restore Align Data..." on page 2010)

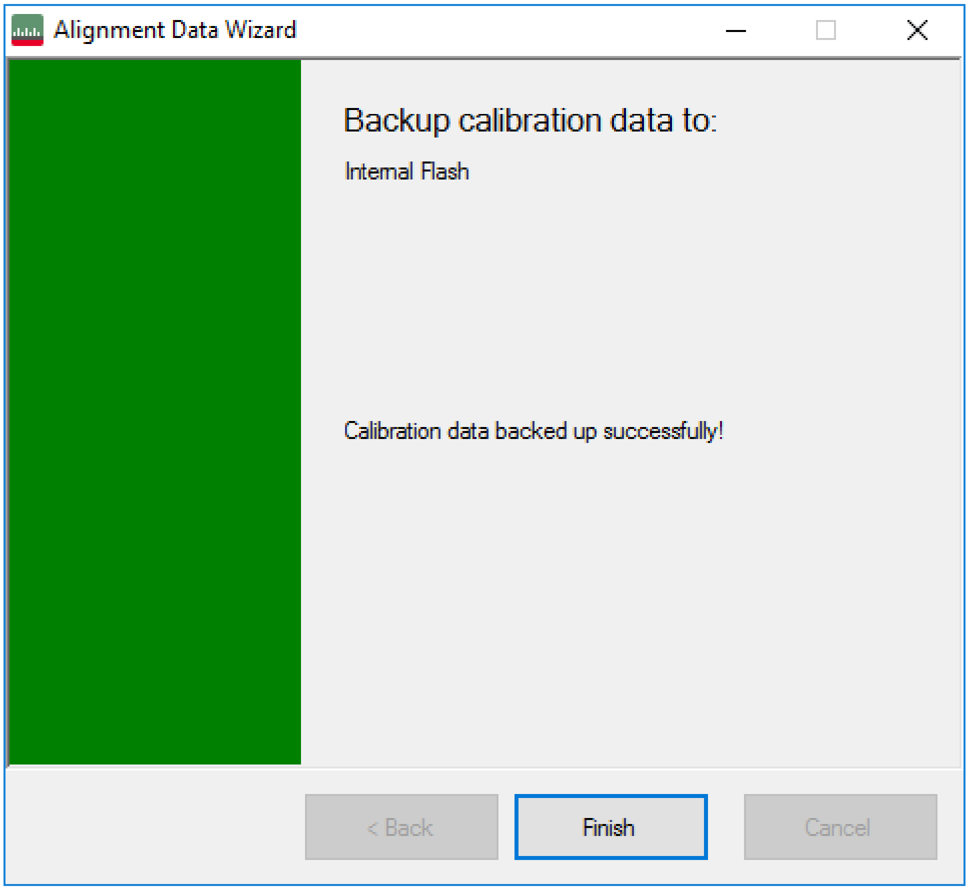




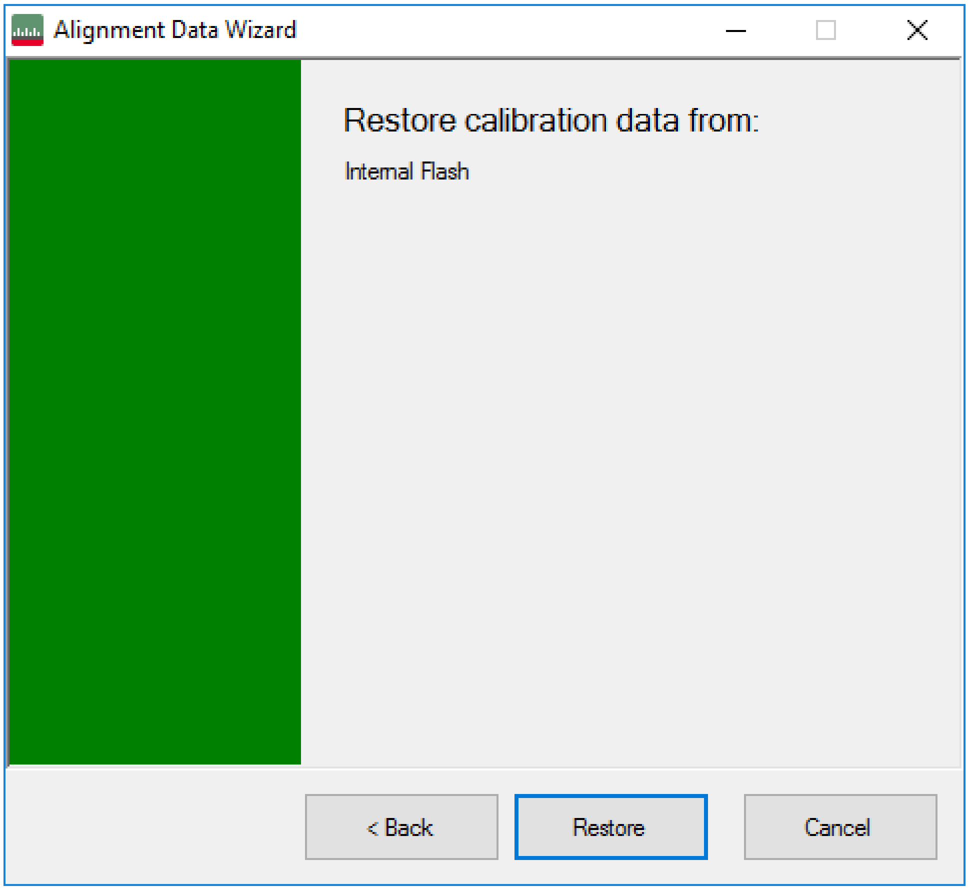
The final page of the wizard asks you to confirm the choices made in the previous pages. When the operation is complete, an indication is displayed on the same page, as below.

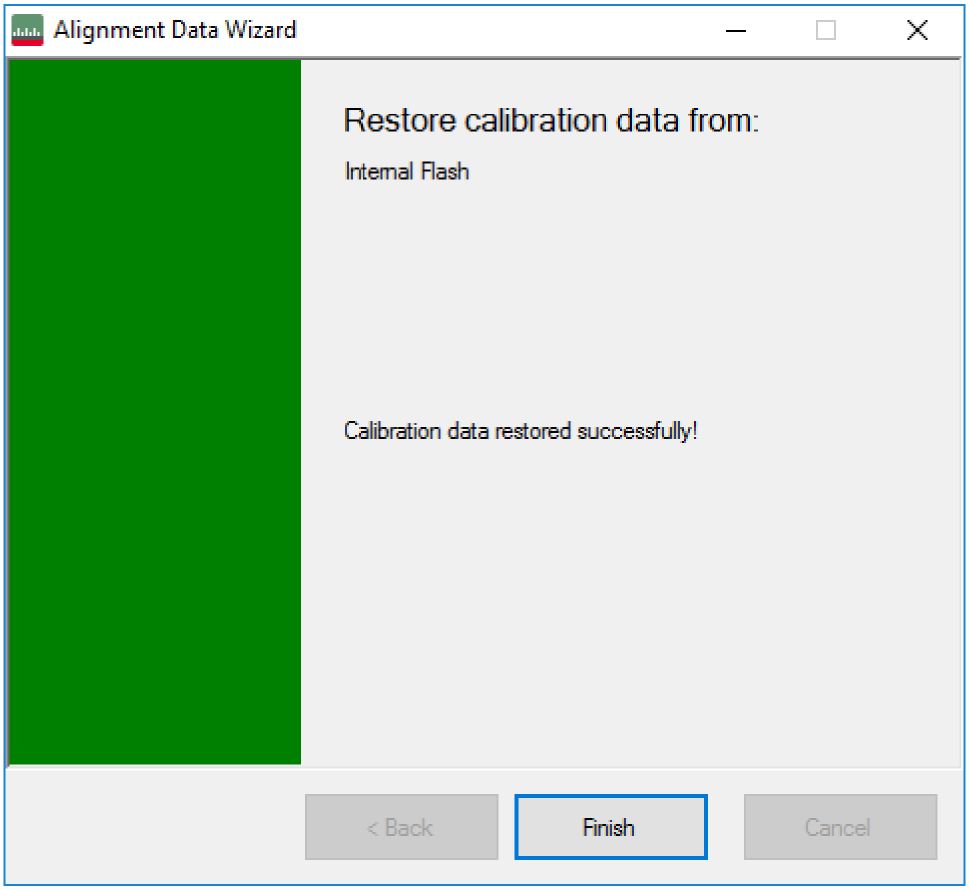
Backup:


Alignment Data Wizard
Backup calibration data to:
Internal Flash
< Back
Save
Cancel

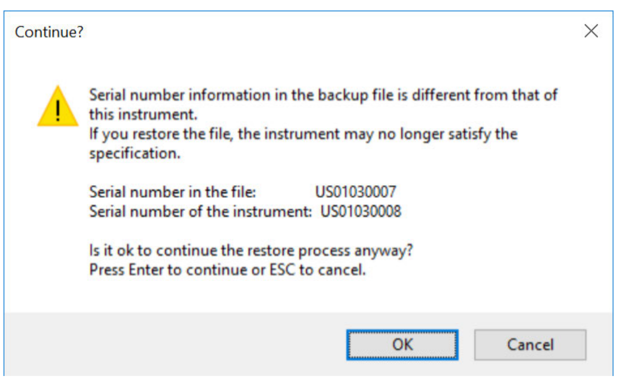

Alignment Data Wizard
Backup calibration data to:
Internal Flash
Calibration data backed up successfully!
< Back
Finish
Cancel

Restore:

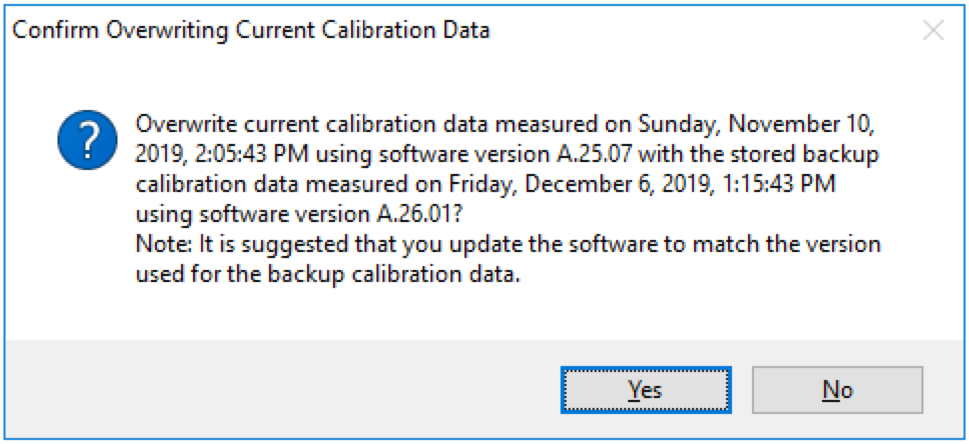

Alignment Data Wizard
Restore calibration data from:
Internal Flash
< Back
Restore
Cancel



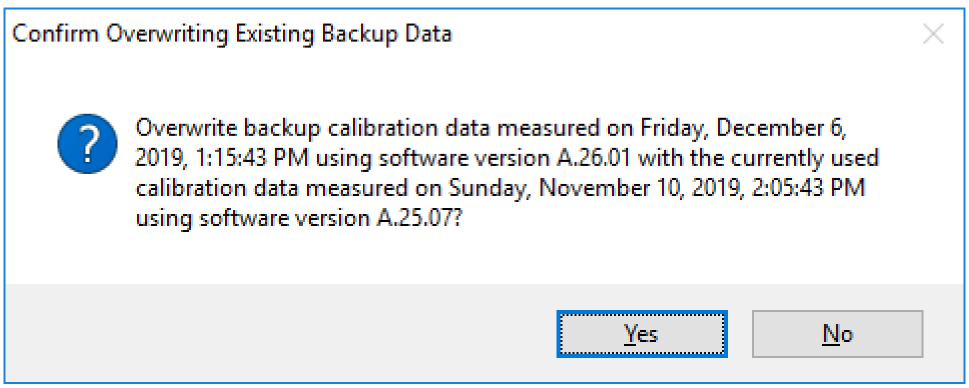
When restoring alignment data, if the serial number information in the backup file being restored is different from that of the instrument, the following message appears (the serial numbers shown are examples):



Immediately before the actual restoration, a final confirmation message is displayed detailing what is being restored and the current database that will be overwritten on the disk (the dates and versions are examples):



When backing up alignment data to the flash, if there is already an existing backup on the flash, a final confirmation message is displayed detailing what is being backed up and what will be overwritten on the flash (again, the dates and versions are examples):



4.6.6.5 Perform Backup (with Flash) (Remote Command Only)

Invokes an alignment data backup operation to the internal flash EEPROM.

Remote Command	`:CALibration:DATA:INTernal:BACKup`
Example	`:CAL:DATA:INT:BACK`

4.6.6.6 Perform Restore (With Flash) (Remote Command Only)

Invokes an alignment data restore operation from the internal flash EEPROM.

Remote Command	`:CALibration:DATA:INTernal:RESTore`
Example	`:CAL:DATA:INT:REST`

4.6.7 Restore Alignment Defaults

Causes the Alignment system settings to be reset to their default values. This does not affect any Alignment data stored in the system.

After performing this function, it may impact the auto-alignment time of the instrument until a new alignment baseline has been established.

When **Alignments** is selected, a message appears saying:

`This will reset all of the settings for the Alignment system to their default values`

`No alignment data will be erased`

`This action cannot be undone. Do you want to proceed?`

The dialog includes **OK** and **Cancel** controls, for you to affirm or cancel the operation.

Align Now All must be executed if the value of the Timebase DAC results in a change.

Example	`:SYST:DEF ALIG`
Notes	Alignment processing that results as the transition to **Auto Align Normal** will be executed sequentially; thus `*OPC?` or `*WAI` will wait until the alignment processing is complete

The parameters affected are:

Parameter	Setting
Timebase DAC	Calibrated
Timebase DAC setting	Calibrated value
Auto Align State	Normal (if the instrument is not operating with default alignment data, Off otherwise)
Auto Align All but RF	Off
Auto Align Alert	Time & Temperature

4.7 Security

Accesses capabilities for operating the instrument in a security controlled environment.

The **Security** page of the **System** menu has two controls: **USB Read/Write** and **Restore Security Defaults**.

Dependencies	This menu is not available on the M9391A or M9393A or UXM

4.7.1 USB Write Protect

The Windows operating system can be configured to disable write access to the USB ports for users who are in a secure environment where transferring data from the instrument is prohibited. The **USB Write Protect** control is a convenient way for you to disable write access to USB.

NOTE **This control is only available to users with Administrator privileges.**

Remote Command	`:SYSTem:SECurity:USB:WPRotect[:ENABle] ON | OFF | 0 | 1` `:SYSTem:SECurity:USB:WPRotect[:ENABle]?`

Example	`:SYST:SEC:USB:WPR ON`
	Sets USB ports to Read-only
	`:SYST:SEC:USB:WPR OFF`
	Sets USB ports to Read-Write

Notes	When the USB ports are in Read-only mode, then no data can be stored to USB, including the internal USB memory used for a back-up location for the calibration data
Dependencies	This control is grayed-out unless the current user has Administrator privileges
Preset	This is unaffected by **Preset** or any **Restore System Defaults.** A Keysight Recovery sets the USB to write protect `OFF`
State Saved	No
Range	Read-Write|Read only

4.7.2 Restore Security Defaults

Sets USB Read/Write to Enable.

NOTE **This control is only available to users with Administrator privileges.**

4.8 Diagnostics

Displays a slider that allows you to view Hardware Statistics.

Dependencies	This menu is not available on the M9391A or M9393A or UXM

4.8.1 Show Hardware Statistics

Provides a display of various hardware statistics. The statistics include the following:

- Mechanical relay cycles (on models with mechanical relays)
- High and Low temperature extremes
- Elapsed time that the instrument has been powered-on (odometer)

The display should appear listing the statistics, product number, serial number, and firmware revision.

The CXA models in which the AC/DC Switch field is called Fixed Atten and that omit the mechanical attenuation fields are the N9000A-503/507 models.

Modular HWs only have time and temperature information in Show Hardware Statistics.

The data will be updated only when **Show Hardware Statistics** is pressed, it will not be updated while the screen is displayed.

The tabular data should be directly printable.

Example	`:SYST:SHOW HWST`
Notes	The values displayed on the screen are only updated upon entry to the screen and not updated while the screen is being displayed

4.8.2 Pathwave Calibration Advisor...

Pathwave Calibration Advisor (PCA) is a separate application that helps maintain your instrument at peak performance. You can set the cal interval, configure cal due reminders, check the cal status, view cal certificates and test reports, and contact Keysight for a cal service.

PCA has its own embedded help documentation, which can be accessed in the instrument at:

`C:\Program Files\Keysight\Calibration Advisor\PCA.chm`

(The help file will open only if PCA has been installed in your instrument.)

or via the **?** button at the top right of the **Pathwave Calibration Advisor** window.

4.8.3 Query the Mechanical Relay Cycle Count (Remote Command Only)

Returns the count of mechanical relay cycles. For N9038A model, there are additional 2 Mechanical Relays, which are <N9038A Input2>, <N9038A Bypass>.

Remote Command	`:SYSTem:MRELay:COUNt?`
Example	`:SYST:MREL:COUN?`
Notes	Query Only The return value is a comma separated list of the individual counts for each mechanical relay The position of the relays in the list is: `“<Cal Signal>,<AC/DC>,<2dB #1 Atten>,<2dB #2 Atten>,<6dB Atten>,<10dB Atten>,<20dB Atten>,<30dB Atten>,<Fixed Atten>,<Low Noise Path Switch>,<Presel Bypass>,<N9038A Input2>, <N9038A Bypass>”` Items in the list not pertaining to your particular hardware configuration return as `-999` for those items For the E7760, all items return `-999`
Dependencies	This SCPI command is *not* supported by the E6607C model

4.8.4 Query the Operating Temperature Extremes (Remote Command Only)

Returns the low operating temperature extreme value. The value survives a power-cycle and is the temperature extreme encountered since the value was reset by the factory or service center.

Remote Command	`:SYSTem:TEMPerature:LEXTreme?`
Example	`:SYST:TEMP:LEXT?`
Notes	Value is in degrees Celsius at which the lowest operating temperature has been recorded since 1st power-up
State Saved	No

Returns the high operating temperature extreme value. The value survives a power-cycle and is the temperature extreme encountered since the value was reset by the factory or service center.

Remote Command	`:SYSTem:TEMPerature:HEXTreme?`
Example	`:SYST:TEMP:HEXT?`
Notes	Value is in degrees Celsius at which the highest operating temperature has been recorded since 1st power-up
State Saved	No

4.8.5 Query the Elapsed Time since 1st power on (Remote Command Only)

Returns the elapsed on-time in minutes since 1st power-on.

Remote Command	`:SYSTem:PON:ETIMe?`
Example	`:SYST:PON:ETIM?`
Notes	Query Only

4.9 Licensing

Accesses capabilities for configuring the licenses in your instrument.

4.9.1 License Manager

Opens the License Explorer for Fixed and Transportable licenses.

NOTE This feature is not available if option SF1 is installed.

For help on licensing, select **Help** in the menu bar at the top of the License Explorer window.

There are also five remote commands available for licensing. See:

– "Install License (Remote Command Only)" on page 2042
– "Remove License (Remote Command Only)" on page 2042
– "List Licenses (Remote Command Only)" on page 2043
– "Validate License (Remote Command Only)" on page 2043
– "Host ID Query (Remote Command Only)" on page 2044
– "List Borrowed Licenses (Remote Command Only)" on page 2039
– "Return a Borrowed License (Remote Command Only)" on page 2040

Notes	No equivalent remote command for this control

Backwards Compatibility Notes	In ESA the SCPI command for displaying the Show Licenses screen is:
	`:SYSTem:CONFigure:LKEY:STATe OFF | ON | 0 | 1`
	`:SYSTem:CONFigure:LKEY:STATe?`
	There are no equivalent SCPI commands in the X-Series for displaying the License Explorer

4.9.2 System Software Version Date

The software version date is the date of the newest features introduced in this release of the firmware. The date is not the same as the build date of the firmware because the date will only change when new features are added. For example, if A.18.06 has only defect fixes and no new features compared to A.18.05, then both A.18.05 and A.18.06 would have the same software version date.

For any feature to be enabled, the SW Support Expiration Date of the enabling license must be greater than or equal to the software version date when that feature was first introduced. See the Keysight web site for features related to a specific software application and their required support date.

The SCPI response is 3 integer values: `<year>,<month>,<day>`.

Remote Command	`:SYSTem:SOFTware:VERSion:DATE?`
Example	`:SYST:SOFT:VERS:DATE?`

4.9.3 Software Support Expiration Date

The **Software Support Expiration Date** is encoded in each software license's Version field in the `YYYY.MMDD` format. This gives the end date of the support contract associated with this license. When a support contract is renewed, a new license will be issued with an updated Version corresponding to the new contract's end date. The functionality available for a license is determined by the features available before the expiration date. For example, if feature X is introduced in a release with System Software Version Date of `2017.0831`, then a license with a Software Support Expiration Date of `2017.0831` or greater would enable feature X, but `2017.0830` or earlier would not enable feature X.

The SCPI response is 3 integer values: `<year>,<month>,<day>`.

Remote Command	`:SYSTem:LKEY:SOFTware:SUPPort:EXPiration:DATE? <feature>`
Example	`:SYST:LKEY:SOFT:SUPP:EXP:DATE? “N9084EM0E-1FP”`
Dependencies	When `<feature>` is not a valid license, one of the following errors will be issued: – -224,“IllegalParameterValue;License is not installed” – -224,“IllegalParameterValue;Unknown license feature” – -224,“IllegalParameterValue;Support contract not offered for this license”

4.9.4 Network Licenses

Network Licenses are available over the customer's network from a server the customer configures. The server has a count for each license and will only allow instruments to “check-out” a license up to that count. Once the count is reached for a specific license, further check-outs fail until one of the licenses is checked back in to the server. What this means is that it is possible for an instrument to have different features available to it based on what licenses are still available on the server when it tries to get licenses.

Setting up network licenses is done via the Keysight Floating License Manager (available on external Keysight web) and it has an Installation Guide that can be downloaded from that web page.

4.9.4.1 Application Licenses

Application Licenses (like N9077EM0E-1NP) are automatically checked out when entering the Mode that uses them, and they are automatically checked in when leaving that Mode. Because the server may have already checked out the last license for the application to another instrument, there is now the possibility that a mode switch will fail because a required license could not be checked out from the server. If the server has a limited number of license compared to the number of users desiring to use that license, this may mean that switching from mode A to mode B then back to mode A may fail when returning to mode A because another instrument checked out the last available license while the user was in mode B. Also, for modes with multiple licenses for different features (like Multi-Standard Radio), the features available may also change when switching out of the mode and back into it.

So, when using network licenses, it is necessary to check `:SYST:ERR?` after every mode switch to verify that it successfully switched. If the mode's required licenses were not successfully checked out, the instrument will post the error:

-310,"System error; feature not licensed"

There is also a potential performance issue when using network licenses because the instrument must communicate with the server on each license check-out and check-in. This operation is usually fast (a few milliseconds), but it depends on the network communication lag between the instrument and server. For remote servers on slow or congested networks, this could be significantly slower than that.

4.9.4.2 Instrument Software Options

Instrument software licenses are those that are reported via `*OPT?` the same as HW options. For example, N9040RT1B-1NP is an instrument software option and will be reported via `*OPT?` as `RT1`. Note that the license is composed of the model number (in this case `N9040B`) combined with the option code (`RT1`).

When instrument software options are available from a network server, the instrument automatically checks them out at start-up, and only checks them in when shutting down.

4.9.4.3 License Checked Out Query (Remote Only)

Shows whether the specified license is checked out from a server. Since network served licenses may not always be available when there are limited licenses available compared to the desired number of users, the features available on an instrument can vary. Use this command to see whether the feature is currently checked-out to the instrument. The return is boolean (0 or 1), returning 1 if the feature exists and is checked out from a server. Note that querying a license that is local to the instrument (-xFP or -xTP) also returns 0, even though the license exists and is valid, because it does not require a check-out. Also, querying a license that does not exist returns 0.

Remote Command	`:SYSTem:LKEY:COUT? <feature>`
Example	`:SYST:LKEY:COUT? “N9080EM0E”` `1`
Notes	`<”OptionInfo”>` contains the feature and the version. You must specify the feature but can omit the version. If you omit the version, the system regards it as the latest one Return Value: 0 if not checked out, 1 if checked out

4.9.4.4 List Licenses Checked Out (Remote Command Only)

Lists the licenses checked out from a server. Since network served licenses may not always be available when there are limited licenses available compared to the desired number of users, the features available on an instrument can vary. Use this command to see which features are currently checked-out to the instrument.

Remote Command	`:SYSTem:LKEY:COUT:LIST?`

Example	`:SYST:LKEY:COUT:LIST?`
	`#284`
	`N9073EM0E,2018.0831`
	`N9077EM0E,2018.0831`
	`N9080EM0E,2018.0831`
	`N9081EM0E,2018.0831`

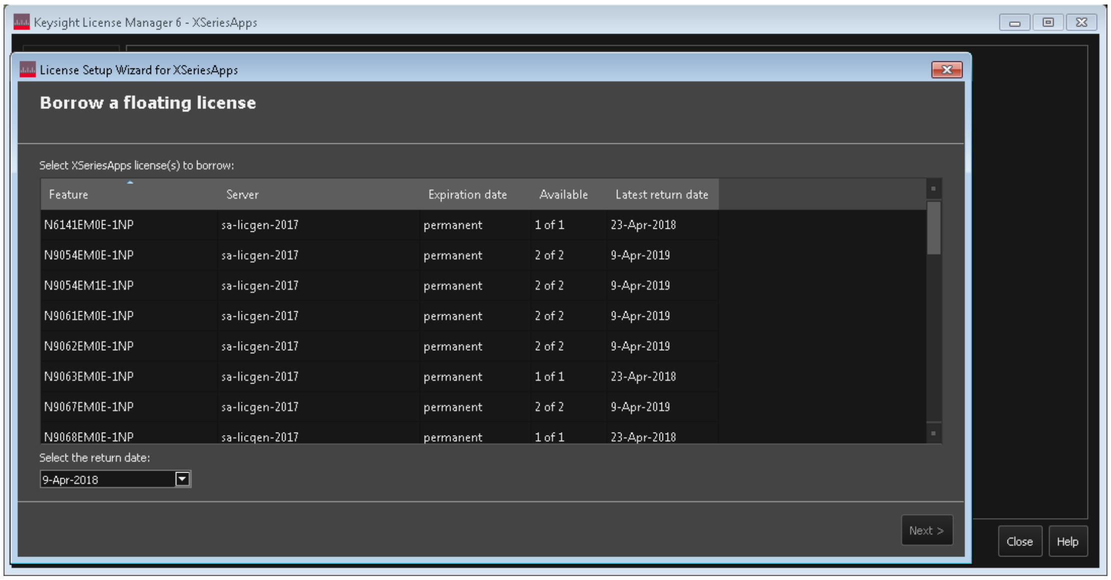
4.9.4.5 Borrowed Network Licenses

Network licenses can be borrowed from the network license server for a time. The maximum amount of time a license can be borrowed is specified in the license installed on the server and is set at the time the license is generated by Keysight. As part of the borrow operation, the user specifies how long to borrow the license. This borrow period is in hours and can be any time up to the maximum allowed by the license. Once borrowed, the license will appear as a local license and can be used even when not connected to the network, and the instrument software will treat them the same as other time-based licenses that are installed on the instrument. This means the licenses are validated when the instrument is started and then are used without the overhead of checking them out and back in when switching modes. At the time of the borrow, a time is specified for how long the license will be borrowed. When that time expires, the license is automatically returned to the network license server even if the instrument is not connected to the network. If the user is done with the license before it automatically returns to the network server, the license can be explicitly returned earlier.

4.9.4.6 Borrow a License

Licenses are borrowed by using the Keysight License Manager 6 application. This can be launched from the **System Licensing** screen.

Graphic



The corresponding remote command is:

Remote Command	:SYSTem:LKEY:BORRow "<feature>[,<version>]",<return date> :SYSTem:LKEY:BORRow? "<feature>[,<version>]"
Example	:SYST:LKEY:BORR "N9080EM0E","20-Aug-2018" :SYST:LKEY:BORR? "N9080EM0E" "20-Aug-2018"
Notes	If <version> is not specified, the highest available version will be borrowed The <return date> is the day when the borrow will automatically be returned to the server
Dependencies	For the command, when <feature> is not a valid license, or when a license is not currently available for borrowing, one of the following errors is issued: – -224,"IllegalParameterValue;License is not installed" – -224,"IllegalParameterValue;Unknown license feature" – -224,"IllegalParameterValue;License not available for borrowing" Additionally, the return date will be evaluated. If it is not a valid date, the following error is issued: – -224,"IllegalParameterValue; Invalid return date"

– -200,"Execution error; No Available Borrow Licenses For Feature: <feature>"

The return date may be clipped to the maximum borrow allowed by the license. When this happens, the following warning is issued:

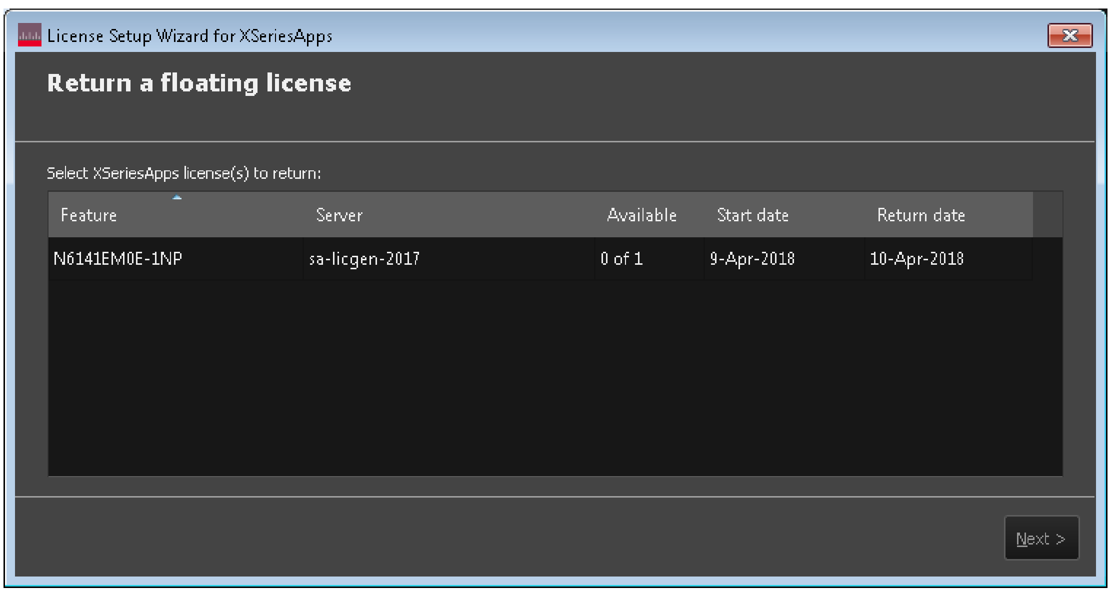
– -221,"Return date clipped to maximum of <max date>"

For the query, the return is the borrow return date (as a string in `dd-mmm-yyyy` format) if the license is borrowed. In all other cases, (not borrowed, not installed, etc.) the return is an empty string

4.9.4.7 Listing Borrowed Licenses and Return a Borrowed License

The Keysight License Manager 6 can also be used to see the currently borrowed licenses or return a license before the automatic return time.

Graphic



List Borrowed Licenses (Remote Command Only)

Remote Command	`:SYSTem:LKEY:BORRow:LIST?`

Example	`:SYST:LKEY:BORR:LIST?`
	`#266`
	`N9073EM0E,2018.0831,20-Aug-2018`
	`N9077EM0E,2018.0831,20-Aug-2018`

Return a Borrowed License (Remote Command Only)

Remote Command	`:SYSTem:LKEY:BORRow:RETurn "<feature>"`
Example	`:SYST:LKEY:BORR:RET "N9080EM0E"`
Dependencies	When `<feature>` is not a valid license or when a license is not borrowed, one of the following errors is issued: – -224,"IllegalParameterValue;License is not installed" – -224,"IllegalParameterValue;Unknown license feature" – -224,"IllegalParameterValue;License not borrowed"

4.9.4.8 Enabling Network Checkouts While Borrowed

The default for borrowed license use is that the user will be explicitly borrowing all desired network licenses, and that all other available network licenses should be ignored. This allows the user to intentionally limit the functionality available to the instrument to what is explicitly borrowed.

For example, the RT1/RT2 options that enable the RTSA mode are automatically checked out when the instrument is started because the hardware must be configured for them at startup time. If the user does not intend to use RTSA, then by borrowing only the licenses they want to use and disabling other network checkouts, the RT1/RT2 licenses will not be checked out at startup. This leave more RTSA licenses available for others to use. Note that the instrument must be restarted after the borrowing has been done to ensure the release of any network licenses already acquired.

If the user's intent in borrowing is to ensure access to a particular feature or application, but still wants to opportunistically use other features or applications, the default behavior can be changed to enable network license checkouts even when licenses have been borrowed.

Remote Command	`:SYSTem:LKEY:BORRow:NETWork:COUT:ENABle`
Example	`:SYST:LKEY:BORR:NETW:COUT:ENAB 0` `:SYST:LKEY:BORR:NETW:COUT:ENAB?`
Dependencies	Control is only visible when licensing is configured to use a network server. SCPI is always available
Preset	This is unaffected by **Preset** but is set to 0 on **Restore Misc Defaults** or **Restore System Defaults->All**
State Saved	Power On Persistent (survives shutdown and restart)

4.9.5 USB Portable Licenses

The USB Portable license is implemented with a physical dongle that is a USB device, like a USB thumb drive. It has a Host ID fixed in the dongle HW. It does not contain any writable data and so is acceptable to high security A/D customers. Transporting licenses from one instrument to another just requires moving the dongle and license files to the desired instrument. The license files can be installed on many instruments, but they will only be valid the one instrument that has the dongle. The use of USB portable licenses requires that the Keysight Floating License Manager is installed on the instrument. The licenses can then be added to the instrument's server.

USB Portable licenses are checked out and in like Network licenses. Because the licenses are local, there will be no network latency involved in the check-out/check-in, but there can still be a slight performance degradation compared to Fixed and Transportable licenses. If the instrument allows multiple concurrent instances of the X-Series software (as is the case for modular products), there may also be availability issues if all licenses are already checked out to other X-Series instances. Plugging/un-plugging the dongle is equivalent to transporting a license to/from the instrument, however, the software must be restarted whenever the dongle is plugged in.

4.9.6 Configuring Network and USB Portable Licenses

The Keysight Floating License Manager must be used to configure the Network or USB Portable licenses before the licenses can be used. Currently, an instrument can only be configured for Network or USB Portable licenses or both.

- To set up USB Portable licenses, in the Keysight Floating License Manager select "Start a floating license server with a license file" and add files containing the USB Portable licenses desired.
- To set up Network licenses, in the Keysight Floating License Manager select "Connect to a floating license server" and enter the network server's name preceded by the "@" character (example: "@myserver").
- To set up both Network and USB Portable license, first configure the USB Portable license, then configure the Network licenses, but append ";@localhost" to the server name (example: "@myserver;@localhost"). Whenever the configuration is changed, the X-Series software must be restarted.

4.9.7 Floating License Manager

Pressing **Floating License Manager** opens the License Explorer for Network and USB Portable licenses.

NOTE: This feature is not available if option SF1 is installed.

For help on licensing, select **Help** in the menu bar at the top of the License Explorer window.

4.9.8 Install License (Remote Command Only)

Used to add a license to the instrument.

An example of such a command would be as below. The parameter is a unique 120 character code for each license.

```
SYST:LKEY “N9073A-
1FP”,”027253AD27F83CDA5673A9BA5F427FDA5E4F25AEB1017638211AC9F60D9C639FE539735909
C551DE0A91”
```

Another example using one of the optional clauses.

```
SYST:LKEY "N9063EM0E-
1FP,2019.0330","02220210867E187713C9AFD4C90EA0DE2B674615DD0255798EE5B237A146A0D4
E411E0ABFE04D3CAFDFA","ISSUED=30-Mar-2018"
```

NOTE: This command will not work for Transportable, Network or USB Portable licenses.

Remote Command	:SYSTem:LKEY <”OptionInfo”>, <”LicenseInfo”>,<”Optional1”>,<”Optional2”>,<”Optional3”>,<”Optional4”>,<”Optional5”>
Notes	<”OptionInfo”> contains the feature and the version. You must specify the feature but can omit the version. If you omit the version, the system regards it as the latest one, since the system knows which version is supported for each feature <”LicenseInfo”> contains the signature, the expiration date, and serial number for transport if transportable. You must specify the signature, but you can omit the other information. If you omit the expiration date, the system regards it as permanent. If you omit the serial number, the system regards it as non-transportable. As a result, this supports reverse compatibility <”Optional#”> are optional parameters that may be needed to match the information in the original license

4.9.9 Remove License (Remote Command Only)

Removes a particular license.

An example of such a command would be as below. The parameter is a unique 120 character code for each license.

```
SYST:LKEY:DEL “N9073A-
1FP”,”027253AD27F83CDA5673A9BA5F427FDA5E4F25AEB1017638211AC9F60D9C639FE539735909
C551DE0A91”
```

NOTE: This command will not work for Transportable, Network or USB Portable licenses.

Remote Command	:SYSTem:LKEY:DELete <”OptionInfo”>,<”LicenseInfo”>
Notes	<”OptionInfo”> contains the feature and the version. You must specify the feature but can omit the

	version. If you omit the version, the system regards it as the latest one, if more than one version is installed `<"LicenseInfo">` contains the signature, the expiration date, and whether or not be transportable. You must specify the signature, but you can omit the other information. If you omit the expiration date, the system regards it as permanent. If you omit the transportability, the system regards it as non-transportable. As a result, this supports reverse compatibility

4.9.10 List Licenses (Remote Command Only)

Returns a list of installed licenses.

Remote Command	`:SYSTem:LKEY:LIST?`

Notes	Return Value:
	An `<arbitrary block data>` of all the installed instrument licenses
	The format of each license is as follows
	`<Feature>,<Version>,<Signature>,<Expiration Date>,<Serial Number for Transport>,…`
	Return Value Example:
	`#3136`
	`N9073A-1FP,1.000,B043920A51CA`
	`N9060A-2FP,1.000,4D1D1164BE64`
	`N9020A-508,1.000,389BC042F920`
	`N9073A-1F1,1.000,5D71E9BA814C,13-aug-2005`
	<arbitrary block data> is:
	`#NMMM<data>`
	Where:
	`N` is the number of digits that describes the number of `MMM` characters. For example if the data was 55 bytes, N would be 2
	`MMM` would be the ASCII representation of the number of bytes. In the previous example, N would be 55
	`<data>` ASCII contents of the data
	Additional fields may appear depending on the type of license (Fixed, Transportable, Network, USB Portable)

4.9.11 Validate License (Remote Command Only)

Allows you to query whether a particular license is currently valid.

Remote Command	`:SYSTem:LKEY? <"OptionInfo">`

Example	`:SYST:LKEY? “N9073A-1FP”`
Notes	`<”OptionInfo”>` contains the feature and the version. You must specify the feature but can omit the version. If you omit the version, the system regards it as the latest one Return Value: `<”LicenseInfo”>` if the license is valid, null otherwise `<”LicenseInfo”>` contains the signature, the expiration date, and serial number if transportable Return Value Example: `“B043920A51CA”`

4.9.12 Host ID Query (Remote Command Only)

Returns the Host ID as a string.

Remote Command	`:SYSTem:HID?`

4.10 Service

Accesses capabilities performed in the factory or under instructions from repair procedures. This menu key is only visible when the logged-in user is "`advanceduser`" or "`saservice`". The first access to the **Service** menu after invoking the instrument application will require an authentication Service Code.

Dependencies	This menu is not available on the M9391A or M9393A or UXM

4.11 System Remote Commands (Remote Commands Only)

These commands have no front-panel key equivalent.

– "List installed Options (Remote Command Only)" on page 2046
– "Lock the Front-panel keys (Remote Command Only)" on page 2046
– "Lock Workstation (Remote Command Only)" on page 2047
– "List SCPI Commands (Remote Command Only)" on page 2049
– "Front Panel activity history (Remote Command only)" on page 2049
– "SCPI activity history (Remote Command only)" on page 2049
– "Instrument start time (Remote Command only)" on page 2050
– "SCPI Version Query (Remote Command Only)" on page 2050
– "Date (Remote Command Only)" on page 2051
– "Time (Remote Command Only)" on page 2051

4.11.1 List installed Options (Remote Command Only)

Lists the installed options that pertain to the instrument (signal analyzer). .

Remote Command	`:SYSTem:OPTions?`
Example	`:SYST:OPT?`
Notes	The return string is a comma separated list of the installed options. For example: `“503,P03,PFR”` `:SYSTem:OPTions?` and `*OPT?` are the same
State Saved	No

4.11.2 Lock the Front-panel keys (Remote Command Only)

Disables the instrument keyboard to prevent local input when the instrument is controlled remotely. Annunciation showing a “K” for ‘Klock” (keyboard lock) alerts the local user that the keyboard is locked. Klock is similar to the GPIB Local Lockout function; namely that no front-panel keys are active with the exception of the Power Standby key. (The instrument is allowed to be turned-off if Klock is `ON`.) The Klock command is used in remote control situations where Local Lockout cannot be used.

Although primary intent of Klock is to lock-out the front panel, it will lock-out externally connected keyboards through USB. Klock has no effect on externally connected pointing devices (mice).

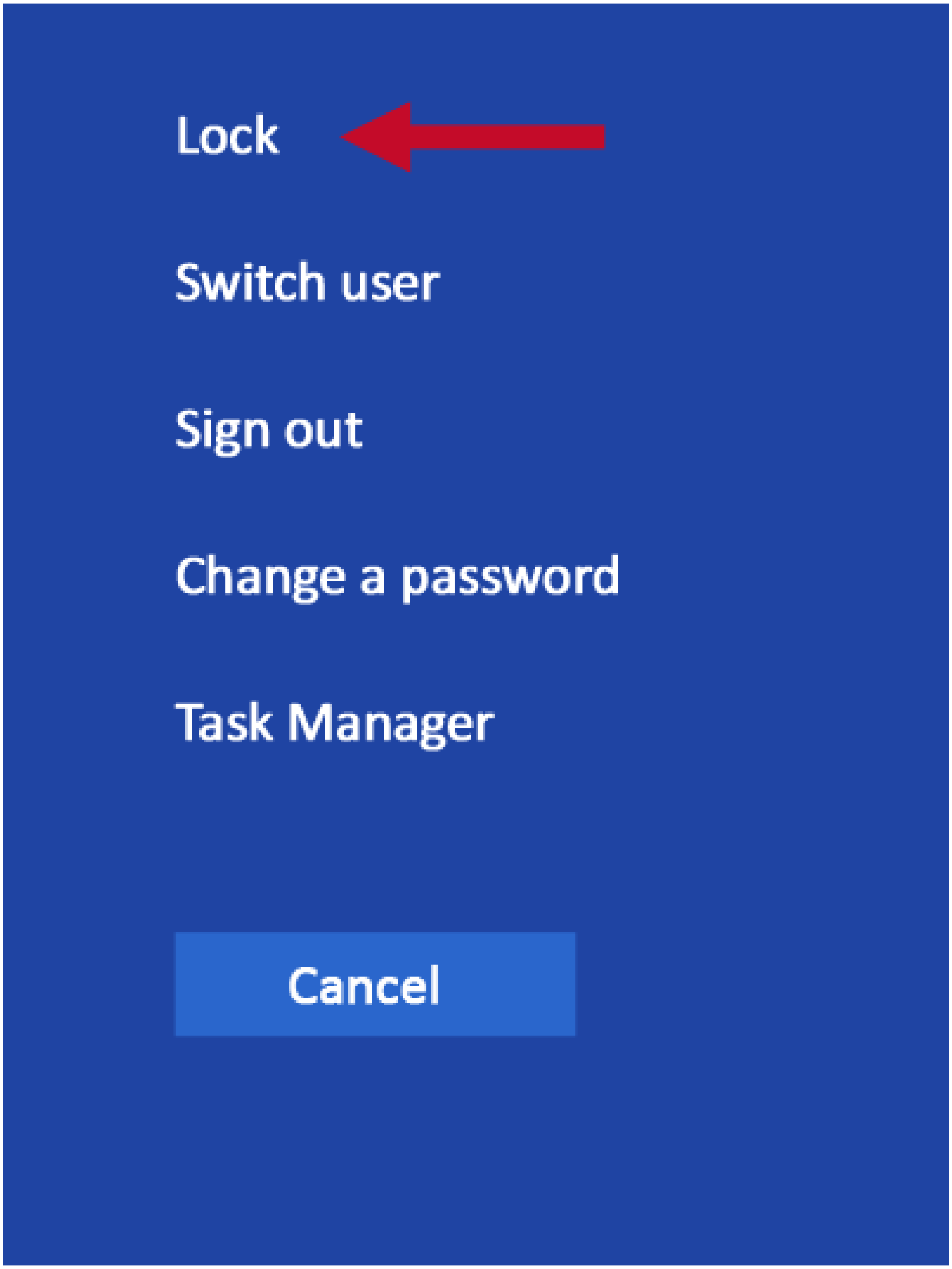
The front panel ‘**Local**’ key (**Cancel**/**Esc**) has no effect if Klock is `ON`.

See also Local Button@5000.

Remote Command	`:SYSTem:KLOCk OFF | ON | 0 | 1` `:SYSTem:KLOCk?`
Example	`:SYST:KLOC ON`
Notes	Keyboard lock remains in effect until turned-off or the instrument is power-cycled
Preset	Initialized to `OFF` at startup, unaffected by **Preset**
State Saved	No

4.11.3 Lock Workstation (Remote Command Only)

Performs the same functionality as the `Win+L` function or the “Lock” function on the `CTL-ALT-DEL` screen in Windows.



As soon as you do this, the computer is locked. The initial login screen appears; no one can access the computer at that point unless they have an account and know the account's password.

If it fails to initiate it puts an error in the Windows event log for SA;

```
"LockWorkStation - Failed to initiate function"
```

See also Local Button@5000.

Remote Command	`:SYSTem:LWSTation`
Example	`:SYST:LWST`
Notes	The lock remains in effect until someone logs in
State Saved	No

4.11.4 List SCPI Commands (Remote Command Only)

Outputs a list of the valid SCPI commands for the currently selected Mode.

Remote Command	`:SYSTem:HELP:HEADers?`
Example	`:SYST:HELP:HEAD?`
Notes	The output is an IEEE Block format with each command separated with the New-Line character (hex `0x0A`)

4.11.5 Front Panel activity history (Remote Command only)

Instrument front panel usage can be monitored by using the query `:SYSTem:METRics:FPANel?`. The monitoring occurs for front panel hardkey or softkey operation (including mouse or touch operation on instruments with Multi-Touch User Interface). The information of the usage pertains to the activity since the instrument application was started; the information does not persist after the application is terminated, or the instrument has been rebooted.

To prevent the front panel from being placed into Remote the monitoring must occur via an I/O protocol such as LAN Socket, or the remote program performing the monitoring must explicitly place the instrument into Local after the query has been performed.

Remote Command	`:SYSTem:METRics:FPANel?`
Example	`:SYST:METR:FPAN?`
Notes	The return value is a string with the format `“YYYY-MM-DD<space>HH:MM:SS”`, in instrument local time If no front panel activity has occurred since the instrument was booted (instrument application started), the return value will be the time the instrument application started. The instrument application start time can be obtained with the query `:SYSTem:METRics:STIMe?`

4.11.6 SCPI activity history (Remote Command only)

Instrument remote operation usage via SCPI can be monitored by using the query `:SYSTem:METRics:SCPI?`. The monitoring occurs for SCPI control from any I/O channel (GPIB, USB, or LAN). The information of the usage pertains to the activity since the instrument application was started; the information does not persist after the application is terminated, or the instrument has been rebooted.

Remote Command	`:SYSTem:METRics:SCPI?`
Example	`:SYST:METR:SCPI?`
Notes	The return value is a string with the format "YYYY-MM-DD<space>HH:MM:SS", in instrument local time The following commands are excluded from the history accounting: – `*IDN?` – `*OPT?` – `:SYSTem:DATE?` – `:SYSTem:TIME?` – `:SYSTem:PON:TIME?` – Queries in the `:SYSTem:ERRor` subsystem – Queries in the `:SYSTem:LKEY` subsystem – Queries in the `:SYSTem:METRics` subsystem – Queries in the `:SYSTem:MODule` subsystem If no SCPI activity has occurred since the instrument was booted (instrument application started), the return value will be the time the instrument application started. The instrument application start time can be obtained with the query `:SYSTem:METRics:STIMe?`

4.11.7 Instrument start time (Remote Command only)

To determine if instrument activity has occurred, `:SYSTem:METRics:STIMe?` can be used to determine the instrument application start time.

Remote Command	`:SYSTem:METRics:STIMe?`
Example	`:SYST:METR:STIM?`
Notes	The return value is a string with the format "YYYY-MM-DD<space>HH:MM:SS", in instrument local time

4.11.8 SCPI Version Query (Remote Command Only)

Returns the SCPI version number with which the instrument complies. The SCPI industry standard changes regularly. This command indicates the version used when the instrument SCPI commands were defined.

Remote Command	`:SYSTem:VERSion?`
Example	`:SYST:VERS?`

4.11.9 Date (Remote Command Only)

The recommended access to the Date, Time, and Time zone of the instrument is through the Windows native control (Control Panel or accessing the Task Bar). You may also access this information remotely, as shown in this command and Time (below).

Sets or queries the date in the instrument.

Remote Command	`:SYSTem:DATE "<year>,<month>,<day>"` `:SYSTem:DATE?`
Example	`:SYST:DATE "2006,05,26"`
Notes	`<year>` is the four digit representation of year (for example, 2006) `<month>` is the two digit representation of year (01 to 12) `<day>` is the two digit representation of day (01 to 28, 29, 30, or 31, depending on the month and year) Unless the current account has Power User or Administrator privileges, an error will be generated by this command and no action will be taken

4.11.10 Time (Remote Command Only)

Sets or queries the time in the instrument.

Remote Command	`:SYSTem:TIME "<hour>,<minute>,<second>"` `:SYSTem:TIME?`
Example	`:SYST:TIME "13,05,26"`
Notes	`<hour>` is the two digit representation of the hour in 24 hour format `<minute>` is the two digit representation of minute `<second>` is the two digit representation of second Unless the current account has Power User or Administrator privileges, an error will be generated by this command and no action will be taken

The Mode column of the Mode/Meas dialog shall display all the modes that are installed and licensed on the instrument Selections will not be visible for unlicensed applications that are installed in the instrument (resident on the hard disk). This is consistent with the UI Design Guide which states that the UI should not be used to advertise capability that could be available if the customer pays for the capability.

5 Preset

The Preset functions are available in two ways; either by pressing the **Mode Preset** or **User Preset** front panel keys, or from the Preset dropdown menu that appears when you press the green Preset icon in the upper right corner of the display.

Types of Preset

The table below shows all possible presets, their corresponding SCPI commands and front-panel access methods.

Instrument settings are tiered in scope from those local to the current measurement to those global to all measurements and modes. There are presets tailored to each scope. The table identifies the scope of each preset type.

NOTE To get a Mode back to a fully predefined state, you should execute a Restore Mode Defaults and an Input/Output Preset, but since Input/Output Preset is a global function it will affect ALL modes.

Type Of Preset	SCPI Command	Scope of Preset	Front Panel Access
Auto Couple	`:COUPle ALL`	Local to the current measurement, only affects Auto/Man variables	Meas Setup Menu
Meas Preset	`:CONFigure:<meas>`	Local to the current measurement Does not preset the RF Source	Meas Setup Menu
Mode Preset	`:SYSTem:PRESet`	Local to the current mode, global to all measurements in the mode, affects most but not all parameters in the mode, does not affect Input/Output or System variables Presets the RF Source	Mode Preset (green key) and Preset Dropdown
Restore Mode Defaults	`:INSTrument:DEFault`	Local to the current mode, global to all measurements in the mode, affects all parameters in the mode but does not affect Input/Output or System variables, does not preset the RF Source.	Preset Dropdown
Restore Defaults All Modes	`:SYSTem:DEFault MODes`	Affects all parameters in ALL modes but does not affect Input/Output or	Preset Dropdown

Type Of Preset	SCPI Command	Scope of Preset	Front Panel Access
		System variables Presets the RF Source	
Restore Screen Defaults	`:SYSTem:DEFault SCReen`	Deletes all Screens but one, restores that screen to its default mode and performs a Mode Preset for that mode. Does not affect Input/Output or System variables Presets the RF Source	Preset Dropdown
User Preset	`:SYSTem:PRESet:USER`	Local to the current mode, global to all measurements in the mode, affects all parameters in the mode as well as the Input/Output variables Does not affect System variables	User Preset hardkey and Preset Dropdown
User Preset All Modes	`:SYSTem:PRESet:USER:ALL`	Same as User Preset but affects all Modes in the current Screen	Preset Dropdown
User Preset All Screens		Affects the entire Screen Configuration; global to all Modes and Screens	Preset Dropdown
*RST	`*RST`	Same as Mode Preset - and in addition always sets Single/Cont to Single	Not available from front panel
Input/Output Preset	`:SYSTem:DEFault INPut`	Affects all Input/Output variables	Input/Output menu, Preset dropdown, and

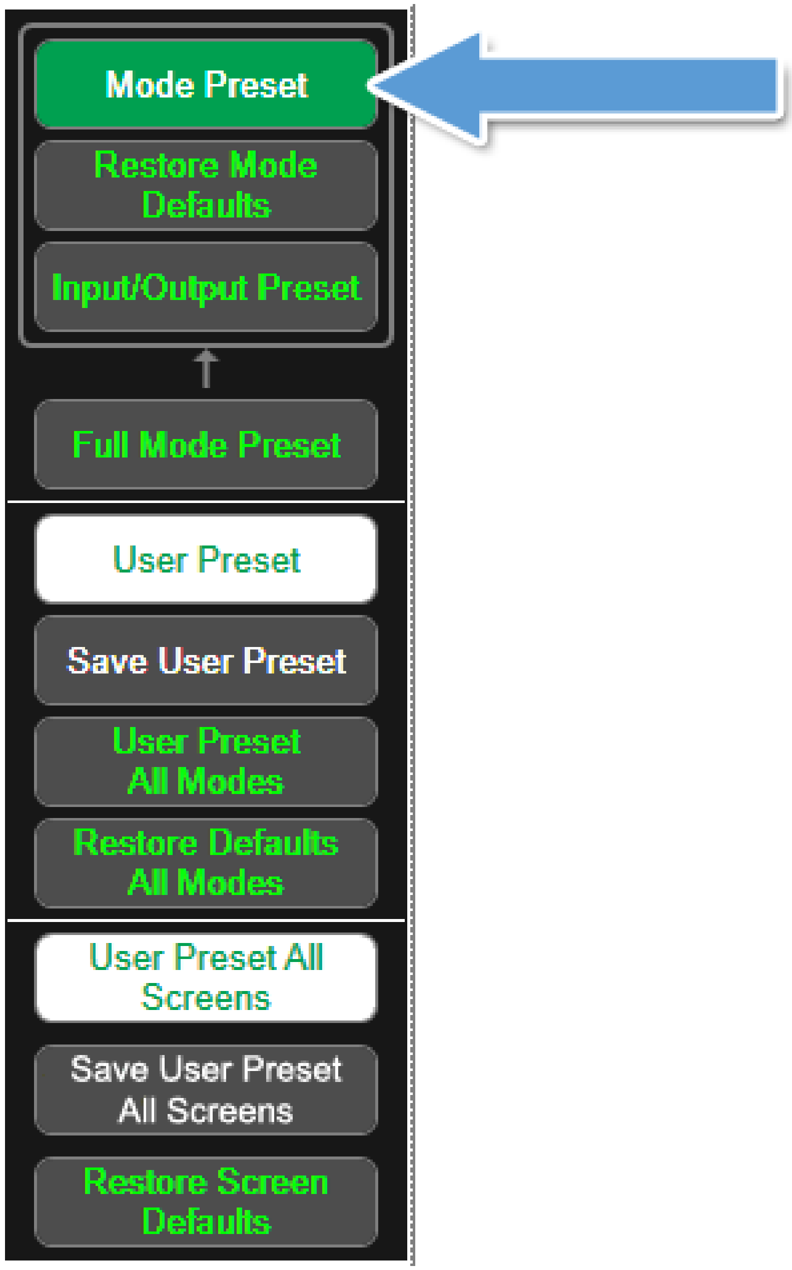
Type Of Preset	SCPI Command	Scope of Preset	Front Panel Access
		Does not preset the RF Source	System Menu, Restore Defaults
Full Mode Preset	`:SYSTem:PRESet:FULL`	Same as doing Mode Preset, Restore Mode Defaults and Input/Output Preset. Essentially a factory preset of the current Mode Presets the RF Source	Preset Dropdown
Restore User Interface Defaults	`:SYSTem:DEFault UINTerface`	Affects all variables in the "User Interface" group Does not preset the RF Source	System Menu, Restore Defaults and User Interface tabs
Restore Power On Defaults	`:SYSTem:DEFault PON`	Affects all variables in the "Power On" group Presets the RF Source	System Menu: Restore Defaults and Power On tabs
Restore Alignment Defaults	`:SYSTem:DEFault ALIGn`	Affects all variables in the "Alignments" group Presets the RF Source	System Menu, Restore Defaults and Alignments tabs
Restore Miscellaneous Defaults	`:SYSTem:DEFault MISC`	Affects various variables not reset by other commands Presets the RF Source	System Menu, Restore Defaults
Restore All Defaults	`:SYSTem:DEFault [ALL]` `:SYSTem:PRESet:PERSistent`	Affects all variables Presets the RF Source	System Menu, Restore Defaults

5.1 Mode Preset

Returns the current Mode to a known state. Mode Preset only presets the current Screen, it does not affect any other Screens.

Mode Preset also presets the RF Source. In this sense it is equivalent to pressing **Source Preset** on the **Input/Output, RF Source** menu panel.

Mode Preset can be executed from the Preset dropdown or by pressing the **Mode Preset** front panel key.



Mode Preset does the following for the currently active mode:

- Aborts the currently running measurement.
- Switches to the default measurement and brings up the default menu for that measurement.
- Sets most parameters for the Mode and all of its Measurements to a preset state.
- Clears the input and output buffers.
- Sets Status Byte to 0.

Mode Preset does not cause a Mode switch or affect any Input/Output or System settings (those set in the System Settings dialog).

Furthermore, there are some Mode settings that are unaffected by a Mode Preset (for example, Noise Floor Extensions, Limit Line data, reference marker numbers, etc.) These are only reset by Restore Mode Defaults, and in each parameter's definition table there is a note that indicates whether it is reset on a Mode Preset or on a Restore Mode Defaults.

See "Preset" on page 2052 for more information.

Remote Command	`:SYSTem:PRESet`
Example	`:SYST:PRES`
Notes	`*RST` is preferred over `:SYST:PRES` for remote operation. `*RST` does a Mode Preset, as done by the `:SYST:PRES` command, and it sets the measurement mode to **Single** measurement rather than **Continuous**, for optimal remote control throughput See "*RST - Reset" on page 2590
Status Bits/OPC dependencies	Clears all pending OPC bits. The Status Byte is set to 0
Backwards Compatibility Notes	In the X-Series, the legacy "Factory Preset" has been replaced with Mode Preset, which only presets the currently active mode, not the entire instrument. In the X-Series, the way to preset the entire instrument is by using System, Restore System Defaults All, which behaves essentially the same way as restore System Defaults does on ESA and PSA There is also no "Preset Type" as there is on the PSA. There is a green Mode Preset front-panel key that does a Mode Preset and a white-with-green-letters User Preset front-panel key that does a User Preset. The old PRESet:TYPE command is ignored (without generating an error), and SYST:PRES without a parameter does a Mode Preset, which should cover most backward code compatibility issues The settings and correction data under the Input/Output front-panel key (examples: Input Z Corr, Ext Amp Gain, etc.) are no longer part of any Mode, so they will not be preset by a Mode Preset. They are preset using Restore Input/Output Defaults, Restore System Defaults All. Note that because User Preset does a Recall State, and all of these settings are saved in State, they *are* recalled when using User Preset

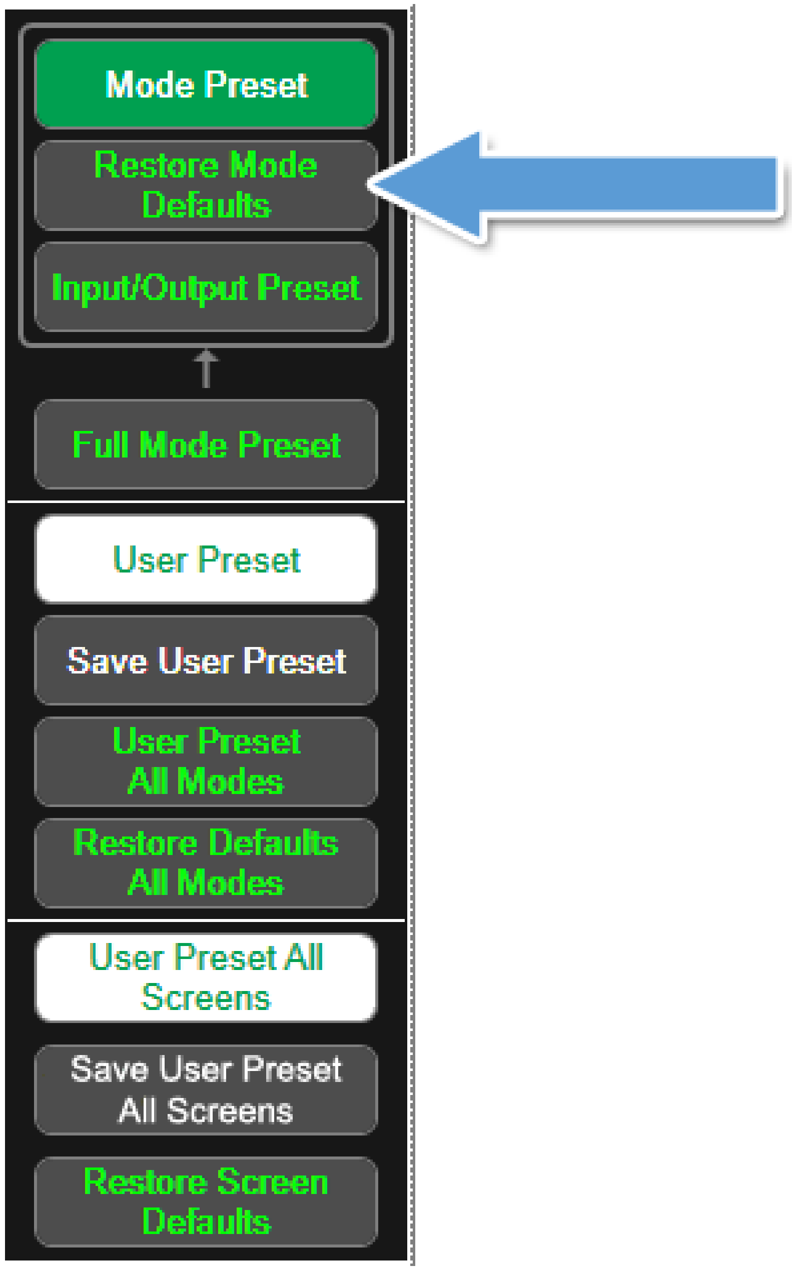
5.2 Restore Mode Defaults

Most settings within a mode are affected by Mode Preset, but there are some Mode settings that are unaffected by a Mode Preset (for example, Noise Floor Extensions, Limit Line data, reference marker numbers, etc.) **Restore Mode Defaults** resets all of these additional settings as well as all of the Mode Preset settings, *except* the RF Source.

In each parameter's definition table, there is a note that indicates whether that parameter is reset on **Mode Preset** or on **Restore Mode Defaults**.

Note that a Recall State affects all of a Mode's settings, both the Mode Preset settings and the ones additionally affected by Restore Mode Defaults.

Restore Mode Defaults can be executed from the Preset dropdown.



When **Restore Mode Defaults** is selected, a message appears saying

`This will reset all of the current Mode’s variables to their default state. This action cannot be undone. Do you want to proceed?`

The message provides **OK** and **Cancel** buttons, to let you affirm or cancel the reset operation.

Remote Command	`:INSTrument:DEFault`
Example	`:INST:DEF`
Notes	Clears all pending OPC bits. The Status Byte is set to 0

Couplings	Restore Mode Defaults causes the currently running measurement to be aborted and causes the default measurement to be active. It gets the mode to a consistent state with all of the default couplings set

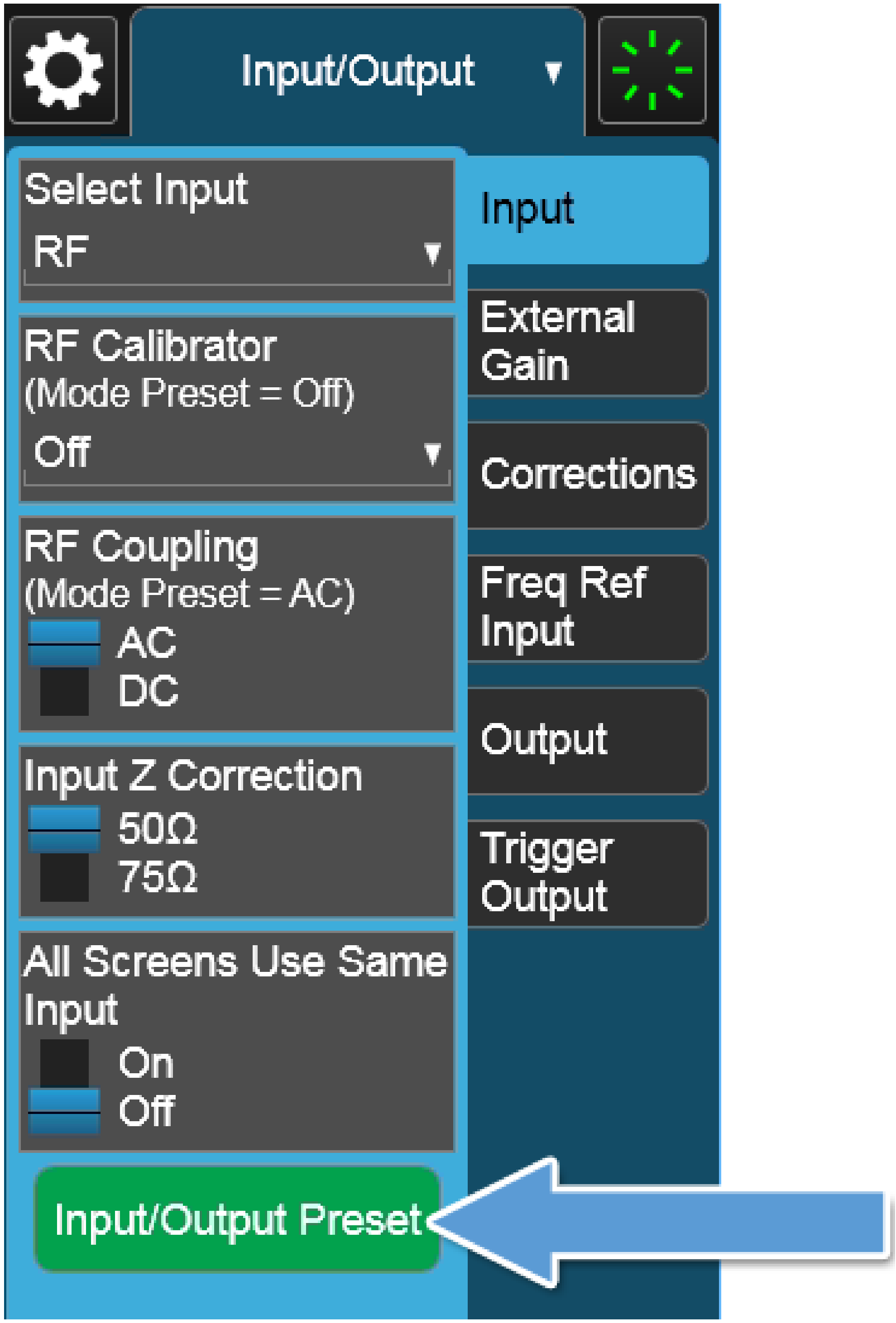
5.3 Input/Output Preset

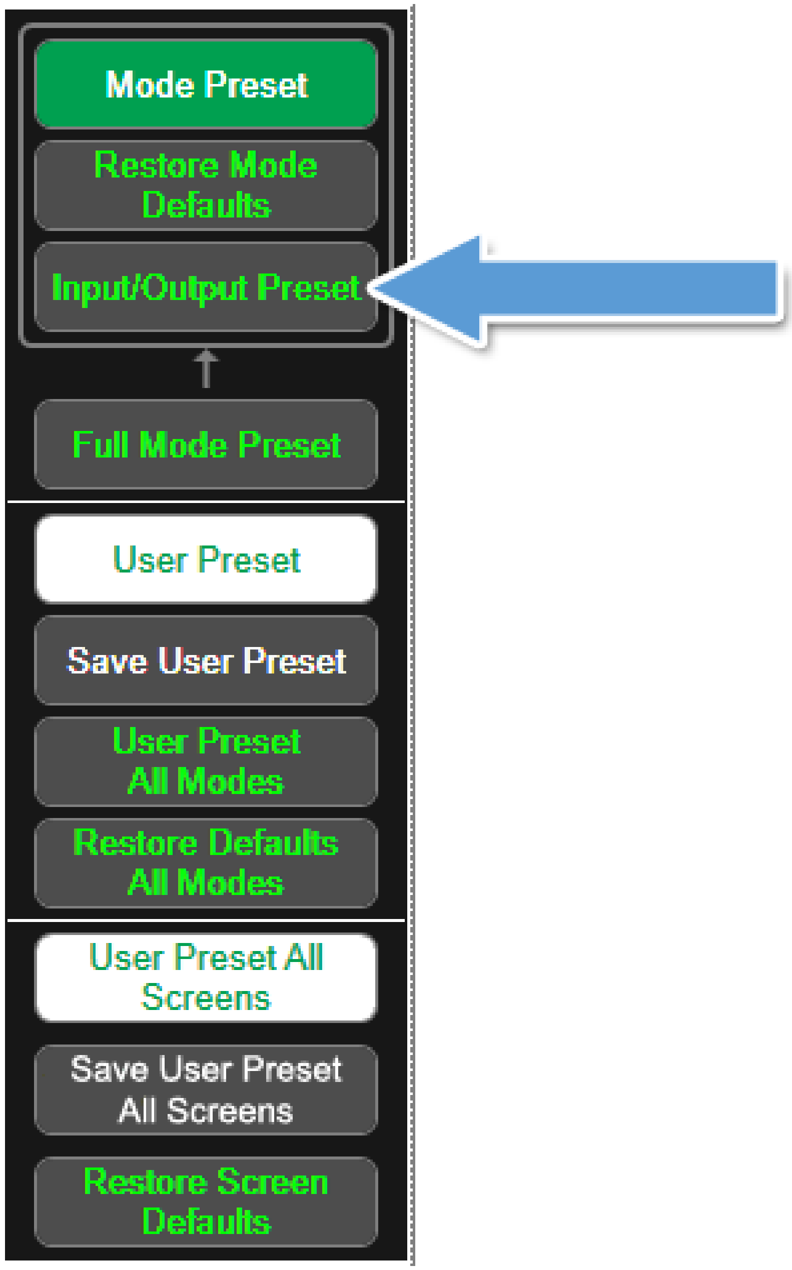
Input/Output Preset resets the group of settings and data associated with the Input/Output front-panel key to their default values. These settings are not affected by a Mode Preset because they are generally associated with connections to the instrument, and most users would not want these resetting every time they pressed the Mode Preset key.

All the variables set under the Input/Output front panel key are reset by Input/Output Preset, including Amplitude Corrections and Data (described in the Corrections section), with the exception of RF Source settings, which are unaffected.

By using Input/Output Preset and Restore Mode Defaults, a full preset of the current mode will be performed, with the caveat that since Input/Output Preset is a global function it will affect ALL modes.

Input/Output Preset can be executed from the Input/Output menu, from the Preset dropdown, or from the Restore Defaults menu under the System key.


Input/Output
Select Input
RF
Input
RF Calibrator
(Mode Preset = Off)
Off
External Gain
Corrections
RF Coupling
(Mode Preset = AC)
AC
DC
Freq Ref Input
Output
Input Z Correction
50Ω
75Ω
Trigger Output
All Screens Use Same Input
On
Off
Input/Output Preset


Mode Preset
Restore Mode Defaults
Input/Output Preset
Full Mode Preset
User Preset
Save User Preset
User Preset All Modes
Restore Defaults All Modes
User Preset All Screens
Save User Preset All Screens
Restore Screen Defaults

When Input/Output Preset is selected, a message appears saying:

“This will reset all of the Input/Output variables to their default state, including which input is selected, all Amplitude Correction settings and data, all External Mixing settings, all Frequency Reference settings and all Output settings.

It will not affect Alignment data or settings.

It will not affect RF Source settings.

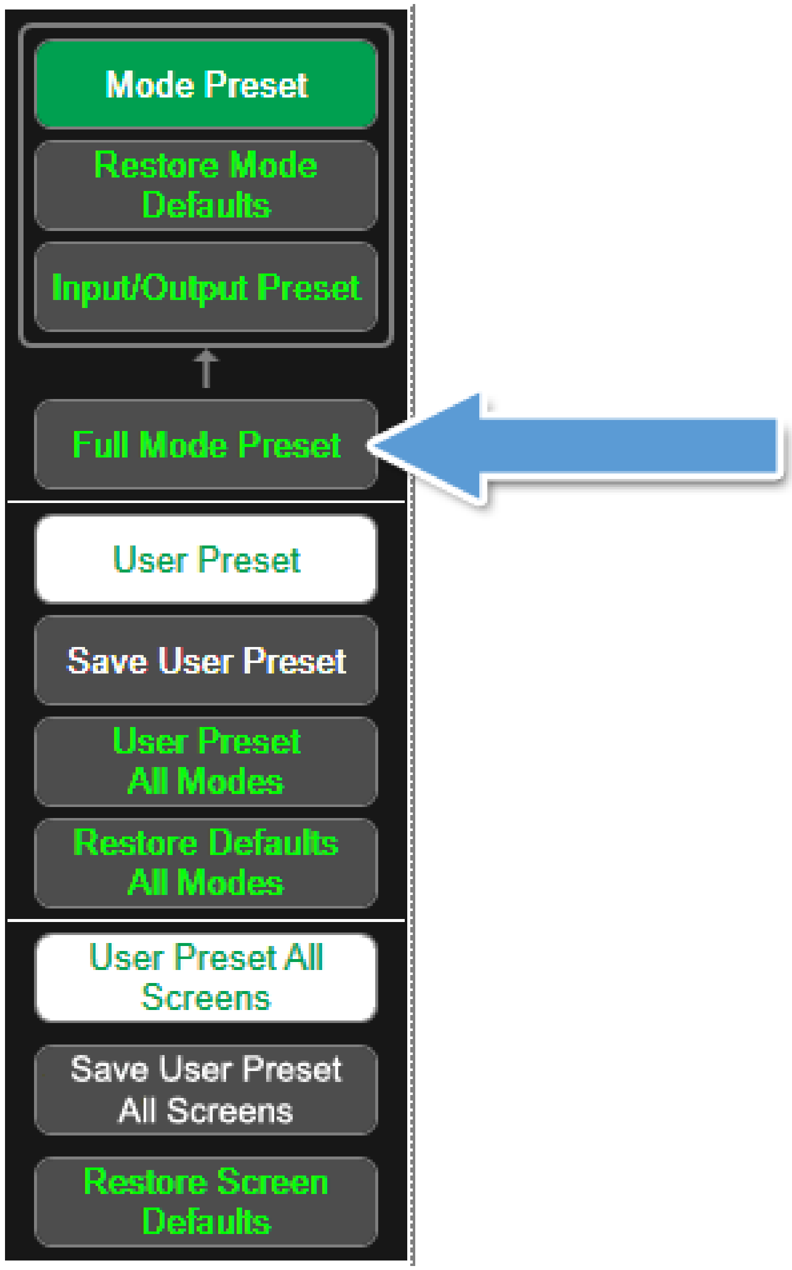
This action cannot be undone. Do you want to proceed?”

The message provides **OK** and **Cancel** buttons, to let you affirm or cancel the operation.

Example	`:SYST:DEF INP` Presets all the Input/Output variables to their factory default values

5.4 Full Mode Preset

Same as doing Mode Preset, Restore Mode Defaults and Input/Output Preset. Essentially a factory preset of the current Mode.



When Full Mode Preset is selected, a message appears saying:

"This will reset all of the current Mode's variables and all of the Input/Output variables to their default state, including Input and Output selection and settings, Amplitude Correction, Frequency Reference and RF Source settings.

It will not affect Alignment data or settings.

This action cannot be undone. Do you want to proceed?”

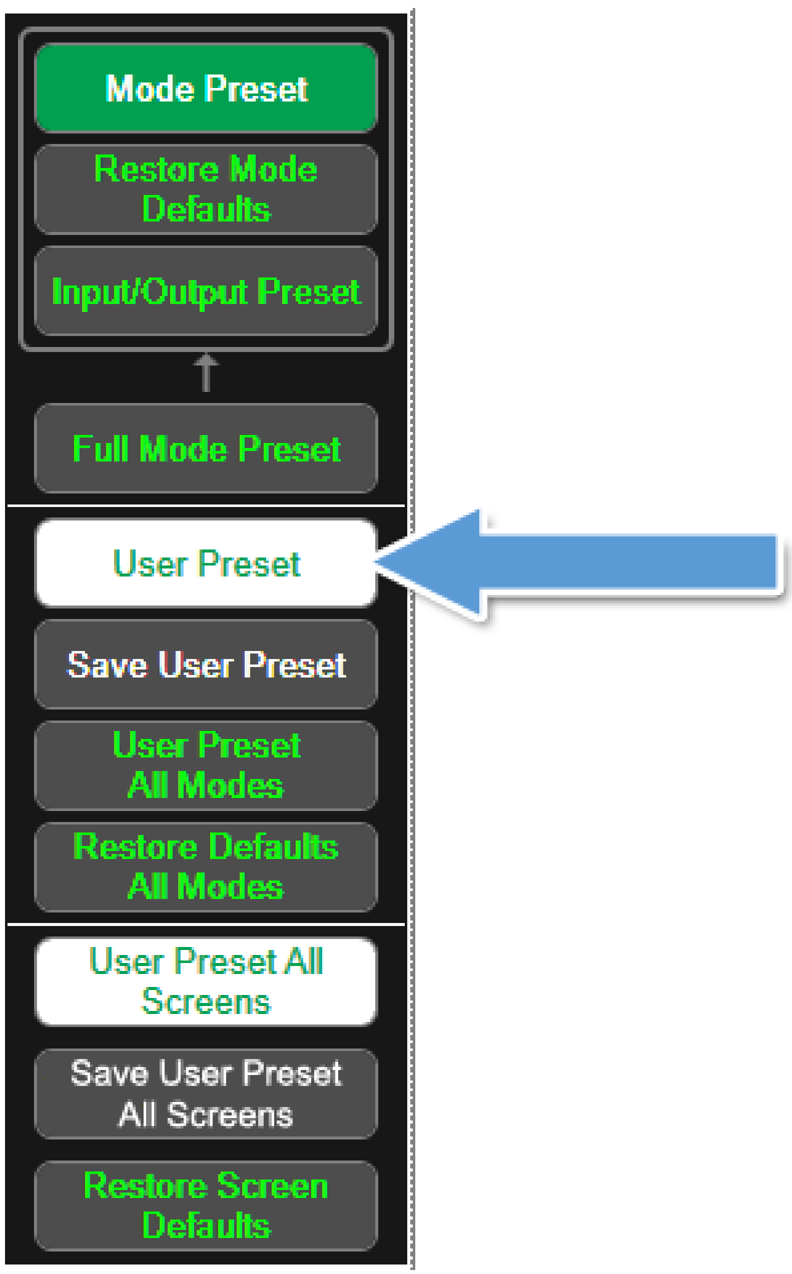
The message provides **OK** and **Cancel** buttons, to let you affirm or cancel the operation.

Remote Command	`:SYSTem:PRESet:FULL`
Example	`:SYST:PRES:FULL`
Status Bits/OPC dependencies	Clears all pending OPC bits. The Status Byte is set to 0

5.5 User Preset

User Preset recalls a state previously saved using the **Save User Preset** function. You can save a User Preset state for each Mode, allowing you to define your own favorite state for each Mode and recall it at the touch of a single button.

User Preset can be executed by pressing the **User Preset** front panel key or from the Preset dropdown.



Because User Preset is actually a Recall State, rather than a predefined Preset, it works a little differently than Mode Preset, in that it affects all of the variables that normally only reset on Restore Mode Defaults, and it affects the Input/Output variables, because both of these are included in State files.

A default User Preset file is provided for each Mode, which simply matches the current Mode's state after a Restore Mode Defaults and Input/Output Preset has been performed.

NOTE **In products that run multiple instances of the X-Series Application, all instances use the same location to save User Preset state. So Save User Preset of one instance will overwrite the Save User Preset of another instance.**

Remote Command	`:SYSTem:PRESet:USER`

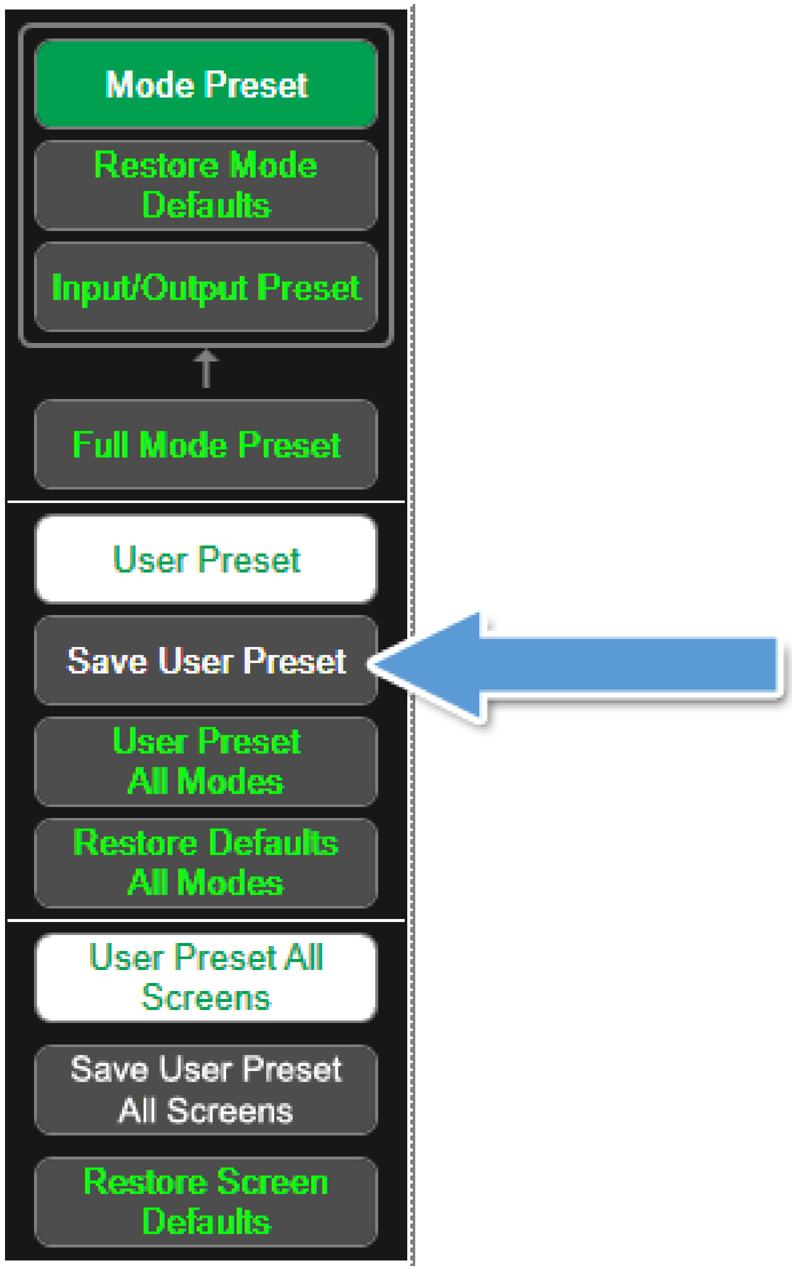
Example	`:SYST:PRES:USER:SAVE`
	Save the User Preset
	`:SYST:PRES:USER`
	Recall the User Preset

Notes	`:SYST:PRES:USER:SAVE` is used to save the current state as the user preset state If loading a User Preset file from a different instrument, some settings may be limited and/or coupled differently, since the capabilities of the mode may have changed from when the User Preset file was saved
Status Bits/OPC dependencies	Clears all pending OPC bits. The Status Byte is set to 0
Backwards Compatibility Notes	In the X-Series A-models, the **User Preset** hardkey opened a menu that let you select from User Preset, Save User Preset, or User Preset All Modes. In the B-models, the **User Preset** hardkey immediately performs a User Preset, and the aforementioned menu is found under the Preset dropdown User Preset actually loads a state, and in legacy analyzers, it was possible to load a state without affecting the trace data, limit lines or correction data. Similarly it was possible to do a User Preset without affecting the trace data, limit lines or correction data In the X-Series, "state" always includes all of this data; so whenever state is loaded, or User Preset is executed, all of the traces, limit lines and corrections are affected. Although this differs from previous behavior, it is desirable behavior, and should not cause adverse issues for users On ESA and PSA, User Preset affected the entire instrument's state. In the X-Series, User Preset only recalls the state for the active mode. There is a User Preset file for each mode. User Preset can never cause a mode switch as it can in legacy analyzers. If you want to recall all modes to their user preset file state, you will need to do a User Preset *after* mode switching into each mode User Preset recalls mode state, which can now include data like traces, whereas on ESA and PSA, User Preset did not affect data

5.6 Save User Preset

Saves the state of the currently active mode in a unique location for recall by the User Preset key. Each Mode has one such location, so for each Mode one User Preset can be defined.

Save User Preset can be executed from the Preset dropdown.



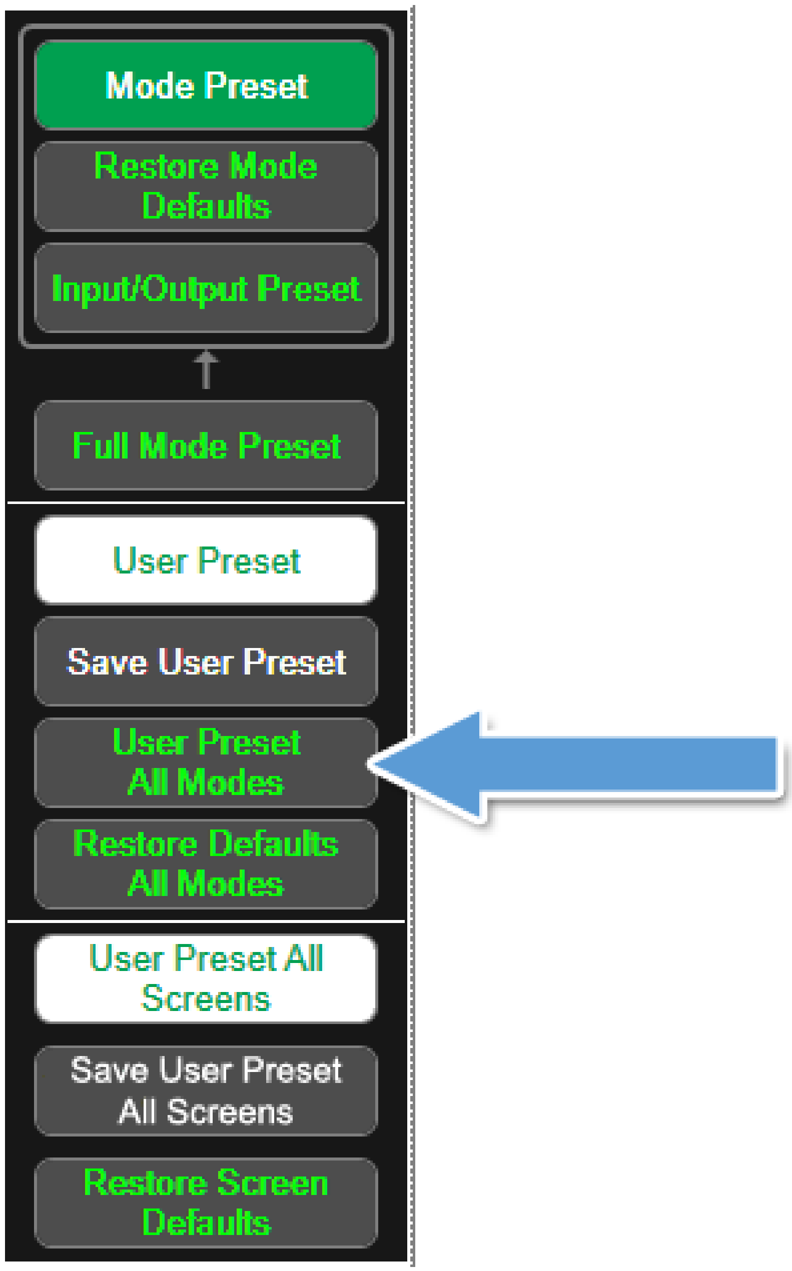
All of the Mode variables are saved, including those reset by Mode Preset and those only reset by Restore Mode Defaults, as well as all of the Input/Output variables, so when you subsequently press the **User Preset** key, the instrument returns to the exact same setup that existed when you pressed the **Save User Preset** control. Thus, User Preset is a preset of larger scope than Mode Preset.

Remote Command	`:SYSTem:PRESet:USER:SAVE`
Example	`:SYST:PRES:USER:SAVE`
Notes	`:SYST:PRES:SAVE` creates the same file as if you requested a `*SAV` or a `:MMEM: STOR:STAT`, except that User Preset Save does not allow you to specify the filename or the location of the file

5.7 User Preset All Modes

User Preset All Modes recalls all of the User Preset files for each mode, switches to the power-on mode, and activates the saved measurement from the power-on mode User Preset file.

User Preset All Modes can be executed from the Preset dropdown.



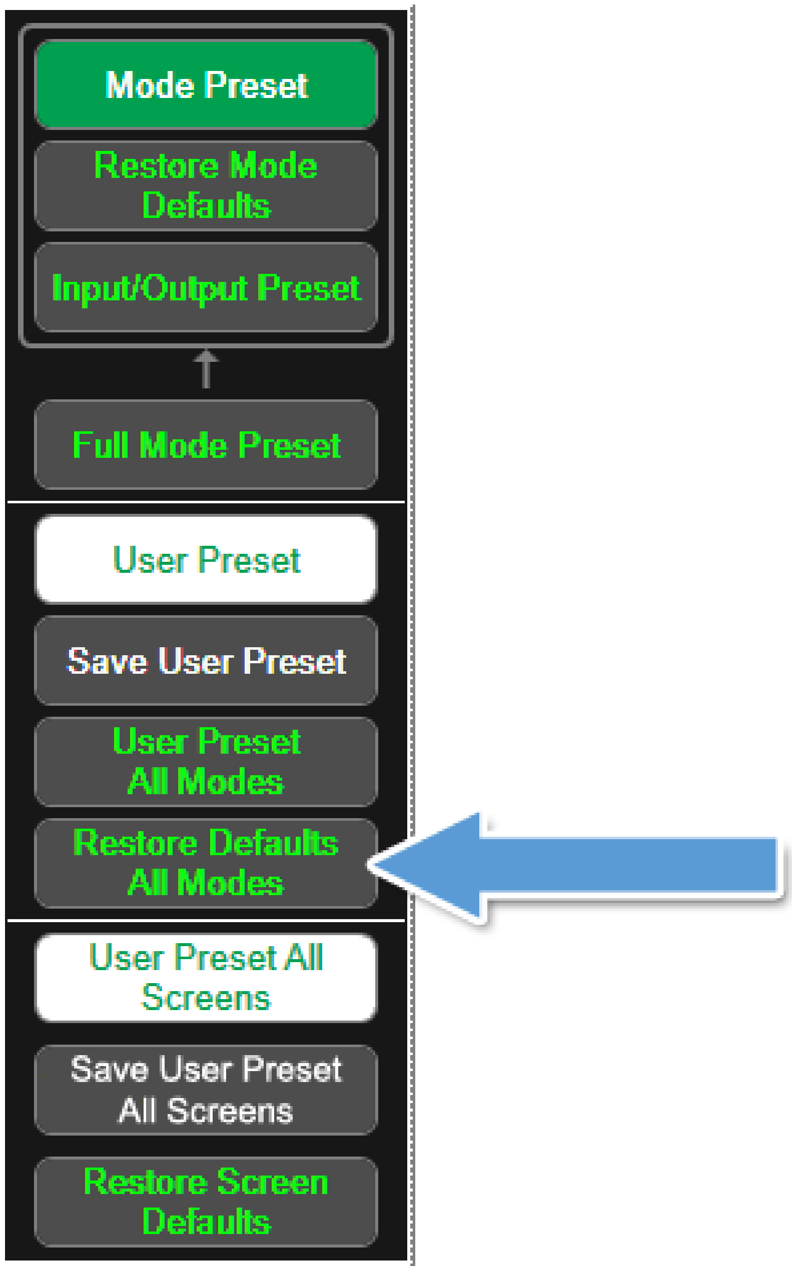
See the "User Preset" on page 2069 description for more details on User Preset.

Remote Command	`:SYSTem:PRESet:USER:ALL`
Example	`:SYST:PRES:USER:SAVE` `:SYST:PRES:USER:ALL`
Notes	`:SYST:PRES:USER:SAVE` is used to save the current state as the user preset state
Status Bits/OPC dependencies	Clears all pending OPC bits. The Status Byte is set to 0

5.8 Restore Defaults All Modes

This selection resets all of the Modes in the current Screen back to their default state just as a Restore Mode Defaults does, switches the current Screen to the power-on mode, and causes the default measurement for the Power On Mode to be active in the current Screen. Only the current Screen is affected.

Restore Defaults All Modes can be executed from the Preset dropdown.



When Restore Defaults All Modes is selected, a message appears saying:

"This will reset all of the variables for all of the Modes in the current Screen to their default state. This action cannot be undone. Do you want to proceed?"

The message provides **OK** and **Cancel** buttons.

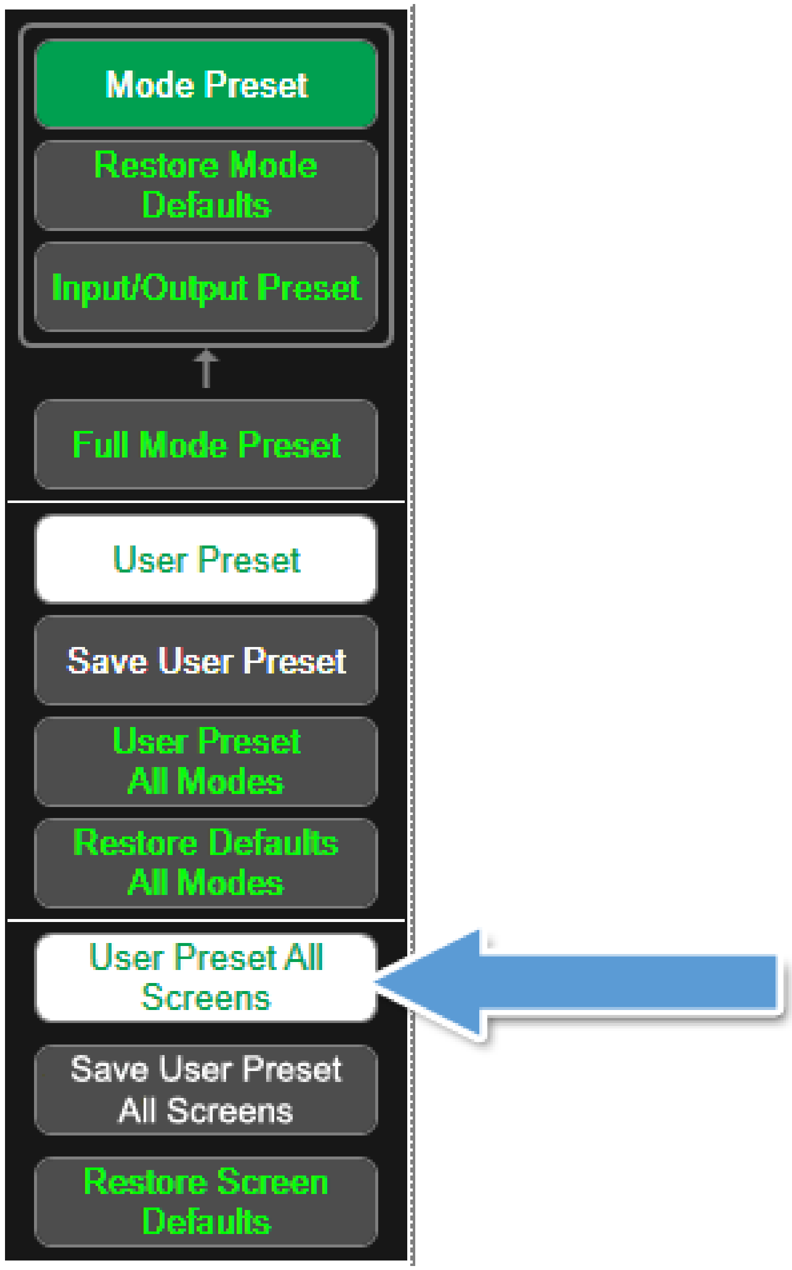
Example	`:SYST:DEF MOD`
Couplings	Causes the currently running measurement to be aborted, a mode switch to the power-on mode, and activates the default measurement for the power-on mode

5.9 User Preset All Screens

User Preset All Screens recalls a screen configuration previously saved using the Save User Preset All Screens function. The complete configuration of all your Screens is loaded, including the state of each Screen.

Because User Preset All Screens performs a Recall State as part of its function, it affects all of the variables that normally only reset on Restore Mode Defaults, and it affects the Input/Output variables, because both of these are included in State files.

Note that recalling a screen configuration in this manner will wipe out your current screen configuration and all states of all Screens.

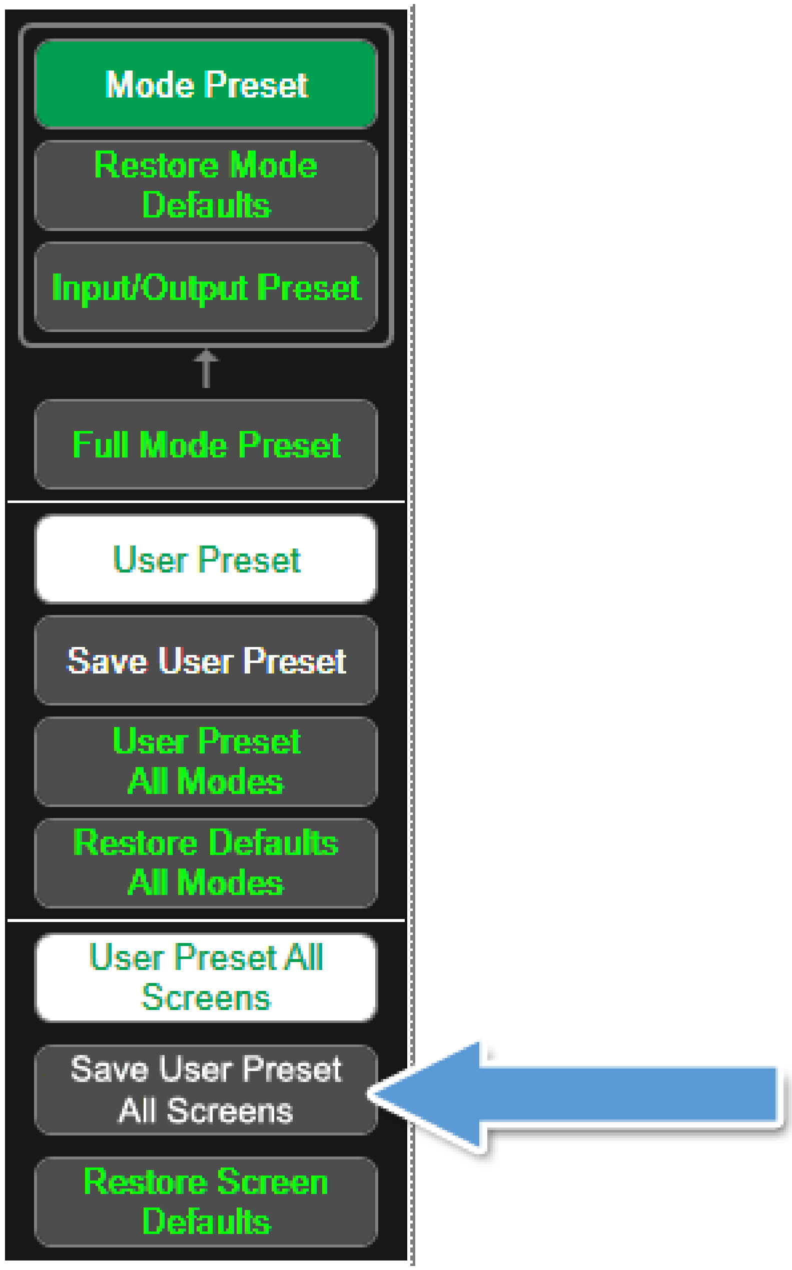


Notes	"Save User Preset All Screens" on page 2079 is used to save the current screen configuration as the "user preset all screens" configuration If loading a User Preset All Screens file from a different instrument, some settings may be limited and/or coupled differently, since the capabilities of the mode may have changed from when the User Preset All Screens file was saved
Status Bits/OPC dependencies	Clears all pending OPC bits The Status Byte is set to 0

5.10 Save User Preset All Screens

Saves the current Screen Configuration in a unique location for recall by the **User Preset All Screens** key.

Save User Preset All Screens can be executed from the Preset dropdown.



Besides the screen configuration, *all* of the Mode variables of all Screens are saved, including those reset by Mode Preset and those only reset by Restore Mode Defaults, as well as all of the Input/Output variables, so when you subsequently press the User

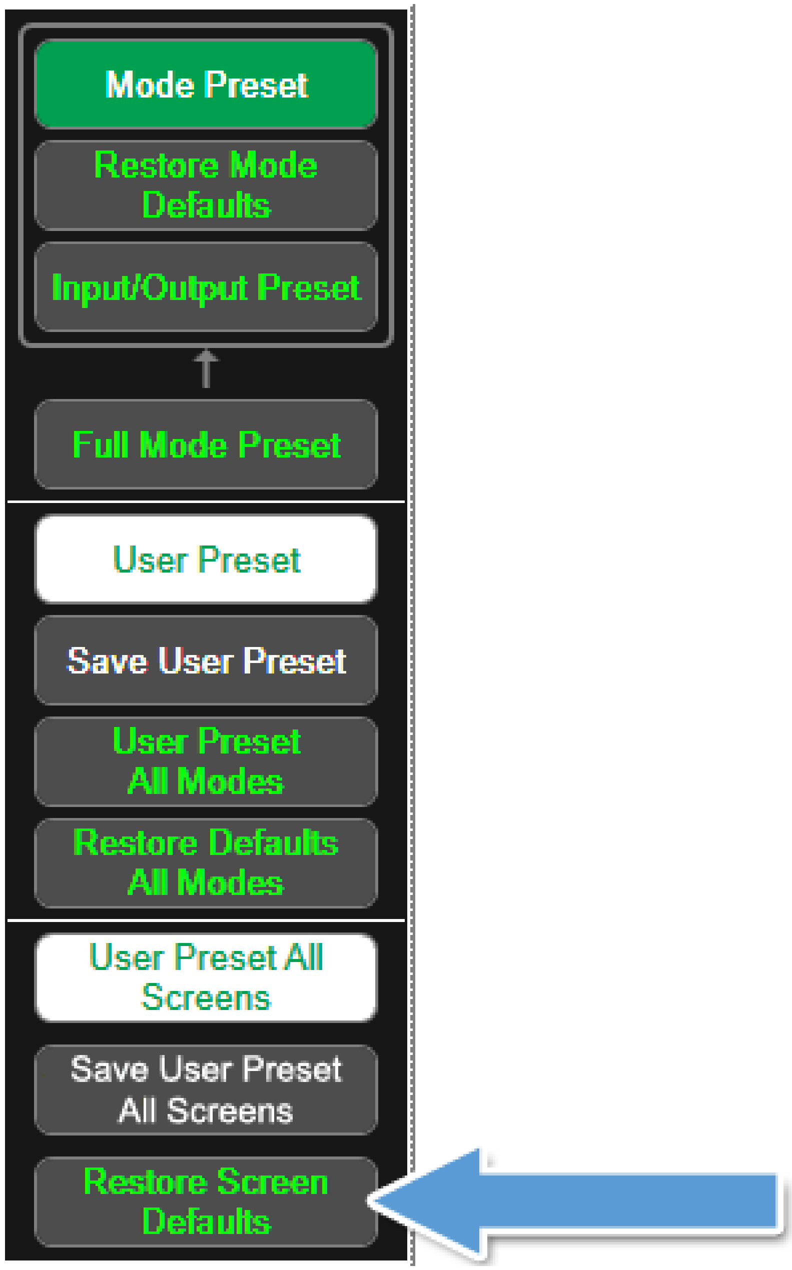
Preset All Screens key, the instrument returns to the exact Screen setup that existed when you pressed the Save User Preset All Screens control.

Notes	Creates the same file as if you requested a Screen Config + State save, except that **Save User Preset All Screens** does not allow you to specify the filename or the location of the file

5.11 Restore Screen Defaults

This selection resets the Screen configuration to the factory default; deleting all screens, all screen names, all screen states, and setting Multi-Screen to Off. A single screen will remain, set to the power-on Mode in a preset state with the default screen name.

Restore Screen Defaults can be executed from the Preset dropdown.



When Restore Screen Defaults is selected, a message appears saying:

"This function will delete all defined screens and their settings. This action cannot be undone.

Do you want to proceed?"

The message provides **OK** and **Cancel** buttons.

Example	`:SYST:DEF SCReen`

5.12 Preset Type (Remote Command Only)

Remote Command	`:SYSTem:PRESet:TYPE FACTory | MODE | USER` `:SYSTem:PRESet:TYPE?`
Example	`:SYST:PRES:TYPE FACT`
Notes	This command is supported for backward compatibility only. It is a no-op, which does not change the behavior of any preset operation
Preset	This is unaffected by Preset but is set to `MODE` on “Restore System Defaults->All”
State Saved	No

5.13 Restart Instrument (Shutdown)

This command shuts down the instrument, then reboots it.

Remote Command	`:SYSTem:PUP`
Example	`:SYST:PUP`

5.14 Restart Application (Application Shutdown)

This command restarts the instrument application without rebooting the instrument. Before you send this command, make sure you have saved any trace or measurement data that you want to preserve.

Remote Command	`:SYSTem:PUP:PROCess`
Example	`:SYST:PUP:PROC` After sending this command, you must wait for the instrument software to restart
Notes	You cannot use `*WAI` or `*OPC?` to synchronize operation after a restart. This command stops and restarts the instrument application, thus the SCPI operation is terminated and restarted. A remote program must use fixed wait time to resume sending commands to the instrument. The wait time will be dependent upon which applications are pre-loaded

5.15 System Log Off (Remote Command Only)

This command provides a means to terminate all open Windows applications, and log off the current user. This is equivalent to performing the Windows command “shutdown –l –f –t0”.

Remote Command	`:SYSTem:LOFF`
Example	`:SYST:LOFF`
Notes	Initiates an immediate log off of the current user. This exits the instrument application, thus any unsaved measurement result will be lost. You cannot use `*WAI` or `*OPC?` to synchronize operation. In addition to the instrument application, all other Windows programs will be terminated, without the opportunity to save any work in progress. To perform a subsequent login and regain instrument operation, human intervention will be required

5.16 Power Standby (Instrument Shutdown)

Pressing the power switch powers down the instrument. You will be notified that shutting down will cause the application to lose unsaved data, and the instrument will wait for you to respond to this prompt before shutting down.

The command below shuts down the instrument in the same way, however you can choose between the normal way (`NORMal`) or the forced way (`FORCe`). In the `NORMal` mode, the system waits until you respond to the warning prompt. In the `FORCe` mode, the system shuts down after 20 seconds, and all data will be lost.

If the instrument is not properly shutdown prior to removal of line power, the system will validate the Journaling File System and the Power On Last State (if the instrument is in Power On Last State) during the following power-on. If a problem is detected, a message will be provided indicating that the system 'recovered' from an inappropriate shutdown. This is only an issue if Power On Type is Last State. If the Last State is not valid, the instrument will power up in the last active mode, but will do a Mode Preset.

Remote Command	`:SYSTem:PDOWn [NORMal | FORCe]`
Example	`:SYST:PDOW` Executes a normal shutdown
Notes	If no parameter is sent, `NORMal` is assumed

6 Input/Output

Accesses menus that let you control the Input/Output parameters of the instrument. In general, these are functions associated with external connections to the instrument, either to the inputs or the outputs.

Since the Input/Output connections tend to be based on how you have your hardware set up, in general the input/output settings do *not* change when you perform a Mode Preset. They can be set to their default values in one of three ways:

– by using **Restore Input/Output Defaults**, on the first page of the **Input/Output** menu

– by using **System->Restore System Defaults->Input/Output Settings** or

– by using **System -> Restore System Defaults->All**

The settings survive a Preset and a Power cycle.

A few of the Input/Output settings *do* respond to Mode Preset; for example, if the Calibrator is on, it turns off on a Preset, and if DC coupling is in effect, it switches to AC on a Preset. These exceptions are made in the interests of reliability and usability, which overrides the need for absolute consistency. Exceptions are noted in the SCPI tables for those functions.

Input/Output features are common across multiple Modes and Measurements. In general, they do not change when you change Mode or Measurement, although some controls appear only in certain measurements.

6.1 RF Source

Lets you control and configure the internal RF Source. This tab only appears in models that support a built-in independent RF Source, which include the E7760 and modular products such as EXM and VXT.

External Source Control and built-in Tracking Sources are controlled using the **Source** tab in **Meas Setup** of the Swept SA measurement.

Dependencies	Only appears in models that support a built-in independent RF Source, such as E7760, EXM and VXT

6.1.1 RF Output

Sets the source RF power output state.

Remote Command	`:OUTPut[:EXTernal][:STATe] ON | OFF | 1 | 0` `:OUTPut[:EXTernal][:STATe]?`
Example	`:OUTP OFF` `:OUTP?`
Notes	This setting is for the independent mode and has no effect on the "List Sequencer" on page 2099. If "Sequencer" on page 2099 is `ON`, the List Sequencer controls the source output and this key is grayed-out When "Sequencer" on page 2099 is `OFF`, makes source leave List Sequencer and this setting is blanked out, taking effect immediately
Dependencies	For the E7760, the RF Output cannot be set to `ON` if the RF Output port is set to `NONE`. If you attempt to set RF Output to `ON` in this situation, the error message -221, "Settings conflict; Source Output is not available while Output Port is None" is displayed `:OUTPut:EXTernal[:STATe]` is supported only when Option "ESC" is installed. Otherwise, only `:OUTPut[:STATe]` is supported
Preset	`OFF`
Range	`ON|OFF`

6.1.2 RF Output Port

Specifies the RF Output Port used by the internal source.

Switching from the RF Output port to one of the RFIO ports changes the transmitter performance of the instrument.

The `NONE` selection is available to allow setting a half-duplex port to an Input if it was previously assigned as an Output. First, set the Output to `NONE`, then any port can be assigned as an Input.

Each port option for M1750A is available as both an input and output port. They both default to NONE, and if either input or output is selected, the opposite will be disabled (NONE).

See Parameters for the M1750A Half Duplex Ports for more details.

When using the VXT M9410A/11A/15A with Remote Radio Heads (such as the Keysight M1740A mmWave Transceiver for 5G), the choices in the dropdown menu will appear as

Head h RFHD p

For example, if you have two Radio Heads (numbered 1 and 2), each of which have two RF half duplex ports, the choices for these ports will appear as below:

Head and Port	Choice in dropdown	SCPI parameter
Head 1, port RF Tx/Rx 1	Head 1 RFHD 1	RRH1RFHD1
Head 1, port RF Tx/Rx 2	Head 1 RFHD 2	RRH1RFHD2
Head 2, port RF Tx/Rx 1	Head 2 RFHD 1	RRH2RFHD1
Head 2, port RF Tx/Rx 2	Head 2 RFHD 2	RRH2RFHD2

When using the E7770A Common Interface Unit, outputs may come from the DUT IF OUT ports on the rear of the CIU or the half-duplex ports on the front of the CIU labelled DUT IF In/Out. You would select GUI parameter IF Out n or SCPI parameter IFOutn for the DUT IF OUT ports or GUI parameter IFHD n or SCPI parameter IFHDn for the DUT IF In/Out ports.

See "Parameters for VXT M9410A/11A/15A and EXM when used with Radio Heads/CIU" on page 2210 for more details.

See "More Information" on page 2091

Remote Command	`[:SENSe]:FEED:RF:PORT:OUTPut RFOut | RFIO1 | RFIO2 | RFIO3 | RFIO4 | RFHD | RFFD | A1 | A2 | A3 | B1 | B2 | B3 | IFIO1 | IFIO2 | GEN | TR | RRHhRFHDp | IFOutn | IFHDn | NONE` `[:SENSe]:FEED:RF:PORT:OUTPut?`

Example	`:FEED:RF:PORT:OUTP RFO`
	Set output to RF Output
	`:FEED:RF:PORT:OUTP RRH1RFHD2`
	Set output to Radio Head 1, RF Tx/Rx Port 2

Notes	The `RRHhRFHDp` parameter is used to select a port on a Radio Head (such as the Keysight M1740A mmWave Transceiver) as an output. The SCPI parameter RRHhRFHDp corresponds to **Head h**, port **RF Tx/Rx p**; for example, RRH1RFHD2 = the port labelled **RF Tx/Rx 2** on **Head 1**
Dependencies	Only appears in models that support multiple output ports. If the SCPI command is sent with unsupported parameters in any other model, an error is generated, -221, “Settings conflict; option not installed” RFHD and RFFD are only available on VXT, option “HDX” is required to enable RFHD port and option “FDX” is required to enable RFFD port

	For M1750A: RF Input Parameter will be disabled if RF Output Port is not `NONE`. If the RF Input Parameter has been selected, then RF Output Port will be disabled For E7760: Ports IFIO1 and IFIO2 are available if option RF2 is installed. Ports A1, A2, A3, B1, B2, B3 are available if option RF3 is installed. Attempting to select a port for which the option is not present will generate the error, -241, “Hardware missing; Output not available”. A port cannot be selected as an Output while it is occupied as an Input. If the SCPI command is sent while port is occupied an error is generated, -221, “Settings conflict; Output Port is not available while occupied by Input”. Additionally, the mmWave ports are divided into two banks; the A Bank and the B Bank. A port cannot be selected as an Output if any port on that same bank is occupied as an Input; if the SCPI command is sent for this situation an error is generated, -221 “Settings conflict; Output Port is not available while port bank is occupied by Input”. Lastly, if RF3 is present and RF4 is absent a mmWave port cannot be selected as an Output if the Input Port is occupied by wwWave Transceiver with a different frequency range; if the SCPI command is sent for this situation an error is generated, -221 “Settings conflict; Output Port is not available while occupied by Input of incompatible frequency” Ports GEN and TR are only available.in modular analyzers and only when the M9470A module is installed, such as in the M8920A. Option HDX is required to enable the T/R port When any output is selected in a measurement that does not support it, the "No result; Meas invalid with this output" error condition occurs, and the measurement returns invalid data when queried
Preset	Unaffected by Mode Preset but is set to default by "Source Preset" or "Restore System Defaults -> All"
State Saved	Saved in State
Backwards Compatibility SCPI	`:FEED:RF:PORT:OUTPut IFIO1` `IFIO1` is treated as `IFO1`, and sets the IF output to be the port labelled “DUT IF Out” on the CIU rear panel. This is for compatibility with earlier implementations on EXM and VXT when using the E7770A Common Interface Unit

More Information

Here are details of the RF Output Port settings:

Value	Example	Notes
RF Output	`:FEED:RF:PORT:OUTP RFO`	On EXM with hardware M9430A, if RF Output is selected as RF Output Port, you need to choose the settings in the **Half Duplex Config** menu to determine which port (`RFIO3` or `RFIO4`) will be used On EXM with hardware M9431A, this setting is not supported. If the SCPI command is sent with this setting, an error is generated, -221, “Settings conflict; option not installed”
RFHD	`:FEED:RF:PORT:OUTP RFHD`	RFHD port is exclusive for RF Input and RF Output. If HD Port is chosen as RF Input port, pressing this key or sending SCPI to set it, an error message is generated : “-221, Settings conflict; RFHD is being used as RF Input Port” Option “HDX” is required to enable RFHD port
RFFD	`:FEED:RF:PORT:OUTP RFFD`	Option “FDX” is required to enable RFFD port
Gen	`:FEED:RF:PORT:OUTP GEN`	Selects the Gen port on an M8920A

Value	Example	Notes
T/R	:FEED:RF:PORT:OUTP TR	Selects the T/R port on an M8920A

6.1.3 Half Duplex Output Port

Specifies whether RFIO3 or RFIO4 is the Half Duplex Output port.

Remote Command	[:SENSe]:HDUPlex:PORT:OUTPut RFIO3 | RFIO4
Example	:HDUPlex:PORT:OUTPut RFIO3 :HDUPlex:PORT:OUTPut?
Dependencies	This control only appears in EXM If RFIO3 is selected as “Half Duplex Input Port”, then “Half Duplex Output Port” will be set to RFIO4 automatically If RFIO4 is selected as “Half Duplex Input Port”, then “Half Duplex Output Port” will be set to RFIO3 automatically
Preset	RFIO4
State Saved	Saved in State

6.1.4 RF Power

Allows you to control the amplitude of the Source output. Same as "RF Power" on page 2093 in Amplitude Setup.

Example	:SOUR:POW -100 dBm

6.1.5 T/R Port High Power Attenuator

Controls whether additional attenuation is added at the T/R Port. The T/R port has two output paths, one which provides a 16 dB attenuator and the other which bypasses this attenuator. When this control is On, the path includes the 16 dB attenuator, so the max output level for this path is 0 dBm. When this control is Off, the 16 dB attenuator is bypassed, so the max output level for this path is +5 dBm.

Example	:FEED:RF:PORT:TR:HPOW:ATT ON

6.1.6 Amplitude Setup

Allows you to access the **Amplitude Setup** sub-menu panel.

Notes	The sub-menu under this button is for independent mode and has no effect on the "List Sequencer" on page 2099. If "Sequencer" on page 2099 is ON, the List Sequencer controls the source output and this

control is grayed-out on the front panel to indicate out-of-scope. When you set "Sequencer" on page 2099 to OFF, makes source leave List Sequencer and this control will be blanked out

6.1.6.1 RF Power

Allows you to adjust the power level of the source using the numeric keypad, step keys, or RPG. Pressing any digit, 0 through 9, on the numeric keypad brings up the unit terminator.

Please refer to the "RF Power Range" on page 2094 table below for the valid ranges.

Remote Command	`:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude] <ampl>` `:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]?`
Example	`:SOUR:POW -100 dBm`
Notes	Amplitude corrections can be specified for use with the source. In the event of amplitude corrections being applied, the valid ranges for the RF power do not change dependent on the current amplitude correction setting. If the combination of RF power + amplitude correction is higher or lower than the source output range, the Source Unleveled bit is set and the “Source Unleveled” indicator will appear on status panel to indicate that the source cannot maintain the output power that has been requested When signal generator is unable to maintain the requested output level, the “Source Unleveled” indicator will appear on status panel. When the source output setting is restored to the normal range, the “Source Unleveled” is removed from status panel Internal source has list sequence mode, which comprises of several steps which contain separate output power, frequency and waveform etc. When the source list sequence playing is complete, the last step keeps playing, and user can use this command to change the list sequence last step’s output power For EXT, The multiport adapter RFIO TX ports and GPS ports cannot ensure power accuracy when power setting is lower than -130dBm, this power setting value is defined by the sum of RF Power setting and related amplitude correction value. But user settable value could be lower than this limit. When application detected there exists power setting lower than -130dBm on MPA RFIO TX ports, then popup warning message . When application detected there exists power setting lower than -130dBm on MPA GPS ports, then popup warning message . This is only warning message, and check is performed when RF is ON
Dependencies	The RF power is dependent on the RF output port and frequency, such that the current frequency and selected output port determine the valid range of power values
Couplings	For VXT models M9410A/11A, if AWGN State is ON and ARB State is ON, this setting will be adjusted to the value to maintain the AWGN power relationship defined by Power Control Mode and other noise settings
Preset	-100 dBm
Min	The range of values depends on the current frequency and selected RF output port. Refer to "RF Power Range" on page 2094 below for the valid ranges
Max	The range of values depends on the current frequency and selected RF output port. Refer to "RF Power Range" on page 2094 below for the valid ranges

RF Power Range

RF Output Port	Frequency Range	Min Output Power	Max Output Power
High Power RF Out	10 MHz ≤ f ≤ 6 GHz	–150 dBm	20 dBm
RFIO 1 & RFIO 2	10 MHz ≤ f ≤ 6 GHz	–150 dBm	0 dBm

Note: This is the UI power range, which is larger than the actual specification.

VXT models M9420A/21A

RF Output Port	Frequency Range	Min Output Power	Max Output Power without Option “1EA”	Max Output Power with Option “1EA”
RF Output	60 MHz ≤ f ≤ 6 GHz	–150 dBm	10 dBm	25 dBm
RFHD	60 MHz ≤ f ≤ 6 GHz	–150 dBm	10 dBm	15 dBm
RFFD	60 MHz ≤ f ≤ 6 GHz	–150 dBm	0 dBm	0 dBm

Note: This is the UI power range, which is larger than the actual specification.

Note1: M9421A does not support RFFD port.

Note2: Max output power with option “1EA” can be set to 25 dBm, but Meas Uncal (measurement uncalibrated) warning is given in the Status Bar in the lower right corner of the screen when output power set to larger than 20 dBm.

VXT model M9410A/11A

Ports	Option LFE	Frequency Range	Min Output Power	Max Output Power without option “1EA”	Max Output Power with “1EA”
RF Output	With Option LFE	1 MHz ≤ f ≤ 60 MHz	–150 dBm	5 dBm	5 dBm
		60 MHz ≤ f ≤ 380MHz	–150 dBm	5 dBm	25 dBm
	Without Option LFE	380 MHz ≤ f ≤ 6 GHz	–150 dBm	5 dBm	25 dBm
RFHD		1 MHz ≤ f ≤ 6 GHz	–150 dBm	5 dBm	5 dBm

Note: Min Output Power is the UI power range, which is smaller than the actual specification.

Note1: Max output power with option “1EA” can be set to 25 dBm for RF Output Port, but Meas Uncal (measurement uncalibrated) warning is given in the Status Bar in the lower right corner of the screen when the output power is set to larger than 20 dBm.

Note2: Option LFE represents for Low Frequency Extension, which covers frequency from 1 MHz to 380 MHz.

VXT model M9415A

RF Output Port	Frequency Range	Min Output Power	Max Output Power without Option “1EA”	Max Output Power with Option “1EA”
RF Output	380 MHz ≤ f ≤ 12.3 GHz	–150 dBm	5 dBm	25 dBm
RFHD	380 MHz ≤ f ≤ 12.3 GHz	–150 dBm	5 dBm	18 dBm

Note1: for RF output port, the Max output power with option “1EA” can be set to 25 dBm for RF Output Port, but Meas Uncal (measurement uncalibrated) warning is given in the Status Bar in the lower right corner of the screen when the output power is set to larger than 20 dBm.

Note2: for RFHD port, the Max output power with option “1EA” can be set to 18 dBm for RF Output Port, but Meas Uncal (measurement uncalibrated) warning is given in the Status Bar in the lower right corner of the screen when the output power is set to larger than 15 dBm.

M8920A

RF Output Port	Frequency Range	Min Output Power	Max Output Power without Option “1EA”	Max Output Power with Option “1EA”
Gen	100 kHz ≤ f ≤ 6 GHz	–150 dBm	3 dBm	15 dBm
T/R	100 kHz ≤ f ≤ 6 GHz	–150 dBm	5 dBm (T/R port high power attenuator Off) -15 dBm (T/R port high power attenuator On)	5 dBm (T/R port high power attenuator Off) -15 dBm (T/R port high power attenuator On)

Note: This is the UI power range, which is larger than the actual specification.

6.1.6.2 Set Reference Power

Allows you to set the power reference. Pressing this key turns the power reference state to ON, sets the reference power value to the current RF output power, maintains this power at the RF output, and sets the displayed power to 0.00 dB. All subsequent RF power values entered under **Source>Amplitude>RF Power** are interpreted as being relative to this reference power.

When you use a power reference, the signal generator outputs an RF power that is set relative to the reference power by the value entered under Source>Amplitude>RF Power as follows:

Output power = reference power – entered power

Where:

- reference power equals the original RF Power entered under Source>Amplitude>RF Power and set as the reference power
- entered power equals a new value entered under Source>Amplitude>Amptd Offset

In addition, the displayed power value is the same as a new value entered under Source>Amplitude>RF Power.

NOTE

If Power Ref is ON with a reference value set, entering a value under **Source>Amplitude>RF Power** and pressing **Set Reference Power** adds that value to the existing Power Ref value.

If you wish to change the reference power value to a new value entered under **Source>Amplitude>RF Power**, first you must set Power Ref to OFF and then press **Set Reference Power**.

Dependencies	This key is unavailable, and is grayed-out when the "List Sequencer" on page 2099 is ON

6.1.6.3 Power Ref

Allows you to toggle the state of the power reference.

When you use a power reference, the signal generator outputs an RF power that is set relative to the reference power by the value entered under Source>Amplitude>RF Power as follows:

Output power = reference power + entered power

Where:

- reference power equals the original RF Power entered under Source>Amplitude>RF Power and set as the reference power
- entered power equals a new value entered under Source>Amplitude>Amptd Offset

For more information on Reference Frequency, see "Set Reference Power" on page 2095.

Remote Command	`:SOURce:POWer:REFerence <ampl>`
	`:SOURce:POWer:REFerence?`
	`:SOURce:POWer:REFerence:STATe OFF | ON | 0 | 1`

	:SOURce:POWer:REFerence:STATe?
Example	:SOUR:POW:REF 0.00 dBm :SOUR:POW:REF:STATe ON
Dependencies	This setting is unavailable and is grayed-out when the "List Sequencer" on page 2099 is ON
Couplings	This value is coupled to "Set Reference Power" on page 2095 such that pressing **Set Reference Power** updates the reference power with the current output power
Preset	0.00 dBm OFF
Min	-125.00 dBm
Max	10.00 dBm

6.1.6.4 Power Unit

Modifies the units for RF Power and Power Ref. The change is immediate and does not force a restart.

Remote Command	:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]:UNIT DBM | W | V | DBUV :SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]:UNIT?
Example	:SOUR:POW:UNIT V Sets the RF Power units to volts
Couplings	RF Power and Power Ref units are modified by Power Unit
Preset	dBm
State Saved	Saved in Instrument State

6.1.6.5 Amptd Offset

Allows you to specify the RF output power offset value.

When the amplitude offset is set to zero (0) and you set a new offset value (positive or negative), the displayed amplitude value will change as follows and the RF output power will not change:

Displayed value = output power + offset value

Where:

- output power equals the original RF Power entered under **Source>Amplitude>RF Power**
- offset value equals the value entered under **Source>Amplitude>Amptd Offset**

When the amplitude offset is set to a value other than zero (0) and you enter a new RF power value under **Source>Amplitude>RF Power**, the displayed power will be the same as the value entered and the RF output power will be equal to the value entered minus the offset value as follows:

Output power = entered power – offset power

Displayed Power = output power + offset power

Displayed power = entered power

Where:

- entered power equals the amplitude entered under **Source>Amplitude>RF Power**
- offset power equals the value previously entered and set under **Source>Amplitude>Amptd Offset**

Remote Command	`:SOURce:POWer[:LEVel][:IMMediate]:OFFSet <rel_ampl>` `:SOURce:POWer[:LEVel][:IMMediate]:OFFSet?`
Example	`:SOUR:POW:OFFS 0.00 dB`
Notes	The amplitude Offset unit follows the units set in Power Unit
Dependencies	This setting is unavailable, and is grayed-out, when List Sequencer is `ON`
Preset	0.00 dB
Min	-200.00 dB
Max	200.00 dB

6.1.6.6 Amplitude Increment

Changes the step size for the RF Power function. Once an increment size has been selected and the RF Amplitude function is active, the step keys (and the `UP|DOWN` parameters for RF Power from remote commands) change the RF Power by the set value. This feature exists in EXG and MXG.

Remote Command	`:SOURce:POWer:STEP[:INCRement] <ampl>` `:SOURce:POWer:STEP[:INCRement]?`
Example	`:SOUR:POW:STEP 1`
Notes	The amplitude Increment unit follows the units set in Power Unit
Couplings	Coupled to the Step size of the RF Power function
Preset	1 dB
Min	0.1 dB
Max	10 dB

6.1.7 Frequency

Allows you to control the frequency of the Source. Same as "Frequency" on page 2124 in the Frequency Setup menu.

Example	`:SOUR:FREQ 1.00 GHz`

6.1.8 List Sequencer

Allows you access to the sub-menus for configuring the **List Sequencer**.

List sequences allow you to enter frequencies and amplitudes at unequal intervals in nonlinear ascending, descending or random order. Each step within the list can also include its own waveform file for playback, step duration, trigger event and trigger output.

The complexities involved in configuring the List Sequencer do not lend themselves to manual configuration; hence the manual configuration for this feature is limited. For easier configuration of the List Sequencer, it is recommended that you use either SCPI, or load a tab delimited file containing the setup parameters in a tabular form. The details of the SCPI for configuring the List Sequencer can be found in "Step Configuration (Remote Command Only)" on page 2115.

Once the List Sequencer has been configured using the front panel, SCPI, or by loading a tab delimited file, the sequence must be initiated using the front panel **Initiate Sequence** key or the corresponding SCPI command.

Dependencies	This control is not available in E7760

6.1.8.1 Sequencer

Allows you to set the state of the List Sequencer:

- When List Sequencer is `ON`, the source outputs the sequence defined by the sequencer
- When List Sequencer is `OFF`, the source outputs a single waveform segment or sequence (independent mode) at a single frequency and amplitude

Remote Command	`:SOURce:LIST[:STATe] ON | OFF | 1 | 0` `:SOURce:LIST[:STATe]?`
Example	`:SOUR:LIST OFF`
Notes	When the sequencer is `ON`, the List Sequencer controls the output of the source
Dependencies	This control is not available in E7760
Couplings	When in Sequence Analyzer mode and the List Sequencer state is `OFF`, Include Source is forced to No, and the **Include Source** key is grayed-out When in Sequence Analyzer mode and the List Sequencer state is `ON`, **Include Source** is available to set, and, an ARB memory related operation such as load or delete will be rejected
Preset	`OFF`
Range	`ON|OFF`

6.1.8.2 Initiate Sequence

Arms the sequence for single execution. Once the sequence is armed, the source begins the sequence as soon as the trigger is received. If trigger is set to **Free Run**, the sequence starts immediately.

Remote Command	`:SOURce:LIST:TRIGger[:IMMediate]`
Example	`:SOUR:LIST:TRIG`
Notes	When in Sequence Analyzer mode and **Include Source** is `ON`, the Initiate List Sequencer operation is rejected, and the key is grayed-out If the file needed by the sequencer is not already in ARB memory, the sequence cannot be initiated and an error is generated There is a blocking SCPI query that can be used to query whether source list sequence was initiated successfully (see "Remote Software Trigger (Remote command Only)" on page 2123)
Dependencies	In Sequence Analyzer Mode, if **Meas Setup->Include Source** is set to `YES`, **Source->List Sequencer->Initiate Sequence** is disabled This control is not available in E7760

6.1.8.3 Repetition

Allows access to the sub-menu for selecting the repetition type for the List Sequencer globally. It cannot be changed between different sequence steps.

In **Single**, the Source list plays one time after initiation. In **Continuous**, the Source list plays continuously after initiation.

This setting is available on EXM.

Remote Command	`:SOURce:LIST:REPetition:TYPE SINGle | CONTinuous`
Example	`:SOUR:LIST:REP:TYPE SING` `:SOUR:LIST:REP:TYPE?`
Dependencies	Available on EXM Not available in E7760
Preset	`SINGle`
Range	`SINGle|CONTinuous`

6.1.8.4 Trig Out Type

Allows access to the sub-menu for selecting the output trigger type for the List Sequencer globally. It cannot be changed between different sequence steps. It sets the output trigger type for the whole source sequence.

Remote Command	`:SOURce:LIST:TRIGger:OUTPut:TYPE STEP | MARKer`

	:SOURce:LIST:TRIGger:OUTPut:TYPE?
Notes	STEP = Start of Step MARKer = Data Marker
Dependencies	Available on EXM Not available in E7760
Preset	STEP
Backwards Compatibility SCPI	:SOURce:LIST:TRIGgerout:TYPe BEGinningofstep | DATamarker

6.1.8.5 Select Data Marker

When "Trig Out Type" on page 2100 is set to Data MARKer, specifies which marker to route.

Remote Command	:SOURce:LIST:TRIGger:OUTPut:TYPE:MARKer M1 | M2 | M3 | M4 :SOURce:LIST:TRIGger:OUTPut:TYPE:MARKer?
Backwards Compatibility SCPI	:SOURce:LIST:TRIGgerout:TYPe:Marker

6.1.8.6 Manual Trigger Now

Pressing this control provides a software trigger event to the List Sequencer. During execution of a sequence, if the sequencer is halted on any step that has been configured with a “Manual” step trigger, then this key press causes the sequencer to continue and execute the step.

Notes	No remote command, front panel only

6.1.8.7 List Sequencer Setup

Accesses the List Sequencer setup menus.

Number of Steps

Allows you to specify the number of steps within the list sequence.

Remote Command	:SOURce:LIST:NUMBer:STEPs <integer> :SOURce:LIST:NUMBer:STEPs?
Example	:SOUR:LIST:NUMB:STEP 1
Notes	Increasing the number of steps creates additional steps at the end of the list, with all the settings within the steps set to their default values

	Decreasing the number of steps removes steps from the end of the list. The settings within the removed steps are not reset. This means that increasing the number of steps again would allow you to retrieve these steps
Dependencies	The Step Count parameter is increased or decreased when you insert or delete a point from within the GUI interface to the sequencer This control is not available in E7760
Preset	1
Min	1
Max	1000

Go To Step

Allows you to select the step number you wish to view or edit.

Notes	No remote command, front panel only
Preset	1
Min	1
Max	Step Count

Insert Step Before

Inserts a new step, containing default values, before the currently selected step. Inserting a step automatically increases the Step Count parameter by 1. If sequence already reaches upper limit of 1000 steps, then this operation will be rejected and popup error -221, “Setting Conflict; Cannot insert more steps, maximum number of steps reached”

Notes	No remote command, front panel only If the list already contains the maximum limit of 1000 steps, pressing this control has no effect

Delete Step

Deletes the current step. Deleting a step automatically decreases the Step Count parameter by 1. If the sequence only has one step left, then this operation will be rejected with popup error -221, “Setting conflict; Cannot delete current step, minimum number of steps reached”

Notes	No remote command; front Panel key only If the list already contains the minimum limit of 1 step, pressing this control has no effect

Clear List

Clears the list. Clearing the list sets the number of steps to the default value of 1 and sets the parameters for the only step to their default values.

Step Trigger

This field in the table allows you to select the trigger input for the current step.

See "More Information" on page 2103

Remote Command	`:SOURce:LIST:STEP[1]|2|...|…|1000:SETup:INPut:TRIGger IMMediate | INTernal | EXTernal2 | KEY | BUS | EXTernal4` `:SOURce:LIST:STEP[1]|2|...|…|1000:SETup:INPut:TRIGger?`
Example	`:SOUR:LIST:STEP2:SET:INP:TRIG BUS` `:SOUR:LIST:STEP2:SET:INP:TRIG?`
Notes	SCPI is supported after A.09.40
Dependencies	This control is not available in E7760
Preset	`IMMediate`
Range	`IMMediate|INTernal|EXTernal2|KEY|BUS|EXTernal4`

More Information

Parameter	SCPI Example	Notes
Free Run	`:SOUR:LIST:STEP2:SET:INP:TRIG IMM`	Sets the trigger input for the current step to Free Run
Internal	`:SOUR:LIST:STEP2:SET:INP:TRIG INT`	Sets the trigger input for the current step to Internal
Manual (Trigger Key)	`:SOUR:LIST:STEP2:SET:INP:TRIG KEY`	Sets the trigger input for the current step to Manual (Trigger Key). Any step in the sequence set to Manual will cause the sequence execution to stop until the manual trigger key is pressed. Sending the Bus Trigger SCPI command will have no effect. At any point in the sequence where the List Sequencer is paused waiting for a software trigger, a pop up dialog is displayed until the trigger event occurs
Bus	`:SOUR:LIST:STEP2:SET:INP:TRIG BUS`	Sets the trigger input for the current step to Bus. Any step in the sequence set to Bus will cause the

Parameter	SCPI Example	Notes
		sequence execution to stop until the Bus Trigger SCPI command is sent. Pressing the manual trigger key has no effect. At any point in the sequence where the List Sequencer is paused waiting for a software trigger, a pop up dialog is displayed until the trigger event occurs
External 2	`:SOUR:LIST:STEP2:SET:INP:TRIG EXT2`	Sets the trigger input for the current step to External 2 Note: When on EXM, trigger 2 is a bi-directional trigger port. So when trigger 2 has been configured as OUTPUT type, choosing External 2 as the input trigger for the current step will generate error

Transition Time

This field in the table allows you to specify the transition time for the current step.

The following table lists recommended values for appropriate settling times to allow for changes within the source.

Value Changed	Recommended Transition Time
Frequency	500 µs
Amplitude	100 µs to within 0.1 dB
	20 µs to within 1.0 dB

If the Transition Time value is shorter than the time necessary for the hardware to settle and a List Sequence is initiated, a **warning** is generated.

If the Transition Time value is longer than the Step Duration, an error is generated when initiating a source list sequence. For source list sequence, transition time is included in the step duration length. If the Transition Time value is longer than the Step Duration Time, the real step duration length is extended to equal the transition time and cause a timing shift.

Remote Command	`:SOURce:LIST:STEP[1]|2|...|…|1000:SETup:TRANsition:TIME <time>` `:SOURce:LIST:STEP[1]|2|...|…|1000:SETup:TRANsition:TIME?`
Example	`:SOUR:LIST:STEP2:SET:TRAN:TIME 1ms` `:SOUR:LIST:STEP2:SET:TRAN:TIME?`
Notes	SCPI is supported after A.09.40
Dependencies	This control is not available in E7760

Preset	1.0 ms
Min	0.0 ms
Max	4.0 ks

Band

This field in the table allows you to select the radio band for use in the current step.

Remote Command	`:SOURce:LIST:STEP[1]|2|...|…|1000:SETup:RADio:BAND <band>` where `<band>` is one of: `NONE | PGSM | EGSM | RGSM | DCS1800 | PCS1900 | GSM450 | GSM480 | GSM700 | GSM850 | TGSM810 | USCELL | USPCS | JAPAN | KOREAN | NMT | IMT2K | UPPER | SECOND | PAMR400 | PAMR800 | IMTEXT | PCS1DOT9G | AWS | US2DOT5G | PUBLIC | LOWER | BANDI | BANDII | BANDIII | BANDIV | BANDV | BANDVI | BANDVII | BANDVIII | BANDIX | BANDX | BANDXI | BANDXII | BANDXIII | BANDXIV | BANDXIX | BAND1 | BAND2 | BAND3 | BAND4 | BAND5 | BAND6 | BAND7 | BAND8 | BAND9 | BAND10 | BAND11 | BAND12 | BAND13 | BAND14 | BAND17 | BAND18 | BAND19 | BAND20 | BAND21 | BAND24 | BAND25 | BAND26 | BAND27 | BAND28 | BAND29 | BAND30 | BAND31 | BAND65 | BAND66 | BAND67 | BAND68 | BAND71 | BAND252 | BAND255 | BAND33 | BAND34 | BAND35 | BAND36 | BAND37 | BAND38 | BAND39 | BAND40 | BAND41 | BAND42 | BAND43 | BAND44 | BAND45 | BAND46 | BANDA | BANDB | BANDC | BANDD | BANDE | BANDF | N1 | N2 | N3 | N5 | N7 | N8 | N12 | N20 | N25 | N28 | N34 | N38 | N39 | N40 | N41 | N50 | N51 | N66 | N70 | N71 | N74 | N75 | N76 | N77 | N78 | N79 | N80 | N81 | N82 | N83 | N84 | N86 | N257 | N258 | N260 | N261` `:SOURce:LIST:STEP[1]|2|...|…|1000:SETup:RADio:BAND?`
Example	`:SOUR:LIST:STEP2:SET:RAD:BAND PGSM` `:SOUR:LIST:STEP2:SET:RAD:BAND?`
Notes	SCPI is supported after A.09.40
Dependencies	This control is not available in E7760

Here are the Radio Standards for each Band, and a SCPI example for each (Step 2 is assumed):

Band	Standard	SCPI Example
None	None	`:SOUR:LIST:STEP2:SET:RAD:BAND NONE`
P-GSM	GSM/EDGE	`:SOUR:LIST:STEP2:SET:RAD:BAND PGSM`
E-GSM	GSM/EDGE	`:SOUR:LIST:STEP2:SET:RAD:BAND EGSM`
R-GSM	GSM/EDGE	`:SOUR:LIST:STEP2:SET:RAD:BAND RGSM`
DCS 1800	GSM/EDGE	`:SOUR:LIST:STEP2:SET:RAD:BAND DCS1800`
PCS 1900	GSM/EDGE	`:SOUR:LIST:STEP2:SET:RAD:BAND PCS1900`
GSM 450	GSM/EDGE	`:SOUR:LIST:STEP2:SET:RAD:BAND GSM450`
GSM 480	GSM/EDGE	`:SOUR:LIST:STEP2:SET:RAD:BAND GSM480`

Band	Standard	SCPI Example
GSM 700	GSM/EDGE	:SOUR:LIST:STEP2:SET:RAD:BAND GSM700
GSM 850	GSM/EDGE	:SOUR:LIST:STEP2:SET:RAD:BAND GSM850
T-GSM 810	GSM/EDGE	:SOUR:LIST:STEP2:SET:RAD:BAND T-GSM810
US Cell	CDMA 2000	:SOUR:LIST:STEP2:SET:RAD:BAND USCELL
US PCS	CDMA 2000	:SOUR:LIST:STEP2:SET:RAD:BAND PCS
Japan Cell	CDMA 2000	:SOUR:LIST:STEP2:SET:RAD:BAND JAPAN
Korean PCS	CDMA 2000	:SOUR:LIST:STEP2:SET:RAD:BAND KOREAN
NMT 450	CDMA 2000	:SOUR:LIST:STEP2:SET:RAD:BAND NMT
IMT 2000	CDMA 2000	:SOUR:LIST:STEP2:SET:RAD:BAND IMT2K
Upper 700	CDMA 2000	:SOUR:LIST:STEP2:SET:RAD:BAND UPPER
Secondary 800	CDMA 2000	:SOUR:LIST:STEP2:SET:RAD:BAND SECOND
400 Euro PAMR	CDMA 2000	:SOUR:LIST:STEP2:SET:RAD:BAND PAMR400
800 PAMR	CDMA 2000	:SOUR:LIST:STEP2:SET:RAD:BAND PAMR800
2.5 GHz IMT EXT	CDMA 2000	:SOUR:LIST:STEP2:SET:RAD:BAND IMTEXT
US PCS 1.9 GHz	CDMA 2000	:SOUR:LIST:STEP2:SET:RAD:BAND PCS1DOT9G
AWS	CDMA 2000	:SOUR:LIST:STEP2:SET:RAD:BAND AWS
US 2.5 GHz	CDMA 2000	:SOUR:LIST:STEP2:SET:RAD:BAND US2DOT5G
700 Public Safety	CDMA 2000	:SOUR:LIST:STEP2:SET:RAD:BAND PUBLIC
C2K Lower 700	CDMA 2000	:SOUR:LIST:STEP2:SET:RAD:BAND LOWER
Band I	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDI
Band II	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDII
Band III	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDIII
Band IV	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDIV
Band V	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDV
Band VI	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDVI
Band VII	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDVII
Band VIII	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDVIII
Band IX	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDIX
Band X	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDX
Band XI	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDXI
Band XII	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDXII
Band XIII	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDXIII
Band XIV	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDXIV
Band XIX	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDXIX
Band 1	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND1
Band 2	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND2
Band 3	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND3

Band	Standard	SCPI Example
Band 4	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND4
Band 5	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND5
Band 6	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND6
Band 7	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND7
Band 8	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND8
Band 9	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND9
Band 10	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND10
Band 11	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND11
Band 12	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND12
Band 13	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND13
Band 14	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND14
Band 17	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND17
Band 18	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND18
Band 19	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND19
Band 20	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND20
Band 21	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND21
Band 24	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND24
Band 25	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND25
Band 26	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND26
Band 27	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND27
Band 28	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND28
Band 29	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND29
Band 30	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND30
Band 31	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND31
Band 65	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND65
Band 66	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND66
Band 67	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND67
Band 68	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND68
Band 71	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND71
Band 252	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND252
Band 255	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND255
Band 33	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND33
Band 34	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND34
Band 35	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND35
Band 36	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND36
Band 37	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND37
Band 38	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND38
Band 39	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND39
Band 40	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND40

Band	Standard	SCPI Example
Band 41	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND41
Band 42	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND42
Band 43	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND43
Band 44	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND44
Band 45	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND45
Band 46	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND46
Band A	TD-SCDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDA
Band B	TD-SCDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDB
Band C	TD-SCDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDC
Band D	TD-SCDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDD
Band E	TD-SCDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDE
Band F	TD-SCDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDF
N 1	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N1
N 2	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N2
N 3	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N3
N 5	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N5
N 7	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N7
N 8	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N8
N 12	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N12
N 20	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N20
N 25	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N25
N 28	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N28
N 34	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N34
N 38	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N38
N 39	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N39
N 40	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N40
N 41	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N41
N 50	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N50
N 51	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N51
N 66	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N66
N 70	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N70
N 71	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N71
N 74	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N74
N 75	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N75
N 76	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N76
N 77	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N77
N 78	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N78

Band	Standard	SCPI Example
N 79	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N79
N 80	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N80
N 81	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N81
N 82	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N82
N 83	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N83
N 84	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N84
N 86	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N86
N 257	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N257
N 258	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N258
N 260	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N260
N 261	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N261

Device

This field in the table allows you to specify the radio band link direction for the steps within the list sequence. The link is used in conjunction with the channel band and channel number to determine the output frequency.

Setting	Option	Description
Uplink	UP	The source calculates the uplink frequency according to an uplink formula together with selected channel band and channel number
Downlink	DOWN	The source calculates the downlink frequency according to a downlink formula together with selected channel band and channel number

Remote Command	:SOURce:LIST:STEP[1]|2|...|…|1000:SETup:RADio:BAND:LINK DOWN | UP :SOURce:LIST:STEP[1]|2|...|…|1000:SETup:RADio:BAND:LINK?
Example	:SOUR:LIST:STEP2:SET:RAD:BAND:LINK UP :SOUR:LIST:STEP2:SET:RAD:BAND:LINK?
Notes	SCPI is supported after A.09.40
Dependencies	This control is not available in E7760
Preset	DOWN
Range	DOWN | UP

Freq/Chan

This field in the table allows you to select the frequency or channel value for the current step. If the Band selection for the current row is NONE, you should enter a frequency. Otherwise you should enter a channel, which will cause the frequency to be automatically selected based on the Band selection.

Entering a Frequency

If the Band selection for the current row is NONE, you enter a Frequency. This field in the table allows you to select the frequency value for the current step.

Remote Command	`:SOURce:LIST:STEP[1]|2|...|…|1000:SETup:CNFRequency <double>` `:SOURce:LIST:STEP[1]|2|...|…|1000:SETup:CNFRequency?`
Example	`:SOUR:LIST:STEP2:SET:CNFR 1GHz` `:SOUR:LIST:STEP2:SET:CNFR?`
Notes	SCPI is supported after A.09.40 Used to setup channel number or frequency setting, according to the current Radio Band setting. If Radio Band is NONE, then the value is frequency. If Radio Band is not NONE, then the value is channel number
Dependencies	This control is not available in E7760
Couplings	The frequency value is coupled to the channel band and number for the step, such that updates to the radio band and channel number will update the frequency value to the corresponding absolute frequency. The reverse is also true, changing the frequency value causes the value of the channel number to be updated
Preset	1.00 GHz
Min	10.00 MHz
Max	Hardware Dependent: – Option 503 = 3.6 GHz – Option 504 = 3.9 GHz – Option 506 = 6.00 GHz – Option F06 = 6.08 GHz – Option F06 & EP6 = 6.60 GHz

Entering a Channel

If the Band selection for the current row is not NONE, you enter a Channel Number. This field in the table allows you to select the channel value for the current step. The frequency will be selected automatically, based on the Band.

Remote Command	`:SOURce:LIST:STEP[1]|2|...|…|1000:SETup:CNFRequency <double>` `:SOURce:LIST:STEP[1]|2|...|…|1000:SETup:CNFRequency?`
Example	`:SOUR:LIST:STEP2:SET:CNFR 124` `:SOUR:LIST:STEP2:SET:CNFR?`
Notes	SCPI is supported after A.09.40 Used to setup channel number or frequency setting, according to current Radio Band setting. If Radio Band is NONE, then the value is a frequency. If Radio Band is not NONE, then the value is a channel number

Dependencies	This control is not available in E7760
Couplings	The channel number is coupled to the step frequency value. When the step frequency value is changed, the channel number increases or decreases to match the new step frequency. If the step frequency is not at an exact match for a channel number, the nearest channel number is displayed, along with a greater-than or less-than sign, to indicate the frequency is above or below the channel number
Preset	1
Min	0 (See "Channel" on page 2126, for valid ranges)
Max	10838 (See "Channel" on page 2126, for valid ranges)

Power

This field in the table allows you to specify the power value for the current step.

Remote Command	`:SOURce:LIST:STEP[1]|2|...|…|1000:SETup:AMPLitude <double>` `:SOURce:LIST:STEP[1]|2|...|…|1000:SETup:AMPLitude?`
Example	`:SOUR:LIST:STEP2:SET:AMPL -50dBm` `:SOUR:LIST:STEP2:SET:AMPL?`
Dependencies	The RF power is dependent on the RF output port and frequency, such that the current frequency and selected output port determine the valid range of power values This control is not available in E7760
Preset	-100 dBm
Min/Max	The range of values depends on the current frequency and selected RF output port See "RF Power" on page 2093 and the RF Power Range table for valid ranges

Waveform

This field in the table allows you to select the waveform to be played back during the current step. Pressing this field lets you choose between CW, a Waveform file, to continue the previous step’s waveform, or Off.

For full details of options, see "More Information" on page 2112

Remote Command	`:SOURce:LIST:STEP[1]|2|...|…|1000:SETup:WAVeform <string>`
	where `<string>` is one of:
	`”CW”, “waveform name”, “Cont”, “Off”`
	`:SOURce:LIST:STEP[1]|2|...|…|1000:SETup:WAVeform?`

Example	`:SOUR:LIST:STEP2:SET:WAV “CW”` `:SOUR:LIST:STEP2:SET:WAV?`
Notes	SCPI is supported after A.09.40
Dependencies	This control is not available in E7760 For VXT models M9410A/11A, if the Waveform is not Continue Previous, there is always a time gap

	between the current step and the previous step
Preset	CW
Range	”CW”, “waveform name”, “Cont”, “Off”

More Information

Parameter	SCPI Example	Notes
CW	:SOUR:LIST:STEP2:SET:WAV “CW”	Sets the current step to output a CW tone
Selected Waveform	:SOUR:LIST:STEP2:SET:WAV “waveform name”	Inserts a waveform from the Select Waveform dialog as the waveform for playback during the current step If the selected waveform contains header (which contains ARB play parameters), source list sequence will automatically apply header settings of the selected waveform in that step
Continue Previous	:SOUR:LIST:STEP2:SET:WAV “Cont”	Sets the current step to continue with playback of the waveform from the previous step. When continuing the previous waveform, the ARB playback will not pause while the source retunes to the new frequency or amplitude that may be defined for the new step
Off	:SOUR:LIST:STEP2:SET:WAV “Off”	Disable RF output of the current step

Waveform File

Pressing the slide-aside field of this column (>) opens the "Select Waveform" on page 2168 screen, which lets you select a waveform in ARB memory to playback during the current step. When you select a waveform, and press OK, it returns to the List Sequencer Setup screen with that filename in the table.

Step Duration

The first field under Step Duration in the table allows you to select the duration of play for the current step.

The duration can be set to be either the number of times for the ARB file associated with the sequence to play, or a specific time value, or continuous. If the step is set to play a CW tone, the step duration cannot be set to a play count.

Remote Command	:SOURce:LIST:STEP[1]|2|...|…|1000:SETup:DURation:TYPE TIME | COUNt | CONTinuous | CABort

	For option details, see "More Information" on page 2113 `:SOURce:LIST:STEP[1]|2|...|…|1000:SETup:DURation:TYPE?`
Example	`:SOUR:LIST:STEP2:SET:DUR:TYPE TIME` `:SOUR:LIST:STEP2:SET:DUR:TYPE?`
Dependencies	This control is not available in E7760 If the Step Duration is Time or Play Count in VXT models M9410A/11A, only **Free Run** is available for the next step. Otherwise an error message is generated “Parameter error; only Free Run is available as step trigger on step<n>”
Range	`TIME|COUNt|CONTinuous|CABort`

More Information

Parameter	SCPI Example	Notes
Time	`:SOUR:LIST:STEP2:SET:DUR:TYPE TIME`	Sets the duration of the current step to be a time value for the length of time the step will play When `TIME` is selected, the Time may be set using the second field under **Step Duration** and/or by the "Duration Time" on page 2114 command
Count	`:SOUR:LIST:STEP2:SET:DUR:TYPE COUN`	Sets the duration of the current step to be an integer value for the number of times (play count) the ARB file is selected for playback during this step. For example, a 5 second ARB will be set to play 5 times during the step When `COUNt` is selected, the Count may be set using the second field under **Step Duration** and/or by the "Play Count" on page 2114 command
Continuous	`:SOUR:LIST:STEP2:SET:DUR:TYPE CONT`	Sets the current step to be played continuously until the next step starts. The waveform will always play completely before transitioning to the next step
Continuous Abort	`:SOUR:LIST:STEP2:SET:DUR:TYPE CABort`	Sets the current step to be played continuously or until the trigger event of the next step is detected. When a trigger event is received, the waveform play will be aborted after the interval specified by the Duration Time parameter and it will then transition to the next step

Parameter	SCPI Example	Notes
		When Continuous Abort is selected, the Duration Time may be set using the second field under Step Duration and/or by the "Duration Time" on page 2114 command

Duration Time

The second field under Step Duration in the table allows you to specify the length of time the current step will play when "Step Duration" on page 2112 is Time.

When "Step Duration" on page 2112 is Continuous Abort, this parameter specifies the maximum duration that the waveform will continue to play after a step trigger is received before the transition to the next waveform will occur. Duration is limited to a maximum of 20 seconds.

If the Transition Time value is longer than the Step Duration Time, an error is generated when initiating a source list sequence. For source list sequence, transition time is included in the step duration length (not occupy additional time). If the Transition Time value is longer than the Step Duration Time, the real step duration length is extended to equal the transition time and cause a timing shift.

Remote Command	`:SOURce:LIST:STEP[1]|2|...|…|1000:SETup:DURation:TCOunt <double>` `:SOURce:LIST:STEP[1]|2|...|…|1000:SETup:DURation:TCOunt?`
Example	`:SOUR:LIST:STEP2:SET:DUR:TCO 1s` `:SOUR:LIST:STEP2:SET:DUR:TCO?`
Notes	When Repetition is Single, the last step continues playing after the sequence is completed. In this extended playing time, `:STAT:OPER:COND?` returns 0 for the Source Sweeping Status Bit (bit 9) SCPI is supported after A.09.40 If current “Duration Type” is “Continuous”, then popup error -221, "Settings conflict; Cannot accept time or count input when step duration type is Continuous on step #"
Dependencies	This control is not available in E7760
Preset	1.00 ms
Min	100 µs
Max	1800 s

Play Count

The second field under **Step Duration** in the table allows you to specify the number of times the current ARB waveform file will play during a step when "Step Duration" on page 2112 is Count.

Remote Command	`:SOURce:LIST:STEP[1]|2|...|…|1000:SETup:DURation:TCOunt <double>` `:SOURce:LIST:STEP[1]|2|...|…|1000:SETup:DURation:TCOunt?`
Example	`:SOUR:LIST:STEP2:SET:DUR:TCO 10` `:SOUR:LIST:STEP2:SET:DUR:TCO?`
Notes	SCPI is supported after A.09.40 This command is reused by "Play Count" and "Duration Time" according to current Duration Type setting if "Play Count" or "Duration Time" If current "Duration Type" is "Continuous", then popup error -221, "Settings conflict; Cannot accept time or count input when step duration type is Continuous on step #" If "Play Count" is set for the last step, the last step of ARB keeps playing as if set to "Continuous" after play count setting is reached
Dependencies	This control is not available in E7760
Preset	1
Min	1
Max	65536

Trig Out

This field in the table allows you to specify the trigger output for the current step. The trigger output signal is sent at the start of the step.

When this is `ON`, a trigger event occurs on both Internal and External2 paths. Selecting `OFF` turns off trigger output.

Remote Command	`:SOURce:LIST:STEP[1]|2|...|…|1000:SETup:OUTPut:TRIGger ON | OFF | 1 | 0` `:SOURce:LIST:STEP[1]|2|...|…|1000:SETup:OUTPut:TRIGger`
Example	`:SOUR:LIST:STEP2:SET:OUTP:TRIG ON` `:SOUR:LIST:STEP2:SET:OUTP:TRIG?`
Notes	SCPI is supported after A.09.40
Dependencies	Not available in E7760
Preset	`OFF`
Range	`ON|OFF`

Step Configuration (Remote Command Only)

Used to configure the List Sequencer, as detailed in the table below. The command is defined such that you send one command per step, with the step number being specified as a subopcode of the SCPI command. Each command includes all the parameter settings for the step. As a step is setup, the values entered are run through several levels of validation.

Remote Command	`:SOURce:LIST:STEP[1]|2|...|…|1000:SETup <step_trigger>, <trans_time>, <band>, <link_type>, <freq_chan>, <power>, <waveform>, <duration>, <time_count>, <trig_state>`
	For details of each option, see "Step Configuration Parameters" on page 2116 below
	`:SOURce:LIST:STEP[1]|2|...|…|1000:SETup?`

Example	`:SOUR:LIST:STEP1:SET INT, 1ms, PGSM, DOWN, 10, -25 dBm, "GSM_Test1.bin", TIME, 10ms, OFF`
Dependencies	The range of subopcode values is 1 to 1000, and the value you enter is determined by the number of steps you have configured. For details see "Number of Steps" on page 2101 If you attempt to remotely set or query a subopcode that is out of range, an error is generated

Step Configuration Parameters

There are 10 parameters for each step, which must be in the following order in the command:

1	Step Trigger `<step_trigger>`	Data Type: enum Specifies the input trigger for the step. For further details, see "Step Trigger" on page 2103
2	Transition Time `<trans_time>`	Data Type: enum Specifies the transition time for the step in seconds. For further details, see "Transition Time" on page 2104
3	Radio Band `<band>`	Data Type: enum Specifies the radio band for the step, as any one of: `NONE | PGSM | EGSM | RGSM | DCS1800 | PCS1900 | TGSM810 | GSM450 | GSM480 | GSM700 | GSM850 | BANDI | BANDII | BANDIII | BANDIV | BANDV | BANDVI | BANDVII | BANDVIII | BANDIX | BANDX | BANDXI | BANDXII | BANDXIII | BANDXIV | BANDXIX | USCELL | USPCS | JAPAN | KOREAN | NMT | IMT2K | UPPER | SECOND | PAMR400 | PAMR800 | IMTEXT | PCS1DOT9G | AWS | US2DOT5G | PUBLIC | LOWER | NONE | BAND1 | BAND2 | BAND3 | BAND4 | BAND5 | BAND6 | BAND7 | BAND8 | BAND10 | BAND11 | BAND12 | BAND13 | BAND14 | BAND17 | BAND18 | BAND19 | BAND20 | BAND21 | BAND24 | BAND25 | BAND26 | BAND33 | BAND34 | BAND35 | BAND36 | BAND37 | BAND38 | BAND39 | BAND40 | BAND41 | BAND42 | BAND43 | BANDA | BANDB | BANDC | BANDD | BANDE | BANDF | N1 | N2 | N3 | N5 | N7 | N8 | N12 | N20 | N25 | N28 | N34 | N38 | N39 | N40 | N41 | N50 | N51 | N66 | N70 | N71 | N74 | N75 | N76 | N77 | N78 | N79 | N80 | N81 | N82 | N83 | N84 | N86 | N257 | N258 | N260 | N261` For further details, see "Band" on page 2105
4	Radio Band Link `<link_type>`	Data Type: enum Specifies the radio band link direction for the step, as either of:

		`DOWN|UP` For further details, see "Device" on page 2109 The old "Device" BTS|MS is obsolete, but is still supported, acting as an alias for the "Link" parameter
5	Frequency/Channel Number `<freq_chan>`	Data Type: freq/chan num Specifies the frequency in Hz or the channel number for the step. The channel number and frequency are combined as one parameter that represents the frequency or channel number depending on the radio band setting. If the radio band is set to `NONE`, this value is interpreted as a frequency value in Hz. If the radio band is set to a valid band, this value is interpreted as a channel number For further details, see "Freq/Chan" on page 2109
6	Power `<power>`	Data Type: ampl Specifies the output power for the step in dBm. For details of the valid ranges see "Power" on page 2111
7	Waveform `<waveform>`	Data Type: string Specifies the waveform for playback during the step. The step can output either a new ARB waveform, continue playback of the previous waveform, or output a CW tone. The options for specifying these are: `<filename>` — Plays the specified waveform from the start. The filename value is the name of the file within ARB playback memory, it is does not include the windows path to the file on the HDD. If you enter a filename for a waveform that does not reside within ARB playback memory, an error is generated `CONT` — Continues playback of the ARB file from the previous step `CW` — Outputs a CW tone `OFF` — Disables RF output For further details, see "Waveform" on page 2111 and "Waveform File" on page 2112
8	Step Duration `<duration>`	Data Type: enum Specifies the duration of the step, as one of: `TIME|COUNt|CONTinuous` The duration can be specified to be either time, or play count of the ARB file associated with the step, or continuous. If Waveform is set to `CW`, this value cannot be set to Play Count and an error will be generated. If `CONTinuous` is selected, the following Time or Count value is ignored. For further details, see "Step Duration" on page 2112

9	Time or Count `<time_count>`	Data Type: time/int Specifies time duration in seconds, or play count of the ARB file associated with the step For further details, see "Play Count" on page 2114
10	Output Trigger `<trig_state>`	Data Type: boolean Specifies the output trigger state for the step, as one of: `ON|OFF|1|0` For further details, see "Trig Out" on page 2115

Step Configuration of Step Trigger parameter list (Remote Command Only)

Configures the “Step Trigger” parameter array of the whole List Sequencer at one time. The number of array is the same as the step number defined in "Number of Steps" on page 2101. As a step is setup, the value entered runs through several levels of validation.

Remote Command	`:SOURce:LIST:SETup:INPut:TRIGger <enum>, <enum>, <enum>, …` `:SOURce:LIST:SETup:INPut:TRIGger?`
Example	`:SOUR:LIST:SET:INP:TRIG IMM,INT,EXT2` `:SOUR:LIST:SET:INP:TRIG?`
Notes	The command is to setup below parameter array of whole list sequence Step Trigger <**enum**> - specifies the input trigger for the step. For details of the valid types of step trigger see "Step Trigger" on page 2103 If input parameter number exceeds the step number defined by "Number of Steps" on page 2101, then error -221 "Settings conflict; The number of input parameters is too large and is truncated to current list step number" is generated, and only those parameters whose index number falls in number of steps will be updated
Dependencies	The range is 1 to 1000 which is determined by the number of steps you have configured. For details see "Number of Steps" on page 2101

Step Configuration of Transition Time parameter list (Remote Command Only)

This SCPI command is to configure “Transition Time” parameter array of the whole List Sequencer at one time. The number of array is same as step number defined in "Number of Steps" on page 2101. As a step is setup, the value entered run through several levels of validation.

Remote Command	`:SOURce:LIST:SETup:TRANsition:TIME <time>, <time>, <time>, …` `:SOURce:LIST:SETup:TRANsition:TIME?`
Example	`:SOUR:LIST:SET:TRAN:TIME 1ms,1ms,1ms` `:SOUR:LIST:SET:TRAN:TIME?`
Notes	The command is to setup below parameter array of whole list sequence

	Transition Time <time> - specifies the transition time for the step in seconds. For details of the valid ranges for the transition time see "Transition Time" on page 2104 If input parameter number exceeds the step number defined by "Number of Steps" on page 2101, then the error -221, "Settings conflict; The number of input parameters is too large and is truncated to current list step number" is generated, and only those parameters whose index number falls in number of steps will be updated
Dependencies	The range is 1 to 1000 which is determined by the number of steps you have configured. For details see "Number of Steps" on page 2101

Step Configuration of Radio Band parameter list (Remote Command Only)

Configures the “Radio Band” parameter array of the whole List Sequencer at once. The size of the array is the same as the step number defined in "Number of Steps" on page 2101. As a step is setup, the value entered runs through several levels of validation.

Remote Command	`:SOURce:LIST:SETup:RADio:BAND <enum>, <enum>, <enum>, …` `:SOURce:LIST:SETup:RADio:BAND?`
Example	`:SOUR:LIST:SET:RAD:BAND PGSM, EGSM, RGSM` `:SOUR:LIST:SET:RAD:BAND?`
Notes	The command sets up the parameter array of whole list sequence Radio Band <enum> - specifies the radio band for the step. For available options, see "Band" on page 2105 If the input parameter number exceeds the step number defined by "Number of Steps" on page 2101, then error -221, "Settings conflict; The number of input parameters is too large and is truncated to current list step number" is generated, and only those parameters whose index number falls within the number of steps will be updated
Dependencies	The range is 1 to 1000 which is determined by the number of steps you have configured. For details see "Number of Steps" on page 2101

Step Configuration of Radio Band Link parameter list (Remote Command Only)

Configures the “Radio Band Link” parameter array of the whole List Sequencer at one time. The number of array is same as step number defined in "Number of Steps" on page 2101. As a step is setup, the value entered runs through several levels of validation.

Remote Command	`:SOURce:LIST:SETup:RADio:BAND:LINK <enum>, <enum>, <enum>, …` `:SOURce:LIST:SETup:RADio:BAND:LINK?`
Example	`:SOUR:LIST:SET:RAD:BAND:LINK DOWN,UP,UP` `:SOUR:LIST:SET:RAD:BAND:LINK?`
Notes	The command sets up the parameter array of whole list sequence Radio Band Link <enum> - specifies the radio band link direction for the step. Options are:

	DOWN|UP If input parameter number exceeds the step number defined by "Number of Steps" on page 2101, then error -221, "Settings conflict; The number of input parameters is too large and is truncated to current list step number" is generated, and only those parameters whose index number falls within the number of steps will be updated
Dependencies	The range is 1 to 1000, which is determined by the number of steps you have configured. For details see "Number of Steps" on page 2101

Step Configuration of Frequency/Channel Number parameter list (Remote Command Only)

Configures the “Frequency” or “Channel Number” parameter array of the whole List Sequencer at one time. The number of array is same as step number defined in "Number of Steps" on page 2101. As a step is setup, the value entered runs through several levels of validation.

Remote Command	`:SOURce:LIST:SETup:CNFRequency <double>, <double>, <double>, …` `:SOURce:LIST:SETup:CNFRequency?`

Example	`:SOUR:LIST:SET:CNFR 1GHz,100MHz,100MHz`
	`:SOUR:LIST:SET:CNFR?`
	`:SOUR:LIST:SET:CNFR 124,124,124`
	`:SOUR:LIST:SET:CNFR?`

Notes	The command sets up the parameter array of whole list sequence Frequency/Channel Number <freq>/<chan num> - specifies the frequency in Hz or the channel number for the step. The channel number and frequency are combined as one parameter that represents the frequency or channel number depending on the radio band setting. If the radio band is set to NONE, this value is interpreted as a frequency value in Hz. If the radio band is set to a valid band, this value is interpreted as a channel number. For details of the valid ranges for frequency and channel numbers, see "Freq/Chan" on page 2109 and "Freq/Chan" on page 2109 This SCPI is used to setup/query channel number or frequency setting, according to current Radio Band setting of that step. If Radio Band is NONE, then it is frequency. If Radio Band is not NONE, then it is channel number If input parameter number exceeds the step number defined by "Number of Steps" on page 2101, then generate error -221, "Settings conflict; The number of input parameters is too large and is truncated to current list step number", and only those parameters whose index number falls in legal step number will be updated
Dependencies	The range is 1 to 1000, which is determined by the number of steps you have configured. For details see "Number of Steps" on page 2101

Step Configuration of Power parameter list (Remote Command Only)

Configures the “Power” parameter array of the whole List Sequencer at one time. The number of arrays is the same as step number defined in "Number of Steps" on page 2101. As a step is setup, the value entered runs through several levels of validation.

Remote Command	`:SOURce:LIST:SETup:AMPLitude <ampl>, <ampl>, <ampl>, …` `:SOURce:LIST:SETup:AMPLitude?`
Example	`:SOUR:LIST:SET:AMPL -50dBm,-40dBm,-30dBm` `:SOUR:LIST:SET:AMPL?`
Notes	The command sets up the parameter array of whole list sequence Power <**ampl**> - specifies the output power for the step in dBm. For details of the valid ranges, see "Power" on page 2111 If input parameter number exceeds the step number defined by "Number of Steps" on page 2101, then error -221, "Settings conflict; The number of input parameters is too large and is truncated to current list step number" is generated, and only those parameters whose index number falls within legal step number will be updated
Dependencies	The range is 1 to 1000, which is determined by the number of steps you have configured. For details see "Number of Steps" on page 2101.

Step Configuration of Waveform parameter list (Remote Command Only)

Configures the "Waveform" parameter array of the whole List Sequencer at one time. The number of array is same as step number defined in "Number of Steps" on page 2101. As a step is setup, the value entered runs through several levels of validation.

Remote Command	`:SOURce:LIST:SETup:WAVeform <string>, <string>, <string>, …` `:SOURce:LIST:SETup:WAVeform?`
Example	`:SOUR:LIST:SET:WAV “CW”,”Off”,”CONT”` `:SOUR:LIST:SET:WAV?`
Notes	Sets up or queries the parameter array of whole list sequence Waveform <**string**> - specifies the waveform for playback during the step. The step can output either a new ARB waveform, continue playback of the previous waveform, or output a CW tone. The options for specifying these are: `<filename>`: Plays the specified waveform from the start. The filename value is the name of the file within ARB playback memory, it is does not include the windows path to the file on the HDD. If you enter a filename for a waveform that does not reside within ARB playback memory, an error is generated `CONT`: Continues playback of the ARB file from the previous step `CW`: Outputs a CW tone `OFF`: Disables the RF output If input parameter number exceeds the step number defined by "Number of Steps" on page 2101, then error -221, "Settings conflict; The number of input parameters is too large and is truncated to current list step number" is generated, and only those parameters whose index number falls within number of steps will be updated
Dependencies	The range is 1 to 1000 which is determined by the number of steps you have configured. For details see "Number of Steps" on page 2101
Range	`”filename” | “CW” | “Off” | “CONT”`

Step Configuration of Step Duration parameter list (Remote Command Only)

Configures the “Step Duration” parameter array of the whole List Sequencer at one time. The number of array is same as step number defined in "Number of Steps" on page 2101. As a step is setup, the value entered runs through several levels of validation.

Remote Command	`:SOURce:LIST:SETup:DURation:TYPE <enum>, <enum>, <enum>, …` `:SOURce:LIST:SETup:DURation:TYPE?`
Example	`:SOUR:LIST:SET:DUR:TYPE COUN,TIME,CONT` `:SOUR:LIST:SET:DUR:TYPE?`
Notes	Sets up or queries the parameter array of whole list sequence Step Duration <**enum**> - specifies the duration of the step. The duration can be specified to be either time, or play count of the ARB file associated with the step, or continuous. If Waveform is set to “CW”, this value cannot be set to Play Count and an error will be generated. If continuous is selected, the following Time or Count value is ignored. For further details of this setting, see"Step Duration" on page 2112. Options are: `TIME | COUNt | CONTinuous` If input parameter number exceeds the step number defined by "Number of Steps" on page 2101, then error -221, "Settings conflict; The number of input parameters is too large and is truncated to current list step number" is generated, and only those parameters whose index number falls within number of steps will be updated
Dependencies	The range is 1 to 1000, which is determined by the number of steps you have configured. For details see "Number of Steps" on page 2101

Step Configuration of Duration Time or Play Count parameter list (Remote Command Only)

Configures the “Duration Time” or “Play Count” parameter array of the whole List Sequencer at one time. The number of array is same as step number defined in "Number of Steps" on page 2101. As a step is setup, the value entered runs through several levels of validation.

Remote Command	`:SOURce:LIST:SETup:TOCount <time/int>, <time/int>, <time/int>, …` `:SOURce:LIST:SETup:TOCount?`

Example	`:SOUR:LIST:SET:TOC 1s,2s,3s`
	`:SOUR:LIST:SET:TOC?`
	`:SOUR:LIST:SET:TOC 5,6,7`
	`:SOUR:LIST:SET:TOC?`

Notes	Sets up or queries the parameter array of whole list sequence Time or Count <time/int> - specifies time duration in seconds or play count of the ARB file associated

	with the step If input parameter number exceeds the step number defined by "Number of Steps" on page 2101, then an erroris generated, and only those parameters whose index number falls within number of steps will be updated If current "Step Duration" on page 2112 is "Continuous", then error -221, "Settings conflict; Cannot accept time or count input when step duration type is Continuous on step #" is generated
Dependencies	The range is 1 to 1000, which is determined by the number of steps you have configured. For details see "Number of Steps" on page 2101

Step Configuration of Output Trigger parameter list (Remote Command Only)

Configures the "Output Trigger" parameter array of the whole List Sequencer at one time. The number of array is same as step number defined in "Number of Steps" on page 2101. As a step is setup, the value entered runs through several levels of validation.

Remote Command	`:SOURce:LIST:SETup:OUTPut:TRIGger <bool>, <bool>, <bool>, …` `:SOURce:LIST:SETup:OUTPut:TRIGger?`
Example	`:SOUR:LIST:SET:OUTP:TRIG ON,OFF,ON` `:SOUR:LIST:SET:OUTP:TRIG?`
Notes	Sets up or queries the parameter array of whole list sequence Output Trigger <Boolean> - specifies the output trigger for the step. Options are: `ON|OFF|1|0` If input parameter number exceeds the step number defined by "Number of Steps" on page 2101, then error -221,"Settings conflict; The number of input parameters is too large and is truncated to current list step number" is generated, and only those parameters whose index number falls within legal step number are updated
Dependencies	The range is 1 to 1000 which is determined by the number of steps you have configured. For details see "Number of Steps" on page 2101

Clear List (Remote Command Only)

This is the SCPI equivalent of the Clear List UI featuredescribed in "Clear List" on page 2103

Remote Command	`:SOURce:LIST:SETup:CLEar`
Example	`:SOUR:LIST:SETup:CLE`
Dependencies	This control is not available in E7760

6.1.8.8 Remote Software Trigger (Remote command Only)

During execution of a list sequence, the sequence halts and waits at any step that has Step Trigger set to "Bus". Sending this command triggers the step and continues the sequence.

Remote Command	`:SOURce:LIST:TRIGger:INITiate[:IMMediate]`
Example	`:SOUR:LIST:TRIG:INIT`
Dependencies	This control is not available in E7760

6.1.8.9 Query List Sequence Initiation Armed Status (Remote Command Only)

This is a blocking SCPI query to determine whether a source list sequence has been initiated successfully.

Remote Command	`:SOURce:LIST:INITiation:ARMed?`
Example	`:SOUR:LIST:INIT:ARMed?`
Notes	Query only. Returns “1” if list sequence has been initiated successfully, or “0” if not. If the response is “0”, you can use `:SYST:ERR?` to query the actual error Just like `*OPC?`, this command can be blocked until event/status “IsSourceSweeping” happens, and then returns. Doing so can help user’s script query armed status only once during the time interval of the initiation. As an ancillary SCPI of existing SCPI `:SOUR:LIST:TRIGger[:IMMediate]` (see "Initiate Sequence" on page 2100), the correct usage of this command is to use it after `:SOUR:LIST:TRIG`. If not, this command will return “1” immediately The return data is in the following format: Integer There is an alias SCPI: `:SOURce:LIST:TRIGger:INITiation:ARMed?`
Dependencies	This control is not available in E7760

6.1.9 Frequency Setup

Allows you to access the Frequency Setup sub-menu panel.

Notes	The sub-menu under this button is for independent mode and has no effect on the "List Sequencer" on page 2099. If "Sequencer" on page 2099 is `ON`, the List Sequencer controls the source output and this key is grayed-out, to indicate out-of-scope. When "Sequencer" on page 2099 is `OFF`, source leaves List Sequencer and this button is blanked out

6.1.9.1 Frequency

Allows you to set the RF Output Frequency. You can adjust the frequency of the source using the numeric keypad, step keys, or RPG. Pressing any digit, 0 through 9, on the numeric keypad displays the unit terminator.

Remote Command	`:SOURce:FREQuency[:CW] <freq>` `:SOURce:FREQuency[:CW]?`
Example	`:SOUR:FREQ 1.00 GHz`
Notes	Internal source has list sequence mode, which comprises of several steps that contain separate output power, frequency and waveform etc. When the source list sequence playing is complete, the last step

	keeps playing, and you can use this command to change the list sequence last step's output frequency
Couplings	The frequency value is coupled to the current channel band and number, such that updates to the band and number will update the frequency value to the corresponding absolute frequency For E7760A, if the Output Port selected is a mmWave port, and option RF4 is not present, the frequency of the source and analyzer must be the same. Thus, changing this source frequency will also update the analyzer frequency. If option RF4 is present, the frequency of the source and receiver are independent
Preset	For E7760: Dependent on port selected For EXM, if license F1A or 5WC is present, the default Center Frequency is 2.412GHz For VXT Models with Radio Heads/CIU: see "VXT Models with Radio Heads/CIU" on page 2126 For all other models: 1.00 GHz
Min	For E7760: Dependent on port selected. VXT models M9420A/21A: 60 MHz VXT models M9410A/11A/15A: 380 MHz VXT models M9411A: option LFE = 1 MHz For VXT Models with Radio Heads/CIU: see "VXT Models with Radio Heads/CIU" on page 2126 All other models: 10.00 MHz
Max	Hardware Dependent: Option 503 = 3.6 GHz Option 504 = 3.8 GHz Option 506 = 6.00 GHz Option F06 = 6.00 GHz See VXT model M9415A For VXT Models with Radio Heads/CIU: see "VXT Models with Radio Heads/CIU" on page 2126 For E7760: Dependent on port selected For EXM, if license 5WC is present, the frequency range should be limited to: 1.1GHz-1.7GHz, 2.4GHz-2.5GHz, 4.8GHz-6.0GHz. If the user-defined frequency is outside of range, UI will report an error message called "Settings conflict; Frequency is outside available range"

VXT model M9415A

Freq Option	Preset	Min	Max
F06	1 GHz	380 MHz	6.0 GHz
F08	1 GHz	380 MHz	8.0 GHz
F12	1 GHz	380 MHz	12.3 GHz

Note: Option F06 can be set up to maximum 6.6 GHz on UI, but Spec to customer only ensure up to 6.0 GHz (option F06); Option F06 can be set up to maximum 8.6 GHz on UI, but Spec to customer only ensure up to 8.0 GHz (option F08); Option F12 can be set up to maximum 12.9 GHz on UI, but Spec to customer only ensure up to 12.3 GHz (option F12).

The minimum spec frequency is 380 MHz, but the minimum settable value is 330 MHz.

VXT models M9410A/11A

RF Output Port	Preset	Min Without Option “LFE”	Min With Option “LFE”	Max
RF Output	1 GHz	380 MHz	1 MHz	6 GHz
RFHD	1 GHz	380 MHz	1 MHz	6 GHz

Note: Option F06 can be set up to maximum 6.08 GHz on UI, but Spec to customer only ensure up to 6.0 GHz (option F06). Option F06 and EP6 can be set up to maximum 6.60 GHz on UI, but Spec to customer only ensure up to 6.0 GHz.

The minimum spec frequency is 380 MHz, but the minimum settable value is 330 MHz.

E7760

RF Output Port	Preset	Min	Max
IFIO	16 GHz	2 GHz	18 GHz
M1650A	58.32 GHz	55 GHz	69 GHz
M1720A	28 GHz	25 GHz	29 GHz

VXT Models with Radio Heads/CIU

Products with Radio Heads/CIU	Preset	Start frequency	Stop frequency
M9421A + CIU	6 GHz	5.9 GHz	12 GHz
M9410A + CIU	6 GHz	5.9 GHz	12 GHz
M9410A + CIU + RRH	28 GHz	24.25 GHz	43.5 GHz

6.1.9.2 Channel

The frequency of the source can be specified by a channel number of a given frequency band. This key allows you to specify the current channel number. For the appropriate range of channel numbers for a given frequency band, refer to the following tables: "GSM/EDGE Channel Number Ranges" on page 2127, "W-CDMA Channel Number Ranges" on page 2128, "CDMA 2000 / 1xEVDO Channel Number Ranges" on page 2129, and "LTE FDD Channel Number Ranges" on page 2131.

Channel is not available on E7760.

Remote Command	`:SOURce:FREQuency:CHANnels:NUMBer <int>` `:SOURce:FREQuency:CHANnels:NUMBer?`

Example	`:SOUR:LIST:STEP2:SET:RAD:NUMB 1`
Notes	This key is grayed-out when the "Radio Standard/Radio Band" on page 2135 is set to `NONE`
Couplings	The channel number is coupled to the frequency value when the"Radio Standard/Radio Band" on page 2135 is not set to `NONE`. When the frequency value is changed, the channel number will increase or decrease to match the new frequency. If the frequency is not at an exact match for a channel number, the nearest channel number is displayed along with a greater than or less than sign to indicate the frequency is above or below the channel number
Preset	1
Min	Refer to the tables below for the valid ranges
Max	Refer to the tables below for the valid ranges

GSM/EDGE Channel Number Ranges

Band	Link (Device)	Range	Frequency (MHz)
P-GSM	Uplink (MS)	1 £ n £ 124	890.0 + 0.2*n
	Downlink (BS)	1 £ n £ 124	935.0 + 0.2*n
E-GSM	Uplink (MS)	0 £ n £ 124	890.0 + 0.2*n
		975 £ n £ 1023	890.0 + 0.2*(n-1024)
	Downlink (BS)	0 £ n £ 124	935.0 + 0.2*n
		975 £ n £ 1023	935.0 + 0.2*(n-1024)
DCS 1800	Uplink (MS)	512 £ n £ 885	1710.200 + 0.20*(n-512)
	Downlink (BS)	512 £ n £ 885	1805.200 + 0.20*(n-512)
PCS 1900	Uplink (MS)	512 £ n £ 810	1850.200 + 0.2*(n-512)
	Downlink (BS)	512 £ n £ 810	1930.200 + 0.2*(n-512)
R-GSM	Uplink (MS)	0 £ n £ 124	890.0 + 0.2*n
		955 £ n £ 1023	890.0 + 0.2*(n-1024)
	Downlink (BS)	0 £ n £ 124	935.0 + 0.2*n
		955 £ n £ 1023	935.0 + 0.2*(n-1024)
GSM 450	Uplink (MS)	256 £ n £ 293	450.6 + 0.2*(n-259)
	Downlink (BS)	256 £ n £ 293	460.6 + 0.2*(n-259)
GSM 480	Uplink (MS)	306 £ n £ 340	479.000 + 0.20*(n-306)
	Downlink (BS)	306 £ n £ 340	489.000 + 0.20*(n-306)
GSM 850	Uplink (MS)	128 £ n £ 251	824.200 + 0.20*(n-128)
	Downlink (BS)	128 £ n £ 251	869.200 + 0.20*(n-128)
GSM 700	Uplink (MS)	438 £ n £ 516	777.200 + 0.20*(n-438)
	Downlink (BS)	438 £ n £ 516	747.200 + 0.20*(n-438)
T-GSM810	Uplink (MS)	350 £ n £ 425	806.0 + 0.20*(n-350)
	Downlink (BS)	350 £ n £ 425	851.0 + 0.20*(n-350)

W-CDMA Channel Number Ranges

Band	Link (Device)	Range	Frequency (MHz)
Band I	Downlink	10562 £ n £ 10838	n÷5
	Uplink	9612 £ n £ 9888	n÷5
Band II	Downlink	412 £n £687	n÷5 + 1850.1
		9662 £n £9938	n÷5
	Uplink	12 £n £287	n÷5 + 1850.1
		350 £n £425	n÷5
Band III	Downlink	1162 ≤n £1513	n÷5 + 1575
	Uplink	937 ≤n £1288	n÷5 + 1525
Band IV	Downlink	537 ≤n ≤1738	n÷5 + 1805
		1887 ≤n ≤2087	n÷5 + 1735.1
	Uplink	1312 ≤n ≤1513	n÷5 + 1450
		1662 ≤n ≤1862	n÷5 + 1380.1
Band V	Downlink	1007 ≤n ≤1087	n÷5 + 670.1
		4357 ≤n ≤4458	n÷5
	Uplink	782 ≤n ≤862	n÷5 + 670.1
		4132 ≤n ≤4233	n÷5
Band VI	Downlink	1037 ≤n ≤1062	n÷5 + 670.1
		4387 ≤n ≤4413	n÷5
	Uplink	812 ≤n ≤837	n÷5 + 670.1
		4162 ≤n ≤4188	n÷5
Band VII	Downlink	2237 ≤n ≤2563	n÷5 + 2175
		2587 ≤n ≤2912	n÷5 + 2105.1
	Uplink	2012 ≤n ≤2338	n÷5 + 2100
		2362 ≤n ≤2687	n÷5 + 2030.1
Band VIII	Downlink	2937 ≤n ≤3088	n÷5 + 340
	Uplink	2712 ≤n ≤2863	n÷5 + 340
Band IX	Downlink	9237 ≤n ≤9387	n÷5
	Uplink	8762 ≤n ≤8912	n÷5
Band X	Downlink	3112 ≤n ≤3388	n÷5 + 1490
		3412 ≤n ≤3687	n÷5 + 1430.1
	Uplink	2887 ≤n ≤3163	n÷5 + 1135
		3187 ≤n ≤3462	n÷5 + 1075.1
Band XI	Downlink	3712 ≤n ≤3812	n÷5 + 736
	Uplink	3487 ≤n ≤3587	n÷5 + 733
Band XII	Downlink	3837 ≤n ≤3903	n÷5 – 37
		3927 ≤n ≤3992	n÷5 – 54.9
	Uplink	3612 ≤n ≤3678	n÷5 – 22

Band	Link (Device)	Range	Frequency (MHz)
		3702 ≤n ≤3767	n÷5 – 39.9
Band XIII	Downlink	4017 ≤n ≤4043	n÷5 – 55
		4067 ≤n ≤4092	n÷5 – 64.9
	Uplink	3792 ≤n ≤3818	n÷5 + 21
		3702 ≤n ≤3767	n÷5 – 39.9
Band XIV	Downlink	4117 ≤n ≤4143	n÷5 – 63
		4167 ≤n ≤4192	n÷5 – 72.9
	Uplink	3892 ≤n ≤3918	n÷5 + 12
		3942 ≤n ≤3967	n÷5 + 2.1
Band XIX	Downlink	712 £ n £ 763	n÷5 + 735
		787 £ n £ 837	n÷5 + 720.1
	Uplink	312 £ n £ 363	n÷5 + 770
		387 £ n £ 437	n÷5 + 755.1

CDMA 2000 / 1xEVDO Channel Number Ranges

Band	Link (Device)	Range	Frequency (MHz)
US Cellular	Uplink (MS, reverse link)	1 ≤N ≤799 991 ≤N ≤1023 1024 ≤N ≤1323	0.030*N+ 825.000 0.030*(N–1023) + 825.000 0.030*(N–1024) + 815.040
	Downlink (BS, forward link)	1 ≤N ≤799 991 ≤N ≤1023 1024 ≤N ≤1323	0.030*N+ 870.000 0.030*(N–1023) + 870.000 0.030*(N–1024) + 860.040
US PCS	Uplink (MS, reverse link)	0 ≤N ≤1199	1850.000 + 0.050*N
	Downlink (BS, forward link)	0 ≤N ≤1199	1930.000 + 0.050*N
Japan Cellular Band	Uplink (MS, reverse link)	1 ≤N ≤799 801 ≤N ≤1039 1041 ≤N ≤1199 1201 ≤N ≤1600	0.0125*N+ 915.000 0.0125*(N-800)+ 898.000 0.0125*(N-1040)+ 887.000 0.0125*(N-1200)+ 893.000
	Downlink (BS, forward link)	1 ≤N ≤799 801 ≤N ≤1039 1041 ≤N ≤1199	0.0125*N+ 860.000 0.0125*(N-800)+ 843.000 0.0125*(N-1040)+ 832.000

Band	Link (Device)	Range	Frequency (MHz)
		1201 ≤N ≤1600	0.0125*(N-1200)+ 838.000
Korean PCS Band	Uplink (MS, reverse link)	0 ≤ N ≤ 599	0.050*N+ 1750.000
	Downlink (BS, forward link)	0 ≤ N ≤ 599	0.050*N+ 1840.000
NMT-450 Band	Uplink (MS, reverse link)	1 ≤N ≤400	0.025*(N-1)+ 450.000
		472 ≤N ≤871	0.025*(N-472)+ 410.000
		1039 ≤N ≤1473	0.020*(N-1024)+ 451.010
		1536 ≤N ≤1715	0.025*(N-1536)+ 479.000
		1792 ≤N ≤2016	0.020*(N-1792)+ 479.000
	Downlink (BS, forward link)	1 ≤N ≤400	0.025*(N-1)+ 460.000
		472 ≤N ≤871	0.025*(N-472)+ 420.000
		1039 ≤N ≤1473	0.020*(N-1024)+ 461.010
		1536 ≤N ≤1715	0.025*(N-1536)+ 489.000
		1792 ≤N ≤2016	0.020*(N-1792)+ 489.000
IMT-2000 Band	Uplink (MS, reverse link)	0 ≤N ≤1199	1920.000 + 0.050*N
	Downlink (BS, forward link)	0 ≤N ≤1199	2100.000 + 0.050*N
Upper 700 MHz Band	Uplink (MS, reverse link)	0 ≤N ≤240	776.000 + 0.050*N
	Downlink (BS, forward link)	0 ≤N ≤240	746.000 + 0.050*N
Secondary 800 MHz Band	Uplink (MS, reverse link)	0 ≤N ≤719	0.025*N+ 806.000
		720 ≤N ≤919	0.025*(N–720) + 896.000
	Downlink (BS, forward link)	0 ≤N ≤719	0.025*N+ 851.000
		720 ≤N ≤919	0.025*(N–720) + 935.000
2.5 GHz IMT Extension	Uplink (MS, reverse link)	0 ≤N ≤1399	2500.000 + 0.050*N
	Downlink (BS, forward link)	0 ≤N ≤1399	2620.000 + 0.050*N
US PCS 1.9 GHz	Uplink (MS, reverse link)	0 ≤N ≤1299	1850.000 + 0.050*N
	Downlink (BS, forward link)	0 ≤N ≤1299	1930.000 + 0.050*N
AWS	Uplink (MS, reverse link)	0 ≤N ≤899	1710.000 + 0.050*N
	Downlink (BS, forward link)	0 ≤N ≤899	2100.000 + 0.050*N

Band	Link (Device)	Range	Frequency (MHz)
US 2.5 GHz	Uplink (MS, reverse link)	140 ≤N ≤1459	2495.000 + 0.050*N
	Downlink (BS, forward link)	140 ≤N ≤1459	2617.000 + 0.050*N
700 Public Safety	Uplink (MS, reverse link)	0 ≤N ≤240	787.000 + 0.050*N
	Downlink (BS, forward link)	0 ≤N ≤240	757.000 + 0.050*N
C2K Lower 700	Uplink (MS, reverse link)	0 ≤N ≤360	698.000 + 0.050*N
	Downlink (BS, forward link)	0 ≤N ≤360	728.000 + 0.050*N
400 Euro PAMR	Uplink (MS, reverse link)	1 ≤N ≤400	0.025*(N-1)+ 450.000
	Uplink (MS, reverse link)	472 ≤N ≤871	0.025*(N-472)+ 410.000
	Uplink (MS, reverse link)	1536 ≤N ≤1715	0.025*(N-1536)+ 479.000
	Downlink (BS, forward link)	1 ≤N ≤400	0.025*(N-1)+ 460.000
		472 ≤N ≤871	0.025*(N-472)+ 420.000
	Downlink (BS, forward link)	1536 ≤N ≤1715	0.025*(N-1536)+ 489.000
	Downlink (BS, forward link)		
800 PAMR	Uplink (MS, reverse link)	0 ≤N ≤239	870.0125 + 0.025*N
	Downlink (BS, forward link)	0 ≤N ≤239	915.0125 + 0.025*N

LTE FDD Channel Number Ranges

The carrier frequency in the uplink and downlink is designated by the E-UTRA Absolute Radio Frequency Channel Number (EARFCN) in the range 0 - 65535. The relation between EARFCN and the carrier frequency in MHz for the downlink is given by the following equation, where F_{DL_low} and $N_{Offs\text{-}DL}$ are given in table 5.4.4-1 and N_{DL} is the downlink EARFCN.

$F_{DL} = F_{DL\_low} + 0.1(N_{DL} – N_{Offs\text{-}DL})$

The relation between EARFCN and the carrier frequency in MHz for the uplink is given by the following equation where F_{UL_low} and $N_{Offs\text{-}UL}$ are given in table 5.4.4-1 and N_{UL} is the uplink EARFCN.

$F_{UL} = F_{UL\_low} + 0.1(N_{UL} – N_{Offs\text{-}UL})$

Band	Downlink			Uplink		
	F_{DL_low} (MHz)	$N_{Offs\text{-}DL}$	Range of N_{DL}	F_{UL_low} (MHz)	$N_{Offs\text{-}UL}$	Range of N_{UL}
1	2110	0	0 – 599	1920	18000	18000 – 18599
2	1930	600	600 –	1850	18600	18600 –

Band	Downlink			Uplink		
				1199		1 9 1 9 9
3	1805	1200	1200 – 1949	1710	19200	19200 – 19949
4	2110	1950	1950 – 2399	1710	19950	19950 – 20399
5	869	2400	2400 – 2649	824	20400	20400 – 20649
6	875	2650	2650 – 2749	830	20650	20650 – 20749
7	2620	2750	2750 – 3449	2500	20750	20750 – 20449
8	925	3450	3450 – 3799	880	21450	21450 – 21799
9	1844.9	3800	3800 – 4149	1749.9	21800	21800 – 22149
10	2110	4150	4150 – 4749	1710	22150	22150 – 22749
11	1475.9	4750	4750 – 4949	1427.9	22750	22750 – 22949
12	729	5010	5010 – 5179	699	23010	23010 – 23179
13	746	5180	5180 – 5279	777	23180	23180 – 23279
14	758	5280	5280 – 5379	788	23280	23280 – 23379
…						
17	734	5730	5730 – 5849	704	23730	23730 – 23849
18	860	5850	5850 – 5999	815	23850	23850 – 23999
19	875	6000	6000 – 6149	830	24000	24000 – 24149
20	791	6150	6150 – 6449	832	24150	24150 – 24449
21	1495.9	6450	6450 – 6599	1447.9	24450	24450 – 24599
…						
24	1525	7700	7700 - 8039	1626.5	25700	25700 – 26039

Band	Downlink			Uplink		
	25	1930	8040	8040 - 8689	1850	26040 6 0 4 0 - 2 6 6 8 9
26	859	8690	8690 - 9039	814	26690	26690 - 27039

…

Note: The channel numbers that designate carrier frequencies so close to the operating band edges that the carrier extends beyond the operating band edge shall not be used. This implies that the first 7, 15, 25, 50, 75 and 100 channel numbers at the lower operating band edge and the last 6, 14, 24, 49, 74 and 99 channel numbers at the upper operating band edge shall not be used for channel bandwidths of 1.4, 3, 5, 10, 15 and 20 MHz respectively.

LTE TDD Channel Number Ranges

The carrier frequency in the uplink and downlink is designated by the E-UTRA Absolute Radio Frequency Channel Number (EARFCN) in the range 0 - 65535. The relation between EARFCN and the carrier frequency in MHz for the downlink is given by the following equation, where F_{DL_low} and $N_{Offs\text{-}DL}$ are given in table 5.4.4-1 and N_{DL} is the downlink EARFCN.

$$F_{DL} = F_{DL\_low} + 0.1(N_{DL} – N_{Offs\text{-}DL})$$

The relation between EARFCN and the carrier frequency in MHz for the uplink is given by the following equation where F_{UL_low} and $N_{Offs\text{-}UL}$ are given in table 5.4.4-1 and N_{UL} is the uplink EARFCN.

$$F_{UL} = F_{UL\_low} + 0.1(N_{UL} – N_{Offs\text{-}UL})$$

Band	Downlink			Uplink		
	F_{DL_low} (MHz)	$N_{Offs\text{-}DL}$	Range of N_{DL}	F_{UL_low} (MHz)	$N_{Offs\text{-}UL}$	Range of N_{UL}
33	1900	36000	36000 – 36199	1900	36000	36000 – 36199
34	2010	36200	36200 – 36349	2010	36200	36200 – 36349
35	1850	36350	36350 –	1850	36350	36350 –

Band	Downlink			Uplink		
				36949		36949
36	1930	36950	36950 – 37549	1930	36950	36950 – 37549
37	1910	37550	37550 – 37749	1910	37550	37550 – 37749
38	2570	37750	37750 – 38249	2570	37750	37750 – 38249
39	1880	38250	38250 – 38649	1880	38250	38250 – 38649
40	2300	38650	38650 – 39649	2300	38650	38650 – 39649
41	2496	39650	39650 - 41589	2496	39650	39650 - 41589
42	3400	41590	41590 – 43589	3400	41590	41590 – 43589
43	3600	43590	43590 – 45589	3600	43590	43590 – 45589

Note: The channel numbers that designate carrier frequencies so close to the operating band edges that the carrier extends beyond the operating band edge shall not be used. This implies that the first 7, 15, 25, 50, 75 and 100 channel numbers at the lower operating band edge and the last 6, 14, 24, 49, 74 and 99 channel numbers at the upper operating band edge shall not be used for channel bandwidths of 1.4, 3, 5, 10, 15 and 20 MHz respectively.

TDSCDMA Channel Number Ranges

1.28 Mcps TDD Option

No TX-RX frequency separation is required as Time Division Duplex (TDD) is employed. Each subframe consists of 7 main timeslots where all main timeslots (at least the first one) before the single switching point are allocated DL and all main timeslots (at least the last one) after the single switching point are allocated UL.

The nominal channel spacing is 1.6 MHz, but this can be adjusted to optimize performance in a particular deployment scenario.

The carrier frequency is designated by the UTRA absolute radio frequency channel number (UARFCN). The value of the UARFCN in the IMT2000 band is defined in the general case as follows:

Nt = 5*F: 0.0 MHz £ F£ 3276.6 MHz

where F is the carrier frequency in MHz

Additional channels applicable to operation in the frequency band defined in sub-clause 5.2(d) are defined via the following UARFCN definition:

Nt = 5 * (F - 2150.1 MHz): 2572.5 MHz £ F£ 2617.5 MHz

UARFCN

1.28 Mcps TDD Option

The following UARFCN range shall be supported for each band:

Frequency Band	Frequency Range	UARFCN Uplink and Downlink transmission
For operation in frequency band as defined in subclause 5.2 (a)	1900-1920 MHz 2010-2025 MHz	9504 to 9596 10054 to 10121
For operation in frequency band as defined in subclause 5.2 (b)	1850-1910 MHz 1930-1990 MHz	9254 to 9546 9654 to 9946
For operation in frequency band as defined in subclause 5.2 (c)	1910-1930 MHz	9554 to 9646
For operation in frequency band as defined in subclause 5.2 (d)	2570-2620 MHz	12854 to 13096
For operation in frequency band as defined in subclause 5.2 (e)	2300-2400 MHz	11504 to 11996
For operation in frequency band as defined in subclause 5.2 (f)	1880-1920 MHz	9404 to 9596

6.1.9.3 Radio Setup

The Radio Standard dialog allows you to select the radio standard and associated radio band. You can also set the Radio Band Link to Uplink or Downlink.

Radio Standard/Radio Band

The Radio Standard/Radio Band dialog allows you to select the radio standard and associated radio band. The first column of the dialog lets you set the Radio Standard; for each standard, the second column of the dialog changes to show you the available bands.

Once you have selected the radio standard, you can then set an active channel band. The radio standard and the active channel band allow you to use the "Channel" on page 2126 control to set Channel numbers, thus setting the "Frequency" on page 2124 automatically.

Remote	`:SOURce:FREQuency:CHANnels:BAND <band>`

Command	where <band> is one of: NONE | PGSM | EGSM | RGSM | DCS1800 | PCS1900 | GSM450 | GSM480 | GSM700 | GSM850 | TGSM810 | USCELL | USPCS | JAPAN | KOREAN | NMT | IMT2K | UPPER | SECOND | PAMR400 | PAMR800 | IMTEXT | PCS1DOT9G | AWS | US2DOT5G | PUBLIC | LOWER | BANDI | BANDII | BANDIII | BANDIV | BANDV | BANDVI | BANDVII | BANDVIII | BANDIX | BANDX | BANDXI | BANDXII | BANDXIII | BANDXIV | BANDXIX | BAND1 | BAND2 | BAND3 | BAND4 | BAND5 | BAND6 | BAND7 | BAND8 | BAND9 | BAND10 | BAND11 | BAND12 | BAND13 | BAND14 | BAND17 | BAND18 | BAND19 | BAND20 | BAND21 | BAND24 | BAND25 | BAND26 | BAND27 | BAND28 | BAND29 | BAND30 | BAND31 | BAND65 | BAND66 | BAND67 | BAND68 | BAND71 | BAND252 | BAND255 | BAND33 | BAND34 | BAND35 | BAND36 | BAND37 | BAND38 | BAND39 | BAND40 | BAND41 | BAND42 | BAND43 | BAND44 | BAND45 | BAND46 | BANDA | BANDB | BANDC | BANDD | BANDE | BANDF | N1 | N2 | N3 | N5 | N7 | N8 | N12 | N20 | N25 | N28 | N34 | N38 | N39 | N40 | N41 | N50 | N51 | N66 | N70 | N71 | N74 | N75 | N76 | N77 | N78 | N79 | N80 | N81 | N82 | N83 | N84 | N86 | N257 | N258 | N260 | N261 :SOURce:FREQuency:CHANnels:BAND?
Example	:SOUR:LIST:STEP2:SET:RAD:BAND PGSM
Notes	Setting this to NONE grays-out "Channel" on page 2126 in the Frequency Setup menu

Here are the members of each group in Radio Standard and a SCPI example for each:

None – no Radio Standard

None	:SOUR:FREQ:CHAN:BAND NONE

GSM - Sets GSM/EDGE as the radio standard for use and accesses the GSM/EDGE specific channel band sub-menus.

P-GSM	:SOUR:FREQ:CHAN:BAND PGSM
E-GSM	:SOUR:FREQ:CHAN:BAND EGSM
R-GSM	:SOUR:FREQ:CHAN:BAND RGSM
DCS 1800	:SOUR:FREQ:CHAN:BAND DCS1800
PCS 1900	:SOUR:FREQ:CHAN:BAND PCS1900
GSM 450	:SOUR:FREQ:CHAN:BAND GSM450
GSM 480	:SOUR:FREQ:CHAN:BAND GSM480
GSM 700	:SOUR:FREQ:CHAN:BAND GSM700
GSM 850	:SOUR:FREQ:CHAN:BAND GSM850
T-GSM 810	:SOUR:FREQ:CHAN:BAND T-GSM810

CDMA2000 - Sets CDMA 2000 / 1XEVDO as the radio standard for use and accesses the CDMA 2000/1xEVDO specific channel band sub-menus.

US Cell	:SOUR:FREQ:CHAN:BAND USCELL
US PCS	:SOUR:FREQ:CHAN:BAND PCS

Japan Cell	`:SOUR:FREQ:CHAN:BAND JAPAN`
Korean PCS	`:SOUR:FREQ:CHAN:BAND KOREAN`
NMT 450	`:SOUR:FREQ:CHAN:BAND NMT`
IMT 2000	`:SOUR:FREQ:CHAN:BAND IMT2K`
Upper 700	`:SOUR:FREQ:CHAN:BAND UPPER`
Secondary 800	`:SOUR:FREQ:CHAN:BAND SECOND`
400 Euro PAMR	`:SOUR:FREQ:CHAN:BAND PAMR400`
800 PAMR	`:SOUR:FREQ:CHAN:BAND PAMR800`
2.5 GHz IMT EXT	`:SOUR:FREQ:CHAN:BAND IMTEXT`
US PCS 1.9 GHz	`:SOUR:FREQ:CHAN:BAND PCS1DOT9G`
AWS	`:SOUR:FREQ:CHAN:BAND AWS`
US 2.5 GHz	`:SOUR:FREQ:CHAN:BAND US2DOT5G`
700 Public Safety	`:SOUR:FREQ:CHAN:BAND PUBLIC`
C2K Lower 700	`:SOUR:FREQ:CHAN:BAND LOWER`

W-CDMA - Sets WCDMA as the radio standard for use and accesses the W-CDMA specific channel band sub-menus.

Band I	`:SOUR:FREQ:CHAN:BAND BANDI`
Band II	`:SOUR:FREQ:CHAN:BAND BANDII`
Band III	`:SOUR:FREQ:CHAN:BAND BANDIII`
Band IV	`:SOUR:FREQ:CHAN:BAND BANDIV`
Band V	`:SOUR:FREQ:CHAN:BAND BANDV`
Band VI	`:SOUR:FREQ:CHAN:BAND BANDVI`
Band VII	`:SOUR:FREQ:CHAN:BAND BANDVII`
Band VIII	`:SOUR:FREQ:CHAN:BAND BANDVIII`
Band IX	`:SOUR:FREQ:CHAN:BAND BANDIX`
Band X	`:SOUR:FREQ:CHAN:BAND BANDX`
Band XI	`:SOUR:FREQ:CHAN:BAND BANDXI`
Band XII	`:SOUR:FREQ:CHAN:BAND BANDXII`
Band XIII	`:SOUR:FREQ:CHAN:BAND BANDXIII`
Band XIV	`:SOUR:FREQ:CHAN:BAND BANDXIV`
Band XIX	`:SOUR:FREQ:CHAN:BAND BANDXIX`

LTE - Sets LTE FDD as the radio standard for use and accesses the LTE FDD specific channel band sub-menus.

Band 1	`:SOUR:FREQ:CHAN:BAND BAND1`
Band 2	`:SOUR:FREQ:CHAN:BAND BAND2`
Band 3	`:SOUR:FREQ:CHAN:BAND BAND3`
Band 4	`:SOUR:FREQ:CHAN:BAND BAND4`
Band 5	`:SOUR:FREQ:CHAN:BAND BAND5`

Band 6	`:SOUR:FREQ:CHAN:BAND BAND6`
Band 7	`:SOUR:FREQ:CHAN:BAND BAND7`
Band 8	`:SOUR:FREQ:CHAN:BAND BAND8`
Band 9	`:SOUR:FREQ:CHAN:BAND BAND9`
Band 10	`:SOUR:FREQ:CHAN:BAND BAND10`
Band 11	`:SOUR:FREQ:CHAN:BAND BAND11`
Band 12	`:SOUR:FREQ:CHAN:BAND BAND12`
Band 13	`:SOUR:FREQ:CHAN:BAND BAND13`
Band 14	`:SOUR:FREQ:CHAN:BAND BAND14`
Band 17	`:SOUR:FREQ:CHAN:BAND BAND17`
Band 18	`:SOUR:FREQ:CHAN:BAND BAND18`
Band 19	`:SOUR:FREQ:CHAN:BAND BAND19`
Band 20	`:SOUR:FREQ:CHAN:BAND BAND20`
Band 21	`:SOUR:FREQ:CHAN:BAND BAND21`
Band 24	`:SOUR:FREQ:CHAN:BAND BAND24`
Band 25	`:SOUR:FREQ:CHAN:BAND BAND25`
Band 26	`:SOUR:FREQ:CHAN:BAND BAND26`
Band 27	`:SOUR:FREQ:CHAN:BAND BAND27`
Band 28	`:SOUR:FREQ:CHAN:BAND BAND28`
Band 29	`:SOUR:FREQ:CHAN:BAND BAND29`
Band 30	`:SOUR:FREQ:CHAN:BAND BAND30`
Band 31	`:SOUR:FREQ:CHAN:BAND BAND31`
Band 65	`:SOUR:FREQ:CHAN:BAND BAND65`
Band 66	`:SOUR:FREQ:CHAN:BAND BAND66`
Band 67	`:SOUR:FREQ:CHAN:BAND BAND67`
Band 68	`:SOUR:FREQ:CHAN:BAND BAND68`
Band 71	`:SOUR:FREQ:CHAN:BAND BAND71`
Band 252	`:SOUR:FREQ:CHAN:BAND BAND252`
Band 255	`:SOUR:FREQ:CHAN:BAND BAND255`

LTE TDD - Sets LTE TDD as the radio standard for use and accesses the LTE TDD specific channel band sub-menus.

Band 33	`:SOUR:FREQ:CHAN:BAND BAND33`
Band 34	`:SOUR:FREQ:CHAN:BAND BAND34`
Band 35	`:SOUR:FREQ:CHAN:BAND BAND35`
Band 36	`:SOUR:FREQ:CHAN:BAND BAND36`
Band 37	`:SOUR:FREQ:CHAN:BAND BAND37`
Band 38	`:SOUR:FREQ:CHAN:BAND BAND38`
Band 39	`:SOUR:FREQ:CHAN:BAND BAND39`

Band 40	`:SOUR:FREQ:CHAN:BAND BAND40`
Band 41	`:SOUR:FREQ:CHAN:BAND BAND41`
Band 42	`:SOUR:FREQ:CHAN:BAND BAND42`
Band 43	`:SOUR:FREQ:CHAN:BAND BAND43`
Band 44	`:SOUR:FREQ:CHAN:BAND BAND44`
Band 45	`:SOUR:FREQ:CHAN:BAND BAND45`
Band 46	`:SOUR:FREQ:CHAN:BAND BAND46`

TDSCDMA - Sets TDSCDMA as the radio standard for use and accesses the TDSCDMA specific channel band sub-menus.

Band A	`:SOUR:FREQ:CHAN:BAND BANDA`
Band B	`:SOUR:FREQ:CHAN:BAND BANDB`
Band C	`:SOUR:FREQ:CHAN:BAND BANDC`
Band D	`:SOUR:FREQ:CHAN:BAND BANDD`
Band E	`:SOUR:FREQ:CHAN:BAND BANDE`
Band F	`:SOUR:FREQ:CHAN:BAND BANDF`

5GNR - Sets 5G NR as the radio standard for use and accesses the 5G NR specific channel band sub-menus.

N 1	`:SOUR:FREQ:CHAN:BAND N1`
N 2	`:SOUR:FREQ:CHAN:BAND N2`
N 3	`:SOUR:FREQ:CHAN:BAND N3`
N 5	`:SOUR:FREQ:CHAN:BAND N5`
N 7	`:SOUR:FREQ:CHAN:BAND N7`
N 8	`:SOUR:FREQ:CHAN:BAND N8`
N 12	`:SOUR:FREQ:CHAN:BAND N12`
N 20	`:SOUR:FREQ:CHAN:BAND N20`
N 25	`:SOUR:FREQ:CHAN:BAND N25`
N 28	`:SOUR:FREQ:CHAN:BAND N28`
N 34	`:SOUR:FREQ:CHAN:BAND N34`
N 38	`:SOUR:FREQ:CHAN:BAND N38`
N 39	`:SOUR:FREQ:CHAN:BAND N39`
N 40	`:SOUR:FREQ:CHAN:BAND N40`
N 41	`:SOUR:FREQ:CHAN:BAND N41`
N 50	`:SOUR:FREQ:CHAN:BAND N50`
N 51	`:SOUR:FREQ:CHAN:BAND N51`
N 66	`:SOUR:FREQ:CHAN:BAND N66`
N 70	`:SOUR:FREQ:CHAN:BAND N70`
N 71	`:SOUR:FREQ:CHAN:BAND N71`
N 74	`:SOUR:FREQ:CHAN:BAND N74`

N 75	:SOUR:FREQ:CHAN:BAND N75
N 76	:SOUR:FREQ:CHAN:BAND N76
N 77	:SOUR:FREQ:CHAN:BAND N77
N 78	:SOUR:FREQ:CHAN:BAND N78
N 79	:SOUR:FREQ:CHAN:BAND N79
N 80	:SOUR:FREQ:CHAN:BAND N80
N 81	:SOUR:FREQ:CHAN:BAND N81
N 82	:SOUR:FREQ:CHAN:BAND N82
N 83	:SOUR:FREQ:CHAN:BAND N83
N 84	:SOUR:FREQ:CHAN:BAND N84
N 86	:SOUR:FREQ:CHAN:BAND N86
N 257	:SOUR:FREQ:CHAN:BAND N257
N 258	:SOUR:FREQ:CHAN:BAND N258
N 260	:SOUR:FREQ:CHAN:BAND N260
N 261	:SOUR:FREQ:CHAN:BAND N261

Radio Band Link

Allows you to specify the channel band type as either uplink or downlink link direction. This value is used in conjunction with the channel band and channel number to determine the absolute frequency output by the source.

When set to Uplink (UP), the source calculates the uplink frequency using an uplink formula together with the selected channel band and channel number .

When set to Downlink (DOWN) the source calculates the downlink frequency using a downlink formula together with the selected channel band and channel number.

Remote Command	:SOURce:RADio:BAND:LINK DOWN | UP :SOURce:RADio:BAND:LINK?
Example	:SOUR:RAD:BAND:LINK UP
Preset	DOWN
Range	DOWN | UP
Backwards Compatibility SCPI	:SOURce:RADio:DEVice BTS | MS :SOURce:RADio:DEVice?
Backwards Compatibility Notes	DOWN = BTS UP = MS

6.1.9.4 Set Reference Frequency

Allows you to set the frequency reference. Pressing this key turns the frequency reference state to ON, sets the reference frequency value to the current frequency, maintains this frequency at the RF output, and sets the displayed frequency to 0.00 Hz. All subsequent frequencies entered under Source>Frequency>Frequency are interpreted as being relative to this reference frequency.

When you use a frequency reference, the signal generator outputs a frequency that is set relative to the reference frequency by the value entered under Source>Frequency>Frequency as follows:

Output frequency = reference frequency - entered frequency

Where:

- reference frequency equals the original RF frequency entered under Source>Frequency>Frequency and set as the reference frequency
- entered frequency equals a new value entered under Source>Frequency>Frequency

In addition, the displayed frequency value will be the same as the value entered under Source>Frequency>Frequency.

NOTE

If Freq Reference is ON with a reference value set, entering a value under **Source>Frequency>Frequency** and pressing **Set Frequency Reference** adds that value to the existing Freq Reference value.

If you wish to change the reference frequency value to the new value entered under **Source>Frequency>Frequency**, first you must set Freq Reference OFF then press **Set Frequency Reference**.

Remote Command	`:SOURce:FREQuency:REFerence:SET`
Example	`:SOUR:FREQ:REF:SET`
Dependencies	This setting is unavailable, and is grayed-out when List Sequencer is ON

6.1.9.5 Freq Reference

Allows you to toggle the state of the frequency reference. When the frequency reference state is ON, an annunciator is displayed on the main source view to indicate this state to the user.

When you use a frequency reference, the signal generator outputs a frequency that is set relative to the reference frequency by the value entered under Source>Frequency>Frequency as follows:

Output frequency = reference frequency + entered frequency

Where:

- reference frequency equals the original RF frequency entered under Source>Frequency>Frequency and set as the reference frequency
- entered frequency equals a new value entered under Source>Frequency>Frequency

For more information on Reference Frequency refer to "Set Reference Frequency" on page 2140

Remote Command	`:SOURce:FREQuency:REFerence <freq>`
	`:SOURce:FREQuency:REFerence?`
	`:SOURce:FREQuency:REFerence:STATe OFF | ON | 0 | 1`
	`:SOURce:FREQuency:REFerence:STATe?`

Example	`:SOUR:FREQ:REF 0.00 Hz` `:SOUR:FREQ:REF:STATe ON`
Dependencies	This setting is unavailable, and is grayed out when List Sequencer is ON
Couplings	The frequency reference state is coupled to the frequency reference set immediate action. When the reference set immediate action key is pressed, or the SCPI command issued, it turns the frequency reference state ON
Preset	0.00 Hz OFF
Min	0.00 Hz
Max	Hardware Dependent: – Option 503 = 3.6 GHz – Option 504 = 3.8 GHz – Option 506 = 6.00 GHz For E7760: Dependent on port selected

6.1.9.6 Freq Offset

Allows you to specify the frequency offset value. When the frequency offset state is ON, an annunciator is displayed on the main source view to indicate this state to the user.

When the frequency offset is set to zero (0) and you set a new offset value, the displayed frequency value will change as follows and the RF output frequency will not change:

Displayed value = output frequency + offset value

Where:

output frequency equals the original frequency entered under Source>Frequency>Frequency

offset value equals the value entered under Source>Frequency>Freq Offset

When the frequency offset is set to a value other than zero (0) and you enter a new frequency value under Source>Frequency>Frequency, the displayed frequency will be the same as the value entered and the RF output frequency will be equal to the value entered minus the offset value as follows:

Output frequency = entered frequency – offset frequency

Displayed frequency = output frequency + offset frequency

Displayed frequency = entered frequency

Where:

- entered frequency equals the frequency entered under Source>Frequency>Frequency
- offset frequency equals the value previously entered and set under Source>Frequency>Freq Offset

Remote Command	:SOURce:FREQuency:OFFSet <freq> :SOURce:FREQuency:OFFSet?
Example	:SOUR:FREQ:OFFS 0 Hz
Dependencies	This setting is unavailable, and is grayed-out when List Sequencer is ON
Preset	0 Hz
Min	-100.00 GHz
Max	100.00 GHz

6.1.9.7 Freq Increment

Changes the step size for the RF Output Frequency function. Once an increment size has been selected and the RF Output Frequency function is active, the step keys (and the UP|DOWN parameters for RF Frequency from remote commands) change the RF Output Frequency by the increment set value. This feature exists in EXG and MXG.

Remote Command	:SOURce:FREQuency:STEP[:INCRement] <freq> :SOURce:FREQuency:STEP[:INCRement]?
Example	:SOUR:FREQ:STEP 1.0 kHz
Couplings	Coupled to the Step size of the RF Frequency function
Preset	Hardware Dependent. 10% of the span preset value
Min	1 Hz
Max	Hardware Dependent: – Option 503 = 3.6 GHz – Option 504 = 3.8 GHz – Option 506 = 6.00 GHz For E7760: Dependent on port selected For EXM, if license 5WC is present, the frequency range should be limited to: 1.1GHz-1.7GHz, 2.4GHz-2.5GHz, 4.8GHz-6.0GHz. If the user-defined frequency is outside of range, UI will report an error message called “Settings conflict; Frequency is outside available range”

6.1.9.8 Rx/Tx Coupling

Allows coupling between the frequency of the Internal Source, RF Output Frequency, and the frequency of the Analyzer, Center Frequency. With all the settings except NONE, this parameter couples the Center Frequency of the Analyzer to the RF Output Frequency of the source. Valid setting changes result in the Analyzer CF and RF Output Frequency parameters being set to the same value plus the "Rx/Tx Offset" on page 2144.

The four states for coupling are;

SOURce	Source follows Analyzer Coupling is in one direction only. Changes to the Center Frequency will result in the RF Output Frequency being set to the same value, with any Rx/Tx Frequency Offset applied. Changes to the RF Output Frequency will not change the Center Frequency and will change Rx/Tx Frequency Coupling to None
ANALyzer	Analyzer follows Source Coupling is in one direction only. Changes to the RF Output Frequency will result in the Center Frequency being set to the same value, with any Rx/Tx Frequency Offset applied. Changes to the Center Frequency will not change the RF Output Frequency and will change Rx/Tx Frequency Coupling to None
BOTH	Analyzer/Source Coupled Coupling is bi-directional. Changes to the Center Frequency will result in the RF Output Frequency being set to the same value, with any Rx/Tx Frequency Offset applied. Changes to the RF Output Frequency will result in the Center Frequency being set to the same value, with any Rx/Tx Frequency Offset applied
NONE	None RF Output Frequency and CF Frequency are independently controlled

Remote Command	`:SOURce:FREQuency:COUPling NONE | BOTH | SOURce | ANALyzer` `:SOURce:FREQuency:COUPling?`
Example	`:SOUR:FREQ:COUP BOTH`
Dependencies	Only appears in Radio Test Mode
Preset	NONE Input/Output Preset
State Saved	Yes

6.1.9.9 Rx/Tx Offset

Allows you to offset the RF Output Frequency of the source from the Center Frequency of the instrument. See "Rx/Tx Coupling" on page 2144 for coupling behavior.

Remote Command	`:SOURce:FREQuency:COUPling:OFFSet <freq>` `:SOURce:FREQuency:COUPling:OFFSet?`
Example	`:SOUR:FREQ:COUP:OFF 100 kHz`
Notes	The offset between Tx and Rx should always be this value. In order to achieve this the following algorithm will be used; RF Output Frequency = Center Frequency + Rx/Tx Frequency Coupling Offset
Dependencies	Coupled to Rx/Tx Coupling. When Rx/Tx Coupling is set to None this parameter is grayed out. If the grayed out control is selected the following message will be shown; "The parameter cannot be changed when Rx/Tx Coupling is Off" Only appears in Radio Test Mode
Preset	0 Hz (Input/Output Preset)
Min	-6 GHz
Max	Hardware Dependent: – Option 503 = 3.6 GHz – Option 504 = 3.8 GHz – Option 506 = 6.00 GHz For E7760: Dependent on port selected For E6640A, if license 5WC is present, the frequency range should be limited to: 1.1GHz-1.7GHz, 2.4GHz-2.5GHz, 4.8GHz-6.0GHz. If the user-defined frequency is outside of range, UI reports an error message: "Settings conflict; Frequency is outside available range"

6.1.10 Modulation

Allows you to toggle the state of the modulation.

Remote Command	`:OUTPut:MODulation[:STATe] ON | OFF | 1 | 0` `:OUTPut:MODulation[:STATe]?`
Example	`:OUTP:MOD OFF`
Notes	This setting is for independent mode and has no effect on the "List Sequencer" on page 2099. If "Sequencer" on page 2099 is ON, the List Sequencer controls the source output and this key is grayed-out When "Sequencer" on page 2099 is OFF, source leaves List Sequencer, and this setting is blanked out, taking effect immediately When Modulation is ON, the "MOD" annunciator is displayed in the system settings panel. When Modulation is OFF, the "MOD" annunciator is cleared If "Sequencer" on page 2099 is ON, the "MOD" annunciator will be replaced by "SEQ" in the system settings panel, indicating that the output is controlled by List Sequencer
Preset	OFF
Range	On | Off

6.1.11 Modulation Setup

Allows access to the menus for setting up the available modulation types.

This control is not available on E7760.

AM/FM/PM are not available for VXT model M9415A.

6.1.11.1 AM

Enables or disables the amplitude modulation.

Turning AM on when another modulation format is already on results in the previous modulation format being turned off, and generates an error.

Remote Command	`:SOURce:AM:STATe ON | OFF | 1 | 0` `:SOURce:AM:STATe?`
Example	`:SOUR:AM:STAT OFF`
Dependencies	This control is not available in E7760
Preset	`OFF`
Range	`ON|OFF`

6.1.11.2 AM Mod Depth

Allows you to set the amplitude modulation depth in percent.

Remote Command	`:SOURce:AM[:DEPTh][:LINear] <real>` `:SOURce:AM[:DEPTh][:LINear]?`
Example	`:SOUR:AM 0.1`
Dependencies	This control is not available in E7760
Preset	0.1 %
Min	0.1 %
Max	95.0 %

6.1.11.3 AM Rate

Allows you to set the internal amplitude modulation rate.

Remote Command	`:SOURce:AM:INTernal:FREQuency <freq>` `:SOURce:AM:INTernal:FREQuency?`
Example	`:SOUR:AM:INT:FREQ 40.0 Hz`

Dependencies	This control is not available in E7760
Preset	400.0 Hz
Min	10 Hz
Max	40 kHz

6.1.11.4 AM Rate Increment

Changes the step size for the AM Rate function. Once an increment size has been selected and the AM Rate function is active, the step keys (and the UP|DOWN parameters for AM Rate from remote commands) change the AM Rate by the increment value.

Remote Command	`:SOURce:AM:INTernal:FREQuency:STEP[:INCRement] <freq>` `:SOURce:AM:INTernal:FREQuency:STEP[:INCRement]?`
Example	`:SOUR:AM:INT:FREQ:STEP 100 Hz` `:SOUR:AM:INT:FREQ:STEP?`
Couplings	Coupled to the increment size of AM Rate
Preset	10 Hz
State Saved	Yes
Min	1 Hz
Max	40 kHz

6.1.11.5 FM

Enables or disables the frequency modulation.

Turning FM on when another modulation format is already on results in the previous modulation format being turned off and the generation of an error.

Remote Command	`:SOURce:FM:STATe ON | OFF | 1 | 0` `:SOURce:FM:STATe?`
Example	`:SOUR:FM:STAT OFF`
Dependencies	This control is not available in E7760
Preset	Off
Range	On | Off

6.1.11.6 FM Deviation

Allows you to set the frequency modulation deviation.

Remote Command	`:SOURce:FM[:DEViation] <freq>`

	`:SOURce:FM[:DEViation]?`
Example	`:SOUR:FM 1.00 kHz`
Dependencies	This control is not available in E7760
Preset	1.00 Hz
Min	1.00 Hz
Max	100.00 kHz

6.1.11.7 FM Rate

Allows you to set the internal frequency modulation rate.

Remote Command	`:SOURce:FM:INTernal:FREQuency <freq>` `:SOURce:FM:INTernal:FREQuency?`
Example	`:SOUR:FM:INT:FREQ 40.0 Hz`
Dependencies	This control is not available in E7760
Preset	400.0 Hz
Min	10 Hz
Max	40 kHz

6.1.11.8 FM Rate Increment

FM Rate Increment changes the step size for the FM Rate function. Once an increment size has been selected and the FM Rate function is active, the step keys (and the UP|DOWN parameters for FM Rate from remote commands) change the FM Rate by the increment value.

Remote Command	`:SOURce:FM:INTernal:FREQuency:STEP[:INCRement] <freq>` `:SOURce:FM:INTernal:FREQuency:STEP[:INCRement]?`
Example	`:SOUR:FM:INT:FREQ:STEP 100 Hz` `:SOUR:FM:INT:FREQ:STEP?`
Couplings	Coupled to the increment size of FM Rate
Preset	10 Hz
State Saved	Yes
Min	1 Hz
Max	40 kHz

6.1.11.9 PM

Enables or disables the phase modulation.

Turning PM ON when another modulation format is already on results in the previous modulation format being turned OFF and the generation of an error.

Remote Command	:SOURce:PM:STATe ON | OFF | 1 | 0 :SOURce:PM:STATe?
Example	:SOUR:PM:STAT OFF
Dependencies	This control is not available in E7760
Preset	OFF
Range	ON|OFF

6.1.11.10 PM Deviation

Allows you to set the phase modulation deviation in radian.

Remote Command	:SOURce:PM[:DEViation] <real> :SOURce:PM[:DEViation]?
Example	:SOUR:PM 1.00
Dependencies	This control is not available in E7760
Preset	0.1 rad
Min	0.1 rad
Max	20.0 rad

6.1.11.11 PM Rate

Allows you to set the internal phase modulation rate.

Remote Command	:SOURce:PM:INTernal:FREQuency <freq> :SOURce:PM:INTernal:FREQuency?
Example	:SOUR:PM:INT:FREQ 40.0 Hz
Dependencies	This control is not available in E7760
Preset	400.0 Hz
Min	10 Hz
Max	40 kHz

6.1.11.12 PM Rate Increment

Changes the step size for the PM Rate function. Once an increment size has been selected and the PM Rate function is active, the step keys (and the UP|DOWN parameters for PM Rate from remote commands) change the PM Rate by the increment value.

Remote	:SOURce:PM:INTernal:FREQuency:STEP[:INCRement] <freq>

Command	`:SOURce:PM:INTernal:FREQuency:STEP[:INCRement]?`
Example	`:SOUR:PM:INT:FREQ:STEP 100 Hz` `:SOUR:PM:INT:FREQ:STEP?`
Couplings	Coupled to the increment size of PM Rate
Preset	10 Hz
State Saved	Yes
Min	1 Hz
Max	40 kHz

6.1.11.13 ARB Setup

Allows access to the menus for setting up the Arbitrary Waveform Generator.

Basic Control

The Basic Control index tab lets you set up the basic ARB parameters and select a waveform to play.

ARB State

Allows you to toggle the state of the ARB function. When the ARB is On, a “MOD” annunciator is displayed in the system settings panel. When the ARB is turned Off, the MOD annunciator is cleared

Remote Command	`:SOURce:RADio:ARB[:STATe] ON | OFF | 1 | 0` `:SOURce:RADio:ARB[:STATe]?`
Example	`:SOUR:RAD:ARB OFF` `:SOUR:RAD:ARB?`
Notes	If ARB is ON, and you then load or delete another file to ARB memory, the playing waveform segment may not keep phase continuity during the ARB memory operation. The waveform will be replayed after the ARB operation is finished
Dependencies	This setting is for the independent mode and has no effect on the "List Sequencer" on page 2099. If "Sequencer" on page 2099 is ON, this will make the source enter List Sequencer mode, and even if ARB state is ON, the ARB file will not be played. When "Sequencer" on page 2099 is OFF, source leaves List Sequencer and this setting takes effect immediately The ARB can only be turned on when there is a waveform file selected for playback. On the GUI If no waveform is selected, this key is grayed out. If you send the SCPI command to turn the ARB on with no waveform selected for playback, the ARB state remains OFF and an error is generated When you try to recall a certain set of states in which the selected waveform is not in ARB memory and the ARB state is ON, errors are reported
Preset	OFF
Range	ON|OFF

Sample Rate

Allows you to set the ARB waveform playback sample rate.

Remote Command	`:SOURce:RADio:ARB:SCLock:RATE <freq>` `:SOURce:RADio:ARB:SCLock:RATE?`
Example	`:SOUR:RAD:ARB:SCL:RATE 48.00 MHz`
Notes	If there is a sample rate specified in the header of the waveform file, changing that sample rate is not recommended, as it may cause problems with burst timing For E7760, the Sample Rate is fixed. If this control is attempted to be set the error -221, “Settings conflict; Sample Rate is fixed” is generated
Dependencies	When a new waveform is selected for playback the settings contained within the associated waveform header file are applied to the ARB. The sample rate is one of the values stored within the header file. If the newly selected waveform file has an associated header file, the sample rate is updated with the value from the header file. The sample rate will remain unchanged if the newly selected waveform does not have an associated header file

Preset	125.00 MHz, unless noted below
	– E7760A:
	  – 2.64 GHz
	– Option B40:
	  – 50 MHz
	– VXT models M9420A/21A with Option B85:
	100 MHz

Min	1.00 kHz, except as noted below – E7760A: 2.64 GHz

Max	Hardware Dependent:
	– E7760A:
	  – 2.64 GHz
	– VXT models M9420A/21A:
	  – Option B40: 50 MHz
	  – Option B85: 100 MHz
	  – Option B1X: 200 MHz
	– VXT models M9410A/11A:
	  – Option B40: 50 MHz
	  – Option B3X: 375 MHz
	  – Option B6X: 750 MHz

	Option B12: 1.5 GHz

Run-Time Scaling

Allows you to adjust the run-time scaling value. The run-time scaling value is applied in real-time while the waveform is playing.

Remote Command	`:SOURce:RADio:ARB:RSCaling <real>` `:SOURce:RADio:ARB:RSCaling?`
Example	`:SOUR:RAD:ARB:RSC 100.00`
Notes	This setting cannot be set in EXM and VXT. Grayed-out on menu, and the value is fixed at 70.00%
Dependencies	When a new waveform is selected for playback the settings contained within the associated waveform header file are applied to the ARB. The run-time scaling is one of the values stored within the header file. If the newly selected waveform file has an associated header file, the run-time scaling is updated with the value from the header file. The run-time scaling will remain unchanged if the newly selected waveform does not have an associated header file
Preset	70.00 %
Min	1.00 %
Max	100.00 %

Baseband Freq Offs

The Baseband Freq Offset control allows you to adjust the value by which the baseband frequency is offset relative to the carrier.

Remote Command	`:SOURce:RADio:ARB:BASeband:FREQuency:OFFSet <freq>` `:SOURce:RADio:ARB:BASeband:FREQuency:OFFSet?`
Example	`:SOUR:RAD:ARB:BAS:FREQ:OFFS 0.00 Hz`
Dependencies	When a new waveform is selected for playback the settings contained within the associated waveform header file are applied to the ARB. The baseband frequency offset is one of the values stored within the header file. If the newly selected waveform file has an associated header file, the baseband frequency offset is updated with the value from the header file. The baseband frequency offset will remain unchanged if the newly selected waveform does not have an associated header file This control is not available in E7760
Preset	0.00 Hz
Min	-50.00 MHz
Max	50.00 MHz

Baseband Power

Allows you to quickly control the power of the modulator prior to up-conversion to the RF carrier.

Remote Command	`:SOURce:RADio:ARB:BASeband:POWer <ampl>` `:SOURce:RADio:ARB:BASeband:POWer?`
Example	`:SOUR:RAD:ARB:BAS:POW -10 dB`
Notes	The Source Power level equals to RF Power plus Baseband Power. For example, if the RF Power is set to -10 dBm and the Baseband Power is set to -4 dB, the actual Source Power level will be -14 dBm This control can be used to change the output level very quickly compared to the RF Power
Dependencies	This control only appears in VXT models M9410A/11A
Preset	0 dB
Min	-50 dB
Max	20 dB

Mkr 1 Polarity

Allows you to set the polarity of marker 1.

Remote Command	`:SOURce:RADio:ARB:MPOLarity:MARKer1 POSitive | NEGative` `:SOURce:RADio:ARB:MPOLarity:MARKer1?`
Example	`:SOUR:RAD:ARB:MPOL:MARK1 NEG`
Dependencies	When a new waveform is selected for playback the settings contained within the associated waveform header file are applied to the ARB. The marker polarity is one of the values stored within the header file. If the newly selected waveform file has an associated header file, the marker polarity is updated with the value from the header file. The marker polarity will remain unchanged if the newly selected waveform does not have an associated header file This control is not available in E7760
Preset	`POSitive`
Range	`POSitive|NEGative`

Mkr 2 Polarity

Allows you to set the polarity of marker 2.

Remote Command	`:SOURce:RADio:ARB:MPOLarity:MARKer2 POSitive | NEGative` `:SOURce:RADio:ARB:MPOLarity:MARKer2?`
Example	`:SOUR:RAD:ARB:MPOL:MARK2 NEG`
Dependencies	When a new waveform is selected for playback the settings contained within the associated waveform header file are applied to the ARB. The marker polarity is one of the values stored within the header file. If the newly selected waveform file has an associated header file, the marker polarity is updated with the value from the header file. The marker polarity will remain unchanged if the newly selected waveform does not have an associated header file This control is not available in E7760
Preset	`POSitive`
Range	`POSitive|NEGative`

Mkr 3 Polarity

Allows you to set the polarity of marker 3.

Remote Command	:SOURce:RADio:ARB:MPOLarity:MARKer3 POSitive | NEGative :SOURce:RADio:ARB:MPOLarity:MARKer3?
Example	:SOUR:RAD:ARB:MPOL:MARK3 NEG
Dependencies	When a new waveform is selected for playback the settings contained within the associated waveform header file are applied to the ARB. The marker polarity is one of the values stored within the header file. If the newly selected waveform file has an associated header file, the marker polarity is updated with the value from the header file. The marker polarity will remain unchanged if the newly selected waveform does not have an associated header file This control is not available in E7760
Preset	Pos
Range	Neg | Pos

Mkr 4 Polarity

Allows you to set the polarity of marker 4.

Remote Command	:SOURce:RADio:ARB:MPOLarity:MARKer4 POSitive | NEGative :SOURce:RADio:ARB:MPOLarity:MARKer4?
Example	:SOUR:RAD:ARB:MPOL:MARK4 NEG
Dependencies	When a new waveform is selected for playback the settings contained within the associated waveform header file are applied to the ARB. The marker polarity is one of the values stored within the header file. If the newly selected waveform file has an associated header file, the marker polarity is updated with the value from the header file. The marker polarity will remain unchanged if the newly selected waveform does not have an associated header file This control is not available in E7760
Preset	Pos
Range	Neg | Pos

Pulse/RF Blank

Allows you to select which marker is used for the pulse/RF blanking function. The pulse/RF blanking function blanks the RF when the marker signal goes low. The marker polarity determines when the marker signal is high. For a positive polarity, this is during the marker points. For a negative polarity, this is when there are no marker points.

Marker points should be set before using this function. Enabling this function without setting maker points may create a continuous low or high signal, dependent on the marker polarity. This causes either no RF output, or a continuous RF output.

See "More Information" on page 2155

Remote Command	`:SOURce:RADio:ARB:MDEStination:PULSe NONE | M1 | M2 | M3 | M4` `:SOURce:RADio:ARB:MDEStination:PULSe?`
Example	`:SOUR:RAD:ARB:MDES:PULS NONE`
Dependencies	When a new waveform is selected for playback the settings contained within the associated waveform header file are applied to the ARB. The pulse/RF blanking setting is one of the values stored within the header file. If the newly selected waveform file has an associated header file, the pulse/RF blanking setting is updated with the value from the header file. The pulse/RF blanking setting will remain unchanged if the newly selected waveform does not have an associated header file
Range	None | M1 | M2 | M3 | M4

More Information

Parameter	SCPI Example	Notes
None	`:SOUR:RAD:ARB:MDES:PULS NONE`	Sets no marker to be used for the pulse/RF blanking function, essentially turning the RF blanking function off
Marker 1	`:SOUR:RAD:ARB:MDES:PULS M1`	Sets marker 1 to be used for the pulse/RF blanking function
Marker 2	`:SOUR:RAD:ARB:MDES:PULS M2`	Sets marker 2 to be used for the pulse/RF blanking function
Marker 3	`:SOUR:RAD:ARB:MDES:PULS M3`	Sets marker 3 to be used for the pulse/RF blanking function
Marker 4	`:SOUR:RAD:ARB:MDES:PULS M4`	Sets marker 4 to be used for the pulse/RF blanking function

ALC Hold

Allows you to specify which marker is routed for use within the ALC hold function. The ALC hold marker function holds the ALC circuitry at the average value of the sample points set by the marker.

The ALC hold function operates during the low periods of the marker signal. The marker polarity determines when the marker signal is high. For positive polarity, this is during the marker points. For a negative polarity, this is when there are no maker points.

See "More Information" on page 2156

Remote Command	`:SOURce:RADio:ARB:MDEStination:ALCHold NONE | M1 | M2 | M3 | M4` `:SOURce:RADio:ARB:MDEStination:ALCHold?`
Example	`:SOUR:RAD:ARB:MDES:ALCH NONE`
Dependencies	When a new waveform is selected for playback the settings contained within the associated waveform header file are applied to the ARB. The ALC hold setting is one of the values stored within the header file. If the newly selected waveform file has an associated header file, the ALC hold setting is updated with the value from the header file. The ALC hold setting will remain unchanged if the newly selected

	waveform does not have an associated header file. This control is not available in E7760 and VXT models M9410A/11A
Range	None | M1 | M2 | M3 | M4

More Information

None	`:SOUR:RAD:ARB:MDES:PULS NONE`	Sets no marker to be used for the ALC hold function, essentially turning the ALC hold function off
Marker 1	`:SOUR:RAD:ARB:MDES:PULS M1`	Sets marker 1 to be used for the ALC hold function
Marker 2	`:SOUR:RAD:ARB:MDES:PULS M2`	Sets marker 2 to be used for the ALC hold function
Marker 3	`:SOUR:RAD:ARB:MDES:PULS M3`	Sets marker 3 to be used for the ALC hold function
Marker 4	`:SOUR:RAD:ARB:MDES:PULS M4`	Sets marker 4 to be used for the ALC hold function

Trigger Type

The setting for trigger type determines the behavior of the waveform when it plays.

Remote Command	`:SOURce:RADio:ARB:TRIGger:TYPE CONTinuous | SINGle | SADVance` `:SOURce:RADio:ARB:TRIGger:TYPE?`
Example	`:SOUR:RAD:ARB:TRIG:TYPE CONT` `:SOUR:RAD:ARB:TRIG:TYPE?`
Notes	Gated trigger type will be implemented at a later release
Preset	CONTinuous
Range	Continuous | Single | Seg Adv

Continuous trigger

Sets the active trigger type to Continuous. If Continuous is already selected as the active trigger type, pressing this key allows access to the continuous trigger type setup menu. In Continuous trigger mode, the waveform repeats continuously.

See "More Information" on page 2157

Remote Command	`:SOURce:RADio:ARB:TRIGger:TYPE:CONTinuous[:TYPE] FREE | TRIGger | RESet` `:SOURce:RADio:ARB:TRIGger:TYPE:CONTinuous[:TYPE]?`
Example	`:SOUR:RAD:ARB:TRIG:TYPE:CONT FREE`

Preset	FREE
Range	Free Run | Trigger + Run | Reset + Run

More Information

Parameter	SCPI Example	Notes
Free Run	:SOUR:RAD:ARB:TRIG:TYPE:CONT FREE	Selects Free Run as the trigger response for the continuous trigger type. Free Run sets the waveform generator to play a waveform sequence or segment continuously, without waiting for a trigger. In this mode, the waveform generator does not respond to triggers
Trigger + Run	:SOUR:RAD:ARB:TRIG:TYPE:CONT TRIG	Sets Trigger and Run as the trigger response for the continuous trigger type. Trigger and Run sets the waveform generator to play a waveform sequence or segment continuously when the first trigger is received, and to ignore any subsequent triggers
Reset + Run	:SOUR:RAD:ARB:TRIG:TYPE:CONT RES	Sets Reset and Run as the trigger response for the continuous trigger type. Reset and Run sets the waveform generator to play a waveform sequence or segment continuously when the first trigger is received. Subsequent triggers reset the waveform sequence or segment to the start, and then play it continuously

Single trigger

Sets the active trigger type to Single. If Single is already selected as the active trigger type, pressing this key allows access to the single trigger type setup menu. In Single trigger mode, the waveform plays once.

See "More Information" on page 2158

Remote Command	:SOURce:RADio:ARB:RETRigger ON | OFF | IMMediate :SOURce:RADio:ARB:RETRigger?
Example	:SOUR:RAD:ARB:RETR OFF
Notes	ON: Buffered Trigger OFF: No Retrigger Immediate: Restart on Trigger

	This is defined as an enumerated SCPI command, with ON|OFF being considered as enumerated types rather than Boolean. This means the query will return OFF instead of 0, and ON instead of 1
Preset	ON

More Information

Parameter	SCPI Example	Notes
No Retrigger	:SOUR:RAD:ARB:RETR OFF	Selects No Retrigger as the trigger response for single trigger type. No Retrigger sets the waveform generator to play a waveform sequence or segment once when a trigger is received. Any triggers then received during playback are ignored
Buffered Trigger	:SOUR:RAD:ARB:RETR ON	Selects Buffered Trigger as the trigger response for single trigger type. Buffered Trigger sets the waveform generator to play a waveform sequence or segment once when a trigger is received. If a trigger is received during playback, the waveform generator plays the sequence or segment to the end, then plays the sequence or segment once more
Restart on Trigger	:SOUR:RAD:ARB:RETR IMM	Selects Restart on Trigger as the trigger response for single trigger type. Restart on Trigger sets the waveform generator to play a waveform sequence or segment once when a trigger is received. If a trigger is received during playback, the waveform generator resets and plays the sequence or segment from the start

Segment Advance trigger

Sets the active trigger type to Segment Advance. If Segment Advance is already selected as the active trigger type, pressing this key allows access to the segment advance trigger type setup menu.

Segment Advance triggering allows you to control the playback of waveform segments within a waveform sequence. When a trigger is received the ARB advances to the next waveform segment within the waveform sequence. This type of triggering ignores the repetition count for the waveform segment within the waveform sequence. For example, if a waveform segment has a repetition count of 10 and you select single segment advance triggering mode, the waveform segment will only play once.

Segment Advance triggering can also be used for waveform segments only. In this situation, the same waveform segment is played again when a trigger is received.

See "More Information" on page 2159

Remote Command	:SOURce:RADio:ARB:TRIGger:TYPE:SADVance[:TYPE] SINGle | CONTinuous

	:SOURce:RADio:ARB:TRIGger:TYPE:SADVance[:TYPE]?
Example	:SOUR:RAD:ARB:TRIG:TYPE:SADV SING
Dependencies	This control is not available in E7760.
Preset	CONTinuous
Range	Single | Continuous

More Information

Parameter	SCPI Example	Notes
Single	:SOUR:RAD:ARB:TRIG:TYPE:SADV SING	Selects Single as the trigger response for Segment Advance trigger type. With single selected, once a trigger is received a segment is played once. If a trigger is received during playback of a segment, the segment plays to completion and the next segment is played once
Continuous	:SOUR:RAD:ARB:TRIG:TYPE:SADV CONT	Selects Continuous as the trigger response for Segment Advance trigger type. With continuous selected, once a trigger is received a segment is played continuously. When subsequent triggers are received, the currently playing segment plays to completion and then the next segment is played continuously
Trigger Initiate	No remote command, front panel only.	Used to initiate an immediate trigger event if the trigger source is set to Trigger Key

Trigger Source

The trigger source setting determines how the source receives the trigger that starts the waveform playing. Therefore, this control is grayed out if the trigger type is free run, since free run triggers immediately with no trigger source required.

Remote Command	:SOURce:RADio:ARB:TRIGger[:SOURce] KEY | BUS | EXTernal1 | EXTernal2 | PXI :SOURce:RADio:ARB:TRIGger[:SOURce]?
Example	:SOUR:RAD:ARB:TRIGger KEY
Notes	For E7760 the available selections are KEY|BUS
Dependencies	This key is grayed out if the current trigger type is Continuous, Free Run.
Preset	EXTernal2 For E7760: BUS

Range	Key | Bus | External1 | External 2 | PXI

More Information

Parameter	SCPI Example	Notes
Key	`:SOUR:RAD:ARB:TRIG KEY`	Sets the current trigger source to the front panel Trigger key. When Trigger Key is selected, the waveform is triggered when you press the front panel Trigger key
Bus	`:SOUR:RAD:ARB:TRIGger BUS`	Sets the current trigger source to Bus. Selecting Bus trigger source enables triggering over GPIB, LAN, or USB using the :SOURce:RADio:ARB:TRIGger:INITiate command
External 1	`:SOUR:RAD:ARB:TRIG EXT1`	Sets the current trigger source to External 1. Selecting External 1 enables triggering a waveform by an externally applied signal
External 2	`:SOUR:RAD:ARB:TRIG EXT2`	Sets the current trigger source to External 2. Selecting External 2 enables triggering a waveform by an externally applied signal Note: When on EXM, trigger 2 is a bi-directional trigger port. So when trigger 2 has been configured as OUTPUT type, choosing External 2 as the input trigger for the current step will generate error
PXI	`:SOUR:RAD:ARB:TRIG PXI`	Sets the current trigger source to PXI. Selecting PXI enables triggering a waveform by a PXI backplane Line applied signal

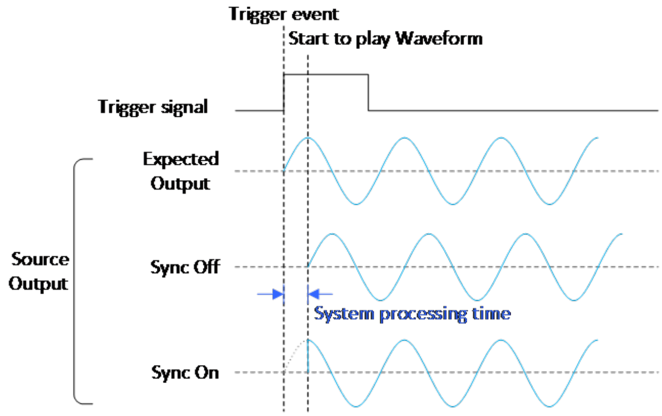
Bus Trigger Command (Remote Command Only)

Used to initiate an immediate trigger event if the trigger source is set to Bus.

Remote Command	`:SOURce:RADio:ARB:TRIGger:INITiate`
Example	`:SOUR:RAD:ARB:TRIG:INIT`

Sync to Trigger Source

There is a time interval(system processing time) between the trigger event and the beginning of playing waveform. Turn on this control to compensate the system latency at the cost of cutting off the beginning of the ARB. The figure below shows you the behavior of turn on and turn off the control.



Remote Command	`:SOURce:RADio:ARB:TRIGger:SYNC[:STATe] ON | OFF | 1 | 0` `:SOURce:RADio:ARB:TRIGger:SYNC[:STATe]?`
Example	`:SOUR:RAD:ARB:TRIG:SYNC ON` `:SOUR:RAD:ARB:TRIG:SYNC?`
Notes	Compensates for the instrument internal latency. The negative trigger delay compensates the external latency (i.e., heads and cables). See "External Trigger Delay" on page 2161 and "PXI Trigger Delay" on page 2164 The first PerARB trigger will be cut off when Sync to Trigger Source is On
Dependencies	Only available when Trigger Source is External or PXI trigger
Preset	OFF
Range	ON|OFF

External Trigger Delay

This key allows you to toggle the state and value of external trigger delay. The value you enter sets a delay time between when an external trigger is received and when it is applied to the waveform. This key is only active if you select external trigger as trigger source. Negative trigger delay is only supported by VXT models M9410A/11A/15A, see "More Information" on page 2162.

Remote Command	`:SOURce:RADio:ARB:TRIGger[:SOURce]:EXTernal:DELay <time>`
	`:SOURce:RADio:ARB:TRIGger[:SOURce]:EXTernal:DELay?`
	`:SOURce:RADio:ARB:TRIGger[:SOURce]:EXTernal:DELay:STATe OFF | ON | 0 | 1`

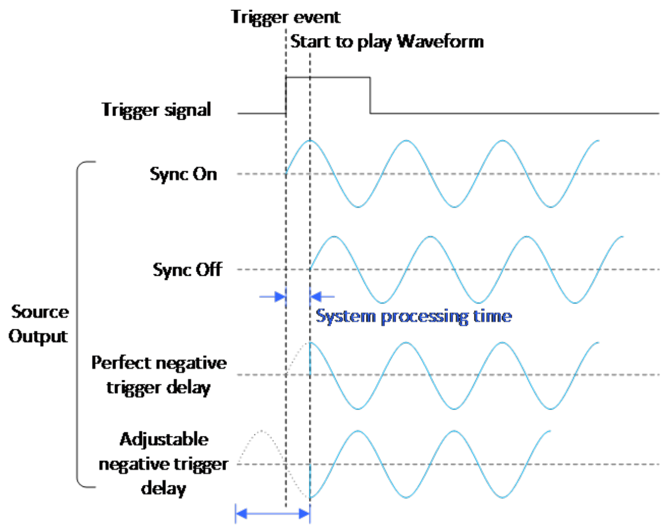
	`:SOURce:RADio:ARB:TRIGger[:SOURce]:EXTernal:DELay:STATe?`

Example	`:SOUR:RAD:ARB:TRIG:EXT:DEL 100ns`
	`:SOUR:RAD:ARB:TRIG:EXT:DEL?`
	`:SOUR:RAD:ARB:TRIG:EXT:DEL:STAT ON`
	`:SOUR:RAD:ARB:TRIG:EXT:DEL:STAT?`

Notes	External trigger delay time set by users will be rounded to the nearest integer multiple of the resolution
Dependencies	This setting is unavailable and is grayed out when Trigger Source is not set to external trigger This control is not available in E7760
Preset	1 ms `OFF`
Min	VXT models M9410A/11A/15A: -10 s
Max	8.589934588 s (Note: This value comes from 4ns * (2^31 – 1) = 8589934588 ns) VXT models M9410A/11A: 11.45324612 s, this value comes from 2.666667ns *(2^32-1) For “Continuous – Trigger + Run” trigger : 11.45324612 s, this value comes from 2.666667ns *(2^32-1) Other trigger conditions: 17.17986918 s, this value comes from 4 ns *(2^32-1)

More Information

There is a time interval (system processing time) between the trigger event and the beginning of playing waveform. The figure below shows you the behavior. The negative trigger delay allows you to specify the beginning of a waveform.



Note: the first PerArb trigger signal will be missed when the trigger delay is negative.

External Trigger Polarity

This key sets the polarity of the external trigger. When Positive is selected, trigger event happens on a rising edge of the external trigger in signal. When Negative is selected, trigger event happens on a falling edge of the external trigger in signal. This key is active only if you select external trigger as trigger source.

Remote Command	`:SOURce:RADio:ARB:TRIGger[:SOURce]:EXTernal:SLOPe POSitive | NEGative` `:SOURce:RADio:ARB:TRIGger[:SOURce]:EXTernal:SLOPe?`
Example	`:SOUR:RAD:ARB:TRIGger:EXT:SLOP POS` `:SOUR:RAD:ARB:TRIGger:EXT:SLOP?`
Dependencies	Unavailable and grayed-out when Trigger Source is not set to external trigger Not available in E7760
Preset	`POSitive`
Range	`POSitive|NEGative`

Select PXI Line

Controls which PXI_TRIG[0..7] backplane line is used for the trigger source.

This control is only found in modular analyzer products.

Remote Command	`:SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:LINE <line>` `:SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:LINE?`
Example	`:SOUR:RAD:ARB:TRIG:PXI:LIN 2`
Dependencies	Unavailable and grayed-out when "Trigger Source" on page 2159 is not set to PXI trigger Not available in E7760
Preset	0
State Saved	Saved in instrument state
Range	[0,7]

PXI Trigger Delay

Allows you to toggle the state and value of PXI trigger delay. The value you enter sets a delay time between when an PXI trigger is received and when it is applied to the waveform. This key is only active if you select PXI trigger as trigger source.

Remote Command	`:SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:DELay <time>`
	`:SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:DELay?`
	`:SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:DELay:STATe OFF | ON | 0 | 1`
	`:SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:DELay:STATe?`

Example	`:SOUR:RAD:ARB:TRIG:PXI:DEL 100ns`
	`:SOUR:RAD:ARB:TRIG:PXI:DEL?`
	`:SOUR:RAD:ARB:TRIG:PXI:DEL:STAT ON`
	`:SOUR:RAD:ARB:TRIG:PXI:DEL:STAT?`

Notes	PXI trigger delay time set by users will be rounded to the nearest integer multiple of the resolution
Dependencies	Unavailable and grayed-out when "Trigger Source" on page 2159 is not PXI trigger Not available in E7760
Preset	1 ms `OFF`
Min	VXT models M9410A/11A/15A: -10 s
Max	8.589934588 s (Note: This value comes from 4ns * (2^31 – 1) = 8589934588 ns) VXT models M9410A/11A: 11.45324612 s, this value comes from 2.666667ns *(2^32-1) For “Continuous – Trigger + Run” trigger : 11.45324612 s, this value comes from 2.666667ns *(2^32-1) Other trigger conditions: 17.17986918 s, this value comes from 4 ns *(2^32-1)

PXI Trigger Polarity

Sets the polarity of the PXI trigger. When Positive is selected, trigger event happens on a rising edge of the PXI trigger in signal. When Negative is selected, trigger event happens on a falling edge of the PXI trigger in signal. This key is active only if you select PXI trigger as trigger source.

Remote Command	`:SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:SLOPe POSitive | NEGative` `:SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:SLOPe?`
Example	`:SOUR:RAD:ARB:TRIGger:PXI:SLOP POS` `:SOUR:RAD:ARB:TRIGger:PXI:SLOP?`
Dependencies	Unavailable and grayed-out when the "Trigger Source" on page 2159 is not set to PXI trigger Not available in E7760
Preset	`POSitive`
Range	`POSitive|NEGative`

I/Q Adjustments

Enables or disables the I/Q adjustments.

Remote Command	`:SOURce:RADio:ARB:IQADjustment:[STATe] OFF | ON | 0 | 1` `:SOURce:RADio:ARB:IQADjustment:[STATe]?`
Example	`:SOURce:RADio:ARB:IQADjustment:[STATe] ON` `:SOURce:RADio:ARB:IQADjustment:[STATe]?`
Dependencies	Not available in E7760
Preset	`OFF`

I/Q Gain

Allows you to adjust the ratio of I to Q while preserving the composite, vector magnitude. Adding Gain (+x dB) to the signal increases the I component and decreases the Q component proportionally. Reducing Gain (-x dB) decreases the I component and increases the Q component proportionally.

Remote Command	`:SOURce:RADio:ARB:IQADjustment:GAIN <value><unit>` `:SOURce:RADio:ARB:IQADjustment:GAIN?`
Example	`:SOURce:RADio:ARB:IQADjustment:GAIN 0.5` `:SOURce:RADio:ARB:IQADjustment:GAIN?`
Notes	Effective only if the I/Q adjustment function is `ON`
Dependencies	Unavailable and grayed-out when the ARB state is `OFF`

	Not available in E7760
Preset	+0.00000000E+000
Min	-1 dB
Max	1 dB

I/Q Delay

Enables you to change the absolute phase of both I and Q with respect to triggers and markers. A positive value delays I and Q. This value affects both the external I/Q out signals and the baseband signal modulated on the RF output. This adjustment does not affect external I/Q inputs.

Remote Command	`:SOURce:RADio:ARB:IQADjustment:DELay <value><unit>` `:SOURce:RADio:ARB:IQADjustment:DELay?`
Example	`:SOURce:RADio:ARB:IQADjustment:DELay 10ps` `:SOURce:RADio:ARB:IQADjustment:DELay?`
Notes	IQ delay time set by users will be rounded to the nearest integer multiple of the resolution
Dependencies	Unavailable and grayed-out when the ARB state is off Not available in E7760
Preset	+0.00000000E+000
Min	-250ns
Max	250ns

RMS

Allows you to directly specify current RMS value used to playback currently selected waveform. Please note incorrect RMS value may cause inaccurate power output in EXM that is sensitive to RMS value.

This setting is also updated by RMS in waveform header or updated when invoking RMS calculation operation.

This setting can be saved to the header of currently selected waveform by invoking "Save Header" on page 2187.

Remote Command	`:SOURce:RADio:ARB:RMS <float>` `:SOURce:RADio:ARB:RMS?`
Example	`:SOUR:RAD:ARB:HEAD:RMS 0.7` `:SOUR:RAD:ARB:HEAD:RMS?`
Notes	The valid range for this setting is 0 to 1.414 (linear), values outside the range will be clipped to the closest boundary Note this value does not affect Source List Sequencer, which always uses the RMS value included in

	each ARB header. If this setting is to take effect in List Sequencer, use "Save Header" on page 2187 to save the current RMS value to the header, then play the ARB in Source List Sequencer
Dependencies	When a new waveform is selected for playback this setting is updated by the RMS value included in the associated waveform header file. If the selected waveform has no associated header file or the header file does not include the RMS value then the instrument will try to calculate the value automatically based on the RMS Calculation Mode setting Pressing the "Calculate" button also updates this setting
Preset	0
Range	0 ~ 1.414

RMS Calculation Mode

Allows you to specify the mode to calculate the current RMS. See "More Information" on page 2167

Remote Command	`:SOURce:RADio:ARB:RMS:CALCulation:MODE AUTO | M1 | M2 | M3 | M4` `:SOURce:RADio:ARB:RMS:CALCulation:MODE?`
Example	`:SOUR:RAD:ARB:RMS:CALC:MODE AUTO`
Notes	If no waveform is selected, or selected waveform is waveform sequence, the key is grayed-out
Preset	`AUTO`
Range	`AUTO | M1 | M2 | M3 | M4`

More Information

Parameter	SCPI Example	Notes
Auto	`:SOUR:RAD:ARB:RMS:CALC:MODE AUTO`	In Auto, RMS will be calculated based on the whole sample range of the currently selected waveform
Marker 1	`:SOUR:RAD:ARB:RMS:CALC:MODE M1`	Selects marker 1 to designate sample range used for RMS calculation
Marker 2	`:SOUR:RAD:ARB:RMS:CALC:MODE M2`	Selects marker 2 to designate sample range used for RMS calculation
Marker 3	`:SOUR:RAD:ARB:RMS:CALC:MODE M3`	Selects marker 3 to designate sample range used for RMS calculation
Marker 4	`:SOUR:RAD:ARB:RMS:CALC:MODE M4`	Selects marker 4 to designate sample range used for RMS calculation

Calculate

Allows you to calculate current RMS based on mode selected. This will update the setting in the "RMS" on page 2166 control.

Remote Command	`:SOURce:RADio:ARB:RMS:CALCulate`
Example	`:SOUR:RAD:ARB:RMS:CALC`
Notes	If no waveform is selected, invoking this operation will get error "-221 Setting conflict; No waveform is selected for RMS operation" If no waveform is selected, or selected waveform is waveform sequence, the key is grayed-out If selected waveform does not contain marker data, but "RMS Calculation Mode" on page 2167 is set to marker, under this circumstance, invoking calculation operation will get error "-221 Setting conflict; There is no marker for currently selected waveform, auto RMS calculation mode is used instead", and "RMS Calculation Mode" on page 2167 will be coupled to "Auto" mode automatically RMS calculation does not suit for waveform sequence. If selected waveform is waveform sequence file, invoking this operation will get error "-221 Setting conflict; RMS calculation does not apply to waveform sequence". But users can still edit current RMS as play parameter, and can save current RMS to waveform sequence header for later use

Use Header RMS

Allows you to quickly set RMS to value in ARB header. This will update the setting in the "RMS" on page 2166 control.

Notes	No remote command, front panel only If no waveform is selected, the key is grayed-out If no waveform is selected, invoking this operation generates error "-221 Setting conflict; No waveform is selected for RMS operation"

Select Waveform

Allows you to select a waveform segment or sequence to be played by the ARB player. It presents you with a list of waveform segments files and waveform sequence files. The list of waveform segment files and waveform sequence files contains the names of all the waveform segments and waveform sequence files currently loaded into ARB playback memory.

Waveform sequences are not available in E7760.

Waveforms formatted in `*.mat`, `*.csv` and `*.txt` are supported by models with a built-in source, such as VXT and EXM.

NOTE **To load a file from the hard drive into ARB memory, go to the Recall, Waveform dialog**

NOTE **Selecting a waveform file does not result in automatic adjustments to burst timing; that adjustment occurs only when a waveform is loaded to ARB memory.**

Remote Command	`:SOURce:RADio:ARB:WAVeform <string>` `:SOURce:RADio:ARB:WAVeform?`
Example	`:SOUR:RAD:ARB:WAV "test_waveform.bin"`
Notes	If the intended waveform is not in the memory yet, then issuing this command invokes ARB loading operation first, which involves a delay of unpredictable length, so this command should be followed by the query `*OPC?`, which holds off subsequent commands until the loading operation is complete `<string>` - specifies the name of the waveform segment or waveform sequence to be played by the ARB Sequence Analyzer Mode only: – If Include Source is Yes, and you attempt to play a waveform sequence but not all the required waveform segments are in the ARB playback memory, the application rejects the loading operation and an error is generated – If Include Source is No, and you attempt to play a waveform sequence but not all the required waveform segments are contained in the ARB playback memory, the application attempts to load the required segments from either the default directory or the current directory. If the ARB memory does not have enough space for all the waveform segments to be loaded, an error is generated and none of the waveform segments is loaded If ARB is ON, and you attempt to play a waveform sequence but not all the waveform segments within the sequence could be found to be loaded into ARB memory, an error is generated. The selected waveform keeps the previous value and ARB state remains On If you specify a waveform segment via SCPI but the waveform segment is not present within ARB playback memory, and cannot be found for auto loading within the current directory or the default directory, an error is generatedand the file selection remains unchanged If you select a waveform for playback and the waveform requires a license that is not installed on the instrument, an error is generated. If ARB is ON and you load a file to ARB memory or delete a file from ARB memory, the playing waveform segment may not keep phase continuity during the ARB memory operation. The waveform will be replayed after the ARB operation is finished

Segments in ARB Memory

Shows you which files are loaded into the ARB memory and lets you select a file for playback.

Recall Waveform

Displays the Recall Waveform dialog. This is the same as **Recall From File** in the **Recall**, **Waveform** dialog.

Delete Segment From ARB Mem

Deletes a segment from ARB memory. This is the same as **Delete Segment From ARB Mem** in the **Recall**, **Waveform** dialog.

Delete All From ARB Memory

Removes all segments from ARB memory. This is the same as **Delete All From ARB Memory** in the **Recall**, **Waveform** dialog.

OK

Inserts the currently highlighted waveform at the end of the waveform sequence, and returns you to the **Edit Sequence** dialog.

Cancel

Discards any changes, and returns you to the **Build New Sequence** dialog.

Query ARB Memory File List (Remote Command Only)

Queries the test set for the list of waveform segments in the ARB memory.

NOTE **This command returns a string for waveform segment names in ARB memory.If you require a string list of waveform segments in the ARB memory, use "Query ARB Memory Full File List (Remote Command Only)" on page 2170**

Remote Command	`:SOURce:RADio:ARB:CATalog?`
Example	`:SOUR:RAD:ARB:CATalog?`
Notes	The return data is in the following format:

<integer>	memory used
<integer>	memory free
<string> ...	comma separated list of waveform segments within ARB memory

Query ARB Memory Full File List (Remote Command Only)

Queries the test set for the string list of waveform segments in the ARB memory. Returns a string list for waveform segment names in the ARB memory.

Remote Command	`:SOURce:RADio:ARB:FCATalog?`
Example	`:SOUR:RAD:ARB:FCATalog?`
Notes	The return data is in the following format:

<integer>	memory used
<integer>	memory free
<integer>	file count in ARB memory
<string>,<string>, ... <string>	comma separated string list of waveform segments within ARB memory

Example: `SOUR:RAD:ARB:FCAT?`

EXT returns: 27499,2069653,3,”c2k.wfm”,”gsm.wfm”,”wcdma.wfm”

Waveform Sequences

This tab is not available in E7760.

Lets you build new sequences or edit existing sequences. The Sequences table displayed in this dialog shows you the sequences in the current directory. You may build a new sequence or select one of the sequences in the table and tap **Edit Selected Sequence**. The default current directory is `C:\NVARB`. Tapping any element of this path lets you select an alternate route. Tapping the **Computer** arrow lets you select a different drive. Tapping the **Back** arrow navigates to the previously selected directory.

Build New Sequence

Lets you build a new sequence of waveform segments. When you build a sequence you are building the “current sequence”, and the next time you press “Build New Sequence” the sequence you have been building will still be there, allowing you to add or remove segments from it.

Segment

This field in the table shows the segment number assigned to this row.

Waveform

This field in the table shows the file name for the waveform inserted into this row. Use "Insert Waveform" on page 2174 to insert a waveform.

Repetitions

This field in the table allows you to specify the number of times the currently selected waveform is played within the sequence.

Notes	No remote command, SCPIfront panel only
Preset	1

Min	1
Max	65535

Marker 1

This field in the table allows you to enable or disable marker 1 for the currently selected waveform. For a waveform sequence, you can enable and disable markers on a per-segment basis, allowing you to output markers from some waveform segments within the sequence, but not for others.

Notes	No remote command, front panel only
Preset	Enabled
Range	Enabled|Disabled

Marker 2

This field in the table allows you to enable or disable marker 2 for the currently selected waveform. For a waveform sequence, you can enable and disable markers on a per-segment basis, allowing you to output markers from some waveform segments within the sequence, but not for others.

Notes	No remote command, front panel only
Preset	Enabled
Range	Enabled|Disabled

Marker 3

This field in the table allows you to enable or disable marker 3 for the currently selected waveform. For a waveform sequence, you can enable and disable markers on a per-segment basis, allowing you to output markers from some waveform segments within the sequence, but not for others.

Notes	No remote command, front panel only
Preset	Enabled
Range	Enabled|Disabled

Marker 4

This field in the table allows you to enable or disable marker 4 for the currently selected waveform. For a waveform sequence, you can enable and disable markers on a per-segment basis, allowing you to output markers from some waveform segments within the sequence, but not for others.

Notes	No remote command, front panel only
Preset	Enabled
Range	Enabled|Disabled

Sync Seq File

Change this setting to enable/disable the function of saving secondary modules' waveform sequence files based on the current primary module segment's waveform settings.

Remote Command	`:SOURce:RADio:ARB:SEQuence:SYNC ON | OFF` `:SOURce:RADio:ARB:SEQuence:SYNC?`
Example	`:SOURce:RADio:ARB:SEQuence:SYNC OFF`
Notes	This setting is available only on primary module If this setting is `ON`, when Sync Config is not `NONE`, the responding secondary module's waveform sequence file will be saved accordingly when save sequence... on primary module, and the primary sequence file name should end with `xxx0.seq`, so the secondary module will be named accordingly, following the "Naming Rule" on page 2173 Waveform names in sequence files should also follow the same rule
Dependencies	This control is not available in E7760
Preset	`OFF`
Range	`ON|OFF`

Naming Rule

If Sync Config is not 2x2 +2x2 or 1x1+1x1, the waveform files to be used should follow this naming convention: the waveform file for the primary source should end in 0; the waveform files for the controlled sources should end in 1, 2, or 3 (reflecting the order of the TRXs). For example, for DL 11AC80 3X3 MIMO, sequence file names for TRX1,TRX2 and TRX3 should be xxx0.xx, xxx1.xx and xxx2.xx

If Sync Config is 2x2+2x2, the waveform files to be used should follow this naming convention: the waveform file for the primary source of first 2x2 should end in 0_0; the waveform files for the secondary source of first 2x2 should end in 0_1; the waveform files for the primary source of second 2x2 should end in 1_0; the waveform files for the secondary source of second 2x2 should end in 1_1. For example, for DL 11AC80 2x2 + 2x2 MIMO, waveform file names for TRX1,TRX2,TRX3 and TRX4 should be xxx0_0.xx, xxx0_1.xx, xxx1_0.xx and xxx1_1.xx

If Sync Config is 1x1+1x1, the waveform files to be used should follow this naming convention: the waveform file for the first source should end in 0_0; the waveform files for the second source should end in 1_0. For example, for DL 11AC80 1x1 + 1x1 MIMO, waveform file names for TRX1 and TRX2 should be xxx0_0.xx and xxx1_0.xx

Insert Waveform

Allows you to select a waveform segment to be added to the sequence.

NOTE To load a file from the hard drive into ARB memory, go to the Recall, Waveform dialog

Segments in ARB Memory

Shows you which files are loaded into the ARB memory and lets you select a file for inclusion in the sequence.

Delete Segment From ARB Mem

Deletes a segment from ARB memory. This is the same as **Delete Segment From ARB Mem** in the **Recall**, **Waveform** dialog.

Delete All From ARB Memory

Removes all segments from ARB memory. This is the same as **Delete All From ARB Memory** in the **Recall**, **Waveform** dialog.

OK

Inserts the currently highlighted waveform at the end of the waveform sequence, and returns you to the **Edit Sequence** dialog.

Cancel

Discards any changes, and returns you to the **Build New Sequence** dialog.

Delete Segment

Allows you to delete the selected segment from the waveform sequence.

Save Sequence

Allows you to save the newly built Waveform Sequence to HDD.

Sequence files have the extension ".seq". The default filename is WfmSequence_0000.seq, where the 4-digit number is the lowest number that does not conflict with any filename in the current directory. Use “File Name” and “File Type’ to specify your waveform sequence. The newly build sequence will be stored in the current directory.

Build New Sequence (Remote Command Only)

This is the SCPI equivalent of the waveform sequence creation features described in "Build New Sequence" on page 2171.

This command writes a waveform sequence file to the hard disk. You must specify the waveform sequence file path and filename which will be saved on the hard disk, and the waveform segment file path and name which will be nested into the waveform sequence file. You can utilize mass storage unit specifier (MSUS) “NVWFM” or use a real full path representation. See the example below. MSUS “NVWFM” is mapped to D:\NVARB directory on test set hard disk.

Any number of segments, up to a segment count limit of 64, can be used to create a sequence. Repeated segments are included in the count limit.

Each waveform segment name string length upper limit is 128 chars. Do not attempt to insert a waveform with a name string that exceeds 128 chars.

The internal source does not support nesting one waveform sequence file into another waveform sequence file.

Remote Command

```
:SOURce:RADio:ARB:SEQuence[:MWAVeform] <filename>, <waveform1>,
<reps>, NONE | M1 | M2 | M3 | M4 | M1M2 | M1M3 | M1M4 | M2M3 | M2M4 |
M3M4 | M1M2M3 | M1M2M4 | M1M3M4 | M2M3M4 | M1M2M3M4 | ALL,
{<waveform2>, <reps>, NONE | M1 | M2 | M3 | M4 | M1M2 | M1M3 | M1M4 |
M2M3 | M2M4 | M3M4 | M1M2M3 | M1M2M4 | M1M3M4 | M2M3M4 | M1M2M3M4 |
ALL,} …
```

For additional description of each item, see Notes below "For Setup SCPI" on page 2175“For Setup SCPI”

```
:SOURce:RADio:ARB:SEQuence[:MWAVeform]? <filename>
```

For additional description of each item, see Notes "For Query SCPI" on page 2177 below

Example

For setup:

```
:SOUR:RAD:ARB:SEQ “NVWFM:testSeq1.seq”, “NVWFM:wfmSegment1.wfm”,10,
M2M3M4, “NVWFM:wfmSegment2.wfm”, 20, M1M3
```

Or

```
:SOUR:RAD:ARB:SEQ “D:\NVARB\testSeq1.seq”, “ D:\NVARB\w-
fmSegment1.wfm”,10, M2M3M4, “ D:\NVARB\wfmSegment2.wfm”, 20, M1M3
```

For query, must specify which waveform sequence file to query

```
:SOUR:RAD:ARB:SEQ? “NVWFM:testSeq1.seq”
```

Or

```
:SOUR:RAD:ARB:SEQ? “D:\NVARB\testSeq1.seq”
```

For Setup SCPI

For the Setup SCPI command, the parameters are:

`<filename>` - String Type

This variable specifies the path and name for the waveform sequence file. The path supports MSUS (NVWFM) or a real full path representation. See example.

`<waveform1>` - String Type

This variable specifies the path and name of the first existing waveform segment. The path supports MSUS (NVWFM) or a real full path representation. See example.

The segment file must reside within ARB playback memory before it can be played by the ARB player.

`<reps>` - Integer Type

This variable specifies the number of times a segment or sequence plays before moving on to the next segment or sequence.

`<marker>` - Enum Type

`NONE` – This choice disables all four markers for the waveform. Disabling markers means that the waveform sequence ignores the segments or sequence marker settings.

`M1, M2, M3, M4` – these choices, either individually or a combination of them, enable the markers for the waveform segment or sequence. Markers not specified are ignored for that segment or sequence.

`ALL` – This choice enables all four markers in the waveform segment or sequence.

`<waveform2>` - String type.

This variable specifies the name of a second existing waveform segment. The path supports MSUS (NVWFM) and real full path representation both. See example.

The segment file must reside within ARB playback memory before it can be played by the ARB player.

`<reps>` same as above, for the 2nd waveform segment.

`<marker>` same as above, for the 2nd waveform segment.

You can insert several waveform segments into a waveform sequence file. Just repeat inserting waveform segments as described above.

Error Checks for Setup SCPI command:

If you do not specify a filename, or you use an unsupported MSUS (that is, not NVWFM), or have an error in the waveform sequence file path, an error is generated.

If the specified waveform sequence file name suffix is not ".seq", error is generated.

If you use an unsupported MSUS (that is, not NVWFM), or have an error in the waveform segment file path, an error is generated.

If the first specified waveform file cannot be found, an error is generated.

If you nest one waveform sequence file into another waveform sequence file, an error is generated.

If the specified repetition value is larger than 65535 or smaller than 1, an error is generated.

If the specified marker type is unrecognized, an error is generated.

For Query SCPI

For the Query the parameters are:

`<filename>` - String type.

This variable specifies the path and name of the waveform sequence file being queried. The path supports MSUS (NVWFM) or a real full path representation. See example.

The return value is a `<string>`, which includes each waveform segment file name, repetitions, and marker type. For example:

```
>:SOUR:RAD:ARB:SEQ? “NVWFM:testSeq1.seq”,
<“wfmSegment1. wfm, 10, ALL, wfmSegment2.wfm, 20, M1M3”,
```

Error Checks for Query SCPI command:

If you do not specify a filename, an error is generated.

If the waveform sequence file name is empty, an error is generated.

If the specified waveform sequence file cannot be found, an error is generated.

Edit Selected Sequence

This dialog lets you edit an existing sequence of waveform segments. A table of the segments in the currently selected sequence displays, allowing you to insert waveform segments or edit the characteristics of each segment.

Segment

This field in the table shows the segment number assigned to this row.

Waveform

This field in the table shows the file name for the waveform inserted into this row. Use "Insert Waveform" on page 2174 to insert a waveform.

Repetitions

This field in the table allows you to specify the number of times the currently selected waveform is played within the sequence.

Preset	1
Min	1

Marker 1

This field in the table allows you to enable or disable marker 1 for the currently selected waveform. For a waveform sequence, you can enable and disable markers on a per-segment basis, allowing you to output markers from some waveform segments within the sequence, but not for others.

Notes	No remote command, front panel only
Preset	Enabled
Range	Enabled|Disabled

Marker 2

This field in the table allows you to enable or disable marker 2 for the currently selected waveform. For a waveform sequence, you can enable and disable markers on a per-segment basis, allowing you to output markers from some waveform segments within the sequence, but not for others.

Notes	No remote command, front panel only
Preset	Enabled
Range	Enabled|Disabled

Marker 3

This field in the table allows you to enable or disable marker 3 for the currently selected waveform. For a waveform sequence, you can enable and disable markers on a per-segment basis, allowing you to output markers from some waveform segments within the sequence, but not for others.

Notes	No remote command, front panel only
Preset	Enabled
Range	Enabled|Disabled

Marker 4

This field in the table allows you to enable or disable marker 4 for the currently selected waveform. For a waveform sequence, you can enable and disable markers on a per-segment basis, allowing you to output markers from some waveform segments within the sequence, but not for others.

Notes	No remote command, front panel only
Preset	Enabled
Range	Enabled|Disabled

Sync Seq File

Change this setting to enable/disable the function of saving secondary modules' waveform sequence files based on the current primary segment's waveform settings.

Remote Command	`:SOURce:RADio:ARB:SEQuence:SYNC ON | OFF` `:SOURce:RADio:ARB:SEQuence:SYNC?`
Example	`:SOURce:RADio:ARB:SEQuence:SYNC Off`
Notes	This setting is available only on primary modules If this setting is `ON`, when Sync Config is not `NONE`, the responding secondary module's waveform sequence file will be saved accordingly when save sequence... on the Primary module, and the primary sequence file name should end with `xxx0.seq`, so the secondary module will be named according to the "Naming Rule" on page 2179 Waveform names in sequence files should also follow the naming rule
Preset	`OFF`
Range	`ON|OFF`

Naming Rule

If Sync Config is not 2x2 +2x2 or 1x1+1x1, the waveform files to be used should follow this naming convention: the waveform file for the primary source should end in 0; the waveform files for the controlled sources should end in 1, 2, or 3 (reflecting the order of the TRXs). For example, for DL 11AC80 3X3 MIMO, sequence file names for TRX1,TRX2 and TRX3 should be xxx0.xx, xxx1.xx and xxx2.xx

If Sync Config is 2x2+2x2, the waveform files to be used should follow this naming convention: the waveform file for the primary source of first 2x2 should end in 0_0; the waveform files for the secondary source of first 2x2 should end in 0_1; the waveform files for the primary source of second 2x2 should end in 1_0; the waveform files for the secondary source of second 2x2 should end in 1_1. For example, for DL 11AC80 2x2 + 2x2 MIMO, waveform file names for TRX1,TRX2,TRX3 and TRX4 should be xxx0_0.xx, xxx0_1.xx, xxx1_0.xx and xxx1_1.xx

If Sync Config is 1x1+1x1, the waveform files to be used should follow this naming convention: the waveform file for the first source should end in 0_0; the waveform files for the second source should end in 1_0. For example, for DL 11AC80 1x1 + 1x1 MIMO, waveform file names for TRX1 and TRX2 should be xxx0_0.xx and xxx1_0.xx

Insert Waveform

This dialog page allows you to select a waveform segment to be added to the sequence.

NOTE **To load a file from the hard drive into ARB memory, go to the Recall, Waveform dialog**

Segments in ARB Memory

This table shows you which files are loaded into the ARB memory and lets you select a file for inclusion in the sequence.

Delete Segment From ARB Mem

Deletes a segment from ARB memory. This is the same as **Delete Segment From ARB Mem** in the **Recall**, **Waveform** dialog.

Delete All From ARB Memory

Removes all segments from ARB memory. This is the same as **Delete All From ARB Memory** in the **Recall**, **Waveform** dialog.

OK

Inserts the currently highlighted waveform at the end of the waveform sequences and returns you to the **Edit Sequence** dialog

Cancel

Discards any changes, and returns you to the **Edit Sequence** dialog.

Delete Segment

Allows you to delete the current segment from the waveform sequence.

Notes	No remote command, front panel only.

Waveform Utilities

This control is not available in E7760.

This tab only appears if there is at least one Multi-pack license installed on the instrument.

On modular instrument like EXM , multi-pack license operations are only allowed on the default module, i.e., “TRX1” module for EXM.

For EXM, if access multi-pack license sub-menu from modules other than “TRX1”, an advisory message like “Please go to “TRX1” to operate multi-pack license” will display.

Add Waveform

Use this dialog to select and add waveforms. Pressing **OK** in this dialog adds the currently highlighted waveform to the next available slot, and returns you to the **Waveform Utilities** dialog.

Remote Command	`:SYSTem:LKEY:WAVeform:ADD <string>`
	or
	`:SYSTem:LICense[:FPACk]:WAVeform:ADD <string>`

Example	`:SYST:LKEY:WAV:ADD “mywaveform.wfm”`
	or
	`:SYST:LIC:WAV:ADD “mywaveform.wfm”`

Notes	The second form, `:SYSTem:LICense[:FPACk]:WAVeform:ADD`, is provided for consistency with Keysight signal sources. You can use either form Since adding a waveform segment to a Multi-Pack license causes the license slot to enter the trial period of only 48 hours, pressing this key causes a confirmation dialog to be displayed to ensure you do want to add the waveform segment to the Multi-Pack If you attempt to license a waveform that is already licensed using another slot an error is generated For EXM, if current module is not “TRX1” module, the key will grey out, and error message is generated “-221 Setting conflict; Not allowed on current module. Go to “TRX1” to operate multi-pack license” when invoking SCPI
Dependencies	This key is only available if the currently selected file is a secure waveform requiring a license, and there is at least one slot available within at least one multi-pack license. If the waveform highlighted is a secure waveform, but is already licensed, this key will be unavailable

OK

Adds the currently highlighted waveform to the next available slot, and returns you to the Waveform Utilities dialog.

Cancel

Discards any changes, and returns you to the Waveform Utilities dialog.

Replace Selected Waveform

Allows you to replace the waveform in the currently selected slot with the waveform currently selected in the Multi-Pack License Waveform Add view. Pressing **OK** in this dialog replaces the waveform in the currently selected slot with that currently highlighted, and returns you to the Waveform Utilities dialog.

Remote Command	`:SYSTem:LKEY:WAVeform:REPLace <int>, <string>`
	or
	`:SYSTem:LICense[:FPACk]:WAVeform:REPLace <int>, <string>`

Example	`:SYST:LKEY:WAV:REPL 1, “myotherwaveform.wfm”`
	or
	`:SYST:LIC:WAV:REPL 1, “myotherwaveform.wfm”`

Notes	The second command form, `:SYSTem:LICense[:FPACk]:WAVeform:REPLace` is provided for consistency with Keysight signal sources. You can use either form If you attempt to license a waveform that is already licensed using another slot an error is generated Waveform slot number <int> is positive. If you attempt to input a slot number less than or equals 0, an error is generated For EXM, if current module is not “TRX1” module, the key will grey out, and error message is generated “-221 Setting conflict; Not allowed on current module. Go to “TRX1” to operate multi-pack license” when invoking SCPI

OK

Replaces the waveform in the currently selected slot with that currently highlighted, and returns you to the Waveform Utilities dialog.

Cancel

Discards any changes, and returns you to the Waveform Utilities dialog.

Clear Waveform from Slot

Allows you to clear the waveform from the selected slot.

Remote Command	`:SYSTem:LKEY:WAVeform:CLEar <int>` or

	:SYSTem:LICense[:FPACk]:WAVeform:CLEar <int>
Example	:SYST:LKEY:WAV:CLE 1 or :SYST:LIC:WAV:CLE 1
Notes	The second SCPI :SYSTem:LICense[:FPACk]:WAVeform:CLEar is provided to be consistent with the style of Keysight signal sources. You can use either one of them Waveform slot number <int> is positive. If you attempt to input a slot number less than or equals 0, an error is generated For EXM, if current module is not "TRX1" module, the key will grey out, and error message is generated "-221 Setting conflict; Not allowed on current module. Go to "TRX1" to operate multi-pack license" when invoking SCPI
Dependencies	This key is only available if the currently selected slot is in the trial state

Lock Waveform in Slot

If the selected slot is in the trial state or the lock required state, the waveform that occupies the slot is locked and permanently licensed.

Remote Command	:SYSTem:LKEY:WAVeform:LOCK <int> or :SYSTem:LICense[:FPACk]:WAVeform:LOCK <int>
Example	:SYST:LKEY:WAV:LOCK 1 or :SYST:LIC:WAV:LOCK 1
Notes	The command form :SYSTem:LICense[:FPACk]:WAVeform:LOCK is provided for consistency with Keysight signal sources. You can use either form Waveform slot number <int> is positive. If you attempt to input a slot number less than or equals 0, an error is generated For EXM, if current module is not "TRX1" module, the key will grey out, and error message is generated "-221 Setting conflict; Not allowed on current module. Go to "TRX1" to operate multi-pack license" when invoking SCPI
Dependencies	This key is only available if the currently selected slot is in the trial state or the lock required state

Slot Status Query (Remote Command Only)

Returns the status of the specified slot.

Remote Command	:SYSTem:LKEY:WAVeform:STATus? <int> or :SYSTem:LICense[:FPACk]:WAVeform:STATus? <int>
Example	:SYST:LKEY:WAV:STAT? 1 :<"Locked"

	or
	`:SYST:LIC:WAV:STAT? 1`
	`:<"Locked"`

Notes	The command form `:SYSTem:LICense[:FPACk]:WAVeform:STATus` is provided for consistency with Keysight signal sources. You can use either form Waveform slot number `<int>` is positive. If you attempt to input a slot number less than or equals 0, an error is generated Result type is string. If input slot number exceeds total available slot number, “Nonexistent” is returned
Range	"Locked" | "Available" | “Trail” | “LockRequired” | “Nonexistent”

Slots Free Query (Remote Command Only)

Returns the number of license slots free.

Remote Command	`:SYSTem:LKEY:WAVeform:FREE?`
	or
	`:SYSTem:LICense[:FPACk]:WAVeform:FREE?`

Example	`:SYST:LKEY:WAV:FREE?`
	or
	`:SYST:LIC:WAV:FREE?`

Notes	The second SCPI `:SYSTem:LICense[:FPACk]:WAVeform:FREE` is provided to be consistent with the style of Keysight signal sources. You can use either one of them

Slot Used Query (Remote Command Only)

Returns the number of license slots used.

Remote Command	`:SYSTem:LKEY:WAVeform:USED?`
	or
	`:SYSTem:LICense[:FPACk]:WAVeform:USED?`

Example	`:SYST:LKEY:WAV:USED?`
	or
	`:SYST:LIC:WAV:USED?`

Notes	The second SCPI `:SYSTem:LICense[:FPACk]:WAVeform:USED` is provided to be consistent with the style of Keysight signal sources. You can use either one of them

Slot Waveform Name Query (Remote Command Only)

Returns the waveform name of the specified slot

Remote Command	`:SYSTem:LKEY:WAVeform:NAME? <int>`
	or
	`:SYSTem:LICense[:FPACk]:WAVeform:NAME? <int>`

Example	`:SYST:LKEY:WAV:NAME? 1`
	`:<"CDMA2K_22.wfm"`
	or
	`:SYST:LIC:WAV:NAME? 1`
	`:<"CDMA2K_22.wfm"`

Notes	Waveform slot number `<int>` is positive. If you attempt to input a slot number less than or equals 0, an error is generated Result type is string. If input slot number exceeds total available slot number, "Nonexistent" is returned If no waveform stored in the specified slot, then empty string is returned

Slot Waveform Unique ID Query (Remote Command Only)

Returns the waveform unique ID of the specified slot

Remote Command	`:SYSTem:LKEY:WAVeform:UID? <int>`
	or
	`:SYSTem:LICense[:FPACk]:WAVeform:UID? <int>`

Example	`:SYST:LKEY:WAV:UID? 2`
	`:<"1346752140"`
	or
	`:SYST:LIC:WAV:UID? 2`
	`:<"1346752140"`

Notes	Waveform slot number <int> is positive. If you attempt to input a slot number less than or equals 0, an error is generated Result type is string. If input slot number exceeds total available slot number, "Nonexistent" is returned Only Signal Studio waveform has unique ID, which is a positive number. (User generated waveform has no unique ID). If no waveform stored in the specified slot, then "0" is returned

Locked Waveform Name List Query (Remote Command Only)

Returns the waveform name list of locked.

Remote Command	`:SOURce:RADio:ARB:MPLicensed:NAME:LOCKed?`
Example	`:SOUR:RAD:ARB:MPL:NAME:LOCKed?` `:<"CDMA2K_27.wfm","GSM_MCS1.WFM","c2kWfm.wfm"`

Locked Waveform Unique ID List Query (Remote Command Only)

Returns the waveform unique id list of locked.

Remote Command	`:SOURce:RADio:ARB:MPLicensed:UID:LOCKed?`
Example	`:SOUR:RAD:ARB:MPL:UID:LOCKed?` `:<"2996927136","3812603511","3710986266"`
Notes	Each Signal Studio waveform has a unique id recorded in header. So if the unique ids are same, that means they are same one waveform. So besides SCPI to query locked waveform name list, also provide a SCPI to query locked waveform unique id list

Multi-Pack License multi-module control state (Remote Command Only)

When the state is `ON`, multi-pack license operations (such as adding/locking/replacinwaveform etc.) from TRXs other than TRX1 are allowed. If the state is `OFF`, only TRX1 is allowed to operate multi-pack license, while other TRXs are only able to show the related multi-pack license information.

Remote Command	`:SERVice[:PRODuction]:SOURce:MCONtrol:MPLicense[:STATe] ON | OFF | 1 | 0` `:SERVice[:PRODuction]:SOURce:MCONtrol:MPLicense[:STATe]?`
Example	`:SERV:SOUR:MCON:MPL OFF`
Notes	This command is only effective in modular based OBT, like EXM
Preset	Off
Range	On | Off

Header Utilities

If there is currently a waveform selected for playback, this table shows you the header information for the file. You can clear the header information out or edit it and save it.

Dependencies	This key is only available if there is currently a waveform selected for playback. If no waveform is selected, the key is grayed out

Clear Header

Allows you to clear the header information from the file header associated with the currently selected waveform.

Remote Command	`:SOURce:RADio:ARB:HEADer:CLEar`

Example	`:SOUR:RAD:ARB:HEAD:CLE`
Notes	Attempting to clear the header details via SCPI when no waveform was selected for playback will generate an error

Save Header

Allows you to save new file header information details to the file.

Remote Command	`:SOURce:RADio:ARB:HEADer:SAVE`
Example	`:SOUR:RAD:ARB:HEAD:SAVE`
Notes	Attempting to save the header details via SCPI when no waveform was selected for playback will generate an error

Query Waveform Unique ID (Remote Command Only)

Each Signal Studio waveform contains a unique waveform ID, which recorded in the header. This command allows you to query the unique waveform ID from the header. This is a SCPI only command.

Remote Command	`:MMEMory:HEADer:ID? “<file name>”`

Example	`:MMEM:HEAD:ID? “test.wfm”`
	query the waveform already loaded into the ARB memory
	`:MMEM:HEAD:ID? “D:\NVARB\test.wfm”`
	query the waveform on the hard disk by absolute path
	`:MMEM:HEAD:ID? “NVWFM:test.wfm”`
	query the waveform on the hard disk by MSUS

Notes	Query only The queried waveform file can be in ARB memory, or on hard disk. If want to query ARB in ARB memory, then give out the file name directly. If want to query ARB on the hard disk, then absolute file path or MSUS should be given along with the file name. The valid MSUS is “NVWFM” which is mapped to D:\NVARB on hard disk If the file cannot be found in ARB memory or on hard disk, an error is generated.and value -1 is returned

Query Selected Waveform Header info (Remote Query Only)

Returns a listing of the current selected ARB header info. If no ARB selected, then empty string is returned.

Remote Command	`:SOURce:RADio:ARB:HEADer:INFormation?`

Example	`:SOUR:RAD:ARB:HEAD:INF?`
Notes	Query only After each colon of field title string, related header info string will be appended The field title string in "Range" part cannot change, for Sequence Studio needs to accurately match those string character to know which header info field it is Below are the abbreviation descriptions:

`DESC`	Description
`SR`	Sample Rate
`RTS`	Run Time Scaling
`RMS`	Root Mean Square
`M1P`	Marker 1 Polarity
`M2P`	Marker 2 Polarity
`M3P`	Marker 3 Polarity
`M4P`	Marker 4 Polarity
`ALCHR`	ALC Hold Routing
`RFBR`	RF Blank Routing
`FOFF`	Frequency Offset
`AWGNST`	AWGN State
`AWGNCN`	AWGN C/N Ratio
`AWGNCBW`	AWGN Carrier Bandwidth
`AWGNNBW`	AWGN Noise Bandwidth
`AWGNCRMS`	AWGN Carrier RMS
`"ORP`	DAC Over Range Protection
`UID`	Unique ID
`LICSTS`	License Status

Range	"DESC:", "SR:", "RTS:", "RMS:", "M1P:", "M2P:", "M3P:", "M4P:", "ALCHR:", "RFBR:", "FOFF:", "AWGNST:", "AWGNCN:", "AWGNCBW:", "AWGNNBW:", "AWGNCRMS:", "ORP:", "UID:", "LICSTS"

6.1.12 Trigger Initiate

Used to initiate an immediate trigger event if the trigger source (under ARB Setup) is set to Key.

Dependencies	Grayed out unless the Trigger Source is set to Key and an ARB waveform is configured

6.1.13 Source Sync

Allows access to the menu for setting up the Source Synchronization for multiple models.

This control only appears in modular products such as VXT, and only when the instrument is configured for MIMO analysis.

6.1.13.1 Sync Config

Allows you to config MIMO type for source.

Sync Config is grayed-out when Primary and Secondary modules are in Sync State.

For option details, see More Information

Remote Command	`:SOURce:SYNC:CONFig NONE | TWO | THRee | FOUR | SIX | EIGHt | DONE | DTWO | DTHR | DFOU` `:SOURce:SYNC:CONFig?`
Example	`:SOURce:SYNC:CONF TWO`
Notes	For VXT models M9421A, Sync Config is based on the fixed setting.
Dependencies	For EXM: 2x2 and 1x1+1x1 MIMO are supported when license E6640A-M22 is enabled 2x2 and 3x3 MIMO are supported when license E6640A-M33 is enabled 2x2, 3x3, 4x4 and 2x2+2x2 MIMO are supported when license E6640A-M44 is enabled For VXT models M9421A: No-Across chassis MIMO is supported when license M9421A-MMO is enabled Across chassis MIMO is supported when license M9421A-MTS is enabled For VXT models M9410A/11A: No-Across chassis MIMO is supported when license M941xA-MMO is enabled Across chassis MIMO is supported when license M941xA-MTS is enabled
Range	`NONE|TWO|THRee|FOUR|SIX|EIGHt|DONE|DTWO|DTHR|DFOU`

More Information

Parameter	SCPI Example	Notes
None	`:SOURce:SYNC:CONF NONE`	Sets MIMO Config type as None
2x2	`:SOURce:SYNC:CONF TWO`	Sets 2x2 as MIMO Config Type. 2 models are configured to Sync
3x3	`:SOURce:SYNC:CONF THRee`	Sets 3x3 as MIMO Config Type. 3 models are configured to Sync
4x4	`:SOURce:SYNC:CONF`	Sets 4x4 as MIMO Config Type. 4 models are

Parameter	SCPI Example	Notes
	FOUR	configured to Sync
6x6	:SOURce:SYNC:CONF SIX	Sets 6x6 as MIMO Config Type. 6 models are configured to Sync
8x8	:SOURce:SYNC:CONF EIGHt	Sets 8x8 as MIMO Config Type. 8 models are configured to Sync
1x1+1x1	:SOURce:SYNC:CONF DONE	Sets 1x1+1x1 as MIMO Config Type. 2 models are configured to Sync with different center frequency. Use Segment 2 Setup to config the second model
2x2+2x2	:SOURce:SYNC:CONF DTWO	Sets 2x2+2x2 as MIMO Config Type. 2 groups of 2x2 MIMO. First group consists of Primary and TRX1. Second group consists of TRX2 and TRX3. Segment 2 Setup allows you to config the second group
3x3+3x3	:SOURce:SYNC:CONF DTHR	Sets 3x3+3x3 as MIMO Config Type. 2 groups of 3x3 MIMO. First group consists of Primary, TRX1 and TRX2. Second group consists of TRX3, TRX4 and TRX5. Segment 2 Setup allows you to config the second group
4x4+4x4	:SOURce:SYNC:CONF DFOU	Sets 4x4+4x4 as MIMO Config Type. 2 groups of 4x4 MIMO. First group consists of Primary, TRX1, TRX2 and TRX3. Second group consists of TRX4, TRX5, TRX6 and TRX7. Segment 2 Setup allows you to config the second group

6.1.13.2 Sync Type

Allows you to set Sync Type.

This menu is grayed-out when models are in Sync State.

Remote Command	:SOURce:SYNC:TYPE PRIMary | SECondary | OFF For details of parameter options, see "Options" on page 2190 :SOURce:SYNC:TYPE?
Example	:SOURce:SYNC:TYPE PRIM
Preset	SECondary
Range	PRIMary|SECondary|OFF

Options

Parameter	SCPI Example	Notes
OFF	:SOURce:SYNC:TYPE OFF	Sets the Sync Type to OFF If the Sync Type is set to OFF, this model will not be listed in the Secondary module List

Parameter	SCPI Example	Notes
SECondary	:SOURce:SYNC:TYPE SEC	Sets the Sync Type to Secondary Use the query :SOURce:SYNC:CONNected:NAME? to obtain the Primary's name in Sync State
PRIMary	SOURce:SYNC:TYPE PRIM	Sets the Sync Type to Primary Sync Setup is only available for Primary

6.1.13.3 Sync Settings

Opens a menu for setting Sync parameters.

This control is grayed-out when Primary and Secondary are in Sync State.

Dependencies	This control is grayed-out when Sync Type is set to OFF or Secondary

Secondary Module List

Shows you the parameters of Secondary modules. The Selected checkbox in each row allows you to select the Secondary module when the Sync Type is set to Primary.

- When Sync Config is set to NxN, use this control to enable N-1 Secondary modules
- When Sync Config is set to NxN+NxN, use this control to enable 2N-1 Secondary modules

See "More Information" on page 2191

Remote Command	:SOURce:SYNC:REMote:SECondary <integer> ON | OFF | 1 | 0 :SOURce:SYNC:REMote:SEC1?
Example	:SOURce:SYNC:REMote:SEC1 ON :SOURce:SYNC:REMote:SEC2 OFF
Notes	<integer> Secondary module number in Available Models
Preset	OFF

More Information

Parameter	SCPI Example	Notes
Available Secondary modules	:SOUR:SYNC:REM:SEC:List?	All the available Secondary models are listed
IP Address	:SOUR:SYNC:REM:SEC<integer>:ADDR? :SOUR:SYNC:REM:SEC1:ADDR?	Refer to Remote Chassis to add the IP Address for remote chassis

Parameter	SCPI Example	Notes
		"Local Host" indicates that the Primary and Secondary modules share the same chassis
Slot Number	:SOUR:SYNC:REM:SEC<integer>:SLOT? :SOUR:SYNC:REM:SEC2:SLOT?	Indicates the slot number of available models
Socket Port	:SOUR:SYNC:REM:SEC<integer>:SPOR? :SOUR:SYNC:REM:SEC2:SPOR?	Indicates the socket port of available models
Secondary module Order		Shows you the models to be Secondary devices Use Selected to choose from available Secondary models

Sync Settings

Lets you apply the source settings of the Primary module to its Secondary modules.

Remote Command	:SOURce:SYNC:SETTings:ENABle ON | OFF | 1 | 0 :SOURce:SYNC:SETTings:ENABle?
Example	:SOUR:SYNC:SETT:ENAB ON :SOUR:SYNC:SETT:ENAB?
Notes	When Sync Settings is set to ON, the source settings of Primary will be applied to Secondary modules. The supported settings are Amplitude, Frequency, Trigger Source, Trigger Type, RF Output and waveform related information When Sync Segment 2 is ON, this Toggle is set to ON simultaneously
Dependencies	Waveform files naming convention: For NxN MIMO: – xxx0.wfm for Primary – xxx[n].wfm for TRX[n] For example, in 3x3 MIMO: – xxx0.wfm for Primary – xxx1.wfm for TRX1 – xxx2.wfm for TRX2 For NxN+NxN MIMO, in the first group: – xxx0_0.wfm for Primary – xxx0_n.wfm for TRX[n] in the second group:

	– xxx1_n.wfm for TRX[n+N] For example, in 3x3+3x3 MIMO: – xxx0_0 for Primary – xxx0_1.wfm for TRX1 – xxx0_2.wfm for TRX2 – xxx1_0.wfm for TRX3 – xxx1_1.wfm for TRX4 xxx1_2.wfm for TRX5
Preset	OFF
Range	ON|OFF

Sync Segment 2

Allows you to config the models in the second group of NxN+NxN MIMO.

Remote Command	`:SOURce:SYNC:SETTings:SEGMent2:ENABle ON | OFF | 1 | 0` `:SOURce:SYNC:SETTings:SEGMent2:ENABle?`
Example	`:SOUR:SYNC:SETT:SEGM2:ENAB ON` `:SOUR:SYNC:SETT:SEGM2:ENAB?`
Notes	Only Frequency in settings is supported
Dependencies	When this setting is On. Sync Settings will be turned on accordingly
Preset	OFF
Range	ON|OFF

Segment 2 Frequency

When Sync Segment 2 is ON, this control allows you to set the frequency of models in the second group of NxN+NxN MIMO.

Remote Command	`:SOURce:SYNC:SETTings:SEGMent2:FREQuency <freq>` `:SOURce:SYNC:SETTings:SEGMent2:FREQuency?`
Example	`:SOUR:SYNC:SETT:SEGM2:FREQ 1.00 GHz` `:SOUR:SYNC:SETT:SEGM2:FREQ?`
Preset	1.00 GHz
Min	VXT models M9421A: 60 MHz VXT models M9410A/11A: 380 MHz
Max	Hardware Dependent

	VXT models M9421A: – Option 504 = 3.8 GHz – Option 506 = 6.0 GHz VXT models M9410A/11A: – Option F06 = 6.0 GHz

IP Address

Allows access to set up the controller's IP address of Remote Secondary models.

Remote Command	`:SOURce:SYNC:REMote:ADDRess <string>`
Example	`:SOURce:SYNC:REMote:ADDRess "192.168.1.2"`
Notes	`<string>` - IP Address

SCPI Socket Port

Allows access to set up the controller's SCPI socket port of Remote Secondary models.

Remote Command	`:SOURce:SYNC:REMote:IPPort <integer>`
Example	`:SOURce:SYNC:REMote:IPPort 5025`
Notes	`<integer>` - Port

Add Secondary Module

Lets you connect the remote chassis specified by IP Address and Socket Port.

Remote Command	`:SOURce:SYNC:REMote:ADDRess:ADD`
Example	`:SOUR:SYNC:REM:ADDR:ADD`

Notes	Example of how to add a remote chassis:
	`:SOURce:SYNC:REMote:ADDRess "192.168.1.2"`
	`:SOURce:SYNC:REMote:IPPort 5025`
	`:SOUR:SYNC:REM:ADDR:ADD`
	Once a remote chassis is connected, "Secondary Module List" on page 2191 shows you the available Secondary modules

Delete Secondary module

Lets you delete a selected remote chassis IP Address from "Secondary Module List" on page 2191.

Remote Command	`:SOURce:SYNC:REMote:ADDRess:DELete`
Example	`:SOUR:SYNC:REM:ADDR:DEL`

Notes	Example of how to delete a remote chassis:
	`:SOURce:SYNC:REMote:ADDRess “192.168.1.2”`
	`:SOUR:SYNC:REM:ADDR:DEL`

Sync Runtime Settings (Remote Command Only)

This setting allows you to Sync runtime settings to the Secondary modules without restarting Sync.

Remote Command	`:SOURce:SYNC:RTSetting:STATe ON | OFF | 1 | 0` `:SOURce:SYNC:RTSetting:STATe?`
Example	`:SOUR:SYNC:RTS:STAT ON` `:SOUR:SYNC:RTS:STAT?`
Notes	When this state is OFF, Sync will be interrupted when changing frequency or power settings on the Primary module. After applying the new settings to the Secondary modules, Sync will be restarted. When this state is ON, setting changes on the Primary module will be applied to the Secondary modules immediately without interrupting Sync status. This is the default behavior. The supported settings are Amplitude and Frequency.
Preset	On
Range	On | Off

6.1.13.4 Sync Start

Allows you to start synchronizing Primary and Secondary modules to play Arb synchronously.

When the Sync connection is built successfully, Primary and Secondary modules are in the Sync State.

Sync Start and Sync Config menu are grayed-out when Primary and Secondary modules are in Sync State.

Remote Command	`:SOURce:SYNC:STARt`
Example	`:SOURce:SYNC:STAR`

Notes	If you change the source settings during Sync State, error message will appear in the status bar as "Settings conflict; Sync connection is already established". And the change will not be applied until Sync Stop

6.1.13.5 Sync Stop

Allows you to stop the Synchronize.

When Sync Stops, Sync Config menu and Sync Start will be available.

Remote Command	`:SOURce:SYNC:STOP`
Example	`:SOURce:SYNC:STOP`

6.1.14 Source Preset

Allows you to preset the source settings to their default values.

Remote Command	`:SOURce:PRESet`
Example	`:SOUR:PRES`

6.2 Input

The controls on this tab let you select and configure the instrument’s inputs.

6.2.1 Select Input

Lets you choose which signal input you want to analyze:

– "RF Input" on page 2199

– "External Mixer" on page 2199

– "I/Q" on page 2202

See also:

– "External Mixer Setup" on page 2223

– "I/Q Setup" on page 2241

Remote Command	`[:SENSe]:FEED RF | AIQ | EMIXer` `[:SENSe]:FEED?`

Example	`:FEED RF`
	Selects the RF Input
	`:FEED EMIX`
	Selects External Mixing
	`:FEED AIQ`
	Selects BBIQ
	`:FEED?`

Dependencies	I/Q only appears when option BBA present Ext Mix only appears when option EXM present
Couplings	The act of connecting the U7227A USB Preamplifier to one of the instrument’s USB ports will cause the Input to automatically switch to the RF Input. If the RF Calibrator is on, it is turned off. Subsequently disconnecting the USB Preamp from USB does not change the Input selection nor restore the previous selection `[:SENSe]:FEED RF` turns the calibrator `OFF`
Preset	Unaffected by a Preset or power cycle. Survives a Mode Preset and mode changes Set to `RF` on "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved	Saved in instrument state
Annotation	Displayed in the Meas Bar as "Input::" followed by: RF or Ext Mix or I/Q depending on which input is selected

Backwards Compatibility SCPI	`[:SENSe]:FEED AREFerence`
	In the PSA the calibrator was one of the inputs and selected using the AREF parameter to the same :FEED command that switched the inputs. In the X-Series it is controlled in a separate menu and overrides the input selection. For code compatibility the [:SENSe]:FEED AREFerence command is provided, and is aliased to [SENSe]:FEED:AREF REF50, which causes the input to be switched to the 50 MHz calibrator. The [:SENSe]:FEED RF command switches the input back to the RF port and turns the calibrator OFF, thus providing full compatibility with the PSA calibrator function
	Note that after sending this, the query [:SENSe]:FEED? will NOT return "AREF" but instead the currently selected input.
	`[:SENSe]:FEED IQ | IONLy | QONLy`
	`[:SENSe]:FEED?`
	The parameters IQ|IONLy|QONLy are supported for backwards compatibility with the E44406A
	`[:SENSe]:FEED IQ aliases to [:SENSe]:FEED: IQ:TYPE IQ`
	`[:SENSe]:FEED IONLy aliases to [:SENSe]:FEED:IQ:TYPE IONLy`
	`[:SENSe]:FEED QONLy aliases to [:SENSe]:FEED:IQ:TYPE QONLy`
	`[:SENSe]:FEED?` always returns `AIQ`, whatever type of legacy parameter `IQ|IONLy|QONLy` has been used

Backwards Compatibility Notes	Most of the settings in the X-Series Input/Output system, including External Gain, Amplitude Corrections settings and data, etc., are shared by all modes and are not changed by a mode switch. Furthermore, most variables in the Input/Output system key are not affected by Mode Preset. Both of these behaviors represent a departure from legacy behavior In X-Series. Input/Output settings are reset by using the "Restore Input/Output Defaults" function. They can also be reset to their default values through System->Restore System Defaults-> In/Out Config or through System ->Restore System Defaults -> All (and corresponding SCPI) While this matches most use cases better, it does create some code compatibility issues. For example, Amplitude Corrections are no longer turned off by a Mode Preset, but instead by using the "Restore Input/Output Defaults" key/SCPI Although Input/Output settings are not part of each Mode's State, they are saved in the Save State files, so that all of the instrument settings can be recalled with Recall State, as in legacy instruments

Example	`:INP:MIX INT` `:INP:MIX?`
Notes	In legacy analyzers you could choose between the Internal mixer or an External Mixer. In the X-Series, the External Mixer is one of the choices for the Input and is selected using the `FEED` command (`:SENSe:FEED EXTMixer`) For compatibility, the INPut:MIXer EXTernal|INTernal legacy command is mapped as follows: 1. When INPut:MIXer EXTernal is received, SENSe:FEED EMIXer is executed 2. When INPut:MIXer INTernal is received, SENSe:FEED RF is executed 3. When INPut:MIXer? is received, the response will be INT if any input other than the external mixer is selected and EXT if the external mixer is selected

Preset	`INT`
Backwards Compatibility SCPI	`:INPut:MIXer EXTernal | INTernal` `:INPut:MIXer?`

Backwards Compatibility Notes	PSA supports the following SCPI Command :
	`:INPut:MIXer:TYPE PRESelected | UNPReselect`
	`:INPut:MIXer:TYPE?`
	PXA does not support the `:INPut:MIXer:TYPE` command

RF Input

Selects the front-panel RF input port to be the instrument signal input. If RF is already selected, pressing this key accesses the RF input setup functions.

External Mixer

This control allows you to choose an External Mixer through which to apply signal input to the instrument. When chosen, the LO/IF port becomes the input to the instrument.

External Mixing requires option EXM. The External Mixer key will not appear unless option EXM is installed. The presence of the LO/IF connector alone does not indicate that you have Option EXM licensed. To verify that option EXM is installed, press **System, Show, System.**

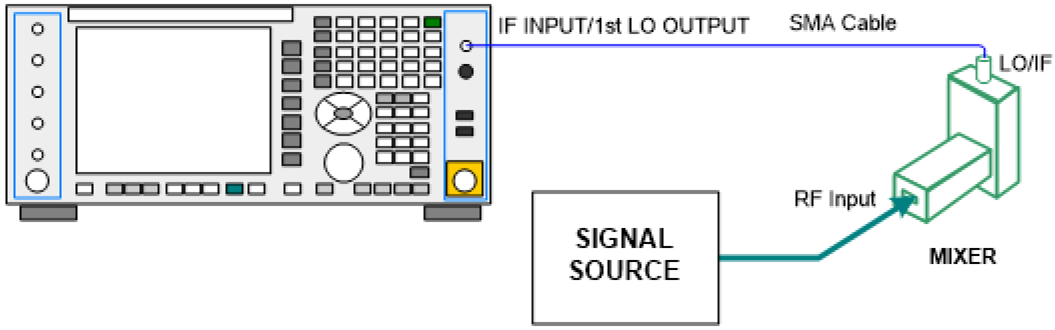
When External Mixer is selected, the **Center Freq** key controls the setting of the Center Freq in external mixing, which is separate from the settings of Center Freq for the RF Input or BBIQ. Each input retains its unique settings for Center Freq. A unique SCPI command is provided solely for the external mixing Center Freq (see the **Center Freq** key description), which only affects the External Mixer CF, although sending the generic Center Freq command while External Mixer is selected also controls the External Mixer CF.

Unless option EXM is present, the External Mixer key is blanked, and all SCPI commands associated with menus accessed by this key return an error

Manual FFT mode is available with external mixing, but not with Signal ID.

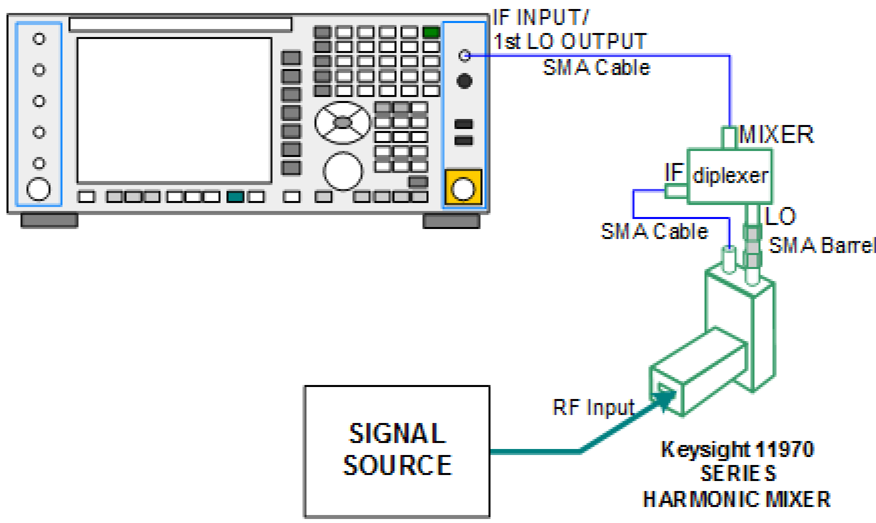
All settings under this key, and all Frequency settings, are remembered when you go out of External Mixer, so that when **External Mixer** is chosen again, all the external mixer functions will retain their previous settings, with the exception of Signal ID which is set to OFF (Signal ID is also set to Off unless External Mixer is the selected Input). Note that this differs from ESA and PSA, in which all external mixer settings including Center Frequency are lost when you turn off External Mixing or Preset the instrument.

X-series instruments have a combined LO Out/IF In connection, whereas earlier instruments used separate ports for the LO Out and the IF in. Internal diplexers in the instrument and the mixer simplify the connection for users – only a single SMA cable is required.



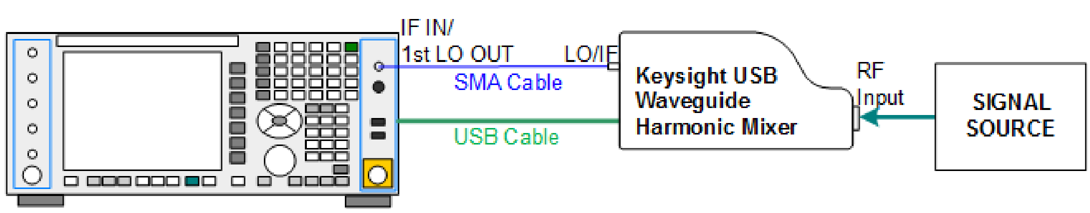
Legacy HP/Agilent and some third party mixers have separate LO In and IF out connections. This requires you to use an external diplexer to connect these mixers. A diplexer can easily be purchased for this purpose (for example, Diplexer Model # DPL.26 or # DPL.313B from OML Inc., Morgan Hill, California, USA).

The connection diagram for such a legacy mixer is:



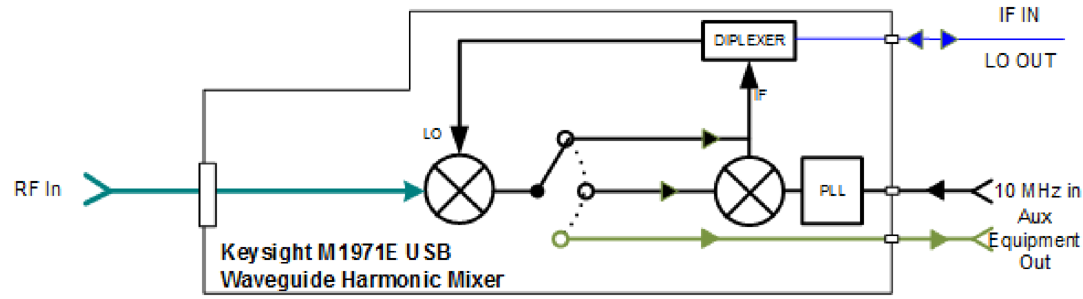
In addition, External Mixing in the X-Series supports the new Keysight M1970 series of Harmonic Mixers, which provide a USB connection for download of calibration data and additional control.

The connection diagram for one of the Keysight USB mixers is:

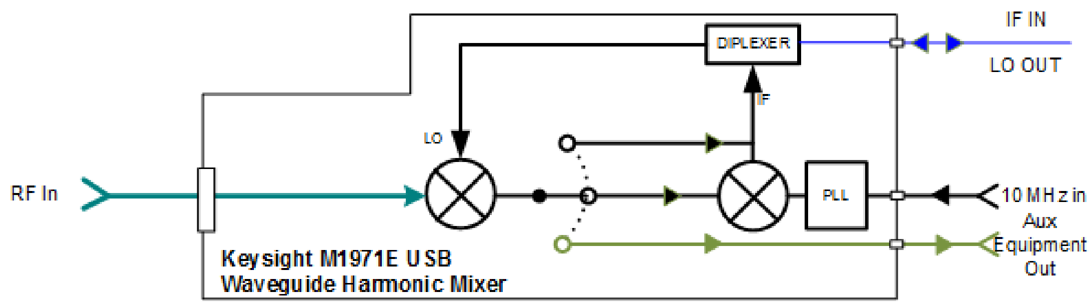


Also available in the M197x series are the M1971 series USB Mixers, which provide additional inputs and outputs for special functionality as described below. These mixers have multiple signal paths which allow them to function in three different states:

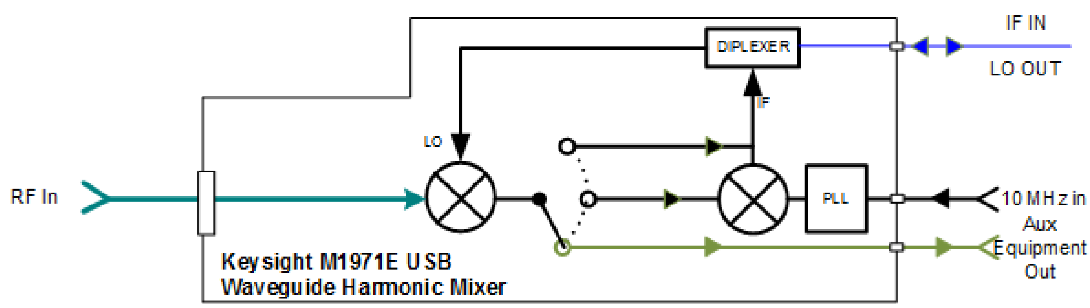
– Normal, in which the mixer functions as a classic external mixer with a single conversion:



– Dual Conversion, which gives you a wider image-free range. In Dual Conversion, the first conversion is to a higher IF frequency and you provide a 10 MHz signal to which an internal PLL is locked, to effect a second downconversion:



– Aux Equipment, wherein the first mixer output drives an output connector on the mixer and the instrument is out of the circuit:



External Mixing is only supported in certain Modes and Measurements in the X-Series, as shown in the table below. When External Mixer is selected in a measurement that does not support it, the "No result; Meas invalid with Ext Mixing" error condition occurs:

Mode	Measurements	Sig ID (Image Suppress only)
Spectrum Analyzer	Swept SA	Y*
	TOI	Y
	Harmonics	N
	Spurious Emissions	Y
	Channel Power	Y
	Occupied BW	Y
	ACP	Y
	Spectrum Emissions Mask	Y
	CCDF	N
	Burst Power	N
	List Sweep	N
Phase Noise	Monitor Spectrum	Y
	Log Plot	Y
	Spot Frequency	N
	Waveform	N
I/Q Analyzer	Complex Spectrum	N
	Waveform	N
Vector Signal Analyzer	Vector Analysis	N
	Analog Demod	N
	Digital Demod	N
Analog Demod	AM	N
	FM	N
	PM	N
	FM Stereo	N

* the Swept SA measurement also supports Image Shift

I/Q

Selects the front-panel I/Q input ports to be the instrument signal input. If I/Q is already selected, pressing this key accesses the I/Q setup menu.

The Baseband I/Q functionality is a hardware option. It is option BBA. If the option is not installed, none of the I/Q functionality is enabled.

The Baseband I/Q has four input ports and one output port. The input ports are I, I-bar, Q, and Q-bar. The I and I-bar together compose the I channel and the Q and Q-bar together compose the Q channel. Each channel has two modes of operation, Single-Ended (also called "unbalanced") and Differential Input (also called "balanced"). When in Single-Ended operation, only the main port (I or Q) is used and the complementary port (I-bar or Q-bar) is ignored. When in Differential Input mode, both main and complementary ports are used.

The input settings (range, attenuation, skew, impedance, external gain) apply to the channels, not the individual ports.

The system supports a variety of 1 MΩ input passive probes as well as the Keysight 113x Series active differential probes using the Infinimax probe interface.

The Keysight 113x Series active probes can be used for both single ended and differential measurements. In either case a single connection is made for each channel (on either the I or Q input). The input is automatically configured to 50 Ω single ended and the probe power is supplied through the Infinimax interface. The probe can be configured for a variety of input coupling and low frequency rejection modes. In addition, a wide range of offset voltages and probe attenuation accessories are supported at the probe interface. The active probe has the advantage that it does not significantly load the circuit under test, even with unity gain probing.

With passive 1 MΩ probes, the probe will introduce a capacitive load on the circuit, unless higher attenuation is used at the probe interface. Higher attenuation reduces the signal level and degrades the signal-to-noise-ratio of the measurement. Passive probes are available with a variety of attenuation values for a moderate cost. Most Keysight passive probes can be automatically identified by the system, setting the input impedance setting required as well as the nominal attenuation. For single ended measurements a single probe is used for each channel. Other passive probes can be used, with the attenuation and impedance settings configured manually.

For full differential measurements, the system supports probes on each of the four inputs. The attenuation of the probes should be the same for good common mode rejection and channel match.

Both active and passive probes in single ended and differential configurations can be calibrated. This calibration uses the Cal Out BNC connection and a probe connection accessory. The calibration achieves excellent absolute gain flatness in a probed measurement. It matches both the gain and frequency response of the I and Q channels as well as any delay skew, resulting in high accuracy in derived measurements such as Error Vector Magnitude (EVM).

When a probe is connected a status message will be displayed. The message will indicate if calibration data is available or not. Calibration data is saved for each type of probe (including "none") for each port and will be reapplied whenever that type of probe is re-connected to the same port. For probes with EEPROM identification, the calibration data will be stored based on the unique probe identifier and will reapply data for that particular probe if it is available. The data will not follow a probe from one port to another. For probes without EEPROM identification, the instrument cannot distinguish between different probes of the same type and it will use the data from the last calibration for that probe type on that port.

When in differential mode, both the main and complementary probes are expected to be of the same type.

In some situations, the I and Q channels should be configured identically. In other situations it is convenient to control them independently. Some menus have a "Q Same as I" setting that will cause the Q channel configuration to mirror the I channel configuration, avoiding the overhead of double data entry when the channels should be the same.

The output port is for calibrating the I/Q input ports, although it can also be manually controlled.

There are two types of calibrations available: cable calibration and probe calibration. The cable calibration will guide the user through connecting each input port in turn. All ports must be calibrated together. The probe calibration is done for a specific channel (I or Q). If in Single-Ended mode, only the main port is calibrated. When in Differential Input mode, the user is guided through calibrating both main and complementary ports.

The front panel I/Q port LEDs indicate the current state of that port. On (green) indicates it is active, and off (dark) indicates it is not in use. For example, the Cal Out port LED is on if and only if there is signal coming out of that port.

The input is a context and some parameters have separate values for each context. The SCPI for these parameters has an optional "[:RF|IQ]" node. If the specific context is omitted, the command acts on the current input context's value. Here are the parameters that are input context sensitive:

- Center Frequency
- Trigger Source

It is important to distinguish between the I and Q input ports and the displayed I and Q data values. The I and Q input ports feed into a digital receiver that does digital tuning and filtering. The I and Q data seen by the user (either on the display or through SCPI) corresponds to the real ("I") and the imaginary ("Q") output from the digital receiver. When the input path is I+jQ or I Only and the center frequency is 0 Hz the I input ends up in as the real output from the receiver and appears as "I" data. Likewise, when the input path is I+jQ and the center frequency is 0 Hz, the Q input ends up as the imaginary output from the receiver and appears as "Q" data. However, when the input path is Q Only, the Q input is sent to the receiver as Q+j0, so the receiver output has the Q input coming out on the real output, and so in Q Only, the signal from the Q input port appears as the "I" data. Another situation where the I and Q data do not necessarily correspond directly to the I and Q inputs is when the center frequency is non-zero. The digital processing involved in the tuning is a complex operation. This will result in I Only data appearing as both "I" and "Q" data, the same as that signal would appear if seen through the RF input port.

BBIQ is only supported in certain Modes and Measurements in the X-Series. When I/Q is selected in a measurement that does not support it, the “No Result; Meas invalid with I/Q inputs” message appears. This is error 135

Baseband I/Q Remote Language Compatibility

For the Agilent E4406A VSA Series Transmitter Tester, Option B7C provided baseband I/Q inputs. Code compatibility has been provided to allow many of the commands for option B7C to function properly with the X-Series. The X-Series has hardware differences and additional capabilities (e.g., E4406A does not have independent settings of I & Q nor does it provide for probe calibrations) which make 100% compatibility impossible.

1. The following commands are supported:

```
:CALibration:IQ:FLATness
:INPut:IMPedance:IQ U50 | B50 | U1M | B1M
:INPut:IMPedance:REFerence <integer>
```

2. The [:SENSe]:FEED RF|IQ|IONLy|QONLy|AREFerence|IFALign command supports all parameters except IFALign. The FEED? query will return only RF|AIQ|AREF.

3. The following commands are not supported:

```
:CALibration:GIQ
:CALibration:IQ:CMR
:INPut:IQ:ALIGn OFF | ON | 0 | 1
```

The Rohde & Schwarz FSQ-B71 also provides baseband I/Q inputs. A certain amount of code compatibility is provided in the X-Series, however hardware differences make this a somewhat limited set.

Supported:

The "<1|2>" is supported as "[1]".

```
INPut<1|2>:IQ:BALanced[:STATe] ON | OFF
INPut<1|2>:IQ:TYPE I | Q | IQ
INPut<1|2>:IQ:IMPedance LOW | HIGH
```

Not Supported:

```
INPut<1|2>:SELect AIQ | RF
TRACe<1|2>:IQ:DATA:FORMat COMPatible | IQBLock | IQPair>
TRACe<1|2>:IQ:DATA:MEMory? <offset samples>,<# of samples>
TRACe<1|2>:IQ:DATA?
TRACe<1|2>:IQ:SET <filter type>,<rbw>,<sample rate>,<trigger source>,<trigger
slope>, <pretrigger samples>, <# of samples>
TRACe<1|2>:IQ:SRATe 10.0kHz to 81.6MHz
TRACe<1|2>:IQ[:STATe] ON | OFF
```

The Rohde & Schwarz FMU has the following SCPI, which is not supported (these commands start/abort the probe calibration procedure, which is manually interactive from the front panel):

```
CALibration:ABORt
CALibration:PROBe[:STARt]
```

6.2.2 RF Input Port

Specifies the RF input port used. The RF Input Port control only appears on units with multiple RF inputs, and lets you switch between the inputs.

Instruments that include multiple RF Input ports include:

- N9041B
- N9000B (CXA)
- N9048B (PXE)
- VXT and EXM
- M8920A
- E7760
- M9391A and M9393A

NOTE: Switching input ports may change the receiver performance of the instrument.

Remote Command	`[:SENSe]:FEED[:RF]:PORT[:INPut] <port>` `[:SENSe]:FEED[:RF]:PORT[:INPut]?`

Example	`:FEED:RF:PORT RFIN`
	Uses the port labeled RF Input when the selected input is RF
	`:FEED:RF:PORT RFIN2`
	Uses the port labeled RF Input 2 when the selected input is RF

Notes	<port> is defined as follows: UXA/PXA/MXA/EXA/CXA/MXE/PXE/NFA (Parameters for UXA/PXA/MXA/EXA/CXA/MXE/PXE/NFA):

RFIN	RF Input
RFIN2	RF Input 2
ERFIN	External RF

EXM ("Parameters for VXT M9410A/11A/15A and EXM when used with Radio Heads/CIU" on page 2210):

RFIO1	RFIO 1
RFIO2	RFIO 2
RFIO3	RF3 I|O
RFIO4	RF4 I|O

VXT:

	RFIN	RF Input
	RFFD	RFIO FD
	RFHD	RFIO HD, Half Duplex

VXT/EXM with Remote Radio Head (e.g., M1740A) and/or CIU (e.g., E7770A) ("Parameters for VXT M9410A/11A/15A and M9420/21A Vector Transceivers" on page 2209):

RRHhRFHDp	Head h, RF Tx/Rx p, e.g. RRH1RFHD2 = Head 1, RF Tx/Rx 2
IFINn	DUT IF IN for Channel n, e.g. IFIN1 = DUT IF IN for Channel 1
IFHDn	DUT IF In/Out for Channel n, e.g. IFHD1 = DUT IF In/Out for Channel 1

E7760 ("Parameters for E7760 Wideband Transceiver" on page 2214):

A1|A2|A3|B1|B2|B3|IFIO1|IFIO2

M8920A ("Parameters for M8920A Radio Test Set" on page 2213):

ANT	Ant
TR	T/R

UXM ("Parameters for UXM Wireless Test Set" on page 2215):

RFIN|RFIO1|RFIO2

Dependencies	This control only appears when RF Input is selected as the Input Only appears in models that support multiple inputs. If the SCPI command is sent with unsupported parameters in any other model, an error is generated, -221, “Settings conflict; option not installed” When any input is selected in a measurement that does not support it, the "No result; Meas invalid with this input" error condition occurs, and the measurement returns invalid data when queried
Couplings	When switching between inputs, you may find the new input has a different frequency range than the current input. This means the frequency at the new input may be limited, depending on where you were tuned When you switch from an input whose maximum frequency is greater than the input to which you are switching: 1. If the current Stop Freq is below the Max Freq for the new input, then neither Stop Freq or Start Freq needs to change 2. But if the current Stop Freq is above the Max Freq for the new input, Stop Freq must change; so it is set to the Max Freq for the new input 3. If the Stop Freq is forced to change then, if possible, the Span is preserved with the new Stop Freq; however the Start Freq can’t go below zero Example: Input 2 has a Max Freq of 110 GHz and Input 1 has a Max Freq of 52 GHz Case 1: Input 2 is selected and Start Freq=40 GHz, Stop Freq=60 GHz. Change to Input 1. Stop Freq changes to 52 GHz so, to preserve Span, Start Freq is set to 32 GHz Case 2: Input 2 is selected and Start Freq=40 GHz, Stop Freq=110 GHz. Change to Input 1. Stop Freq changes to 52 GHz. Span was 70 GHz but new Span maximum is 52 GHz so Start Freq is set to 0 Hz Case 3: Input 2 is selected and Start Freq=10 GHz, Stop Freq=20 GHz. Change to Input 1. No change is necessary, Start Freq and Stop Freq don’t change
Preset	This is unaffected by Mode Preset but is set to RFIN on a "Restore Input/Output Defaults" or "Restore System Defaults -> All" unless noted in the platform-specific sections below

State Saved	Saved in instrument state
Annotation	Annotation in the Meas Bar reads as follows: When input is RF In: Input: RF When input is RF In 2: Input: RF2

Backwards Compatibility SCPI	`:INPut<1|2>:TYPE INPUT1 | INPUT2`
	`:INPut<1|2>:TYPE?`
	Included for R&S ESU compatibility. In the MXE, the INPUT1 parameter is aliased to RFIN and the INPUT2 parameter is aliased to RFIN2

More Information

In models with two inputs, the second input usually has a different maximum frequency than the first input. For your convenience, the actual "Max Freq" value is allowed to go slightly higher than the nominal Max Freq for the second input, just as is the case with the first input.

Model	Nominal Input 2 Max Freq	Absolute Input 2 Max Freq	Transition rule for switching from Input 1 to Input 2
N9038A	1 GHz	1.000025 GHz	If the Stop Freq is above 1.000025 GHz, it is set to 1.000025 GHz, otherwise it does not change If the Start Freq is above 1.000024990 Hz, Start Freq is set to 1.000024990 Hz and Span to 10 Hz, otherwise nothing changes
N9000A with option C75	1.5 GHz	1.58 GHz	If the Stop Freq is above 1.58 GHz, it is set to 1.58 GHz, otherwise it does not change If the Start Freq is above 1.579999990 GHz, Start Freq is set to 1.579999990 GHz and Span to 10 Hz, otherwise nothing changes

Parameters for the UXA/PXA/MXA/EXA/CXA/MXE/PXE/NFA

When using the UXA/PXA/MXA/EXA/CXA/MXE/PXE/NFA instruments, the following should be noted:

Remote Command	`[:SENSe]:FEED[:RF]:PORT[:INPut] RFIN | RFIN2 | ERFIN`

Example	`:FEED:RF:PORT RFIN`
	sets the RF input to be RF Input
	`:FEED:RF:PORT RFIN2`
	sets the RF input to be RF Input 2 if that port exists
	`:FEED:RF:PORT ERFIN`
	sets the RF input to be External RF if the V3050A unit is connected

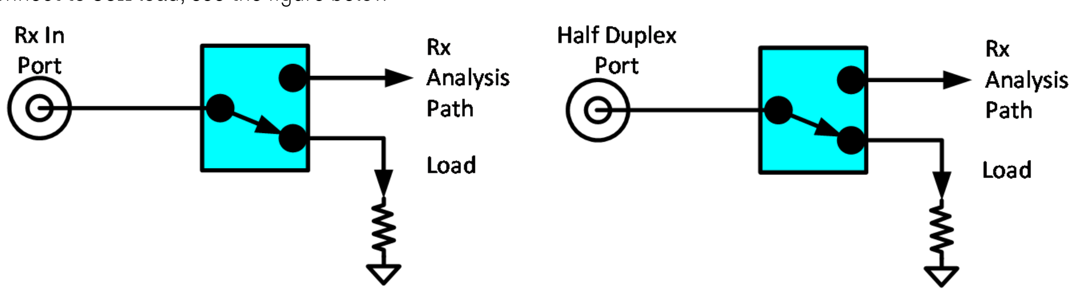
Dependencies	If the SCPI command is sent with RFIN2 or ERFIN and that port does not exist, an error is generated, -221, “Settings conflict; option not installed”
Couplings	Connecting a V3050A will change the Preset to ERFIN and will automatically switch the input to ERFIN. Disconnecting the V3050A will change the Preset back to RFIN and will automatically switch the input to RFIN
Preset	ERFIN when V3050A is connected, otherwise RFIN
Annotation	Annotation in the Meas Bar reads as follows: – When input is RFIN: Input: RF – When input is RFIN2: Input: RF2 When input is ERFIN: Input: Ext RF

Parameters for VXT M9410A/11A/15A and M9420/21A Vector Transceivers

When using the VXT models, the following should be noted:

Remote Command	`[:SENSe]:FEED[:RF]:PORT[:INPut] RFIN | RFFD | RFHD | NONE`

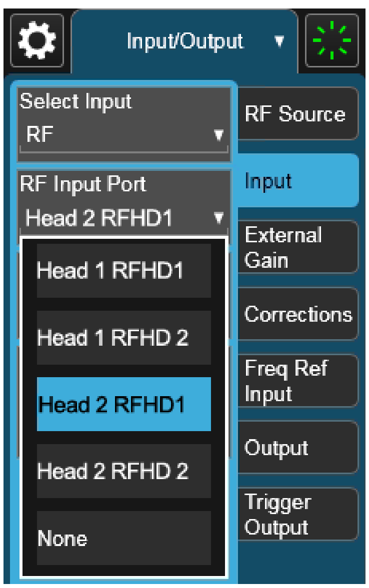
Example	`:FEED:RF:PORT RFIN`
	`:FEED:RF:PORT RFFD`
	`:FEED:RF:PORT RFHD`
	`:FEED:RF:PORT NONE`

Notes	The SCPI parameter RFIN sets the RF input to be the RF Input port, labelled RF Input The SCPI parameter RFFD sets the RF input to be the full duplex port, labelled RFIO FD. Note that Option “FDX” is required to enable this port The SCPI parameter RFHD sets the RF input to be the half duplex port, labelled Half Duplex (M9410A/11A) or RFIO HD (M94120A/21A) The SCPI parameter NONE sets the RF In port and Half Duplex port (if HD Port is not set to RF Output) to connect to 50Ω load, see the figure below  When use Source only, set RF Input to None to provide better isolation. When the input port is set to None, an error appears in the status area: 
Dependencies	Note that Option “HDX” is required to enable the Half Duplex (RFIO HD) port. Also note that you can’t set this port to be the input if it is already set to be the output. Otherwise, an error message will be generated

	: "-221, Settings conflict; RF Input cannot be set to RFIO HD when RF Output is RFIO HD" None is not available in VXT models M9420A/21A
Preset	`RFIN`
Annotation	Annotation in the Meas Bar reads as follows: When input is RF Input: Input: RF When input is RFIO FD: Input: RFFD When input is RFIO HD or Half Duplex: Input: RFHD When input is None: Input: NONE

Parameters for VXT M9410A/11A/15A and EXM when used with Radio Heads/CIU

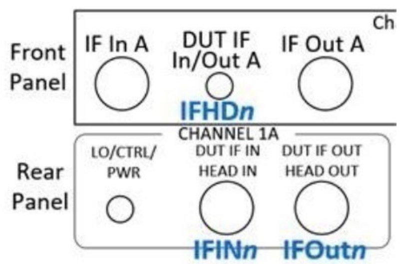
When using a Remote Radio Head (RRH), such as the Keysight M1740A mmWave Transceiver for 5G, with the VXT or EXM, the choices in the dropdown are dependent on which heads are installed. For example, in the case where two M1740A's are present, each with two ports, the dropdown will look like this:



Note the inclusion of the "None" choice, which allows the input port to become unassigned, and thus allows any Output port to be assigned without concern about an Input port conflict. When the input port is unassigned, an error appears in the status area:

The user interface parameter RFHD p corresponds to the port labelled RF Tx/Rx p; for example, RFHD 2 means the port labelled RF Tx/Rx 2 on the M1740A.

When using the E7770A Common Interface Unit, you may make connections to the half-duplex port on the front of the CIU labelled DUT IF In/Out, and/or to ports on the rear of the CIU labelled DUT IF IN and DUT IF OUT. For example, if your DUT has an IF Output you will usually connect it to one of the DUT IF IN ports on the rear panel of the CIU. The user interface parameter IFIN n corresponds to the DUT IF IN port for Channel n on the CIU, so you would choose IFIN 1 in the dropdown to connect to the DUT IF IN port for Channel 1, and the corresponding SCPI parameter would be IFIN1. See the figure below:

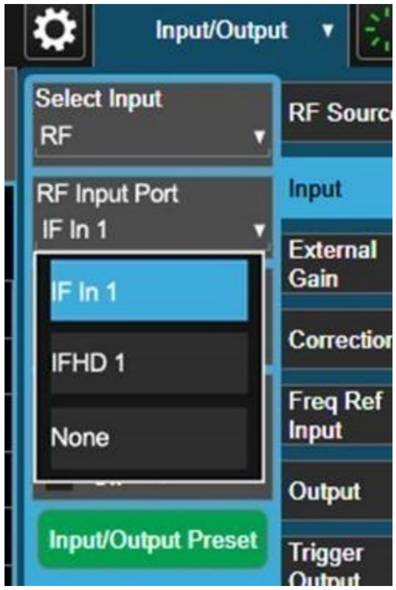


The following table lists the GUI parameter for each input or output on the CIU, and the SCPI parameter for the RF Input Port command (`[:SENSe]:FEED[:RF]:PORT[:INPut]`) and the RF Output Port command (`[:SENSe]:FEED:RF:PORT:OUTPut`):

Port	Port name on CIU	Name displayed in GUI	SCPI parameter for RF Input Port and Output Port commands
IF input port	DUT IF IN	IF In n	IFINn, e.g. IFIN1
IF output port	DUT IF OUT	IF Out n	IFOutn, e.g. IFO1
IF port, half duplex	DUT IF In/Out	IFHD n	IFHDn, e.g., IFHD1

NOTE The value of n for each port, in the multiple-port use case, may vary according to your system configuration. For the value of n for your particular use case, please consult the Startup Guide for your particular system (e.g. S9100A).

An example of the GUI for the CIU ports appears below:



Remote Command	`[:SENSe]:FEED[:RF]:PORT[:INPut] RRHhRFHDp | NONE` `[:SENSe]:FEED[:RF]:PORT[:INPut] IFIN1 | IFIN2 | IFIN3 | IFIN4`

Example	`:FEED:RF:PORT RRH1RFHD2`
	sets the RF input to be the port labelled RF Tx/Rx 2 on Head 1.
	`:FEED:RF:PORT IFIN1`
	sets the RF input to be the Channel 1 port labelled DUT IF IN on the CIU

Notes	The SCPI parameter RRHhRFHDp corresponds to **Head h**, port **RF Tx/Rx p**; for example, RRH1RFHD2 = the port labelled **RF Tx/Rx 2** on **Head 1**. For the CIU, the parameter IFINc corresponds to the **DUT IF IN** for channel c. For example, IFIN1 would connect to the **DUT IF IN** port for Channel 1
Dependencies	The Radio Head and CIU parameters only appear when a Remote Radio Head or CIU is connected to the instrument. If these parameters are sent at any other time, an error is generated, "-221, Settings conflict; option not installed"
Preset	`RRH1RFHD1`
Annotation	Annotation in the Meas Bar reads as follows: Input:Hd h RFHD p For example, in the case above, with RFHD 2 on Head 1 selected: Input:Hd 1 RFHD 1 When using the CIU: – When input is IFIN1: Input: IFIN 1 – When input is IFIN2: Input: IFIN 2 – When input is IFIN3: Input: IFIN 3 When input is IFIN4: Input: IFIN 4

Backwards Compatibility SCPI	`:FEED:RF:PORT A1`
	A1 is treated as RRH1RFHD1 and sets the RF input to be the port labelled RF Tx/Rx 1 on Head 1
	`:FEED:RF:PORT B1`
	B1 is treated as RRH1RFHD2 and sets the RF input to be the port labelled RF Tx/Rx 2 on Head 1
	`:FEED:RF:PORT IFIO2`
	IFIO2 is treated as IFIN1, and sets the IF input to be the port labelled "DUT IF In/Out" on the CIU rear panel

Parameters for EXT, EXF and EXM Wireless Test Sets

(see also "Parameters for VXT M9410A/11A/15A and EXM when used with Radio Heads/CIU" on page 2210)

When using the EXT, EXF and EXM instruments, the following should be noted:

Remote Command	`[:SENSe]:FEED[:RF]:PORT[:INPut] RFIO1 | RFIO2 | RFIO3 | RFIO4 | NONE`

Example	`:FEED:RF:PORT RFIO1`
	sets the RF input to be RFIO 1
	`:FEED:RF:PORT RFIO2`
	sets the RF input to be RFIO 2
	`:FEED:RF:PORT RFIO3`
	sets the RF input to be RF3 I|O
	`:FEED:RF:PORT RFIO4`
	sets the RF input to be RF4 I|O

Dependencies	On EXF, or on EXM with hardware M9430A, if RF Input is selected as RF Input Port, you need to choose the settings in the Half Duplex Config menu to determine which port (RFIO3 or RFIO4) will be used On EXM with hardware M9431A, this setting is not supported. If the SCPI command is sent with this setting, an error is generated, -221, "Settings conflict; option not installed"
Preset	`RFIO1`
Annotation	Annotation in the Meas Bar reads as follows: – When input is RFIO1: Input: RFIO1 – When input is RFIO2: Input: RFIO2 – When input is RFIO3: Input: RFIO3 When input is RFIO4: Input: RFIO4

Parameters for M8920A Radio Test Set

When using the M8920A, the following should be noted:

Remote Command	`[:SENSe]:FEED[:RF]:PORT[:INPut] ANT | TR`

Example	`:FEED:RF:PORT ANT`
	sets the RF input to be the Antenna port on M9470A, labeled Ant
	`:FEED:RF:PORT TR`
	sets the RF input to be the T/R port on M9470A and M8920A, labeled T/R. Note that Option “HDX” is required to enable the T/R port

Dependencies	ANT and TR are only available in modular analyzers and only when the M9470A module is installed, such as in the M8920A. Option HDX is required to enable the T/R port
Preset	`ANT`
Annotation	Annotation in the Meas Bar reads as follows: – When input is Ant: Input: Ant When input is T/R: Input: T/R

Parameters for E7760 Wideband Transceiver

When using the E7760, the following should be noted:

Remote Command	`[:SENSe]:FEED[:RF]:PORT[:INPut] A1 | A2 | A3 | B1 | B2 | B3 | IFIO1 | IFIO2 | NONE`

Example	`:FEED:RF:PORT A1`
	sets the RF input to be A1
	`:FEED:RF:PORT B3`
	sets the RF input to be B3
	`:FEED:RF:PORT IFIO1`
	sets the RF input to be IFIO1

Dependencies	Ports A1,A2,A3,B1,B2,B3 are available if option RF3 is installed. Ports IFIO1 and IFIO2 are available if option RF2 is installed. Note that for the E7760: – attempting to select a port for which the option is not present will generate the error, -241, “Hardware missing; Input not available” – A port cannot be selected as an Input while it is occupied as an Output. If the SCPI command is sent while port is occupied an error is generated, -221.1950, “Settings conflict; Input Port is not available while occupied by Output” – The mmWave ports are divided into two banks; the A Bank and the B Bank. A port cannot be selected as an Input if any port on that same bank is occupied as an Output; if the SCPI command is sent for this situation an error is generated, -221, “Settings conflict; Input Port is not available while port bank is occupied by Output” If RF3 is present and RF4 is absent a mmWave port cannot be selected as an Input if the Output Port is occupied by wwWave Transceiver with a different frequency range; if the SCPI command is sent for this situation an error is generated, -221, “Settings conflict; Input Port is not available while occupied by Output of incompatible frequency”
Preset	For E7760 with Option RF2 the Preset value is `IFIO1`

	For E7760 without Option RF2 the Preset value is the first port with mmWave Transceiver attached. If no mmWave Transceiver attached: NONE
Annotation	Annotation in the Meas Bar reads as follows: – When input is A1: Input: A1 – When input is A2: Input: A2 – When input is A3: Input: A3 – When input is B1: Input: B2 – When input is B2: Input: B2 – When input is B3: Input: B3 – When input is IFIO1: Input: IFIO1 – When input is IFIO2: Input: IFIO2

Parameters for UXM Wireless Test Set

For UXM, the following should be noted:

Remote Command	`[:SENSe]:FEED[:RF]:PORT[:INPut] RFIN | RFIO1 | RFIO2`
Preset	`RFIN`

Parameters for each HD Port in M1750A mmWave Transceiver

When using each TRX instance for M1750A, the following should be noted:

Remote Command	`[:SENSe]:FEED[:RF]:PORT[:INPut] RFIO1 | RFIO2 | RFIO3 | RFIO4 | NONE`
Example	`:FEED:RF:PORT RFIO1`
Notes	Each SCPI parameter represents 1 of the 4 Input/Output ports connected by a switch to the Half Duplex ports of the M1750A
Dependencies	If the RF Output Parameter is not none, then all of options must be disabled as the Half Duplex ports can only act as either a source or receiver at a given time
Preset	`NONE`
Annotation	Annotation in the Meas Bar reads as follows: When input is NONE: NONE When input is RFIOn: Input: RFIOn

6.2.3 SA Frequency Extender Cable Correction

An SA Frequency Extender, such as the V3050A, is attached to the instrument with several cables. Keysight provides several cables for purchase with the frequency extender. Typically, these are 1-, 2-, or 3-meter cables for the RF and IF connections.

Keysight has characterized these cables and can correct for their loss. This control allows you to specify which cable is being used.

If you are using another type of cable, the instrument cannot automatically correct for it, and this function must be set to `OFF`. In this case, you can use RCal to characterize the corrections.

Remote Command	`:INPut:FEXTender:CABLe:CORRection OFF | V3050A1M | V3050A2M | V3050A3M`
Example	`:INP:FEXT:CABL:CORR V3050A1M`
Notes	The RF Input Port selections that support an SA Frequency Extender (like V3050A) are: N9042B: External RF No other instruments support an SA Frequency Extender
Dependencies	An SA Frequency Extender must be attached and the frequency extender's port must be the selected input for this control to be visible – If the instrument does not support frequency extenders, the SCPI command returns error -241, "Hardware missing; option not available" – If the instrument does support frequency extenders, but a frequency extender is not attached, the SCPI command returns error -241, "Hardware missing; Cable selection only available when supporting frequency extender attached" When a frequency extender is attached, the control is not visible unless the frequency extender's port is the selected RF input, but the command will still be available. Setting the cable selection when the frequency extender's port is not active has no effect until the port is selected
Preset	This is unaffected by **Mode Preset** but is set to preset value by **Restore Input/Output Defaults** or **Restore System Defaults -> All**
State Saved	Saved in instrument state

6.2.4 Half Duplex Input Port

Specify whether RFIO3 or RFIO4 is the Half Duplex Input port.

Remote Command	`[:SENSe]:HDUPlex:PORT:INPut RFIO3 | RFIO4`
Example	`:HDUPlex:PORT:INPut RFIO3` `:HDUPlex:PORT:INPut?`
Dependencies	This control only appears in EXM If RFIO3 is selected as "Half Duplex Output Port", then "Half Duplex Input Port" will be set to RFIO4 automatically. And if RFIO4 is selected as "Half Duplex Output Port", then "Half Duplex Input Port" will be set to RFIO3 automatically
Preset	`RFIO3`
State Saved	Saved in State

6.2.5 Port Information (Remote Command Only)

Provides information about an instrument port. The return information is two fields separated by a comma.

Field 1: the connection status (0 or 1)

Field 2: a string of port information

The return information is device-dependent.

Remote Command	`[:SENSe]:FEED[:RF]:PORT:INFormation? RFIN | RFIN2 | RFFD | RFHD | A1 | A2 | A3 | B1 | B2 | B3 | IFIO1 | IFIO2 | ANT | TR`
Example	`:FEED:PORT:INF? A1` example = 1,"US56160060" where 1 is the connection status and "US56160060" is the port information
Notes	For the E7760: The connection status (first field in the return value) indicates: 0 – the port is either not licensed for use or is not connected to a mmWave Transceiver 1 – the port is licensed; and for the case of mmWave ports, the port is connected to a mmWave Transceiver The port information (second field in the return value) contains: "" (empty string) – no applicable information Serial Number – the serial number of the connected mmWave Transceiver If you send an incompatible parameter, the return values will be 0,""
Dependencies	This query is only valid for the E7760

6.2.6 RF Preselector

In models that support the RF Preselector, such as PXE (N9048B), this key allows you to turn the preselector on and off.

NOTE

When using the RF Preselector, if your measurement starts below 3.6 GHz and finishes above 3.6 GHz, the preselector bypass switch will have to switch in and out for every measurement. When this is the case, you will hear a clicking sound from the instrument and a warning message will be displayed: "Settings Alert: Mechanical switch cycling". You are advised to avoid such setups as much as possible, to minimize switch wear. Pressing Mode Preset will reset the Stop Freq to 3.6 GHz and get you out of this state, or you can manually set the Stop Freq to be below 3.6 GHz.

Remote Command	`[:SENSe]:POWer[:RF]:RFPSelector[:STATe] 1 | 0 | ON | OFF` `[:SENSe]:POWer[:RF]:RFPSelector[:STATe]?`
Example	`:POW:RFPS 1`

	`:INP:PRES:STAT ON`
Notes	[:SENSe]:POWer[:RF]:RFPSelector[:STATe] 1|ON. Sets to full compliance measurement [:SENSe]:POWer[:RF]:RFPSelector[:STATe] 0|OFF. Sets to pre-compliance measurement
Dependencies	Only appears when RF Input is selected as the Input Only appears in MXE and PXE The RF Preselector is not available in all measurements. The key is grayed out in measurements that do not support it, unless you are in a Mode in which no measurements support it, in which case the key does not appear at all. If the preselector is unavailable, it is forced to Off. Attempting to turn it on or off in measurements that do not support it generates the error message: -221, Settings conflict; Feature not supported for this measurement The RF Preselector is not available when FFT Sweep Type is manually selected. Attempting to turn it on or off when this is the case generates an error message: "-221, Settings conflict; RF Presel unavailable when Sweep Type=Manual FFT" This key only appears in Modes that support the RF Preselector, in other Modes, setting or querying the SCPI generates an error In Frequency Scan measurement, this key is grayed out when final measurement is running. Warning message "Function not available while measurement is running" appears if the grayed-out key is pressed
Preset	`ON`
Annotation	When RF Preselector=On, "RF PRESEL" is displayed on the Settings Panel

Backwards Compatibility SCPI	`:INPut<1|2>:PRESelection[:STATe] ON | OFF`
	`:INPut<1|2>:PRESelection[:STATe]?`
	Included for R&S ESU compatibility

6.2.7 Notch Filter

In some models that support the RF Preselector, such as PXE, there is also a notch filter to suppress signals in the frequency band from 2.4 GHz to 2.5 GHz. This control allows you to turn the notch filter on and off.

Remote Command	`[:SENSe]:POWer[:RF]:RFPSelector:NFILter[:STATe] OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:RFPSelector:NFILter[:STATe]?`
Example	`:POW:RFPS:NFIL 1` `:POW:RFPS:NFIL?`
Dependencies	Only appears when RF Input is selected as the Input This control only appears in models which support the notch filter, such as PXE. Attempting to turn it on or off via SCPI in models that do not support it generates an error message: -241 Hardware missing; Not available for this model number This control only appears in measurements which support the Notch Filter, such as EMI Receiver measurements. Attempting to turn it on or off via SCPI in measurements that do not support it generates an error message: -221, Settings conflict; Feature not supported for this measurement

	In Frequency Scan measurement, this key is grayed out when final measurement is running, aligned with the `RF Preselector` key. The warning message "Function not available while measurement is running" appears if the grayed out key is pressed
Preset	`OFF`
State Saved	Saved in instrument state
Range	`OFF|ON`
Annotation	Due to limited space in the Measurement Bar, Notch Filter annotation is shown as part of the RF Presel state – `RF Presel: On, NF`, when both RF Presel and Notch Filter are turned on – `RF Presel: On`, when RF Presel = on and Notch Filter= off `RF Presel: Off`, when RF Presel = off
Backwards Compatibility SCPI	`:INPut<1|2>:PRESelection:FILTer:NOTCh[:STATe] ON | OFF` `:INPut<1|2>:PRESelection:FILTer:NOTCh[:STATe]?`

6.2.8 RF Calibrator

Lets you choose a calibrator signal to look at or turns the calibrator off.

Remote Command	`[:SENSe]:FEED:AREFerence REF50 | REF4800 | OFF` `[:SENSe]:FEED:AREFerence?`

Example	`:FEED:AREF REF50`
	selects the 50 MHz amplitude reference as the signal input
	`:FEED:AREF REF4800`
	selects the 4.8 GHz amplitude reference as the signal input
	`:FEED:AREF OFF`
	turns the calibrator "off" (switches back to the selected input - RF or I/Q)

Dependencies	Only appears when RF Input is selected as the Input Selecting an input (RFExt Mix or I/Q) turns the Calibrator OFF. This is true whether the input is selected using the menu panel or with the [:SENSe]:FEED command The 4.8 GHz internal reference is only available in some models and frequency range options. If the 4.8 GHz reference is not present, the **4.8 GHz** choice will not show, and if the REF4800 parameter is sent, the instrument will generate an error
Couplings	When one of the calibrator signals is selected, the instrument routes that signal (an internal amplitude reference) to the instrument, and changes the main input selection to RF so the calibrator signal can be seen. When you turn the calibrator off it does not switch back to the previously selected input
Preset	`OFF`
State Saved	Saved in instrument state
Annunciation	An advisory message is sent, indicating that the input is set to internal

Notes	For ESA backwards compatibility In the ESA the calibrator was a separate output which you connected to the input and switched on with this command In the X-Series, the ON parameter is aliased to the `[:SENSe]:FEED:AREF REF50` command and the OFF parameter is aliased to `[:SENSe]:FEED:AREF OFF` When `:CALibration:SOURce:STATe?` is received, 1 will be returned if any of the references is selected and 0 if the Calibrator is "Off"
Preset	`OFF`
Backwards Compatibility SCPI	`:CALibration:SOURce:STATe OFF | ON | 0 | 1` `:CALibration:SOURce:STATe?`

6.2.9 RF Coupling

Specifies alternating current (AC) or direct current (DC) coupling at the instrument RF input port. Selecting AC coupling switches in a blocking capacitor that blocks any DC voltage present at the instrument input. This decreases the input frequency range of the instrument, but prevents damage to the input circuitry of the instrument if there is a DC voltage present at the RF input.

NOTE

When operating in DC coupled mode, ensure protection of the instrument input circuitry by limiting the DC part of the input level to within 200 mV of 0 Vdc. In AC or DC coupling, limit the input RF power to +30 dBm (1 Watt).

Remote Command	`:INPut:COUPling AC | DC` `:INPut:COUPling?`
Example	`:INP:COUP DC`
Dependencies	Only appears when RF Input is selected as the Input This control does not appear in models that are always AC coupled. When the SCPI command to set DC coupling is sent to these models, it results in the error “Illegal parameter value; This model is always AC coupled” In these models, the SCPI query INP:COUP? always returns AC This control does not appear in models that are always DC coupled.When the SCPI command to set AC coupling is sent to these models, it results in the error “Illegal parameter value; This instrument is always DC coupled” In these models, the SCPI query INP:COUP? always returns DC
Preset	`AC` on models that support AC coupling On models that are always DC coupled, such as millimeter wave models (frequency ranges 30 GHz and above), the preset is `DC`
State Saved	Saved in instrument state
Annunciation	When the RF Input is selected, and AC coupling is selected, annunciators appear in the Meas Bar to that effect: 

appears in the settings panel (the row of annunciators across the top of the display) to that effect, as shown below:

When the RF Input is selected, and DC coupling is in effect, the annunciator changes as shown below:

Note the amber color, which indicates that you should exercise caution when applying a signal to any DC coupled input (see note above this table for the specific cautions)

On models that support both AC and DC coupling: when DC coupling is selected, a warning condition message appears in the status line "DC coupled" as shown below:

On models that support both AC and DC coupling: when AC coupling is selected, and any part of the displayed frequency range is below 10 MHz, a warning condition message appears in the status line: "AC: Accy unspec'd below 10 MHz"

In AC coupling mode, you can view signals below the corner frequency of the DC block, but below a certain frequency the amplitude accuracy is not specified.

The lowest frequency for which specifications apply is:

X-Series Model	Lowest Freq for meeting specs when AC coupled	Lowest Freq for meeting specs when DC coupled
CXA-503/507	100 kHz	n/a
CXA-C75 Input 2	1 MHz	n/a
CXA-513/526	10 MHz	9 kHz
CXA-m	10 MHz	9 kHz
EXA	10 MHz	9 kHz
MXA	10 MHz	20 Hz
PXA	10 MHz	3 Hz
UXA	10 MHz	3 Hz

Some amplitude specifications apply only when coupling is set to DC. Refer to the appropriate amplitude specifications and characteristics for your instrument.

6.2.10 Input Z Correction

Sets the input impedance for unit conversions. This affects the results when the y-axis unit is voltage or current units (dBmV, dBµV, dBµA, V, A), but not when it is power units (dBm, W). The impedance you select is for computational purposes only, since the actual impedance is set by internal hardware to 50 ohms. Setting the computational input impedance to 75 ohms is useful when using a 75 ohm to 50 ohm adapter to measure a 75 ohm device on an instrument with a 50 ohm input impedance.

There are a variety ways to make 50 to 75 ohm transitions, such as impedance transformers or minimum loss pads. The choice of the solution that is best for your measurement situation requires balancing the amount of loss that you can tolerate with the amount of measurement frequency range that you need. If you are using one of these pads/adaptors with the **Input Z Corr** function, you might also want to use the **Ext Gain** key. This function is used to set a correction value to compensate for the gain (loss) through your pad. This correction factor is applied to the displayed measurement values.

Remote Command	`[:SENSe]:CORRection:IMPedance[:INPut][:MAGNitude] 50 | 75` `[:SENSe]:CORRection:IMPedance[:INPut][:MAGNitude]?`

Example	`:CORR:IMP 75`
	sets the input impedance correction to 75 ohms
	`:CORR:IMP?`

Couplings	In CXA option C75, when RF Input 2 is selected, the Input Z Correction will automatically change to 75 ohms. You may then change it to whatever is desired. When the main RF Input is selected, the Input Z Correction will automatically change to 50 ohms. You may then change it to whatever is desired
Preset	This is unaffected by a Preset but is set to 50 ohms on a "Restore Input/Output Defaults" or "Restore System Defaults->All" Some instruments/options may have 75 ohms available
State Saved	Saved in instrument state

6.2.11 All Screens Use Same Input

If “All Screens Use Same Input” is On then all Screens share the same Input settings. This is the default state.

If “All Screens Use Same Input” is Off, then certain settings are allowed to be local to each Screen, meaning one Screen can have them set one way and another can have them set another way.

The Input settings which become local to each Screen when “All Screens Use Same Input” is Off are:

Input Tab:

- Selected Input (RF, Ext Mix, BBIQ)
- RF Input Port (only appears on boxes with multiple RF ports like N9041B, MXE, and CXA)
- RF Coupling (AC/DC)
- Input Z Correction

External Gain Tab:

- External Preamp
- MS
- BTS

Corrections Tab:

- For each Correction, whether it is on or off

Note that if “All Screens Use Same Input” is Off and you press the “+” control to create a new Screen, the new Screen contains a copy of the old Screen’s state, including all its Input/Output variables.

Remote Command	`:INSTrument:COUPle:SCReen:INPut ON | OFF | 1 | 0` `:INSTrument:COUPle:SCReen:INPut?`
Example	`:INST:COUP:SCR:INP OFF`
Preset	ON (not affected by Input/Output Preset but set to ON by Restore Input/Output Defaults)

6.2.12 External Mixer Setup

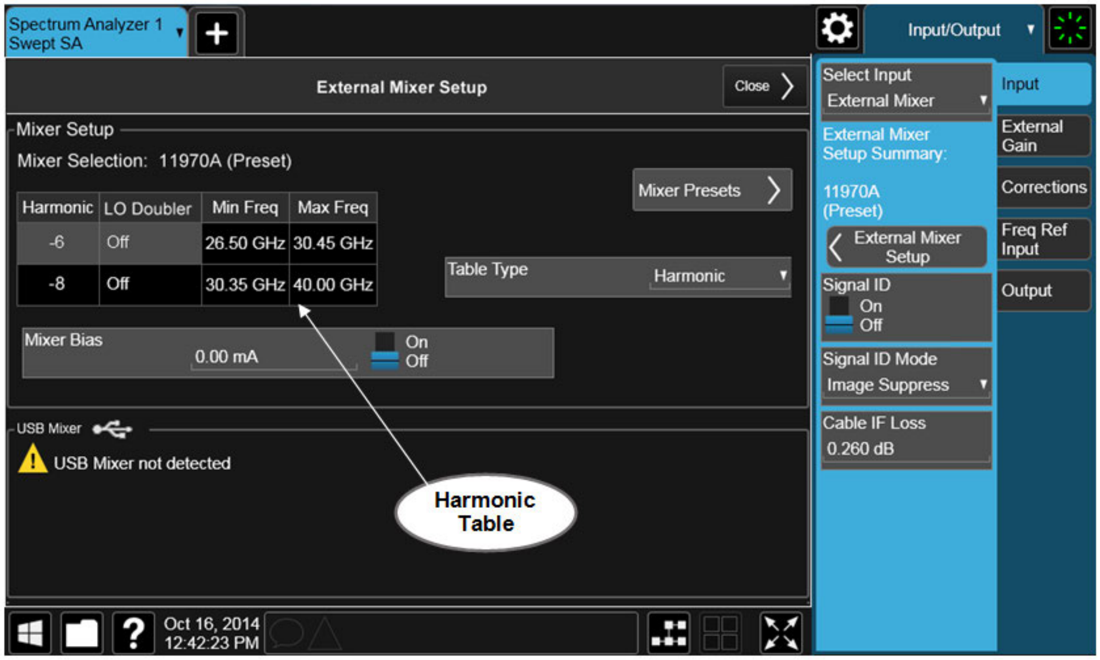
This dialog lets you select the mixer type, and lets you configure your mixer (if necessary). The first page of the dialog shows you the current settings for the selected mixer. These settings may be dependent on which IF path is currently in use, whether a + or – harmonic is currently selected, etc.

To apply any amplitude correction factors needed to correct mixer flatness, you enter values into one of the Correction tables (under Input/Output, Corrections). The correction conversion loss values can be extracted from data supplied with the mixer or from manual measurements you make to determine the conversion loss. Note that the correction applied by the Correction tables is global to the instrument; therefore you should make sure to turn off the External Mixer corrections when you are not using the External Mixer input.

NOTE **The Keysight USB Mixers automatically give their flatness data to the instrument, and the correction is applied internally. No correction needs to be entered, and the correction does not appear in the user-accessible Corrections tables. You are free to enter additional corrections into the Correction tables under Input/Output, Corrections.**

Notes	The setup summary on the menu panel appears just above this control, showing the current external mixer setup
Dependencies	Only appears when External Mixer is selected as the Input
State Saved	All settings in the External Mixer Setup dialog are part of the Input/Output system, and hence are saved whenever State is saved

The External Mixer Setup screen looks like this:



The current Mixer selection (the current or most recently connected USB Mixer, or the most recent Mixer Preset, or "Custom" if you have modified the setup) reads out at the top of this screen as "Mixer Selection:"

The Harmonic Table currently being used reads out below the Mixer Selection. It shows each range being used for the current mixer. Note that a band may be made up of up to 3 ranges. Each range represents a choice of mixer harmonic and doubler state. When you select a Mixer Preset, it sets the instrument Start and Stop frequency to the values shown in the Harmonic Table; Start Freq is set to the Min Freq for the bottom range, and Stop Freq is set to the Max Freq for the top range. In many cases you can exceed these nominal values; the absolute maximum and minimum frequency for each preset are shown in the tables that accompany the control descriptions for the Mixer Presets.

NOTE

If the current measurement has a limited Span available to it, and cannot achieve the Span shown in the table (Span=Stop Freq - Start Freq), the instrument uses the maximum Span the measurement allows, and sets the Center Freq to the midpoint of the Start and Stop Freq values in the Harmonic Table.

You may edit some of the Harmonic and LO Doubler fields in the Harmonic Table, as shown by the gray backgrounds of these fields. When you edit the Harmonic Table, the Mixer Selection changes to "Custom." To change it back you must go back into the Mixer Presets menu and select a Preset. See for more detail on editing the table.

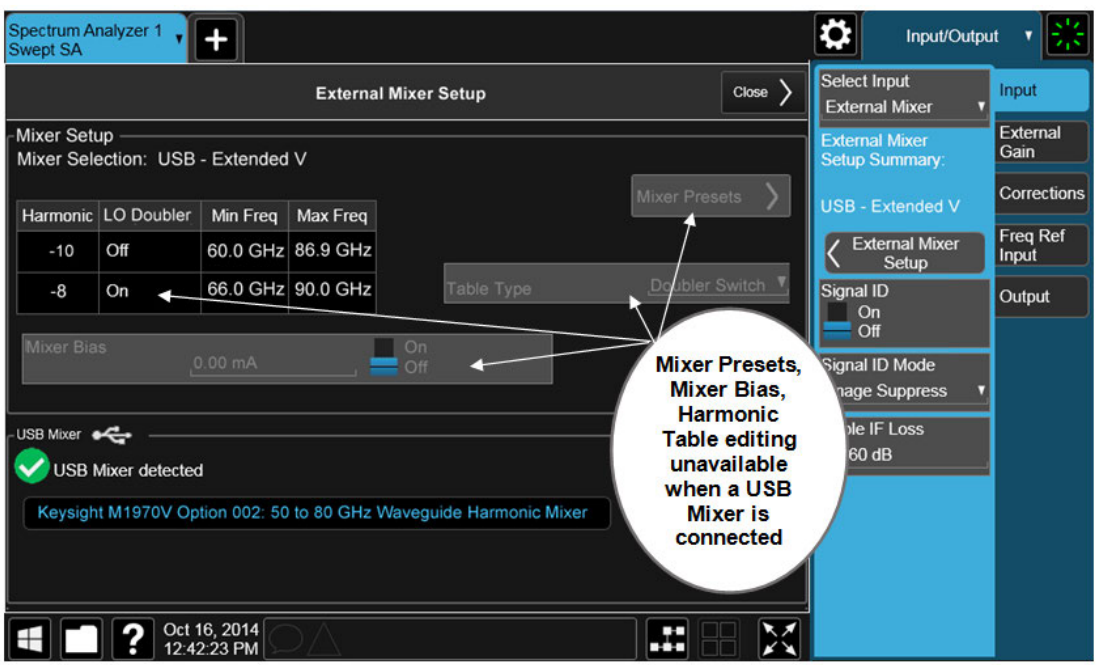
When you edit the Harmonic Table, the nominal Min Freq and Max Freq that are available will usually be different than the Preset you were using; and the absolute frequency limits will change as well. This may result in a change to your Start and/or Stop Freq, if the current values fall outside the new range, requiring you to retune your Center Freq to get your signal back in the center.

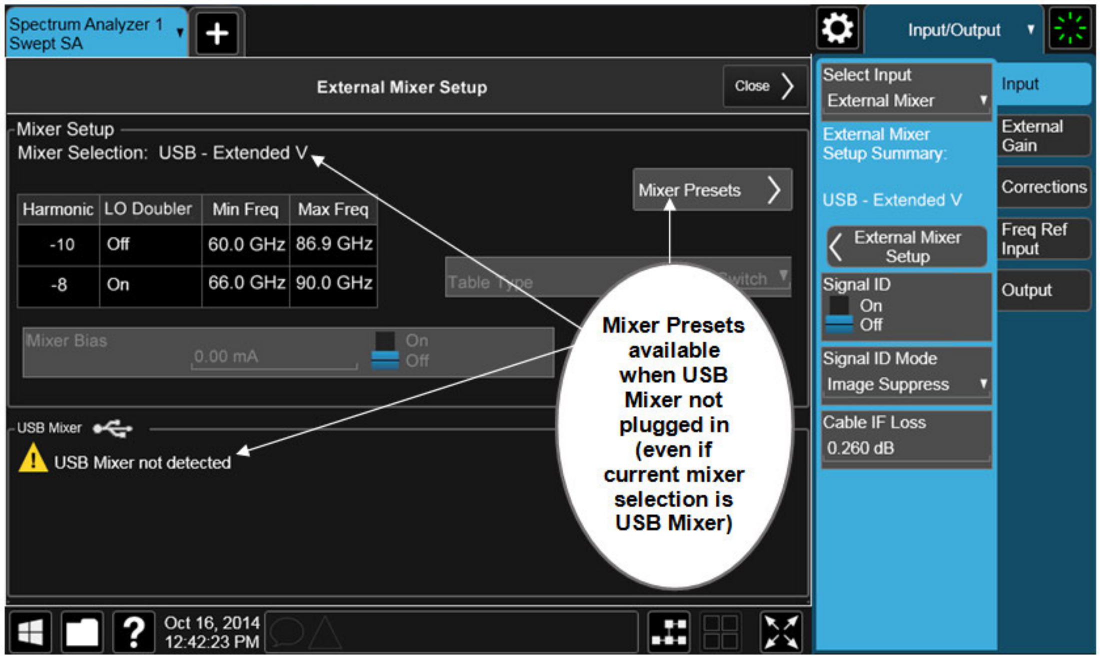
The instrument supports the Keysight M1970 Series Harmonic Mixers with USB connection. While in External Mixing, if one of these mixers is plugged in to a USB port, it is automatically detected and displayed in the "USB Mixer" area of the setup screen, including its model number and serial number.

The instrument assumes that if you plug a mixer into the USB you want to use that mixer, so:

1. If a USB mixer is connected to the USB port, the Mixer Presets button is grayed out, as none of the presets make sense with a USB Mixer connected. Note that once the instrument has acquired the USB Mixer, the mixer selection will remain if it is subsequently unplugged from the USB, allowing you to plug it back in with no change to your settings. However, once you unplug it, the Mixer Presets control will stop being grayed out, allowing you to preset to a different mixer.
2. When Restore Input/Output Defaults is performed, if a Keysight USB Mixer is plugged into the instrument's USB port, the Mixer Selection remains unchanged.
3. When recalling an instrument state, if a Keysight USB Mixer is plugged into the instrument's USB port, and the Mixer Selection in the recalled state is for a USB Mixer that does not match the mixer currently plugged in, you will have to unplug your mixer and then plug it back in to get the instrument to recognize your mixer.

As long as the selection in Ext Mixer Setup shows one of the USB mixers, the **Mixer Bias** control is grayed out and the Harmonic Table is no longer editable, as shown by the fact that the fields in the Harmonic Table are now black and the **Table Type** control is grayed out.





Only one USB Mixer is supported at a time. To switch to a different USB Mixer, disconnect the one that is no longer being used prior to connecting a new one.

The Mixer Selection displayed and menu panel readback for the Keysight M1970 series mixers is:

Mixer Model	Mixer Selection display on Setup Screen	Readback
Keysight M1970E: Option 001: 60 to 90 GHz Waveguide Harmonic Mixer	USB - M1970E-001 E-Band	USB Mixer E-Band
Keysight M1971E: Option 001: 60 to 90 GHz Waveguide Harmonic Mixer	USB - M1971E-001 E-Band	USB Mixer E-Band
Keysight M1971E: Option 003: 55 to 90 GHz Waveguide Harmonic Mixer	USB - M1971E-003 Extended E-Band	USB Mixer Extended E
Keysight M1971V: Option 001: 50 to 75 GHz Waveguide Harmonic Mixer	USB - M1971E-001 V-Band	USB Mixer V-Band
Keysight M1971W: Option 001:75 to 110 GHz Waveguide Harmonic Mixer	USB - M1971E-001 W-Band	USB Mixer W-Band
Keysight M1970V Option 001: 50 to 75 GHz Waveguide Harmonic Mixer	USB - M1970V-001 V-Band	USB Mixer V-Band
Keysight M1970V Option 002: 50 to 80	USB - M1970V-002 Extended V-Band	USB Mixer

Mixer Model	Mixer Selection display on Setup Screen	Readback
GHz Waveguide Harmonic Mixer		Extended V
Keysight M1970W Option 001: 75 to 110 GHz Waveguide Harmonic Mixer	USB - M1970W-001 W-Band	USB Mixer W-Band

The Keysight USB mixer essentially acts as a “remote front end” and is fully calibrated over the specified frequency range, without requiring any user interaction. This is particularly useful at high mm-wave frequencies, where cable loss is typically quite large, and it is desirable to bring the front end right up to the device under test, rather than bringing the mm-wave signal to the instrument using a lossy and uncalibrated cable or waveguide connection.

Connecting the mixer to the USB port on the instrument switches you to External Mixing, aborts the current measurement, and initiates an alignment of the mixer. A popup message, “USB Mixer connected” appears on the display. When a USB mixer and the LO/IF cable are connected the alignment is performed. When the alignment begins, an “Aligning” popup replaces the previous message on the display. When the alignment completes, the current measurement restarts.

6.2.12.1 Mixer Presets

This dialog lets you preset the mixer setup for the particular type of mixer that you are using.

These presets are divided into four groups:

- One for legacy HP/Agilent/Keysight mixers (11970)
- Three for general purpose mixers

presets that use a single harmonic and no doubling

presets that use a single harmonic but double the LO

presets that use multiple harmonics

Note that the IF/LO port provides a 3.8-14 GHz LO in two bands: 3.8-8.7 (LO fundamental), and 8.6-14 GHz (doubled LO).

In most cases, once you have executed the preset, you will not need to adjust any further settings.

Remote Command	`[:SENSe]:MIXer:BAND A | Q | U | V | W | NA | ND | NE | NF | NG | NJ | NK | NQ | NU | NV | NW | NY | NEXT | DD | DF | DG | DJ | DK | DQ | DV | DW | DY | DEXT | MA | ME | MU | MCOAX | USB` `[:SENSe]:MIXer:BAND?`
Example	`:MIX:BAND A`

	`:MIX:BAND?`
Notes	A|Q|U|V|W select HP/Agilent/Keysight 11970 mixer presets NA|ND|NE|NF|NG|NJ|NK|NQ|NU|NV|NW|NY|NEXT select single harmonic, non-doubled LO presets DD|DF|DG|DJ|DK|DQ|DV|DW|DY|DEXT select single harmonic, doubled LO presets MA|ME|MU|MCOAX select multiple harmonic presets All of these presets are detailed in their respective control descriptions The query form of this command returns the most recent preset, UNLESS the harmonic table has been edited after the preset was executed. If the harmonic table has been edited it returns CUSTOM The command USB will refresh the USB mixer connection and automatically detect the mixer band. The query form of this command returns the following if an Keysight USB Mixer is plugged into the instrument's USB port:

USBE	Keysight E-Band USB Mixer
USBV	Keysight V-Band USB Mixer
USBVEXT	Keysight Extended V-Band USB Mixer
USBW	Keysight W-Band USB Mixer

Note that the parameters CUSTOM, USBV, USBVEXT, and USBW are query responses only, and cannot be sent *to* the instrument

The following cross-reference matches the mixer band designators used by Keysight to the EIA waveguide designations:

EIA	Keysight	Freq Range
WR-28	A	26.5 - 40 GHz
WR-22	Q	33 - 50 GHz
WR-19	U	40 - 60 GHz
WR-15	V	50 - 75 GHz
WR-12	E	60 - 90 GHz
WR-10	W	75 - 110 GHz
WR-8	F	90 - 140 GHz
WR-6	D	110 - 170 GHz
WR-5	G	140 - 220 GHz
WR-3	J	220 - 325 GHz

Preset	When Restore Input/Output Defaults is performed, an "A" mixer preset is also issued (11970A band), unless a Keysight USB Mixer is plugged into the instrument's USB port, in which case the Mixer Selection remains unchanged When using Keysight USB Mixers, if a Restore All Defaults (SCPI command SYSTem:DEFault) has been perform, either remove and reinsert the USB cable or press the Refresh USB Mixer Connection control

11970

This column allows you to preset for one of the models in the HP/Agilent/Keysight 11970 series.

Because the X-Series has an LO range of 3.8 - 14 GHz, and older analyzers had an LO range of 3.0 - 6.8 GHz, the harmonic numbers used in the X-Series may differ from those used on older analyzers for the same mixers. Additionally, some of the 11970 mixers cannot be operated over their full range with the X-Series without switching harmonics. Consequently, you will find that some of the bands (A-Band, for example) are broken into two ranges for use with the X-Series.

Below are the 11970A presets. The 11970U and the 11970W use a single harmonic. The other three switch harmonics mid-band. Both harmonic ranges are shown in the table. None of these mixers use LO doubling.

The 11970 K-band mixer and the 11974 preselected mixer series are not supported.

Preset	Readout on setup dialog and menu panel	Range	Harm #	RF start	RF stop	RF center
A-band	11970A	1	-6	26.5	30.45	28.475
		2	-8	30.35	40	35.175
Q-band	11970Q	1	-8	33	40.8	36.9
		2	-10	39.8	50	44.9
U-band	11970U	..	-10	40	60	50
V-band	11970V	1	-12	50	66	58
		2	-14	53	75	64
W-band	11970W	..	-18	75	110	92.5

Single Harmonic

These presets choose a setup that uses a single harmonic and no doubling for the LO.

Mixer	Readout on setup dialog and menu panel	Harm #	RF start	RF stop	RF center
K-band	K-band Single Harmonic, no doubler	-4	18	26.5	22.25
A-band	A-band Single Harmonic, no doubler	-6	26.5	40	33.25
D-band	D-band Single Harmonic, no doubler	-20	110	170	140
E-band	E-band Single Harmonic, no doubler	-12	60	90	75
F-band	F-band Single Harmonic, no doubler	-18	90	140	115

Mixer	Readout on setup dialog and menu panel	Harm #	RF start	RF stop	RF center
Q-band	Q-band Single Harmonic, no doubler	-6	33	50	41.5
U-band	U-band Single Harmonic, no doubler	-8	40	60	50
V-band	V-band Single Harmonic, no doubler	-10	50	75	62.5
W-band	W-band Single Harmonic, no doubler	-14	75	110	92.5
G-band	G-band Single Harmonic, no doubler	-26	140	220	180
Y-band	Y-band Single Harmonic, no doubler	-30	170	260	215
J -band	J-band Single Harmonic, no doubler	-38	220	325	272.5
Extended	Extended Single Harmonic, no doubler	-40	155	345	250

Single Harmonic with doubler

These presets choose a setup that uses a single harmonic and doubling for the LO.

Mixer	Readout on setup dialog and menu panel	Harm #	RF start	RF stop	RF center
D-band	D-band Single Harmonic w/doubler	-14	110	170	140
F-band	F-band Single Harmonic w/doubler	-10	90	140	115
G-band	G-band Single Harmonic w/doubler	-16	140	220	180
J-band	J-band Single Harmonic w/doubler	-24	220	325	272.5
K-band	K-band Single Harmonic w/doubler	-2	18	26.5	22.25
Q-band	Q-band Single Harmonic w/doubler	-4	33	50	41.5
V-band	V-band Single Harmonic w/doubler	-6	50	75	62.5
W-band	W-band Single Harmonic w/doubler	-8	75	110	92.5
Y-band	Y-band Single Harmonic w/doubler	-20	170	260	215
Extended	Extended Single Harmonic w/doubler	-28	245	390	317.5

Multiple Harmonics

These presets choose a setup that uses multiple harmonics and may or may not use doubling for the LO.

Mixer	Readout on setup dialog and menu panel	Range	Harm #	Dblr?	RF start	RF stop	RF Center
A-band	A-band Multiple Harmonic	1	-4	N	26.5	34.1	30.3
		2	-4	Y	33.1	40	36.55
E-band	E-band Multiple Harmonic	1	-6	Y	60	83	71.5
		2	-8	Y	65	90	77.5
U-band	U-band Multiple Harmonic	1	-6	N	40	51.5	45.75
		2	-6	Y	49.5	60	54.75
Coaxial	Coaxial Multiple Harmonic	1	-4	N	26.5	34	30.25
		2	-4	Y	32.5	55	43.75
		3	-6	Y	50	70	60

6.2.12.2 Mixer Bias

Adjusts an internal bias source for use with external mixers. The bias signal is present on the center conductor of the IF input connector on the front panel. The shunt current range is from -10 mA to 10 mA and it can be set whether Mixer Bias state is On or Off, but it will only be applied if it is On.

The bias remains as set if you switch to another input (e.g., the RF Input).

Remote Command	`[:SENSe]:MIXer:BIAS <real>`
	`[:SENSe]:MIXer:BIAS?`
	`[:SENSe]:MIXer:BIAS:STATe OFF | ON | 0 | 1`
	`[:SENSe]:MIXer:BIAS:STATe?`

Example	`:MIX:BIAS 0`
	`:MIX:BIAS?`
	`:MIX:BIAS:STAT 0`
	`:MIX:BIAS:STAT?`

Preset	Unaffected by Preset but set to `OFF` (0) by "Restore Input/Output Defaults" `OFF`
State Saved	Saved in instrument state

Min	-10 mA
Max	10 mA
Annunciation	When the bias is turned on this (together with the bias polarity) is indicated in the Meas Bar with a plus or minus sign:  otherwise it reads “Off”

6.2.12.3 Table Type

This parameter determines which type of configuration you want the Custom Mixer to be. You can choose Single Row, Harmonic Switching, or Doubler Switching. See detail under each of these keys.

The Harmonic Table can be configured:

- as a single row (meaning only one harmonic number is used and the LO Doubler is either on or off),
- as two rows where the harmonic number switches between the first row and the second, or
- as two rows where the LO Doubler state switches between the first row and the second

In the Single Row type, the External Mixer always stays in the same Harmonic Number and the LO Doubler is either on or off and does not change state during a sweep. You may change the Harmonic Number and you may change the state of the Doubler.

In the Harmonic Switching type, the External Mixer switches the Harmonic Number in the middle of the sweep. The Lo Doubler may be on or off but it is the same for both Harmonic Numbers. You can set the initial Harmonic Number, and when it switches it decrements by two when the harmonic is negative and increments by two when the harmonic is positive. For example, if you set the initial number to -6, when it switches it will go to -8. If you set the harmonic number to 8 when it switches it will go to 10.

In the Doubler Switching type, the External Mixer switches the doubler from Off to On in the middle of the sweep. You can set the Harmonic Number but it stays the same for the Doubler Off state as for the Doubler On state. The LO Doubler control is grayed out in this table type.

The fields you can edit vary with the Table Type:

Table Type	Fields you can edit
Single Row	Harmonic and LO Doubler cells
Harmonic Switching	Harmonic and LO Doubler cells (only the first row)
Doubler Switching	Harmonics cell (only the first row)

Note that you cannot add or delete rows from the table; you can only modify the rows that are already there.

Remote Command	`[:SENSe]:MIXer:TTYPe SINGle | HARMonic | DOUBler` `[:SENSe]:MIXer:TTYPE?`
Example	`:MIX:TTYP SING`
Couplings	When you change the Table Type, the Mixer Selection changes to “Custom”
Preset	Depends on the current Mixer Preset. This is unaffected by Mode Preset, but on a "Restore Input/Output Defaults" the Mixer is preset to 11970A, for which the Table Type is Harmonic Switching
State Saved	Saved in instrument state

6.2.12.4 Harmonic

Touching the Harmonic field in the Harmonic Table lets you enter the Harmonic value with its associated sign (mixing mode). Only the first row of the table is editable. When you edit a value or change the Table Type, the Mixer Selection changes to “Custom”.

In Custom mode, your maximum start and stop frequencies are strictly set by the LO range and the harmonic number you have chosen. The undoubled LO range is approximately 3.8 - 8.7 GHz , and (for LO’s that support doubling) the doubled range is approximately 8.0 – 14.0 GHz. That range times the harmonic you have selected will determine your tuning range. If your frequency is currently outside that range when you edit the Harmonic Table, your frequency will be changed to fall at the edge of the range. To change it back you must go into the Mixer Presets menu and select a Preset.

The harmonic number is a signed integer, where the sign has the meaning of choosing between positive and negative mixing products. Desired mixing products occur at an IF frequency which equals the difference between the RF frequency (f_{RF}) and the LO frequency (Nf_{LO}). When this difference is positive, we can say $f_{IF} = f_{RF} - Nf_{LO}$. When this difference is negative, we can say $f_{IF} = Nf_{LO} - f_{RF}$. Thus, a negative harmonic means the instrument will be tuned such that the harmonic of the LO is higher than the indicated frequency by the frequency of the first IF. A positive harmonic means the instrument will be tuned such that the harmonic of the LO is lower than the indicated frequency by the frequency of the first IF.

Remote Command	`[:SENSe]:MIXer:HARMonic <integer>` `[:SENSe]:MIXer:HARMonic?`
Example	`:MIX:HARM -28` `:MIX:HARM?`
Notes	The query returns the harmonic value of the first row of the harmonic table.
Couplings	When you set a value for the Harmonic via SCPI, the Mixer Selection changes to “Custom”
Preset	This is unaffected by Mode Preset, but on a "Restore Input/Output Defaults" editing is turned off, the Harmonic Table returns to normal, and the Mixer is preset to 11970A, which has -6 in the first row of its Harmonic Table

State Saved	Saved in instrument state
Min	-400
Max	400

6.2.12.5 LO Doubler

Touching the LO Doubler field in the Harmonic Table lets you enter whether the Doubler is on or off. Only the first row of the table is editable, and the LO Doubler field is only editable in Single Row and Harmonic Switching table types. When you edit a value or change the Table Type, the Mixer Selection changes to “Custom”.

The LO Doubler setting controls the choice of the LO doubler state for LO’s that support doubled operation. In Single Row mode it is either on or off for the one row in the table. In Harmonic Switching mode it is on for both rows or off for both rows. In Doubler switching it is off for row 1 and on for row 2, so it is not editable.

In LO’s that support doubling, the fundamental band is approximately 3.8 – 8.7 GHz, and the doubled band is approximately 8.0 – 14 GHz. The higher LO frequency can result in a lower mixer harmonic and reduced mixer conversion loss.

Remote Command	`[:SENSe]:MIXer:LODoubler ON | OFF | 0 | 1` `[:SENSe]:MIXer:LODoubler?`
Example	`:MIX:LOD 0` `:MIX:LOD?`
Notes	The query returns the doubler value of the first row of the harmonic table
Dependencies	This control is grayed out and set to Off when Table Type is set to Doubler Switching. Grayout message “-221 Settings conflict; Function unavailable while Table Type=Doubler Switching”
Couplings	When you set a value for the doubler setting via SCPI, the Mixer Selection changes to “Custom”
Preset	This is unaffected by Mode Preset, but on a "Restore Input/Output Defaults" editing is turned off, the Harmonic Table returns to normal, and the Mixer is preset to 11970A, which has the doubler Off in the first row of its Harmonic Table
State Saved	Saved in instrument state

6.2.12.6 Refresh USB Mixer Connection

This operation re-reads the USB devices and refreshes connection to Keysight USB mixers. This operation is the same as physically removing and reinserting the mixer’s USB connection.

Example	`:MIX:BAND USB`
Notes	When using Keysight USB Mixers, if a Restore All Defaults (SCPI command SYSTem:DEFault) has been perform, either remove and reinsert the USB cable or press the Refresh USB Mixer Connection control

6.2.13 Mixer Path

This parameter determines which path you wish to use when using M1971 series USB mixers:

- Normal, in which they function as a classic external mixer with a single conversion
- Dual Conversion, in which the first conversion is to a higher IF frequency (nominally 1.5 GHz) and you provide a 10 MHz signal to which an internal PLL is locked, to effect a second downconversion. The higher IF frequency used in Dual Conversion increases the image frequency offset, giving you a wider image-free conversion range. This reduces aliasing effects and improves the image suppress functionality for wideband signals
- Aux Equipment, wherein the first mixer output drives an output connector on the mixer and the instrument is out of the circuit. When you connect an M1971 Mixer to USB, the instrument will pull the IF and RF flatness data from the USB mixer and write this data to a user-accessible file in .csv format for your use when Aux Equipment is selected

Remote Command	`[:SENSe]:MIXer:MPATh NORMal | DUAL | AUX` `[:SENSe]:MIXer:MPATh?`
Example	`:MIX:MPAT NORM`
Dependencies	This control only appears when an M1971 series Mixer is connected to the USB port of the instrument When Aux Equipment is the selection, Sig Id is turned off to avoid shifting the LO. It is not turned back on when a different path is selected When Aux Equipment is the selection, there is no valid result, so the instrument displays a "No Result; Meas invalid with Aux Equip" error condition message. This is error 135 Dual Conversion is grayed out unless in the Swept SA measurement. If grayed out and the SCPI for Dual Conversion is sent, an error is generated:"-221, Settings Conflict; Dual Conversion mixer path is only available in Swept SA." If in Dual Conversion and Swept SA is exited, reverts to Normal setting. If subsequently return to Swept SA, does not automatically return to Dual Conversion When Dual Conversion is selected, if no signal is sensed at the 10 MHz input port, an error condition will be generated, "Ref missing or out of range;M1971" (error 521). This also lights the Error LED on the mixer itself
Couplings	When the Aux Equipment path is chosen, the instrument switches to Zero Span
Preset	`NORMal`
State Saved	Saved in instrument state
Annotation	In the Meas Bar, if an M1971 series Mixer is connected to the USB port of the instrument, the field Mixer Path appears and says: – Normal for Normal – 2xConv for Dual Conversion – Aux for Aux Equipment

6.2.14 User IF Freq

Specifies the desired IF frequency when using the Aux Equipment path. This setting determines the LO frequency that the instrument will drive into the mixer to correspond to the specified center frequency. Note that the Aux Equipment path always uses “Negative Mixing”, that is, the LO frequency is always higher than the RF frequency.

Remote Command	`[:SENSe]:MIXer:UIFFfreq <real>` `[:SENSe]:MIXer:UIFFreq?`
Example	`:MIX:UIFF 300 MHz`
Dependencies	Only appears if an M1971 mixer is connected to USB and the Mixer Path is Aux Equipment
Preset	1.2 GHz
State Saved	Saved in Input/Output state
Min	0 GHz
Max	4 GHz

6.2.15 Signal ID On/Off

Toggles the Signal ID (signal identification) function On or Off. This function lets you identify multiple responses of a single input signal that are generated when using un-preselected external mixers. The use of mixers without pre-selecting filters offers the advantage of improved receiver sensitivity because of the absence of the filter insertion loss, but results in multiple responses due to images and undesired harmonic mixing products.

While in Signal ID, basic spectrum analyzer functions work normally (for example, you can change Span normally), but some functions are disabled (for example, some traces are unavailable).

There are two forms of Signal ID, Image Suppress and Image Shift. Choose the one most appropriate for your application. For Image Shift, an LO-shifted and an unshifted trace are taken in Trace 1 and Trace 2 and displayed together. Any peaks that are not the same in both traces are images. For Image Suppress, image cancellation is performed in the background using two hidden traces, and the result displayed in Trace 1, which shows only the valid signals.

When Signal ID is on this is indicated in the Meas Bar as Signal ID: On. The annotation is displayed in amber color to alert you to the fact that Signal ID is on, as it can cause unexpected behavior if you are not aware that it is on.

Remote Command	`[:SENSe]:SIDentify[:STATe] OFF | ON | 0 | 1` `[:SENSe]:SIDentify[:STATe]?`
Example	`:SID 0`

	:SID?
Notes	Signal ID uses data from two successive sweeps. Therefore, if the instrument is in single sweep mode, two sweep triggers are used to generate the data needed for signal identification For the Log Plot measurement in the Phase Noise mode, Signal ID works only in the segment of LO sweeping where the offsets are greater than the Rejection Offset setting. When turning it on, you may notice a discontinuity in the Phase Noise trace at the Rejection Offset setting frequency by a few dB due to the under response inherent to Signal ID
Dependencies	Only appears when External Mixer is selected as the Input Signal ID is not available in some measurements. If the Signal ID control does not appear or is grayed out while in your measurement, then it is not available Because Signal ID uses data from two successive sweeps, several trace and sweep functions are grayed out in Signal ID. See the documentation for your measurement for details on which trace functions are grayed out Signal ID is not available with Signal Track so Signal ID is grayed out if in Signal Track Signal ID will be turned off when External Mixer is turned off. Signal ID cannot be turned on when using internal mixing Rules for auto coupling of the Sweep and FFT controls are changed with Signal ID on. For both the dynamic range case and the speed case, swept is chosen whenever any form of Signal ID is on. If Manual FFT is selected, the Signal ID control is grayed out If Signal ID is selected in a measurement that does not support it, a warning message is generated
Couplings	The Auto Rules for detector selection select Normal for all active traces when Signal ID is turned on
Preset	This is unaffected by Preset but is set to OFF on a "Restore Input/Output Defaults"
Annunciation	When Signal ID is on this is indicated in the Meas Bar as Signal ID: On. The annotation is displayed in amber color to alert you to the fact that Signal ID is on, as it can cause unexpected behavior if you are not aware that it is on

6.2.16 Signal ID Mode

Lets you set which Signal ID mode you will use, either Image Suppress or Image Shift.

Image Suppress

The Image Suppress mode of Signal ID mathematically removes all image and multiple responses of signals present at the mixer input. Two hidden sweeps are taken in succession. The second sweep is offset in LO frequency by 2*IF/N. For each point in each trace, the smaller amplitude from the two traces is taken and placed in that point in the selected trace. The Peak detector is auto-selected to improve the image suppression effectiveness. Responses of each trace that lie on top of one another will remain and are valid signals, others are images and are suppressed. The action of taking the smaller of the two traces will make the average noise level lower in all points that do not have an image, thus reducing the accuracy of the measurement of noise and noise-like signals.

NOTE When changing from Image Shift to Image Suppress mode, Trace 2 is blanked, as it was used for Image Shift and contains data that you will probably not want to see in Image Suppress

Image Shift

Like the Image Suppress mode, Image Shift is a two sweep sequence. The data from the first sweep is placed in Trace 1 and the data from the second (LO frequency shifted by 2*IF/N) sweep is placed in Trace 2. On alternate sweeps, the alternate trace (trace 2) is placed in front of trace 1. This way, you can see a signal at the same place on alternate sweeps, showing in yellow (trace1) and blue (trace2). Signal responses of Trace 1 and Trace 2 that have the same horizontal position are considered to be in the current band and therefore can be analyzed with the amplitude and frequency measurement systems of the SA. All other responses are invalid and should be ignored.

NOTE This function takes control of and uses Trace 1 and Trace 2. Any data in these traces prior to activating Image Shift will be lost.

Remote Command	`[:SENSe]:SIDentify:MODE ISUPpress | ISHift` `[:SENSe]:SIDentify:MODE?`

Example	`:SID:MODE ISUP`
	`:SID:MODE ISH`
	`:SID:MODE?`

Dependencies	Only appears when External Mixer is selected as the Input
Preset	This is unaffected by Preset but is set to `ISUPpress` by "Restore Input/Output Defaults"
State Saved	Saved in instrument state

6.2.17 Cable IF Loss

The loss at the IF in the IF/LO cable can be compensated for with this function, by entering the loss in dB for your cable.

The cable loss will depend on the IF frequency. The IF frequency varies depending on which IF path your measurement is using. For best accuracy, characterize your cable's loss for the IF frequency or frequencies you will be using.

IF Frequencies:

- 10 MHz path: 322.5 MHz
- 25 MHz path: 322.5 MHz

- 40 MHz path: 250 MHz
- 140 MHz path: 300 MHz

Remote Command	`[:SENSe]:MIXer:CIFLoss <rel_ampl>` `[:SENSe]:MIXer:CIFLoss?`
Example	`:MIX:CIFL 0.23 DB` `:MIX:CIFL?`
Dependencies	Only appears when External Mixer is selected as the Input
Preset	0.26 dB
State Saved	Saved in instrument state
Min	-100
Max	100

6.2.18 I/Q Path

Selects which I/Q input channels are active. The LED next to each I/Q input port will be on when that port is active.

The analysis bandwidth for each channel is the same as that of the instrument. For example, the base N9020A has a bandwidth of 10 MHz. With I/Q input the I and Q channels would each have an analysis bandwidth of 10 MHz, giving 20 MHz of bandwidth when the I/Q Path is I+jQ. With option B25, the available bandwidth becomes 25 MHz, giving 25 MHz each to I and Q and 50 MHz to I+jQ.

I/Q voltage to power conversion processing is dependent on the I/Q Path selected.

- With I+jQ input we know that the input signal may not be symmetrical about 0 Hz, because it has a complex component. Therefore, above 0 Hz only the positive frequency information is displayed, and below 0 Hz only the negative frequency information is displayed
- With all other Input Path selections, the input signal has no complex component and therefore is always symmetrical about 0 Hz. In this case, by convention, the power conversion shows the combined voltage for both the positive and negative frequencies. The information displayed below 0 Hz is the mirror of the information displayed above 0 Hz. This results in a power reading 6.02 dB higher (for both) than would be seen with only the positive frequency voltage. Note also that, in this case the real signal may have complex modulation embedded in it, but that must be recovered by further signal processing

See "More Information" on page 2240

Remote Command	`[:SENSe]:FEED:IQ:TYPE IQ | IONLy | QONLy` `[:SENSe]:FEED:IQ:TYPE?`
Example	`:FEED:IQ:TYPE IQ`

	Set the input to be both the I and Q channels, combined as I + j * Q
	`:FEED:IQ:TYPE IONL`
	Set the input to be only the I channel
	`:FEED:IQ:TYPE QONL`
	Set the input to be only the Q channel
	`:FEED:IQ:TYPE IND`
	Turn on both I and Q channels and treat I as channel 1 and Q as channel 2

Dependencies	Only appears when I/Q is the selected input
Preset	IQ
State Saved	Yes This is unaffected by a Preset but is set to the default value on a "Restore Input/Output Defaults" or "Restore System Defaults->All"

Notes	For R&S FSQ-B71 compatibility
Preset	`IQ`
Backwards Compatibility SCPI	`:INPut[1]:IQ:TYPE IQ | I | Q` `:INPut[1]:IQ:TYPE?`

More Information

I+jQ

Sets the signal input to be both the I and Q channels. The I and Q channel data will be combined as I + j * Q.

I Only

Sets the signal input to be only the I channel. The Q channel will be ignored. The data collected is still complex. When the center frequency is 0 the imaginary part will always be zero, but for any other center frequency both the real and imaginary parts will be significant.

Q Only

Sets the signal input to be only the Q channel. The I channel will be ignored. The Q channel will be sent to the digital receiver block as Q+j0. The receiver's output is still complex. When the center frequency is 0 the imaginary part will always be zero, but for any other center frequency both the real and imaginary parts will be significant. Note that since the receiver's real output is displayed as the "I" data, when the center frequency is 0, the Q Only input appears as the "I" data.

6.2.19 Reference Z

Sets the value of the impedance to be used in converting voltage to power for the I and Q channels. This does not change the hardware's path impedance (see "Input Z" on page 2242).

Remote Command	`:INPut:IMPedance:REFerence <integer>` `:INPut:IMPedance:REFerence?`
Example	Set the I/Q reference impedance to 50 Ω `:INP:IMP:REF 50`
Dependencies	Only appears when I/Q is the selected input
Preset	50 Ω
State Saved	Yes This is unaffected by a Preset but is set to the default value on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Min/Max	1 Ω - 1 MΩ

6.2.20 I/Q Setup

This dialog allows you to set up and calibrate various parameters for the I/Q inputs.

Dependencies	Only appears when I/Q is the selected input

6.2.20.1 I Setup

Access the channel setup parameters for the I channel.

Differential

Selects differential input on or off for the I channel. For differential input (also called balanced input), the instrument uses both main and complementary ports. When differential input is off (also called single-ended or unbalanced input), the instrument uses only the main port.

Remote Command	`:INPut:IQ[:I]:DIFFerential OFF | ON | 0 | 1` `:INPut:IQ[:I]:DIFFerential?`

Example	`:INP:IQ:DIFF ON`
	Put the I channel in Differential mode
	`:INP:IQ:DIFF OFF`
	Put the I channel in Single Ended mode

Notes	When I Differential Input = On, the instrument will check for attenuation mismatches between the I and I-

	bar ports. If the difference in attenuation values exceeds 0.5 dB a Settings Alert error condition, error 159 will be set When I Differential Input = On, and IQ Path is I+jQ, the Q Differential input must also be On. Similarly, when I Differential Input = Off, and IQ Path is I+jQ, the Q Differential input must also be Off. If the states of the two inputs do not match, an error condition message is generated, 159, Settings Alert; I/Q mismatch: Differential
Couplings	Some active probes include built-in differential capability. When one of these probes is sensed, this key is disabled. Since the differential capability is handled in the probe, the Instrument will use only the main port and the key will show that the Instrument's Differential Input mode is Off (indicating that the complementary port is not in use) When Q Same as I is On, the value set for I will also be copied to Q
Preset	OFF (Single Ended) !This is unaffected by Mode Preset but is set to the default value on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved	Yes
Annotation	The LED on the I-bar port indicates the Differential Input setting.

Notes	For R&S FSQ-B71 compatibility, with no independent settings for the I and Q channels. Therefore, it is tied only to the I channel and does not provide an equivalent for the Q channel. For proper operation of the backwards compatibility command Q Same as I should be `ON`
Preset	`OFF`
Backwards Compatibility SCPI	`:INPut[1]:IQ:BALanced[:STATe] OFF | ON | 0 | 1` `:INPut[1]:IQ:BALanced[:STATe]?`

Input Z

Selects the input impedance for the I channel. The impedance applies to both the I and I-bar ports.

The input impedance controls the hardware signal path impedance match. It is not used for converting voltage to power. The voltage to power conversion always uses the Reference Z parameter. The Reference Z parameter applies to both I and Q channels.

Remote Command	`:INPut[1]:IQ[:I]:IMPedance LOW | HIGH` `:INPut[1]:IQ[:I]:IMPedance?`

Example	`:INP:IQ:IMP HIGH`
	Set the I channel input impedance to 1 MΩ
	`:INP:IQ:IMP LOW`
	Set the I channel input impedance to 50 Ω

Notes	LOW = 50 Ω, HIGH = 1 MΩ When IQ Path is I+jQ, the I Input Z setting must be the same as the Q Input Z setting. If the settings of the

	two inputs do not match, an error condition message is generated, 159; Settings Alert; I/Q mismatch: Input Z
Couplings	Input impedance is a built-in characteristic of a probe. Therefore, whenever a probe is sensed, this key is disabled and the value is set to match the probe When no probe is sensed on Q and Q Same as I is On, the value set for I will also be copied to Q
Preset	`LOW` This is unaffected by Mode Preset but is set to the default value on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved	Yes
Annotation	"I:<I Input Z>" (examples, "I:50Ω" or "I:1MΩ") in the Measurement Bar. The annotation shows both the I and Q Input Z values

Skew

Sets the skew factor for the I channel. The skew will shift the channel's data in time. Use this to compensate for differences in the electrical lengths of the input paths due to cabling.

Remote Command	`[:SENSe]:CORRection:IQ[:I]:SKEW <seconds>` `[:SENSe]:CORRection:IQ[:I]:SKEW?`
Example	Delay the data for the I channel by 10 ns `:CORR:IQ:SKEW 10 ns`
Preset	0
State Saved	Yes This is unaffected by Preset but is set to the default value on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Range	0 s to 100 ns
Min	0 s
Max	+100 ns

Combined Differential/Input Z (Remote Command Only)

This is Remote Command only (no front panel) and is for backwards compatibility only. It combines the Differential Input and Input Z selections into a single SCPI command.

Example	`:INPut:IMPedance:IQ U50`
	This is equivalent to the following two SCPI commands:
	`:INP:IQ:DIFF OFF`
	`:INP:IQ:IMP 50`

Notes	Provided for E4406A code compatibility.

	The enum values translate as follows: U50: Differential Input = Off, Input Z = 50 Ω B50: Differential Input = On, Input Z = 50 Ω U1M: Differential Input = Off, Input Z = 1 MΩ B1M: Differential Input = On, Input Z = 1 MΩ This command is for backwards compatibility. It combines the Input Z (50 Ω or 1 M Ω) parameter with the Differential Input (Off = "Unbalanced", On = "Balanced") parameter into a single enumeration This backwards compatibility SCPI command was for an instrument without independent settings for the I and Q channels. Therefore, it is tied only to the I channel and does not provide an equivalent for the Q channel. For proper operation of the backwards compatibility command Q Same as I should be set to On Also, note the subtle difference between this SCPI command and the backwards compatibility command for Input Z. The Input Z SCPI has "IQ" before "IMP" while this command has that order reversed
Couplings	This command does not have an independent parameter, but instead is tied to the Differential Input and Input Z parameters. The coupling for those parameters apply to this command too
Preset	`U50`
Backwards Compatibility SCPI	`:INPut:IMPedance:IQ U50 | B50 | U1M | B1M` `:INPut:IMPedance:IQ?`

6.2.20.2 I Probe

Access the probe setup parameters for the I channel.

Dependencies	Only appears when I/Q is the selected input

The set of I/Q probe setup parameters will change based on the type of probe that is sensed. All probe types have the Attenuation parameter, and all probe types can be calibrated. The remaining parameters are only available for some probe types and will not be shown when not available. The probe type is determined by and reported for only for the I and Q ports, never the I-bar or Q-bar ports. The menu title will be "<ch>: <probe id>", where "<ch>" is either "I" or "Q" and "<probe id>" is the type of probe. For example, for the I Probe setup with an Keysight 1130A probe connected to the I port, the title will be "I: 1130A".

Probe calibration data is stored for each probe type for each channel. When no probe is sensed, the probe type "Unknown" is used, and this is also treated like a probe type with its own calibration data. When a probe is changed, the calibration data for that probe type for that port is restored. An advisory message will be displayed showing the new probe type and the calibration status. The calibration data is stored permanently (survives a power cycle) and is not affected by a Preset or any of the Restore commands. When the probe has EEPROM identification (most newer Keysight probes have this), the calibration data is stored by probe serial number and port, so if you have two probes of the same type, the correct calibration data will be used for each. For probes that do not have EEPROM identification, the calibration data is stored by probe type and port and the instrument cannot distinguish between different probes of the same type. In all cases (with or without EEPROM identification), the calibration data is port specific, so it will not follow a specific probe from port to port if the probe is moved.

The "Unknown" probe type is used whenever no probe is sensed. When no calibration data exists for "Unknown" the latest cable calibration data is used.

Attenuation

The attenuation is part of the calibration data stored with the probe type and is initially the value that was returned by the last calibration. You can modify this value and any changes will be stored with the calibration data and will survive power cycles and presets. When a probe calibration is performed the attenuation value will be overwritten by the calibration.

Remote Command	`[:SENSe]:CORRection:IQ:I:ATTenuation:RATio <real>` `[:SENSe]:CORRection:IQ:I:ATTenuation:RATio?`
Example	Set the attenuation for the current I probe to 100.00:1 `:CORR:IQ:I:ATT:RAT 100`
Notes	Each probe type has its own attenuation setting. As probes are changed the attenuation value will reflect the new probe's setting. Changing the attenuation affects only the current probe type's setting and leaves all others unchanged When the IQ Path is I+jQ, the Q probe attenuation setting must match the I Probe attenuation setting within 1 dB. If this is not the case, an error condition message is generated, 159; Settings Alert; I/Q mismatch: Attenuation
Preset	1
State Saved	Saved with probe calibration data. It survives a power cycle and is not affected by a Preset or Restore
Min/Max	0.001/10000

This is an alternate form of the SCPI that allows input as a power instead of a ratio.

Remote Command	`[:SENSe]:CORRection:IQ:I|Q:ATTenuation <rel_ampl>` `[:SENSe]:CORRection:IQ:I|Q:ATTenuation?`
Example	Set the attenuation for the current I probe type to 100.00:1 `:CORR:IQ:I:ATT 20 dB`
Min/Max	-60 dB /+80 dB

Offset

Some active probes have DC offset capability. When one of these probes is connected this control will be visible. The signal is adjusted for the DC offset before entering the instrument's port. This allows for removal of a DC offset before reaching the instrument's input port voltage limits. For example, a signal that varies 1 V peak-to-peak with a DC offset equal to the instrument's max input voltage would exceed the input limits of the instrument for half its cycle. Removing the DC offset allows the instrument to correctly process the entire signal.

Remote Command	`:INPut:OFFSet:I <voltage>` `:INPut:OFFSet:I?`
Example	Remove a DC offset of -0.5 V from the I channel input `:INP:OFFS:I -0.5`
Notes	Only some probe types support Offset. For those that do, each probe type has its own Offset setting. As probes are changed the Offset value will reflect the new probe's setting. Changing the Offset affects only the current probe type's setting and leaves all others unchanged
Preset	0 V
State Saved	Saved with probe calibration data. It survives power cycle and is not affected by Preset or Restore
Min/Max	-18 V/+18 V

Coupling

Some probe types allow coupling to reject low frequencies. This will filter out the DC component of a signal that is composed of a DC bias plus some AC signal. This control is visible only for probe types that have this capability.

Remote Command	`:INPut:COUPling:I DC | LFR1 | LFR2` `:INPut:COUPling:I?`

Example	`:INP:COUP:I DC`
	Turn off low frequency rejection on the I channel, allowing signals down to DC
	`:INP:COUP:I LFR1`
	Turn on low frequency rejection on the I channel for frequencies lower than 1.7 Hz
	`:INP:COUP:I LFR2`
	Turn on low frequency rejection on the I channel for frequencies lower than 0.14 Hz

Notes	Only some probe types support Coupling. For those that do, each probe type has its own Coupling setting. As probes are changed the Coupling value will reflect the new probe's setting. Changing the Coupling affects only the current probe type's setting and leaves all others unchanged
Preset	`DC`
State Saved	Saved with probe calibration data. It survives a power cycle and is not affected by a Preset or Restore
Range	DC | AC 1.7 Hz LFR1 | AC 0.14 Hz LFR2

Clear Calibration

Clears the calibration data for the current port and probe. It does not clear the data for other probe types or other ports. If the sensed probe has EEPROM identification, only the data for that specific probe is cleared. After this command has completed, the probe calibration state will be the same as if no probe calibration had ever been performed for the specified channel and probe. The probe attenuation will be the default value for that probe type and the Cable Calibration frequency response corrections will be used. This command is dependent on the Differential Input state.

When Differential Input is on, both the data for the probe attached to the main port and the data for the probe attached to the complementary port are cleared. When Differential Input is off, only data for the probe attached to the main port is cleared.

Remote Command	`:CALibration:IQ:PROBe:I:CLEar`
Example	`:CAL:IQ:PROBe:I:CLE` Clear the calibration data for the I channel and the current probe (with EEPROM identification) or probe type (without EEPROM identification)

6.2.20.3 Calibrate

Invokes the guided probe calibration. The guided probe calibration is context sensitive and depends on the channel (I or Q) and the Differential Input state. The calibration is only performed on the selected channel. When the Differential control is switched to Differential, both the probe attached to the main port and the probe attached to the complementary port are calibrated. When the Differential control is switched to Single Ended, only the probe attached to the main port is calibrated.

Calibrating the Baseband I/Q ports requires several steps and manual connections. The Guided Calibration will interactively step you through the required steps, displaying diagrams to help with the connections. The steps will vary depending on the setup.

In the Guided Calibration windows, the date and time of the last calibration are displayed. If any of the items listed are displayed in yellow, this indicates that the calibration for that item is inconsistent with the latest calibration, and you should complete the entire calibration process before you exit the calibration. For passive probes with Differential On, any calibration that is more than a day older than the most recent calibration will be displayed with the color amber.

The I/Q probe calibration creates correction data for one of the front panel I/Q channels. When the probe has EEPROM identification, the data is unique to that specific probe. When the probe does not have EEPROM identification, the data will be used for all probes of the same type. The data is also unique to the channel, so calibration data for the I channel will not be used for the Q channel and vice versa.

The guided calibration (front panel only) will show connection diagrams and guide you through the I/Q Isolation Calibration and through calibrating each port. The calibration data for each port is stored separately, so as soon as a port is calibrated that data is saved and will be used. If a user presses "Exit" to exit the calibration process, the data for the port already completed will still be used. It is recommended that a calibration be completed once started, or if exited, that it be properly done before the next use of the probe. The "Next" button will perform the calibration for the current port and then proceed to the next step in the calibration procedure. The "Back" button will return to the prior port in the procedure. Both softkeys and dialog buttons are supplied for ease of use. The dialog buttons are for mouse use and the softkeys for front panel use.

The calibration can also be done via SCPI, but no connection diagrams will be shown. You will need to make the correct connections before issuing each port calibration command. Again, it is recommended that all ports be calibrated at the same time.

For Active probes or when Differential is Off, only the main port is calibrated, otherwise both the main and complementary ports are calibrated.

The instrument state remains as it was prior to entering the calibration procedure except while a port is actually being calibrated. Once a port is calibrated it returns to the prior state. A port calibration is in process only from the time the "Next" button is pressed until the next screen is shown. For SCPI, this corresponds to the time from issuing the CAL:IQ:PROB:I|IB|Q|QB command until the operation is complete.

For example, if the prior instrument state is Cal Out = Off, Input = I+jQ, and Differential = Off, then up until the time the "Next" button is pressed the I Input and Q Input LEDs are on and the Cal Out, I-bar Input and Q-bar Input LEDs are off. Once the "Next" button is pressed for the I port calibration, only the Cal Out and I Input LEDs will be on and the others will be off. When the screen progresses to the next step ("Next" button again enabled), the prior state is restored and only the I Input and Q Input LEDs are on (Cal Out is off again).

I/Q Isolation Calibration

The I/Q Isolation Calibration must be run before calibrating any port with either the I/Q Cable Calibration or I/Q Probe Calibration. This calibration is performed with nothing connected to any of the front panel I/Q ports. This is the first step in both the I/Q Cable Calibration and the I/Q Probe Calibration. This dialog appears if the Calibration is being run for the first time. It can also be accessed by pressing Back from the I Input Cal, the Q Input Cal, or the I/Q Cable Cal. Pressing Next from this dialog runs the calibration

Remote Command	`:CALibration:IQ:ISOLation`
Example	`:CAL:IQ:ISOL`
Notes	All front panel I/Q ports must not be connected to anything.
State Saved	No

I/Q Isolation Calibration Time (Remote Command Only)

Returns the last date and time that the I/Q Isolation Calibration was performed. This is a remote query command only.

Remote Command	`:CALibration:IQ:ISOLation:TIME?`
Example	`:CAL:IQ:ISOL:TIME?`
Notes	Returns 6 integer values: year, month, day, hour, minute, second. When no calibration has been performed, all values will be 0
Annunciation	Guided Calibration, Isolation Calibration, Last Calibration

I Port

The I port calibration is performed with the probe body attached to the front panel's I port and the probe tip connected via an adapter to the Cal Out port. The guided calibration will show a diagram of the required connections.

Remote Command	`:CALibration:IQ:PROBe:I`
Example	`:CAL:IQ:PROB:I`
Notes	The I port must be connected to the Cal Out port before issuing the SCPI command The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands
State Saved	No

I Port Probe Calibration Time (Remote Command Only)

Return the last date and time that the I/Q Probe Calibration was performed for a specific port. This is a remote query command only.

Remote Command	`:CALibration:IQ:PROBe:I|:TIME?`
Example	`:CAL:IQ:PROB:I:TIME?`
Notes	This returns 6 integer values: year, month, day, hour, minute, second. When no calibration has been performed, all values will be 0. The value is specific to both the port and probe, so the value will change as probes are connected or disconnected

I-bar Port

The I-bar port calibration is performed with the probe body attached to the front panel's I-bar port and the probe tip connected via an adapter to the Cal Out port. The I-bar probe calibration is only available for passive probes with Differential On. The guided calibration will show a diagram of the required connections.

Remote Command	`:CALibration:IQ:PROBe:IBar`
Example	`:CAL:IQ:PROB:IB`
Notes	The I-bar port must be connected to the Cal Out port before issuing the SCPI command The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands
State Saved	No

I-bar Port Probe Calibration Time (Remote Command Only)

Return the last date and time that the I/Q Probe Calibration was performed for a specific port. This is a remote query command only.

Remote Command	`:CALibration:IQ:PROBe:IBAR:TIME?`
Example	`:CAL:IQ:PROB:IBAR:TIME?`
Notes	This returns 6 integer values: year, month, day, hour, minute, second. When no calibration has been performed, all values will be 0. The value is specific to both the port and probe, so the value will change as probes are connected or disconnected
Annunciation	Guided Calibration, Probe Calibration, Last Calibration

6.2.20.4 Q Setup

Access the channel setup parameters for the Q channel.

Dependencies	Only appears when I/Q is the selected input

Q Same as I

Many, but not all, usages require the I and Q channels have an identical setup. To simplify channel setup, the Q Same as I will cause the Q channel parameters to be mirrored from the I channel. That way you only need to set up one channel (the I channel). The I channel values are copied to the Q channel, so at the time Q Same as I is turned off the I and Q channel setups will be identical. This does not apply to Probe settings or to parameters that are determined by the probe.

Remote Command	`:INPut:IQ:MIRRored OFF | ON | 0 | 1` `:INPut:IQ:MIRRored?`
Example	Turn off the mirroring of parameters from I to Q `:INP:IQ:MIRR OFF`
Couplings	Only displayed for the Q channel. When Yes, the I channel values for some parameters are mirrored (copied) to the Q channel. However, when a parameter is determined by the type of probe and a probe is sensed, the probe setting is always used and the I channel setting is ignored. The following parameters are mirrored: Differential Input (when not determined by probe) Input Z (when not determined by probe)
Preset	This is unaffected by a Preset but is set to the default value (Q Same as I set to "On") on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved	Saved in instrument state
Range	On | Off

Differential

Selects differential input on or off for the Q channel. For differential input (also called balanced input), the instrument uses both the Q and Q-bar ports. When differential input is off (also called single-ended or unbalanced input), the instrument uses only the Q port.

Remote Command	`:INPut:IQ:Q:DIFFerential OFF | ON | 0 | 1` `:INPut:IQ:Q:DIFFerential?`

Example	`:INP:IQ:Q:DIFF ON`
	Put the Q channel in Differential mode
	`:INP:IQ:Q:DIFF OFF`
	Put the Q channel in Single Ended mode

Notes	When Differential Input = On, the instrument will check for attenuation mismatches between the Q and Q-bar ports. If the difference in attenuation values exceeds 0.5 dB a Settings Alert error condition, error 159 will be set When Q Differential Input = On, and IQ Path is I+jQ, the I Differential input must also be On. Similarly, when Q Differential Input = Off, and IQ Path is I+jQ, the I Differential input must also be Off. If the states of the two inputs do not match, an error condition message is generated, 159; Settings Alert; I/Q mismatch: Differential
Couplings	Some active probes include built-in differential capability. When one of these probes is sensed, this key is disabled. Since the differential capability is handled in the probe, the Instrument will use only the main port and the key will show that the Instrument's Differential Input mode is Off (indicating that the complementary port not in use) When a differential probe is not sensed and Q Same as I is On, the value set for I will be copied to Q. This key is disabled when Q Same as I is On
Preset	Off
State Saved	Yes This is unaffected by a Preset but is set to the default value on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Range	Off | On
Annotation	The LED on the Q-bar port indicates the Differential Input setting

Input Z

Selects the input impedance for the Q channel. The impedance applies to both the Q and Q-bar ports.

The input impedance controls the hardware signal path impedance match. It is not used for converting voltage to power. The voltage to power conversion always uses the Reference Z parameter. The Reference Z parameter applies to both I and Q channels.

Remote	`:INPut[1]:IQ:Q:IMPedance LOW | HIGH`

Command	`:INPut[1]:IQ:Q:IMPedance?`

Example	`:INP:IQ:Q:IMP HIGH`
	Set the Q channel input impedance to 1 MΩ
	`:INP:IQ:Q:IMP LOW`
	Set the Q channel input impedance to 50 Ω

Notes	LOW = 50 Ω, HIGH = 1 MΩ When IQ Path is I+jQ, the I Input Z setting must be the same as the Q Input Z setting. If the settings of the two inputs do not match, an error condition message is generated, 159; Settings Alert; I/Q mismatch: Input Z
Couplings	Input impedance is a built-in characteristic of a probe. Therefore, whenever a probe is sensed, this key is disabled and the value is set to match the probe When no probe is sensed and Q Same as I is On, the value set for I will also be copied to Q. This key is disabled when Q Same as I is On
Preset	LOW
State Saved	Yes This is unaffected by Preset but is set to the default value on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Range	50 Ω | 1 MΩ
Annotation	"Q:<Q Input Z>" (examples, "Q:50Ω" or "Q:1MΩ") in the Measurement Bar. The annotation shows both the I and Q Input Z values

Skew

Sets the skew factor for the Q channel. The skew will shift the channel's data in time. Use this to compensate for differences in the electrical lengths of the input paths due to cabling and probes.

Remote Command	`[:SENSe]:CORRection:IQ:Q:SKEW <seconds>` `[:SENSe]:CORRection:IQ:Q:SKEW?`
Example	Delay the data for the Q channel by 10 ns `:CORR:IQ:Q:SKEW 10 ns`
Preset	0
State Saved	Yes This is unaffected by a Preset but is set to the default value on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Min/Max	0 s/ 100 ns

6.2.20.5 Q Probe

Accesses the probe setup parameters for the Q channel. See"Combined Differential/Input Z (Remote Command Only)" on page 2243

Dependencies	Only appears when I/Q is the selected input

Attenuation

The attenuation is part of the calibration data stored with the probe type and is initially the value that was returned by the last calibration. You can modify this value and any changes will be stored with the calibration data and will survive power cycles and presets. When a probe calibration is performed the attenuation value will be overwritten by the calibration.

Remote Command	`[:SENSe]:CORRection:IQ:Q:ATTenuation:RATio <real>` `[:SENSe]:CORRection:IQ:Q:ATTenuation:RATio?`
Example	Set the attenuation for the current Q probe to 100.00:1 `:CORR:IQ:Q:ATT:RAT 100`
Notes	Each probe type has its own attenuation setting. As probes are changed the attenuation value will reflect the new probe's setting. Changing the attenuation affects only the current probe type's setting and leaves all others unchanged When the IQ Path is I+jQ, the Q probe attenuation setting must match the I Probe attenuation setting within 1 dB. If this is not the case, an error condition message is generated, 159; Settings Alert; I/Q mismatch: Attenuation
Preset	Each probe type has its own default. The default for the "Unknown" probe type is 1:1
State Saved	Saved with probe calibration data. It survives a power cycle and is not affected by a Preset or Restore
Min/Max	0.001/10000

This is an alternate form of the SCPI that allows input as a power instead of a ratio.

Remote Command	`[:SENSe]:CORRection:IQ:I|Q:ATTenuation <rel_ampl>` `[:SENSe]:CORRection:IQ:I|Q:ATTenuation?`
Example	Set the attenuation for the current I probe type to 100.00:1 `:CORR:IQ:I:ATT 20 dB`
Min/Max	-60 dB /+80 dB

Offset

Some active probes have DC offset capability. When one of these probes is connected this control will be visible. The signal is adjusted for the DC offset before entering the instrument's port. This allows for removal of a DC offset before reaching the instrument's input port voltage limits. For example, a signal that varies 1 V peak-to-peak with a DC offset equal to the instrument's max input voltage would exceed the input limits of the instrument for half its cycle. Removing the DC offset allows the instrument to correctly process the entire signal.

Remote Command	`:INPut:OFFSet:Q <voltage>` `:INPut:OFFSet:Q?`

Example	Remove a DC offset of -0.5 V from the Q channel input `:INP:OFFS:Q -0.5`
Notes	Only some probe types support Offset. For those that do, each probe type has its own Offset setting. As probes are changed the Offset value will reflect the new probe's setting. Changing the Offset affects only the current probe type's setting and leaves all others unchanged
Preset	0 V
State Saved	Saved with probe calibration data. It survives power cycle and is not affected by Preset or Restore
Min/Max	-18 V/+18 V

Coupling

Some probe types allow coupling to reject low frequencies. This will filter out the DC component of a signal that is composed of a DC bias plus some AC signal. This control is visible only for probe types that have this capability.

Remote Command	`:INPut:COUPling:Q DC | LFR1 | LFR2` `:INPut:COUPling:Q?`

Example	`:INP:COUP:Q DC`
	Turn off low frequency rejection on the Q channel, allowing signals down to DC
	`:INP:COUP:Q LFR1`
	Turn on low frequency rejection on the Q channel for frequencies lower than 1.7 Hz
	`:INP:COUP:Q LFR2`
	Turn on low frequency rejection on the Q channel for frequencies lower than 0.14 Hz

Notes	Only some probe types support Coupling. For those that do, each probe type has its own Coupling setting. As probes are changed the Coupling value will reflect the new probe's setting. Changing the Coupling affects only the current probe type's setting and leaves all others unchanged
Preset	DC
State Saved	Saved with probe calibration data. It survives a power cycle and is not affected by a Preset or Restore
Range	DC | AC 1.7 Hz LFR1 | AC 0.14 Hz LFR2

Clear Calibration

Clears the calibration data for the current port and probe. It does not clear the data for other probe types or other ports. If the sensed probe has EEPROM identification, only the data for that specific probe is cleared. After this command has completed, the probe calibration state will be the same as if no probe calibration had ever been performed for the specified channel and probe. The probe attenuation will be the default value for that probe type and the Cable Calibration frequency response corrections will be used. This command is dependent on the Differential Input state. When Differential Input is on, both the data for the probe attached to the main port and the data for the probe attached to the complementary port are cleared. When Differential Input is off, only data for the probe attached to the main port is cleared.

Remote Command	:CALibration:IQ:PROBe:Q:CLEar
Example	:CAL:IQ:PROBe:I:CLE Clear the calibration data for the Q channel and the current probe (with EEPROM identification) or probe type (without EEPROM identification)

6.2.20.6 Calibrate

Invokes the guided probe calibration. The guided probe calibration is context sensitive and depends on the channel (I or Q) and the Differential Input state. The calibration is only performed on the selected channel. When the Differential control is switched to Differential, both the probe attached to the main port and the probe attached to the complementary port are calibrated. When the Differential control is switched to Single Ended, only the probe attached to the main port is calibrated.

The I/Q Isolation Calibration must be run before calibrating any port with either the I/Q Cable Calibration or I/Q Probe Calibration. See "I/Q Isolation Calibration" on page 2248

Q Port

The Q port calibration is performed with the probe body attached to the front panel's Q port and the probe tip connected via an adapter to the Cal Out port. The guided calibration will show a diagram of the required connections.

Remote Command	:CALibration:IQ:PROBe:Q
Example	:CAL:IQ:PROB:Q
Notes	The Q port must be connected to the Cal Out port before issuing the SCPI command The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands
State Saved	No

Q Port Probe Calibration Time (Remote Command Only)

Return the last date and time that the I/Q Probe Calibration was performed for a specific port. This is a remote query command only.

Remote Command	:CALibration:IQ:PROBe:Q:TIME?
Example	:CAL:IQ:PROB:Q:TIME?
Notes	This returns 6 integer values: year, month, day, hour, minute, second. When no calibration has been performed, all values will be 0. The value is specific to both the port and probe, so the value will change as probes are connected or disconnected
Annunciation	Guided Calibration, Probe Calibration, Last Calibration

Q-bar Port

The Q-bar port calibration is performed with the probe body attached to the front panel's Q-bar port and the probe tip connected via an adapter to the Cal Out port. The Q-bar probe calibration is only available for passive probes with Differential On. The guided calibration will show a diagram of the required connections.

Remote Command	`:CALibration:IQ:PROBe:QBar`
Example	`:CAL:IQ:PROB:QB`
Notes	The Q-bar port must be connected to the Cal Out port before issuing the SCPI command The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands
State Saved	No

Q-bar Probe Calibration Time (Remote Command Only)

Return the last date and time that the I/Q Probe Calibration was performed for a specific port. This is a remote query command only.

Remote Command	`:CALibration:IQ:PROBe:QBAR:TIME?`
Example	`:CAL:IQ:PROB:QBAR:TIME?`
Notes	This returns 6 integer values: year, month, day, hour, minute, second. When no calibration has been performed, all values will be 0. The value is specific to both the port and probe, so the value will change as probes are connected or disconnected
Annunciation	Guided Calibration, Probe Calibration, Last Calibration

6.2.21 I/Q Cable Calibrate

The I/Q cable calibration creates correction data for each of the front panel I/Q ports. This calibration data is used whenever no probe specific calibration data is available. It is important that all ports are calibrated using the same short BNC cable so that the data is comparable from port to port.

The guided calibration (front panel only) will show connection diagrams and guide you through the isolation calibration and calibrating each port. The calibration data for each port is stored separately, so as soon as a port is calibrated that data is saved and will be used. If you press "Exit" to exit the calibration process, the data for the ports already completed will still be used. It is recommended that a calibration be completed once started, or if exited, that it be properly done before the next use of the I/Q ports. The "Next" button will perform the calibration for the current port and then proceed to the next step in the calibration procedure. The "Back" button will return to the prior port in the procedure. Both keys and dialog buttons are supplied for ease of use. The dialog buttons are for mouse use and the softkeys for front panel use.

The calibration can also be done via SCPI, but no connection diagrams will be shown. You will have to make the correct connections before issuing each port calibration command. Again, it is recommended that all ports be calibrated at the same time.

The instrument state remains as it was prior to entering the calibration procedure except while a port is actually being calibrated. Once a port is calibrated it returns to the prior state. A port calibration is in process only from the time the "Next" button is pressed until the next screen is shown. For SCPI, this corresponds to the time from issuing the CAL:IQ:FLAT:I|IB|Q|QB command until the operation is complete.

For example, if the prior instrument state is Cal Out = Off, Input = I+jQ, and Differential = Off, then up until the time the "Next" button is pressed the I Input and Q Input LEDs are on and the Cal Out, I-bar Input and Q-bar Input LEDs are off. Once the "Next" button is pressed for the I port calibration, only the Cal Out and I Input LEDs will be on and the others will be off. When the screen progresses to the next step ("Next" button again enabled), the prior state is restored and only the I Input and Q Input LEDs are on (Cal Out is off again).

The last calibration date and time for each port will be displayed. Any calibrations that are more than a day older than the most recent calibration will be displayed with the color amber.

The I/Q Isolation Calibration must be run before calibrating any port with either the I/Q Cable Calibration or I/Q Probe Calibration. See "I/Q Isolation Calibration" on page 2248

Dependencies	Only appears when I/Q is the selected input

6.2.21.1 I Port

The I port calibration is performed with the front panel's I port connected via a short BNC cable to the Cal Out port. The guided calibration will show a diagram of the required connections.

Remote Command	`:CALibration:IQ:FLATness:I`
Example	`:CAL:IQ:FLAT:I`
Notes	The recommended procedure is to use the same BNC cable to calibrate all I/Q ports. All I/Q ports should be calibrated sequentially during the procedure The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands The I port must be connected to the Cal Out port before issuing the SCPI command
State Saved	No

6.2.21.2 I-bar Port

The I-bar port calibration is performed with the front panel's I-bar port connected via a short BNC cable to the Cal Out port. The guided calibration will show a diagram of the required connections.

Remote Command	`:CALibration:IQ:FLATness:IBAR`
Example	`:CAL:IQ:FLAT:IBAR`
Notes	The recommended procedure is to use the same BNC cable to calibrate all I/Q ports. All I/Q ports should be calibrated sequentially during the procedure The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands The I-bar port must be connected to the Cal Out port before issuing the SCPI command
State Saved	No

6.2.21.3 Q Port

The Q port calibration is performed with the front panel's Q port connected via a short BNC cable to the Cal Out port. The guided calibration will show a diagram of the required connections.

Remote Command	`:CALibration:IQ:FLATness:Q`
Example	`:CAL:IQ:FLAT:Q`
Notes	The recommended procedure is to use the same BNC cable to calibrate all I/Q ports. All I/Q ports should be calibrated sequentially during the procedure The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands The Q port must be connected to the Cal Out port before issuing the SCPI command
State Saved	No

6.2.21.4 Q-bar Port

The Q-bar port calibration is performed with the front panel's Q-bar port connected via a short BNC cable to the Cal Out port. The guided calibration will show a diagram of the required connections.

Remote Command	`:CALibration:IQ:FLATness:QBAR`
Example	`:CAL:IQ:FLAT:QBAR`
Notes	The recommended procedure is to use the same BNC cable to calibrate all I/Q ports. All I/Q ports should be calibrated sequentially during the procedure

	The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands The Q-bar port must be connected to the Cal Out port before issuing the SCPI command
State Saved	No

6.2.21.5 I/Q Cable Calibration Time (Remote Command Only)

Returns the last date and time that the I/Q Cable Calibration was performed for a specific port. This is a remote query command only.

Remote Command	`:CALibration:IQ:FLATness:I|IBAR|Q|QBAR:TIME?`
Example	`:CAL:IQ:FLAT:I:TIME?`
Notes	This returns 6 integer values: year, month, day, hour, minute, second. When no calibration has been performed, all values will be 0
Annunciation	Guided Calibration, Cable Calibration, Last Calibration

6.2.22 Audio Input Channel

Determines which Audio Input to be used for audio measurements.

Remote Command	`[:SENSe]:FEED:AFINput:PORT CH1 | CH2` `[:SENSe]:FEED:AFINput:PORT?`
Example	`:FEED:AFIN CH1`
Dependencies	Only appears in the Radio Test Mode Only appears in modular products and only if the M9260A Audio Analyzer module is installed
Preset	Unaffected by Mode Preset, but set to Channel 1 by Input/Output Preset

6.2.23 Audio Calibrator

Lets you turn on the internal calibrator in the X-Series Audio board.

Remote Command	`[:SENSe]:FEED:AFALign OFF | REF10` `[:SENSe]:FEED:AFALign?`
Example	`:FEED:AFAL REF10`
Dependencies	Only appears in Measuring Receiver Mode’s Audio Measurements and Option 107 is present
Preset	`OFF`

6.2.24 Audio Coupling

Lets you set AC or DC coupling for the currently selected audio input.

Remote Command	`[:SENSe]:AFINput[1]|2:COUPling AC | DC` `[:SENSe]:AFINput[1]|2:COUPling?`
Example	`:AFIN:COUP AC`
Dependencies	Only appears in Measuring Receiver Mode and Radio Test Mode In Measuring Receiver, only appear in Audio Measurements and only if Option 107 is present In Radio Test, only appears in modular products and only if the M9260A Audio Analyzer module is installed
Preset	`AC`

6.2.25 Audio Input Ground

This control lets you float or ground the low side of the currently selected audio input channel. When you choose Float, the low side of the input is disconnected from ground.

Remote Command	`[:SENSe]:AFINput[1]|2:LOW FLOat | GROund` `[:SENSe]:AFINput[1]|2:LOW?`
Example	`:AFIN2:LOW FLO`
Dependencies	Only appears in the Radio Test Mode Only appears in modular products and only if the M9260A Audio Analyzer module is installed
Preset	Unaffected by Mode Preset, but set to `GROund` by Input/Output Preset

6.2.26 Audio In Impedance

Lets you set the Impedance of the currently selected audio input channel.

The value you enter is rounded up to the nearest allowed value.

Remote Command	`[:SENSe]:AFINput[1]|2:IMPedance 50 | 600 | 1000000` `[:SENSe]:AFINput[1]|2:IMPedance?`
Example	`:AFIN:IMP 50`
Dependencies	Only appears in the Radio Test Mode Only appears in modular products and only if the M9260A Audio Analyzer module is installed
Preset	Unaffected by Mode Preset, but set to 600 by Input/Output Preset

6.2.27 Input/Output Preset

Resets the group of settings and data associated with the Input/Output front-panel key to their default values. These settings are not affected by a Mode Preset because they are generally associated with connections to the instrument, and most users would not want these resetting every time they pressed the Mode Preset key.

This is the same as the button found in the Preset dropdown, and also the same as the Input/Output button in the Restore Defaults menu under the System key.

All the variables set under the Input/Output front panel key are reset by Input/Output Preset, including Amplitude Corrections and Data (described in the Corrections section), with the exception of **RF Source** settings, which are unaffected.

By using Input/Output Preset and Restore Mode Defaults, a full preset of the current mode will be performed, with the caveat that since Input/Output Preset is a global function it will affect ALL modes.

When Input/Output Preset is selected, a message appears saying:

“This will reset all of the Input/Output variables to their default state, including which input is selected, all Amplitude Correction settings and data, all External Mixing settings, all Frequency Reference settings and all Output settings.

It will not affect Alignment data or settings.

It will not affect RF Source settings.

This action cannot be undone. Do you want to proceed?”

The message provides an **OK** and **Cancel** button for you to affirm or cancel the operation.

Example	`:SYST:DEF INP` presets all the Input/Output variables to their factory default values

6.3 External Gain

Contains controls that allow you to compensate for gain or loss in the measurement system outside the instrument. The External Gain is subtracted from the amplitude readout (or the loss is added to the amplitude readout). So, the displayed signal level represents the signal level at the output of the device-under-test, which can be the input of an external device that provides gain or loss.

Entering an External Gain value does not affect the Reference Level, therefore the trace position on screen changes, as do all of the values represented by the trace data. Thus, the values of exported trace data, queried trace data, marker amplitudes, trace data used in calculations such as N dB points, trace math, peak threshold, etc., are all affected by External Gain. Changing the External Gain, even on a trace that is not updating, will immediately change all of the above, without new data needing to be taken.

NOTE **Changing the External Gain causes the instrument to immediately stop the current sweep and prepare to begin a new sweep. The data will not change until the trace data updates because the offset is applied to the data as it is taken. If a trace is exported with a nonzero External Gain, the exported data will contain the trace data with the offset applied.**

In the Spectrum Analyzer mode, a Preamp is the common external device providing gain or loss. In a measurement application mode like GSM or W-CDMA, the gain or loss could be from a BTS (Base Transceiver Station) or an MS (Mobile Station). So in the Spectrum Analyzer mode MS and BTS would be grayed out and the only choice would be Ext Preamp. Similarly in some of the digital communications applications, Ext Preamp will be grayed out and you would have a choice of MS or BTS.

The Ext Preamp, MS, and BS controls may be grayed out depending on which measurement is currently selected. If any of the grayed out controls are pressed, or the equivalent SCPI command is sent, an advisory message is generated.

6.3.1 External Preamp

This function is similar to the reference level offset function. Both affect the displayed signal level. Ref Lvl Offset is a mathematical offset only, no instrument configuration is affected. Ext Preamp gain is used when determining the auto-coupled value of the Attenuator. The External Gain value and the Maximum Mixer Level settings are both part of the automatic setting equation for the RF attenuation setting. (10 dB of Attenuation is added for every 10 dB of External Gain.)

Note that the Ref Lvl Offset and Maximum Mixer Level are described in the Amplitude section. They are reset by Mode Preset. The External Preamp Gain is reset by the "Restore Input/Output Defaults" or "Restore System Defaults->All functions.

The Swept SA Measurement only supports the “Ext Preamp” function under External Gain, the other External Gain functions are grayed out and generate a settings conflict if the SCPI for them is sent.

See "More Information" on page 2263

Remote Command	`[:SENSe]:CORRection:SA[:RF]:GAIN <rel_ampl>` `[:SENSe]:CORRection:SA[:RF]:GAIN?`

Example	`:CORR:SA:GAIN 10`
	sets the Ext Gain value to 10 dB
	`:CORR:SA:GAIN -10`
	sets the Ext Gain value to -10 dB (that is, an attenuation of 10 dB)

Notes	Does not auto return The above SCPI command is new in X-Series
Dependencies	The reference level limits are determined in part by the External Gain/Atten, Max Mixer Level, and RF Atten This key is grayed out in Modes that do not support External Gain
Preset	This is unaffected by Preset but is set to 0 dB on a "Restore Input/Output Defaults" or "Restore System Defaults->All" 0.00 dB, Gain
State Saved	Saved in instrument state
Min	-120 dB
Max	120 dB
Annotation	Displayed in the Meas Bar as "Ext Gain <value>". When the gain is zero, no annotation is shown
Backwards Compatibility SCPI	`[:SENSe]:CORRection:OFFSet[:MAGNitude]` The legacy "Ext Preamp Gain" key is now called "Ext Gain" and the sub-menu has choices of Ext Preamp | MS | BTS for backwards compatibility

More Information

The U7227A USB Preamplifier is an accessory for the X-Series Signal Analyzer that provides gain externally, and whose gain settings are automatically loaded into the instrument over USB whenever it is connected to one of the instrument’s USB ports.

While the USB Preamplifier is plugged into one of the instrument’s USB ports, the instrument will consider it to be in the signal path of the RF Input and will apply the calibration data from the USB Preamp to measurements taken at the RF Input (on 2 input boxes, it will be considered to be in the signal path of RF Input 1; it is not supported for RF Input 2).

The USB Preamplifier contains its own cal data. This includes a noise trace suitable for use with NFE, for those models which support NFE. The act of connecting the Preamp to USB will cause the cal data to be downloaded from the preamp. When this happens an informational message is provided saying “Cal data loaded from USB

Preamp”. The instrument will then automatically apply the calibration factors loaded from the Preamp in any measurement that supports the USB Preamp.

The External Preamp Gain setting may still be used, even though it is not required for the USB Preamp (since the USB Preamp supplies its own gain data to the instrument which is applied automatically). Connecting the USB Preamp does not change the External Preamp Gain setting, however unless you have another gain or attenuation element in the signal path, the appropriate setting for External Preamp Gain is 0 dB.

Overload detection and reporting will apply when the USB preamplifier is connected to USB. The USB Preamplifier has its own overload detector which reports overloads to the instrument over USB. This generates an error condition, “Input Overload; USB Preamp.”

If, while the USB Preamp is connected to USB, a measurement is selected that does not support the USB preamplifier, the "No result; Meas invalid with Preamp" error condition is generated.

6.3.2 External Gain - MS

Sets an external gain/attenuation value for MS (Mobile Station) tests.

Remote Command	`[:SENSe]:CORRection:MS[:RF]:GAIN <rel_ampl>` `[:SENSe]:CORRection:MS[:RF]:GAIN?`

Example	`:CORR:MS:GAIN 10`
	sets the Ext Gain value to 10 dB
	`:CORR:MS:GAIN -10`
	sets the Ext Gain value to -10 dB (that is, a loss of 10 dB)

Notes	Does not auto return
Dependencies	The reference level limits are determined in part by the External Gain, Max Mixer Level, RF Atten This key is grayed out in modes that do not support MS
Preset	This is unaffected by a Preset but is set to 0 dB on a "Restore Input/Output Defaults" or "Restore System Defaults->All" 0.00 dB, Gain
State Saved	Saved in instrument state
Min	-100 dB
Max	100 dB

Example	`:CORR:MS:LOSS 10`
	sets the Ext Gain value to -10 dB, and subsequently querying :LOSS will give 10 dB
	`:CORR:MS:LOSS -10`
	sets the Ext Gain value to 10 dB, and subsequently querying :LOSS will give -10 dB

Notes	A positive value of <rel_ampl> in the above command means a loss and a negative value indicates a gain Anytime :LOSS is set it sets :GAIN to the negative value of the parameter sent Anytime :LOSS is queried it gives the negative of :GAIN
Preset	This is unaffected by a Preset but is set to 0 dB on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Min	100 dB
Max	-100 dB
Backwards Compatibility SCPI	`[:SENSe]:CORRection:MS[:RF]:LOSS <rel_ampl>` `[:SENSe]:CORRection:MS[:RF]:LOSS?`

6.3.3 External Gain - BTS

Sets an external attenuation value for BTS (Base Transceiver Station) tests.

Remote Command	`[:SENSe]:CORRection:BTS[:RF]:GAIN <rel_ampl>` `[:SENSe]:CORRection:BTS[:RF]:GAIN?`

Example	`:CORR:BTS:GAIN 10`
	sets the Ext Gain value to 10 dB
	`:CORR:BTS:GAIN -10`
	sets the Ext Gain value to -10 dB (that is, a loss of 10 dB)

Notes	Does not auto return
Dependencies	The reference level limits are determined in part by the External Gain, Max Mixer Level, RF Atten This key is grayed out in modes that do not support BTS
Preset	This is unaffected by a Preset but is set to 0 dB on a "Restore Input/Output Defaults" or "Restore System Defaults->All" 0.00 dB, Gain
State Saved	Saved in instrument state
Min	-100 dB
Max	100 dB

Example	`:CORR:BTS:LOSS 10`
	sets the Ext Gain value to -10 dB, and subsequently querying :LOSS will give 10 dB
	`:CORR:BTS:LOSS -10`
	sets the Ext Gain value to 10 dB, and subsequently querying :LOSS will give -10 dB

Notes	A positive value of <rel_ampl> in the above command means a loss and a negative value indicates a gain Anytime :LOSS is set it sets :GAIN to the negative value of the parameter sent Anytime :LOSS is queried it gives the negative of :GAIN

Preset	This is unaffected by a Preset but is set to 0 dB on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Min	100 dB
Max	-100 dB
Backwards Compatibility SCPI	`[:SENSe]:CORRection:BTS[:RF]:LOSS <rel_ampl>` `[:SENSe]:CORRection:BTS[:RF]:LOSS?`

6.3.4 I Ext Gain

This function affects the I channel input. However, when Q Gain in I+jQ is set to Same as I Gain, this value is applied to both I and Q channel inputs.

Remote Command	`[:SENSe]:CORRection:IQ:I:GAIN <rel_ampl>` `[:SENSe]:CORRection:IQ:I:GAIN?`

Example	Set the I Ext Gain to 10 dB
	`:CORR:IQ:I:GAIN 10`
	Set the I Ext Gain to -10 dB (that is, a loss of 10 dB.)
	`:CORR:IQ:I:GAIN -10`

Dependencies	Not available unless option BBA is installed Grayed out when I/Q Path is Q Only
Preset	0 dB This is unaffected by a Preset but is set to 0 dB on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved	Yes
Min	-100 dB
Max	100 dB
Annotation	Ext Gain: <I Ext Gain> dB No annotation is shown when Input is not I/Q. Also not shown when I Ext Gain is 0.00 dB. I Ext Gain is not shown for Input Path Q Only. When the Input Path is Independent I and Q and I Ext Gain is not the same as Q Ext Gain, both are shown. "Ext Gain: <I Ext Gain> dB, <Q Ext Gain> dB"

6.3.5 Q Ext Gain

This function affects the Q channel input.

Remote Command	`[:SENSe]:CORRection:IQ:Q:GAIN <rel_ampl>` `[:SENSe]:CORRection:IQ:Q:GAIN?`
Example	Set the Q Ext Gain to 10 dB `:CORR:IQ:Q:GAIN 10`

	Set the Q Ext Gain to -10 dB (that is, a loss of 10 dB) `:CORR:IQ:Q:GAIN -10`
Dependencies	Not available unless option BBA is installed Grayed out when Q gain in I+jQ is set to Same as I Gain
Preset	0 dB This is unaffected by a Preset but is set to 0 dB on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved	Saved in instrument state
Min	-100 dB
Max	100 dB
Annotation	Ext Gain: <Q Ext Gain> dB No annotation is shown when Input is not I/Q. Also not shown when Q Ext Gain is 0.00 dB. Q Ext Gain is not shown for Input Path I Only or I+jQ. When Input Path is Independent I and Q and when I and Q Ext Gain are both non-zero but are the same the annotation will be "Ext Gain: <Ext Gain> dB" and when I Ext Gain is not the same as Q Ext Gain, both are shown. "Ext Gain: <I Ext Gain> dB, <Q Ext Gain> dB"

6.3.6 Q Gain in I+jQ

When Same as I Gain is selected, I Ext Gain value is applied to both I and Q channel input if the Input Path is I+jQ. When Independent is selected, I and Q Ext Gain values are applied to I and Q channel input independently.

Remote Command	`[:SENSe]:CORRection:IQ:Q:GAIN:COUPle ON | OFF | 0 | 1` `[:SENSe]:CORRection:IQ:Q:GAIN:COUPle?`
Example	`:CORR:IQ:Q:GAIN:COUP ON` `:CORR:IQ:Q:GAIN:COUP?`
Preset	`ON`
State Saved	Yes
Range	Same as I Gain|Independent

6.4 Data Source

Contains controls that let you select the source of the data being fed to the instrument analysis engine.

The ability to Save and Record files of I/Q data is an important feature of some X-Series applications, and the Data Source controls allow you to switch back and forth from actual data at the instrument input and recorded data from a File.

In addition, some measurements allow you to retain a single measurement record in a Capture Buffer, and some measurements allow you to retain a specified length data record internally in a Recorded data area.

So, for measurements that support it, the controls on this tab allow you to select data from the instrument inputs, a recalled recording File, the Capture Buffer, or the Recorded data area. For measurements that do not support these features, the **Data Source** tab does not appear, and if `:FEED:DATA SCPI` is sent, an Undefined Header error is generated.

The available choices depend on which measurement you are running. All measurements support Input; Capture Buffer and File are only available in certain measurements, as shown in the table below. The choice of the internal Recorded data area is only available in Pulse Mode.

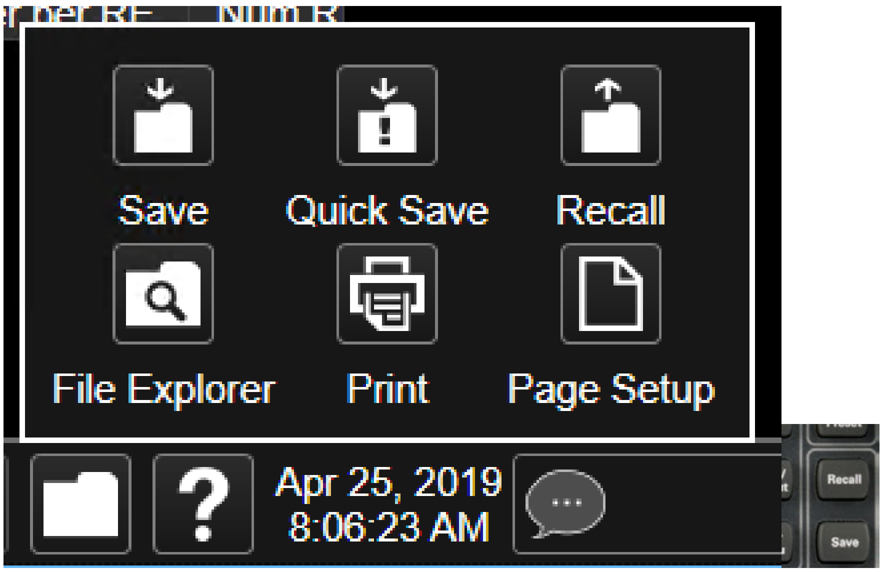
Measurement	Capture Buffer	File
WCDMA Code Domain	x	
WCDMA Mod Accuracy	x	
VMA Digital Demod		x
VMA Custom OFDM		x
5G NR Modulation Analysis		x
FDD LTE-A Modulation Analysis		x
TDD LTE-A Modulation Analysis		x
WLAN Modulation Analysis	x	x
WLAN Spectral Flatness		x
WLAN MIMO Modulation Analysis		x
Analog Demod AM		x
Analog Demod PM		x
Analog Demod FM		x
Analog Demod FM Stereo		x
Bluetooth Transmit Analysis	x	x
IoT & SRComms LoRa CSS Demod		x

How to Record and Playback I/Q Data

In several Demod measurements (and certain other measurements), it is possible to record I/Q data to files on your hard drive or network, and then recall these files for subsequent playback. These are the measurements shown in the table above with an "x" in the **File** column.

The Recording and Playback of signal data files is a multi-step process which involves controls in several menus (listed below).

Menus involved in Record/Playback:



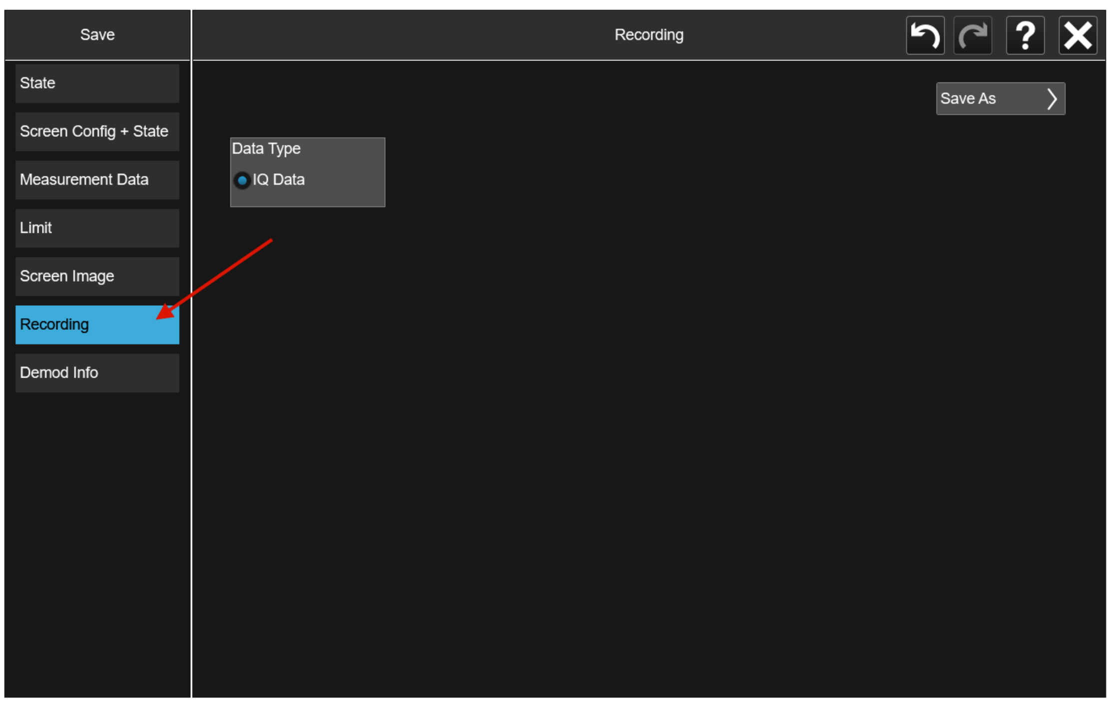
- **Save**, **Recording** (under the **Save** hardkey or the **Save** icon in the **File** panel)
- **Recall**, **Recording** (under the **Recall** hardkey or the **Recall** icon in the **File** panel)
- **Sweep**, **Recording** tab
- **Sweep**, **Playback** tab
- **Input/Output**, **Data Source** tab (this tab)

Saving a Recording

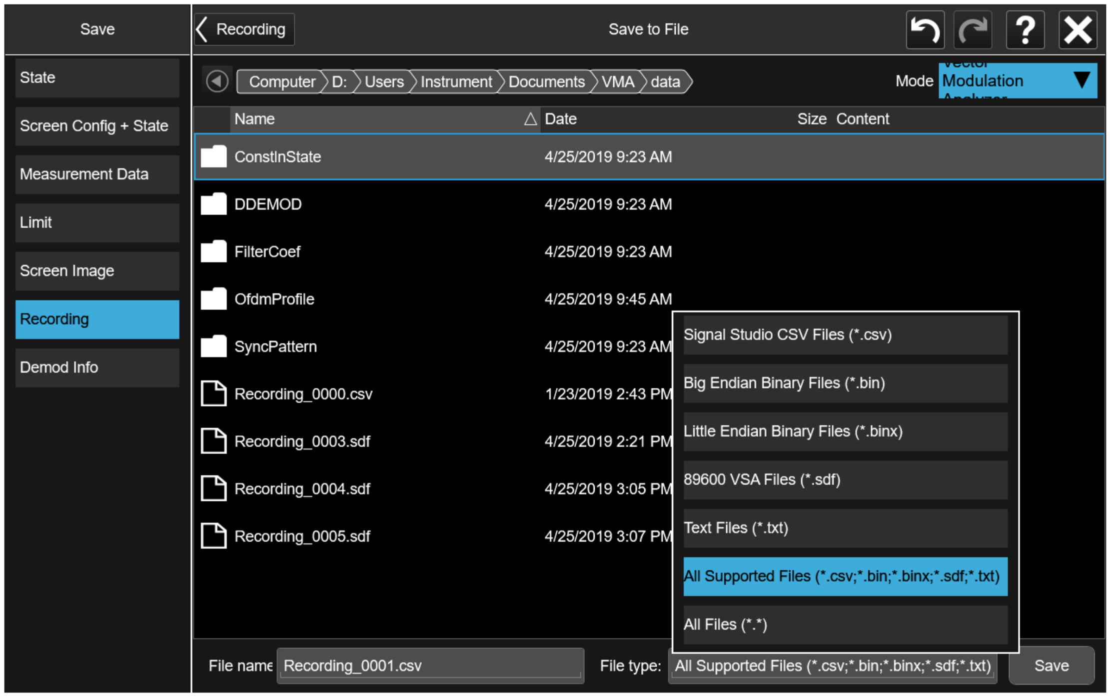
When you save a recording, a certain number of measurement records are saved to a Recording file. The amount of data that is saved varies depending on the measurement and measurement settings. The following example uses VMA Digital Demod to illustrate the process.

If you press the **Recording** tab in the **Sweep** menu, you will see a certain number of parameters displayed on the menu panel. Before you save a Recording, these parameters are all 0, as shown below:

To save the data for the current measurement, press the **Save** hardkey (or the **Save** icon in the **File** panel) and press the **Recording** tab on the left side of the **Save** panel:

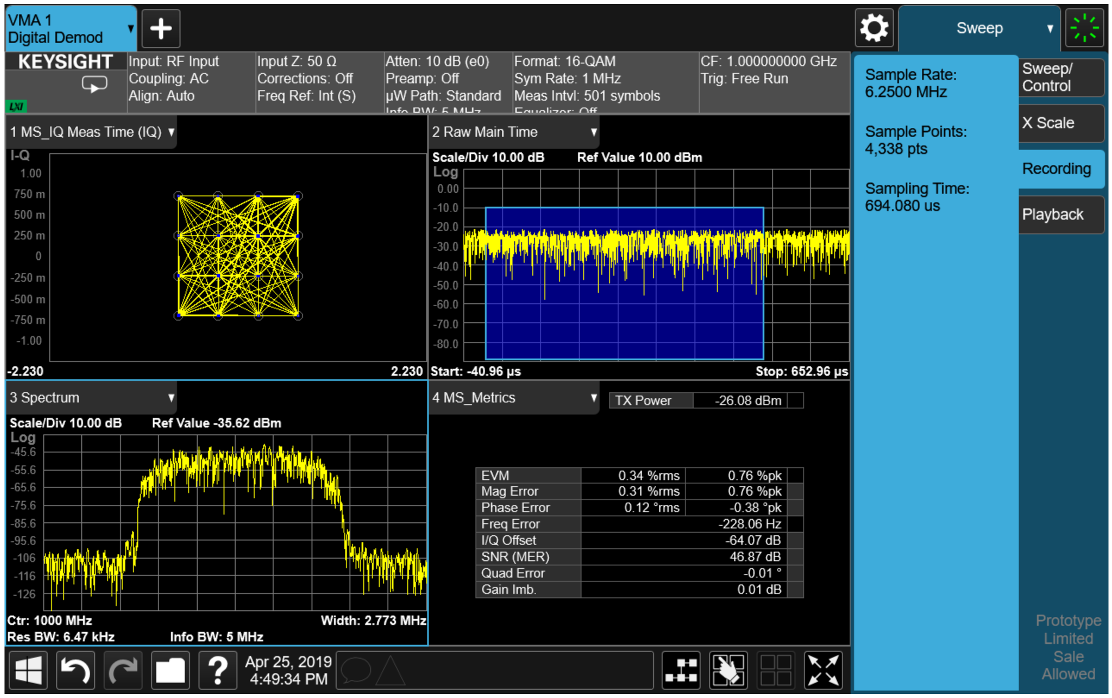


Then press **Save As** and choose the file type you would like to use for the Save (`CSV`, `SDF`, `TXT`, `BIN`, `BINX`). You can find details of the file formats in **Save > Recording**.



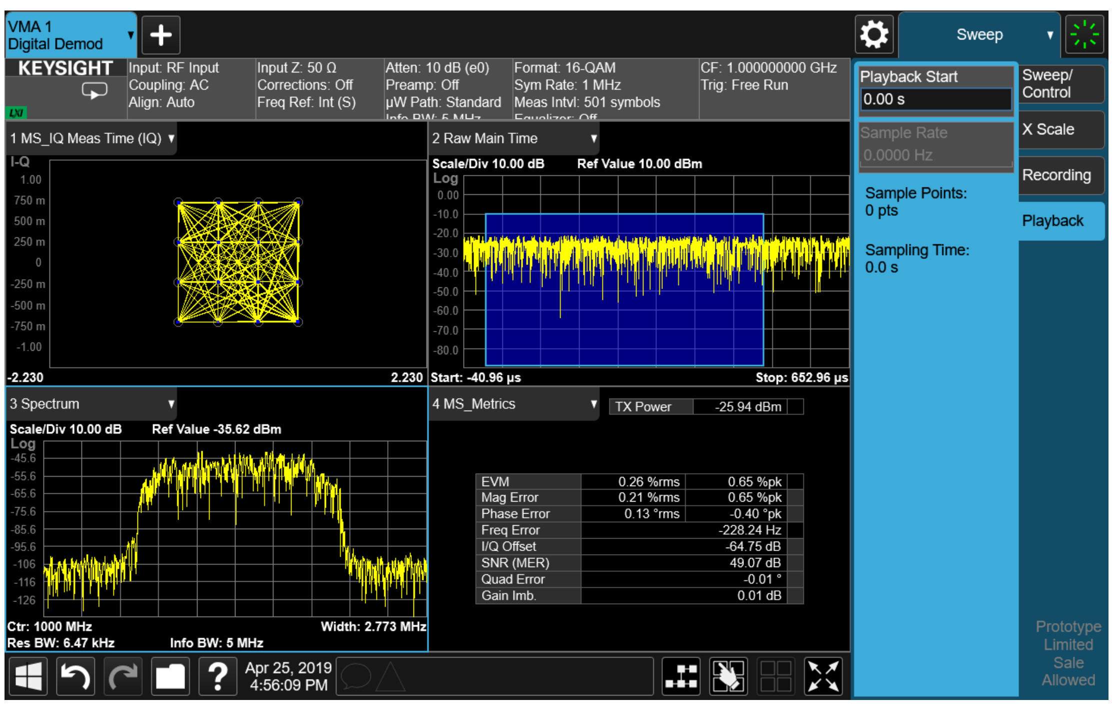
Then press **Save** to save the raw I/Q data of the current measurement.

After the Save, you will see that the data on the Recording panel has changed to describe the data in the file you just saved. You should note this data in case you need to refer to it when you recall the file, particularly as not all file formats include the Sample Rate that was used to save the data. In particular, `BIN` and `BINX` files do not include sampling rate information inside the file, so after recalling one of these file types, you will need to set the Sample Rate manually in the **Sweep**, **Playback** menu.



Step 2: Recalling a Recording

If you go press the **Playback** tab in the **Sweep** menu, you will see a certain number of parameters displayed on the menu panel. Before you recall a Recording, these parameters are all 0, as shown below:



To recall a Recording, press the **Recall** hardkey (or the **Recall** icon in the **File** panel) and press the **Recording** tab on the left side of the **Recall** panel. Then press **Recall From** and choose the file you would like to recall. This will read the raw I/Q data from the specified file and feed it to the current measurement.

After the Recall, you will see that the data on the Recording panel has changed to describe the data in the file you just recalled:

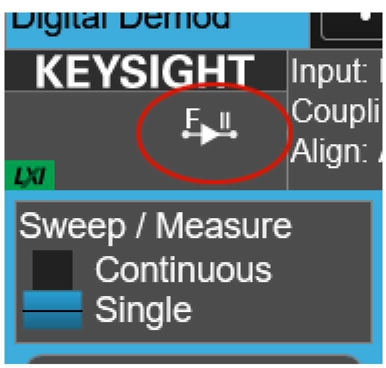
Note that the **Sample Rate** key is grayed out if the file type you loaded contains Sample Rate information. `BIN` and `BINX` files do not include sampling rate information inside the file, so after recalling one of these file types, you will need to set the Sample Rate. You should have noted the Sample Rate that was displayed on the **Sweep**, **Recording** menu panel after you saved the file.

After the recall is performed, you will also see that the **Data Source** control has switched to **File**. You can see this on the **Data Source** menu panel, and also on the dropdown from the Measurement Bar on the far left side of the instrument:

You can also see that the control indicator on the measurement bar has an "F" in it and the playback symbol (right facing triangle) displayed:

This indicates that the instrument is in **Continuous Playback** mode and is using data from a File.

If you select **Single** in the control dropdown, the indicator will change to show that it is in **Single Pause** mode as below:



You can now examine data in the recorded file which you loaded. How you do this depends on whether you are in **Continuous Playback** mode or **Single Pause** mode.

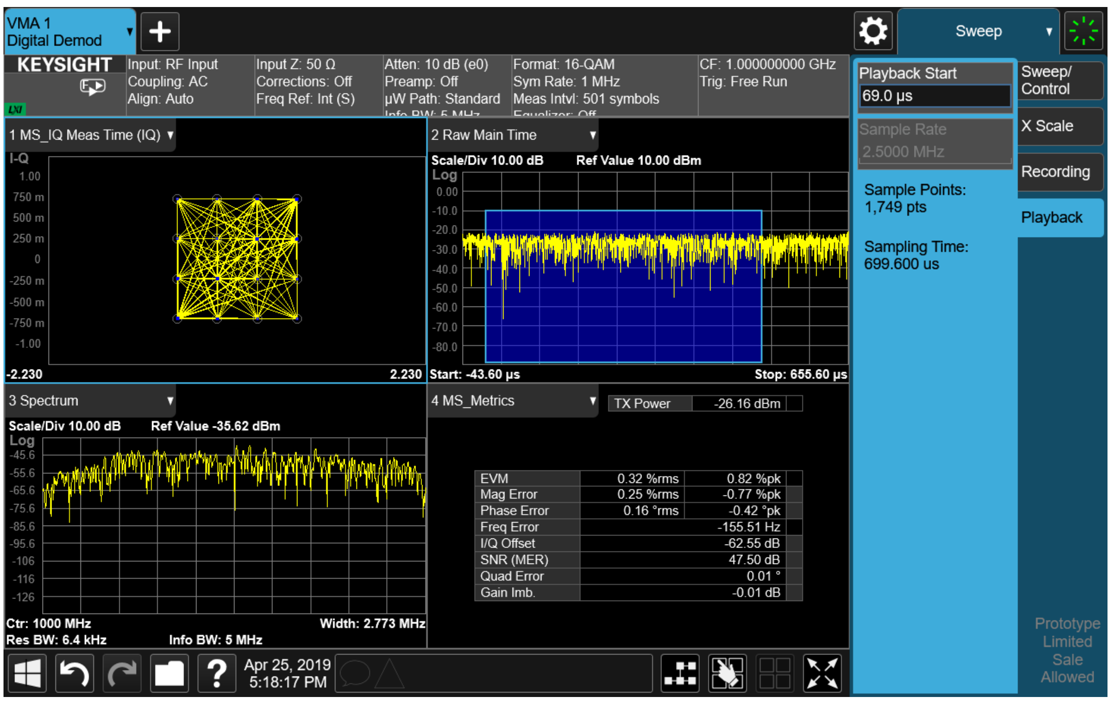
If you wish to return to looking at data at the instrument input, simply change the **Data Source** control from **File** back to **Input**.

Looking at your Recorded data

To examine the data you loaded, go to the **Playback** menu panel under **Sweep**. How you proceed from here depends on whether you are in **Continuous Playback** mode or **Single Pause** mode.

Continuous Playback mode

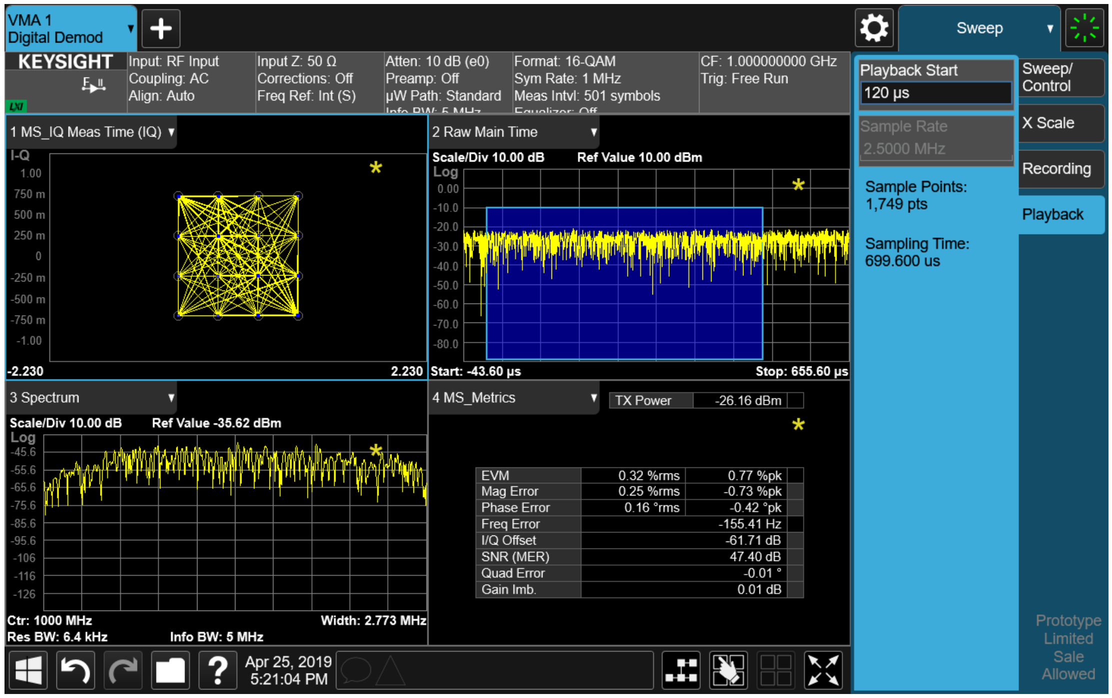
In this mode, turn the knob clockwise or use the **Up** key on the front panel to move through successive records in the recording. You will see the Playback Start control change from 0 to successively higher values as you move through the records.



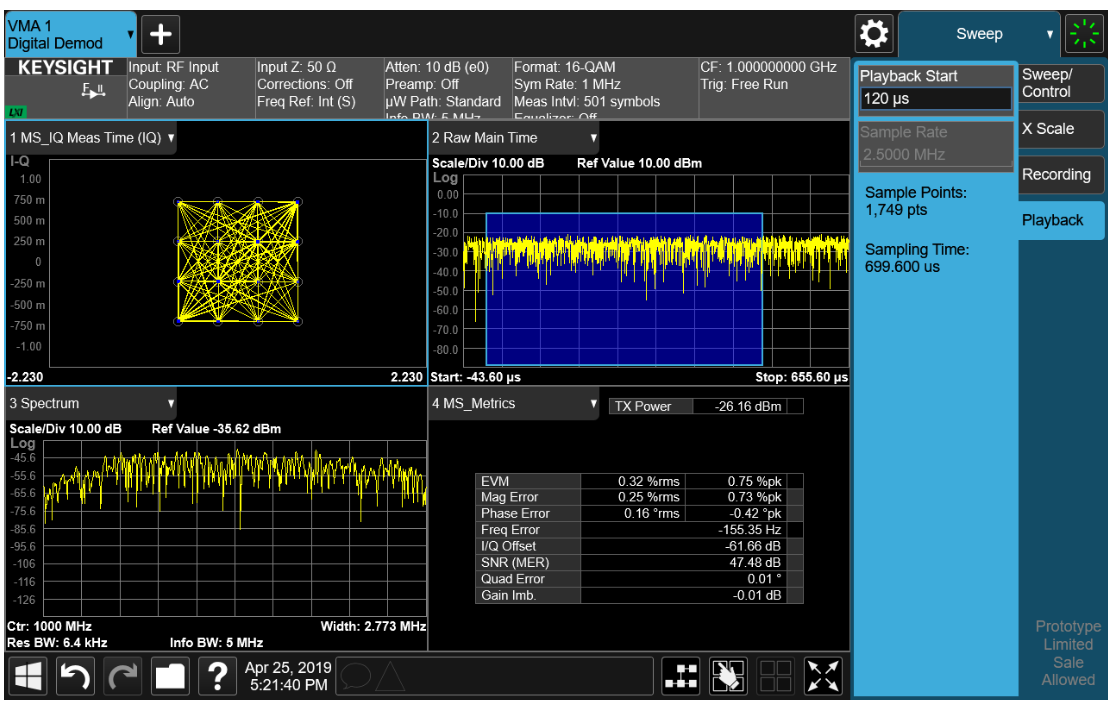
Single Pause mode

In this mode, you can only look at one record. Set the Playback Start time to the desired offset from zero and press **Restart**. A single record will be displayed.

Note that until you press **Restart**, the “invalid data” indicator (yellow asterisk) will be displayed in each window as below:



Once you hit **Restart**, the invalid data indicator will disappear, as below:



6.4.1 Data Source

Allows you to select the input to the analysis engine. The following options are available:

Input	INPut	A hardware input signal (the default). This causes the measurement to take its input data from the hardware input (for example RF, I/Q,orEXTMixer) currently selected on the Input tab under Input/Output
Capture Buffer	STORed	Data stored in a storage buffer from a single earlier acquisition. Selecting "Capture Buffer" allows you to use data that has been previously stored using the "Current Meas -> Capture Buffer" control. You can make a measurement and then, if you want to make a different measurement using the exact same data, store the raw data using the "Current Meas -> Capture Buffer" control and select “Capture Buffer” as the Data Source, then switch to the other measurement. You must have previously done a "Current Meas -> Capture Buffer" before the Capture Buffer choice is available for use
Recorded	RECorded	Data recorded to memory from a set of earlier acquisitions. Selecting “Recorded” lets you use the record buffer, previously filled by using the “Recording” tab in the Sweep menu, as the input (only available in the Pulse measurement)
File	FILE	Data recorded on a storage device from a set of earlier acquisitions. If you load a Recording using Recording under the Recall key, “File” is automatically selected, which lets you use the recorded data as though it were coming from the Input

See Data Source for a table of available choices on a per-measurement basis.

Remote Command	`[:SENSe]:FEED:DATA INPut | STORed | RECorded | FILE` `[:SENSe]:FEED:DATA?`

Example	`:FEED:DATA INP`
	causes the measurement to look at the input selection
	`:FEED:DATA STOR`
	causes stored measurement data to be used with a different measurement that supports this
	`:FEED:DATA?`

Dependencies	If you switch to a measurement that does not support the currently selected Data Source, the instrument switches Data Source to "Input". Attempting to select an unavailable Data Source via SCPI generates an error The Data Source setting is independent for each mode. Not all Data Sources are available in all modes
Preset	This is unaffected by Preset but is set to `INPut` on **Restore Input/Output Defaults** or **Restore System Defaults->All**
State Saved	Saved in instrument state
Backwards Compatibility SCPI	`[:SENSe]:FEED:SOURce INPut | STORed` `[:SENSe]:FEED:SOURce?`

6.4.2 Current Meas -> Capture Buffer

Pressing this control stores the raw data of one measurement in the internal memory of the instrument where it can then be used by a different measurement by pressing **Stored Data**. When raw data is stored, then the data source selection switch automatically changes to **Stored Data**. Stored raw data cannot be directly accessed. There is no save/recall function to save the raw data in an external media. If you want to get the stored raw data, you must first perform a measurement using the stored raw data. Now you can access the used raw data, which is the same as stored raw data, using the `:FETch` or `:READ` commands.

Remote Command	`[:SENSe]:FEED:DATA:STORe`
Example	`:FEED:DATA:STOR` stores recorded data
Notes	Command only, there is no query
Dependencies	Grayed-out in the SA measurement
Backwards Compatibility SCPI	`[:SENSe]:FEED:SOURce:STORe`

6.5 Corrections

Accesses the **Corrections** menu, which lets you select, turn on and off, and configure and edit Corrections. You can also select, turn on and off and configure Complex Corrections and Corrections Groups.

Corrections arrays provide Amplitude Corrections, and can be enteredby the user, sent over SCPI, or loaded from a file. They allow you to correct the response of the instrument for various use cases. X-Series supports eight separate Corrections arrays, each of which can contain up to 2000 points. They can be turned on and off individually and any or all can be on at the same time. Corrections Groups let you load several (Amplitude) Corrections at a time into a Correction Group.

Complex Correction arrays provide both Amplitude and Phase Corrections, and can be loaded from a file. Currently the file type supported has the extension .s2p. Complex Corrections operate in much the same manner as Corrections - the X-series supports eight separate Complex Corrections arrays, each of which can contain up to 30000 points, and each Complex Correction can be turned on and off individually and any or all can be on at the same time. Some Modes, such as Spectrum Analyzer Mode, only support only the Amplitude (Magnitude) element of Complex Corrections. Other Modes, such as IQ Analyzer Mode and VMA, support both the Amplitude and Phase elements of Complex Corrections. If a Complex Correction is turned on in a Measurement that does not support Phase, only the Magnitude information will be used for the Correction.

Trace data is in absolute units and corrections data is in relative units. You can edit the Corrections arrays in the Corrections editor using the “Edit Correction” dialog (you cannot edit the Complex Corrections arrays, they can only be loaded from a file).

In zero span measurements (such as Zero Span in the Swept SA measurement), where the frequency is always the center frequency of the instrument, we apply the (interpolated) correction for the center frequency to all points in the trace. In the event where there are two correction amplitudes at the center frequency, we apply the first one in the table.

Note that the corrections are applied as the data is taken; therefore, a trace in **View** (Update Off) will not be affected by changes made to the corrections after the trace is put in **View**.

The **Corrections** tab only appears in Modes and Measurements that support Corrections and/or Complex Corrections. In other Modes, sending SCPI for Corrections and/or Complex Corrections will generate a Settings Conflict message

Corrections and Complex Corrections arrays are not affected by a Preset, because they are in the Input/Output system. They also survive shutdown and restarting of the instrument application, which means they will survive a power cycle. Corrections and Complex Corrections arrays are reset (deleted) by Restore Input/Output Defaults. The following commands delete the correction registers:

- User Preset the current mode `:SYST:PRES:USER`
- User Preset all modes `:SYST:PRES:USER ALL`
- Full mode preset `:SYST:PRES:FULL`
- Restore power on default `:SYST:DEF PON`
- Restore all defaults `:SYST:DEF`; `:SYST:DEF ALL`
- Preset Input/Output variables `:SYST:DEF INP`
- Delete all corrections `:CORR:CSET:ALL:DEL`

The instrument Save State and Save Screen Config + State includes the data in the correction registers. If a measurement setup is saved and then recalled at a later time, the correction data will be recalled as well. This feature is useful for recreating the full instrument condition, but the user has to be careful that the recalled correction data is the desired data. For example, if the state is recalled on a different instrument different correction data might be needed. Or if the system is recalibrated, the correction data in the save state would then be stale. Applications that use measured data for corrections will generally need to reload the correction data from file whenever a state is recalled; this ensures that the correction data is current and applies to hardware in use.

In the EXM and EXF, on the RF Input/Output panel, there are two full-duplex RF ports (RFIO1 and RFIO2), RF Input and RF Output. When RF Input is selected, it will correspond to one input port from two half-duplex RF ports(RFIO3 and RFIO4), and when RF Output is selected, it will correspond to one output port from two half-duplex RF ports(RFIO3 and RFIO4). So there are 8 sets of corrections in all that can be applied to the RF ports. Ports cannot share the same set of corrections but a single port can have multiple corrections applied to it. The correction data is applied to incoming signals as well as transmitted signals and is in the form of a list of spot frequencies and amplitude correction levels.

Annotation	In EMI Mode, you can choose to display the correction details in the graph area by turning on Display, Annotation, Correction Annotation

6.5.1 Select Correction

Specifies the selected correction. The term "selected correction" is used throughout this document to specify which correction will be affected by the functions.

Notes	The selected correction is remembered even when not in the correction menu
Preset	Set to Correction 1 by Restore Input/Output Defaults

6.5.2 Correction On/Off

Turning the Selected Correction from OFF to ON allows the values in it to be applied to the data. This state transition also automatically turns on "Apply Corrections" (sets it to ON), otherwise the correction would not take effect.

A new sweep is initiated if an amplitude correction is switched on or off. Note that changing, sending or loading corrections data does *not* directly initiate a sweep, however in general these operations will turn corrections on, which *does* initiate a sweep.

Remote Command	`[:SENSe]:CORRection:CSET[1]|2|...|16[:STATe] ON | OFF | 1 | 0` `[:SENSe]:CORRection:CSET[1]|2|...|16[:STATe]?`
Example	`:SENS:CORR:CSET1 ON`
Dependencies	Changing this from OFF to ON automatically turns on "Apply Corrections" Note that if any Correction is turned on that has a transducer unit set (other than “None”), the Y-Axis Unit of the instrument is forced to that Transducer Unit. All other Y-Axis Unit choices are grayed-out This command will generate an “Option not available” error unless you have the proper option installed in your instrument
Preset	Not affected by a Preset. Set to OFF by **Restore Input/Output Defaults**
State Saved	Saved in instrument state
Annotation	If *any* Correction is turned on, Corr in the Meas Bar will display in amber to indicate Corrections are in use
Backwards Compatibility Notes	Unlike legacy instruments, Preset does not turn Corrections off (**Restore Input/Output Defaults** does)

6.5.3 Correction Port

Maps one of the sets of corrections to a particular I/O port. This control allows any Input port (including External Mixing, BBIQ, the RF2 input, etc.) to be mapped to a specific Correction, so that the Correction is only applied when that Port is being used by the current Screen. You can also map any internal source Output port to a specific Correction.

When Current Input (CINPut) is selected for **Correction Port**, it chooses the current input port of the current Screen for the selected Correction. In other words, the Correction applies to whichever input is selected. If the input changes, the correction applies to the new input.

When using the VXT M9410A/11A with Remote Radio Heads (such as the Keysight M1740A mmWave Transceiver for 5G), the choices in the dropdown menu appear as :

Head h RFHD p

For example, if you have two Radio Heads (numbered 1 and 2), each of which have two RF half duplex ports, the choices for these ports appear as below:

Head and Port	Choice in dropdown	SCPI parameter
Head 1, port RF Tx/Rx 1	Head 1 RFHD 1	RRH1RFHD1
Head 1, port RF Tx/Rx 2	Head 1 RFHD 2	RRH1RFHD2
Head 2, port RF Tx/Rx 1	Head 2 RFHD 1	RRH2RFHD1
Head 2, port RF Tx/Rx 2	Head 2 RFHD 2	RRH2RFHD2

Remote Command	[:SENSe]:CORRection:CSET[1]|2|...|16:RF:PORT CINPut | RFIN | RFIN2 | AIQ | EMIXer | RFIO1 | RFIO2 | RFIO3 | RFIO4 | RFOut | RFHD | RFFD | ANT | GEN | TR | A1 | A2 | A3 | B1 | B2 | B3 | IFIO1 | IFIO2 | RRHnRFHDp | ERFIN [:SENSe]:CORRection:CSET[1]|2|...|16:RF:PORT?
Example	:CORR:CSET:RF:PORT CINP Set Correction Port for Correction 1 to apply to the currently selected input :CORR:CSET4:RF:PORT RRH1RFHD2 Set Correction Port for Correction 4 to apply to Radio Head 1, RF Tx/Rx Port 2
Notes	The RF node in this command is retained for backwards compatibility, even though the scope of the Correction Port command goes beyond the RF ports and includes BBIQ and External Mixing
Dependencies	RFIN2|AIQ|EMIXer are only available on C/E/M/P/UXA analyzers with the appropriate options loaded RFOut is only available on modular products such as VXT ANT, GEN and TR are only available in VXT and only when the M9470A module is installed, such as in the M8920A. Option “HDX” is required to enable the TR port RFHD and RFFD are only available on VXT, option HDX is required to enable RFHD port and option FDX is required to enable RFFD port, RFFD is not available on M9421A RFIO3 and RFIO4 are only available on EXM with hardware M9431A RFIN and RFOut are not available on EXM with hardware M9431A ERFIN requires option “EXW”
Preset	Unaffected by Preset. Set as below by Restore Input/Output Defaults: For VXT: RFIN For EXM, EXF: RFIO1 For all other models: CINPut (the currently selected input)
State Saved	Saved in State

Parameters, notes and examples. Note that the presence of these ports is highly hardware dependent.

Correction Port	Example	Note
Current Input	:CORR:CSET:RF:PORT CINP	The correction will be applied to whichever input is currently selected in the Input menu

Correction Port	Example	Note
RF Input	`:CORR:CSET:RF:PORT RFIN`	Main RF Port Not available on EXM with hardware M9431A
RF Input 2	`:CORR:CSET:RF:PORT RFIN2`	Second RF Port, labeled RF Input 2 Only available on certain instruments. Not available on modular instruments
BBIQ input	`:CORR:CSET:RF:PORT AIQ`	Requires option BBA Not available on modular instruments
External Mixer	`:CORR:CSET:RF:PORT EMIX`	Requires option EXM Not available on modular instruments
Antenna	`:CORR:CSET:RF:PORT ANT`	Antenna input port on M9470A, labeled Ant
Generator	`:CORR:CSET:RF:PORT ANT`	Generator output port on M9470A, labeled Gen
T/R	`:CORR:CSET:RF:PORT TR`	T/R port on M9470A, labeled T/R
RF Full Duplex	`:CORR:CSET:RF:PORT RFFD`	On modular instruments, labeled RFFD. Option “FDX” is required to enable RFFD port
RF Half Duplex	`:CORR:CSET:RF:PORT RFHD`	On modular instruments, labeled RFHD. Option “HDX” is required to enable RFHD port
A1	`:CORR:CSET:RF:PORT A1`	On E7760
A2	`:CORR:CSET:RF:PORT A2`	On E7760
A3	`:CORR:CSET:RF:PORT A3`	On E7760
B1	`:CORR:CSET:RF:PORT B1`	On E7760
B2	`:CORR:CSET:RF:PORT B2`	On E7760
B3	`:CORR:CSET:RF:PORT B3`	On E7760
IFIO1	`:CORR:CSET:RF:PORT IFIO1`	On E7760
IFIO2	`:CORR:CSET:RF:PORT IFIO2`	On E7760
RF Output	`:CORR:CSET:RF:PORT RFO`	Appears on some modular instruments Not available on EXM with hardware M9431A
RFIO1	`:CORR:CSET:RF:PORT RFIO1`	Appears on some modular instruments
RFIO2	`:CORR:CSET:RF:PORT RFIO2`	Appears on some modular instruments
RFIO3	`:CORR:CSET:RF:PORT RFIO3`	Only available in EXM with hardware M9431A
RFIO4	`:CORR:CSET:RF:PORT RFIO4`	Only available in EXM with hardware M9431A
GPS out	`:CORR:CSET:RF:PORT GPS`	Appears on some modular instruments
GNSS out	`:CORR:CSET:RF:PORT GNSS`	Appears on some modular instruments

6.5.4 Correction Direction

Selects whether corrections will be applied when the device associated with the specified correction is being used as an input, an output or in both directions. The choices are:

INPut	Correct the port only when the port is used as an Input
OUTPut	Correct the port only when the port is used as an Output
BOTH	Correct the port when the port is used as either an Input or an Output (or both)

A port that is only an Output is always corrected as an output if the Correction is On. A port that is only an Input is always corrected as an Input if the Correction is On. For a port that can be either an Input or an Output (or both), the Correction is determined by the Correction Direction setting. The default is BOTH, which means that by default a port that can be either an Input or an Output (or both) is corrected in both directions if the Correction is On.

Remote Command	[:SENSe]:CORRection:CSET[1]|2|...|16:DIRection INPut | OUTPut | BOTH [:SENSe]:CORRection:CSET[1]|2|...|16:DIRection?
Example	:CORR:CSET2:DIR INP
Dependencies	The Correction Direction control only appears when Correction Port selects a port that can either function as an input or an output (or both simultaneously), such as RFIO HD, RFFD or T/R. If the SCPI command is sent to any other port, it is accepted but ignored
Preset	Not affected by a Preset. Set to BOTH by **Restore Input/Output Defaults**
State Saved	Saved in State
Backwards Compatibility SCPI	The following SCPI results in the selection of BOTH (included for compatibility with early Multitouch implementations): [:SENSe]:CORRection:CSET[1]|2|...|8:DIRection BIDirectiona included for compatibility with A-models modular products: [:SENSe]:CORRection:CSET[1]|2|...|8:RF:PORT:RFFD SOURce | ANALyzer | BOTH [:SENSe]:CORRection:CSET[1]|2|...|8:RF:PORT:RFIO1 SOURce | ANALyzer | BOTH [:SENSe]:CORRection:CSET[1]|2|...|8:RF:PORT:RFIO2 SOURce | ANALyzer | BOTH [:SENSe]:CORRection:CSET[1]|2|...|8:RF:PORT:RFIO3 SOURce | ANALyzer | BOTH [:SENSe]:CORRection:CSET[1]|2|...|8:RF:PORT:RFIO4 SOURce | ANALyzer | BOTH

6.5.5 Edit Correction

Invokes the integrated editing facility for this correction set.

When entering the menu, the editor window turns on, the selected correction is turned **On**, **Apply Corrections** is set to **On**, the amplitude scale is set to **Log**, and the Amplitude Correction ("Ampcor") trace is displayed. The actual, interpolated correction trace is shown in green for the selected correction. Note that since the actual interpolated correction is shown, the correction trace may have some curvature to it. This trace represents only the correction currently being edited, rather than the total, accumulated amplitude correction for all amplitude corrections which are currently on, although the total, accumulated correction for all corrections which are turned on is still applied to the data traces.

Because corrections data is always in dB, but the Y-axis of the instrument is in absolute units, it is necessary to establish a reference line for display of the Corrections data. The reference line is halfway up the display and represents 0 dB of correction. It is labeled "0 dB CORREC". It is drawn in blue.

Corrections data is always in dB. Whatever dB value appears in the correction table represents the correction to be applied to that trace at that frequency. So if a table entry shows 30 dB that means we ADD 30 dB to each trace to correct it before displaying it. By definition all points are connected. If a gap is desired for corrections data, enter 0 dB.

Note that a well-designed Corrections array should start at 0 dB and end at 0 dB. This is because whatever the high end point is will be extended to the top frequency of the instrument, and whatever the low end point is will be extended down to 0 Hz. So for a Corrections array to have no effect outside its range, you should start and end the array at 0 dB.

NOTE **The table editor only operates properly if the instrument is sweeping, because its updates are tied to the sweep system. Thus, you should not try to use the editor in single sweep, and its response will be sluggish during compute-intensive operations like narrow-span FFT sweeps.**

When exiting the edit menu (by using the **Return** key or by pressing an instrument front-panel key), the editor window turns off and the Ampcor trace is no longer displayed; however, **Apply Corrections** remains **On**, any correction that was on while in the editor remains on, and the amplitude scale returns to its previous setting.

Corrections arrays are not affected by a Preset, because they are in the Input/Output system. They also survive shutdown and restarting of the instrument application, which means they will survive a power cycle.

When editing a correction, the editor remembers which correction and which element in the correction array you were editing, and returns you to that correction and that element when you return to the editor after leaving it.

6.5.5.1 Select Correction

Specifies the selected correction. The term "selected correction" is used throughout this document to specify which correction will be affected by the functions.

Notes	The selected correction is remembered even when not in the correction menu
Preset	Set to Correction 1 by Restore Input/Output Defaults

6.5.5.2 Frequency

Touching a frequency value makes the touched row the current row and lets you edit the frequency.

Min	0
Max	1 THz

6.5.5.3 Amplitude

Touching an amplitude value makes the touched row the current row and lets you edit the amplitude.

Min	-1000 dB
Max	1000 dB

6.5.5.4 Go to Row

Lets you move through the table to edit the desired point.

Min	1
Max	2000

6.5.5.5 Insert Row Below

Inserts a point below the current point. The new point is a copy of the current point and becomes the current point. The new point is not yet entered into the underlying table, and the data in the row is displayed in light gray. To enter the row into the table, press the Enter key, or tap either value and edit it.

6.5.5.6 Delete Row

Deletes the currently-selected point, whether or not that point is being edited, and selects the Navigate functionality. The point following the currently-selected point (or the point preceding if there is none) will be selected.

6.5.5.7 Scale X Axis

Matches the X-Axis to the selected Correction, as well as possible. Sets the Start and Stop Frequency to contain the minimum and maximum Frequency of the selected Correction. The range between Start Frequency and Stop Frequency is 12.5% above the range between the minimum and maximum Frequency, so that span exceeds this range by one graticule division on either side. If in zero-span, or there is no data in the Ampcor table, or the frequency range represented by the table is zero, no action is taken. Standard clipping rules apply if the value in the table is outside the allowable range for the X-Axis.

Dependencies	If either the first or last point in the array is outside the frequency range of the current input, an error message is generated: "-221. Settings conflict; Start or Stop Freq out of range for current input settings"

6.5.5.8 Delete Correction

Deletes the correction values for this set. When this key is pressed, a prompt appears on the screen saying "Please press **Enter** or **OK** key to delete correction. Press **ESC** or **Cancel** to close this dialog." The deletion is only performed if you press **OK** or **Enter**.

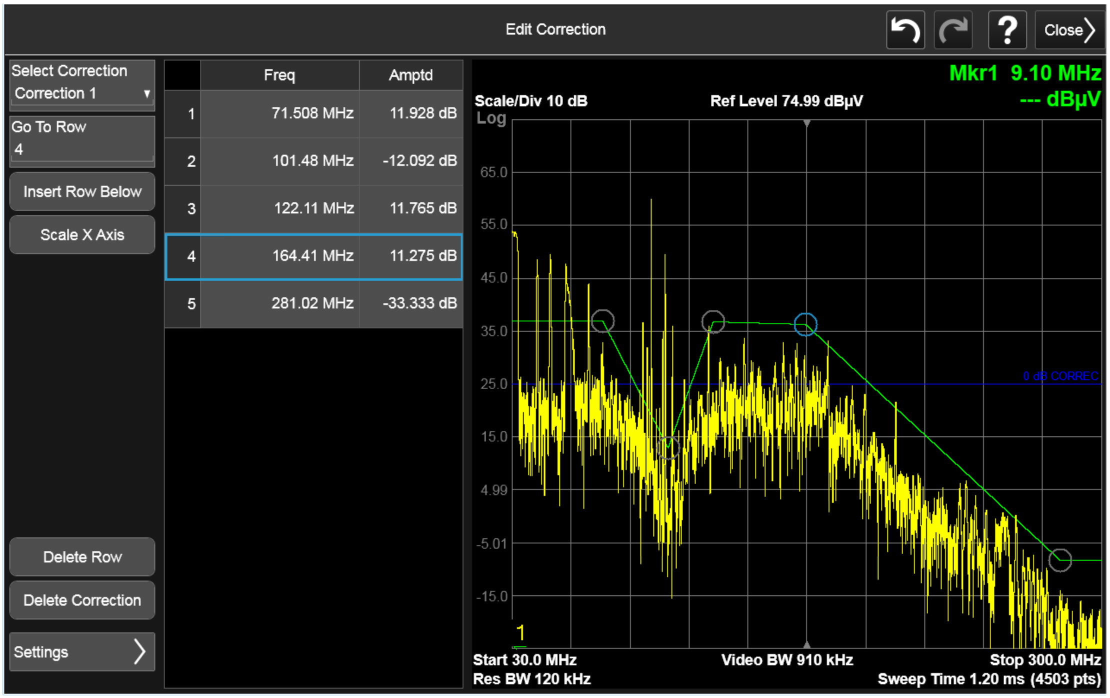
Remote Command	`[:SENSe]:CORRection:CSET[1]|2|...|16:DELete`

Example	`:CORR:CSET:DEL`
	`:CORR:CSET1:DEL`
	`:CORR:CSET4:DEL`

Notes	Pressing this key when no corrections are present is accepted without error

6.5.5.9 Correction Graph

The **Correction Graph** embedded in the Edit Correction dialog lets you edit the Amplitude Correction visually. Each node in the Correction is represented by a gray circle. The current node has a blue outline in the table and a blue circle in the graph. Touch any circle and drag it where you want it to go.



6.5.6 Edit Correction Settings

Opens another menu page that lets you set certain properties of the selected correction, such as Interpolation, Transducer Unit, Description and Comment.

6.5.6.1 Select Correction

Specifies the selected correction. The term "selected correction" is used throughout this document to specify which correction will be affected by the functions.

Notes	The selected correction is remembered even when not in the correction menu
Preset	Set to Correction 1 by Restore Input/Output Defaults.

6.5.6.2 Freq Interpolation

Controls how the correction values per-bucket are calculated. We interpolate between frequencies in either the logarithmic or linear scale.

This setting is handled and stored individually per correction set.

VXT models M9410A/11A/15A only support Linear Interpolation. For more details, see "Interpolation" on page 2289

Remote Command	`[:SENSe]:CORRection:CSET[1]|2|...|16:X:SPACing LINear | LOGarithmic` `[:SENSe]:CORRection:CSET[1]|2|...|16:X:SPACing?`

Example	`:CORR:CSET:X:SPAC LIN`
Preset	Unaffected by a Preset. Set to Linear by Restore Input/Output Defaults
State Saved	Saved in instrument state

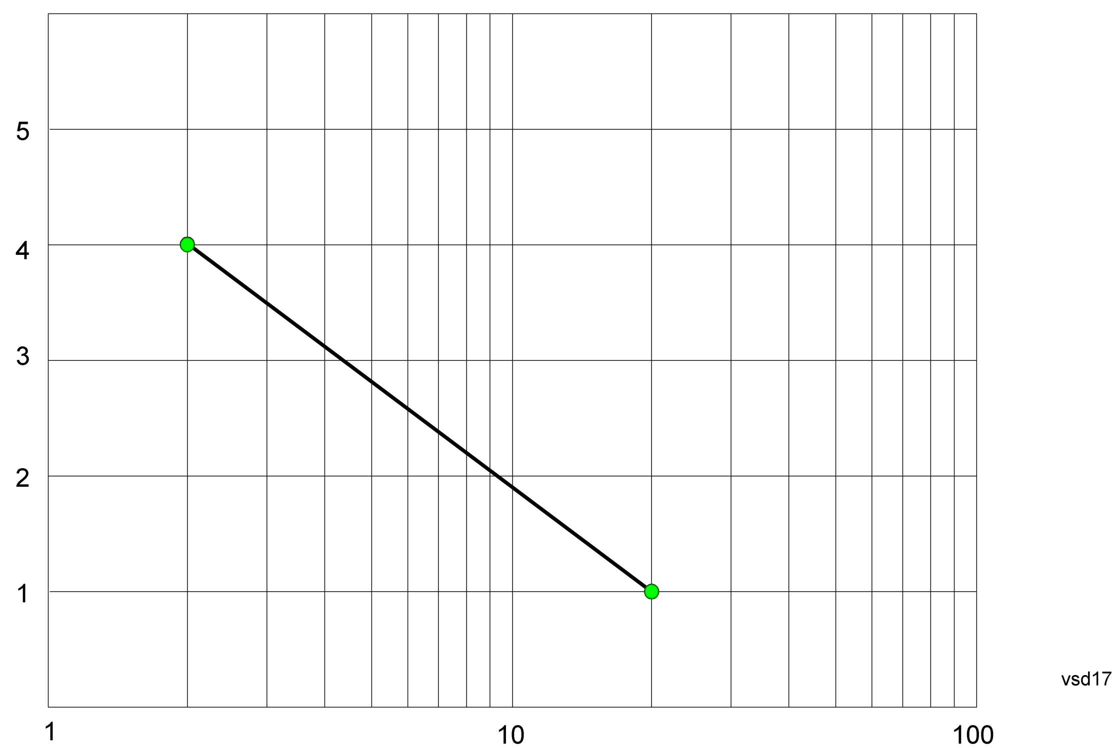
Interpolation

For each bucket processed by the application, all of the correction factors at the frequency of interest (center frequency of each bucket) are summed and added to the amplitude. All trace operations and post processing treat this post-summation value as the true signal to use.

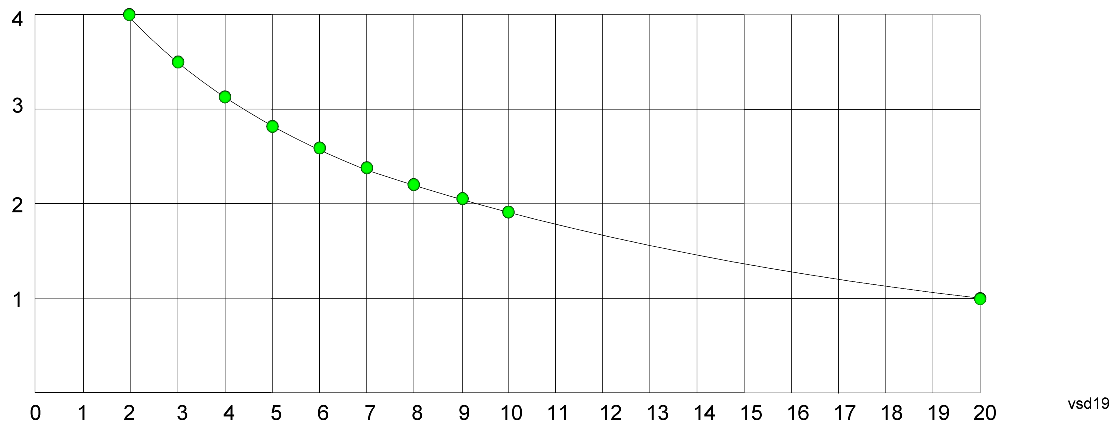
To effect this correction, the goal, for any particular start and stop frequency, is to build a correction trace, whose number of points matches the current Sweep Points setting of the instrument, which will be used to apply corrections on a bucket by bucket basis to the data traces.

For amplitudes that lie between two user specified frequency points, we interpolate to determine the amplitude value. You may select either linear or logarithmic interpolation between the frequencies.

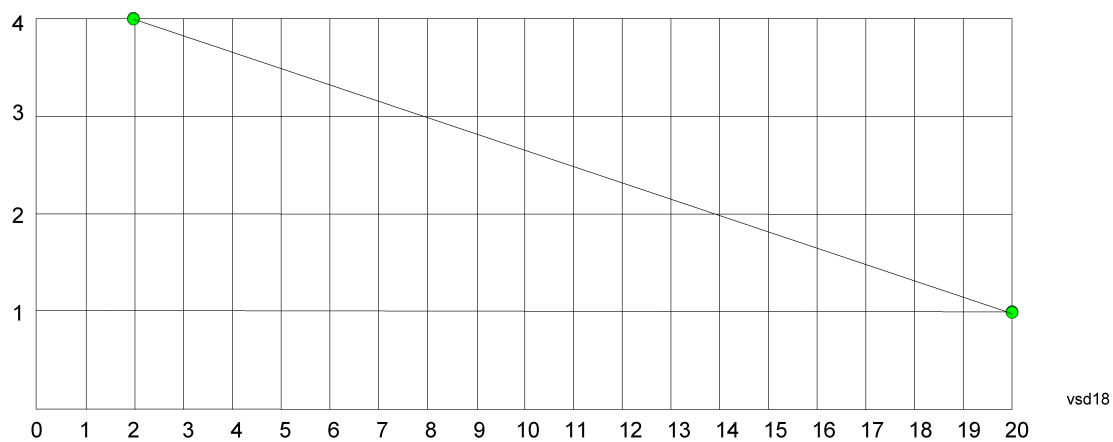
If we interpolate on a log scale, we assume that the line between the two points is a straight line on the log scale. For example, let's say the two points are (2,4) and (20,1). A straight line between them on a log scale looks like:



On a linear scale (like that of the spectrum analyzer), this translates to:



If we interpolate on a linear scale, we assume that the two points are connected by a straight line on the linear scale, as below:



The correction to be used for each bucket is taken from the interpolated correction curve at the center of the bucket.

6.5.6.3 Transducer Unit

For devices (like antennas) that make measurements of field strength or flux density, the correction array should contain within its values the appropriate conversion factors such that, when the data on the instrument is presented in dBµV, the display is calibrated in the appropriate units. The "Transducer Unit" used for the conversion is contained within the corrections array database. It may be specifiedor loaded in from an external file or SCPI.

When an array with a Transducer Unit other than "None" is turned on, the Y Axis Unit of the instrument is forced to that unit. When this array is turned on, and it contains a Transducer Unit other than “None”, the Y Axis Unit of the instrument is forced to that Transducer Unit., and all other Y Axis Unit choices are grayed out.

Transducer Unit only appears in certain Modes, it does not appear in all Modes that support Corrections.

See "Examples" on page 2291

Remote Command	`[:SENSe]:CORRection:CSET[1]|2|...|16:ANTenna[:UNIT] GAUSs	PTESla	UVM	UAM	UA	NOConversion` `[:SENSe]:CORRection:CSET[1]|2|...|16:ANTenna[:UNIT]?`
Example	`:CORR:CSET:ANT GAUS`
Dependencies	Only one Transducer units can be on at any given time. Note that this means that if a correction file with a Transducer Unit is loaded into a particular Correction, all other Corrections are set to that same Transducer unit When Normalize is On (in the Trace, Normalize menu) Transducer Unit is grayed out and forced to None
Preset	Unaffected by Preset. Set to NOC by Restore Input/Output Defaults
State Saved	Saved in instrument state

Examples

The units that may be specified and what appears in the file and on the screen are shown below:

Transducer Unit	SCPI Example	In the Correction file	On the screen (also Y Axis Unit forced to)
dBµV/m	`:CORR:CSET:ANT UVM`	Antenna Unit=µV/m	dBµV/m
dBµA/m	`:CORR:CSET:ANT UVA`	Antenna Unit=µA/m	dBµA/m
dBµA	`:CORR:CSET:ANT UA`	Antenna Unit=µA	dBµA
dBpT	`:CORR:CSET:ANT PTES`	Antenna Unit=pTesla	dBpT
dBG	`:CORR:CSET:ANT GAUS`	Antenna Unit=Gauss	dBG
None	`:CORR:CSET:ANT NOC`	Antenna Unit= (or no line at all)	none (not forced)

6.5.6.4 Description

Sets an ASCII description field which will be stored in an exported file. Can be displayed in the active function area by selecting as the active function, if desired to appear in a screen capture.

Remote Command	`[:SENSe]:CORRection:CSET[1]|2|...|16:DESCription "text"` `[:SENSe]:CORRection:CSET[1]|2|...|16:DESCription?`
Example	`:CORR:CSET1:DESC "11941A Antenna correction"`
Notes	45 chars max; may not fit on display if max chars used
Preset	Unaffected by a Preset. Set to empty by Restore Input/Output Defaults
State Saved	Saved in instrument state

6.5.6.5 Comment

Sets an ASCII comment field which will be stored in an exported file. Can be displayed in the active function area by selecting as the active function, if desired to appear in a screen capture.

Remote Command	`[:SENSe]:CORRection:CSET[1]|2|...|16:COMMent "text"` `[:SENSe]:CORRection:CSET[1]|2|...|16:COMMent?`
Example	`:CORR:CSET1:COMM "this is a comment"`
Notes	60 chars max; may not fit on display if max chars used
Preset	Unaffected by Preset. Set to empty by **Restore Input/Output Defaults**
State Saved	Saved in instrument state

6.5.7 Complex Corrections

This dialog is used to set up and display information about the **Complex Corrections** set. It also lets you view and edit certain information such as the Description and Comment for the selected Complex Correction.

Complex Corrections (loaded from `.s2p` files) support both magnitude and phase corrections, whereas standard corrections (loaded from standard Ampcor `.csv` files) support only magnitude corrections.

When loading an `.s2p` file, the component representing S21 is the one that is used to generate the complex correction. If no S21 component is present, a Mass Storage error is reported.

NOTE

Data types RI, MA, and DB are supported.

The phase components of the S2P file are taken to be in degrees, not in radians. You must provide the phase correction in degrees.

Unlike Correction files, S2P files describe device characteristics, rather than the correction required to compensate for those characteristics; so when an S2P file is loaded, both the magnitude and phase are negated to turn it into a correction

Complex Corrections and standard corrections can be turned on at the same time. For example, you could turn on Correction 2, Correction 4, and Complex Correction 1 and 2, all at the same time. The magnitude part of all the corrections would add, and the phase part of the complex corrections would add.

You can have up to 64 Complex Corrections loaded simultaneously. Each Complex Correction can hold up to 30,000 points.

You can load a standard correction into Complex Corrections, but it will only provide a magnitude correction, not a phase correction.

NOTE	A standard correction (from a CSV file) can be loaded into a Complex Correction, but when it is loaded the Phase correction is set to 0 for all points. For M1750A only Magnitude will be applied with Complex Corrections. Some measurements, like Swept SA, have no phase component to the measurement, but nonetheless support Complex Corrections. For such measurements, only the Magnitude part of the Complex Correction is applied.

6.5.7.1 Go To Row (Select Correction)

Specifies the selected complex correction. The selected correction will be identified by the blue outlined row in the dialog.

The "selected complex correction" is an important concept when sending SCPI commands to the Complex Corrections system, because in each case the SCPI command is directed to the currently selected Complex Correction and that will be the Correction which is modified by the SCPI command.

Remote Command	`[:SENSe]:CCORrection:CSET:SELect <integer>` `[:SENSe]:CCORrection:CSET:SELect?`
Example	`:CCOR:CSET:SEL 3` `:CCOR:CSET:SEL?`
Notes	The selected correction is remembered even when not in the correction menu
Preset	Set to Correction 1 by Restore Input/Output Defaults
Min	1
Max	64

6.5.7.2 Delete Row

Deletes the currently-selected Complex Correction and clears all entries in that row to the default.

Remote Command	`[:SENSe]:CCORrection:CSET:DELete`

Example	Select correction 3:
	`:CCOR:CSET:SEL 3`
	Delete correction 3:
	`:CCOR:CSET:DEL`

6.5.7.3 Delete All

Deletes all complex corrections and clears all entries in all rows to the default.

When this key is pressed a prompt is placed on the screen that says “Please press Enter or OK key to delete all complex corrections. Press ESC or Cancel to close this dialog.” The deletion is only performed if you press **OK** or **Enter**.

Remote Command	`[:SENSe]:CCORrection:CSET:ALL:DELete`
Example	`:CCOR:CSET:ALL:DEL`

6.5.7.4 Correction On

Checking or unchecking this box turns the Selected Complex Correction `ON` or `OFF`. Turning it `ON` causes the values in it to be applied to the data. This state transition also automatically turns on "Apply Corrections" (sets it to `ON`), otherwise the correction would not take effect.

A new sweep/acquisition is initiated if a complex correction is switched on or off. Note that changing, sending or loading corrections data does *not* directly initiate a sweep, however in general these operations will turn corrections on, which *does* initiate a sweep.

Remote Command	`[:SENSe]:CCORrection:CSET[:STATe] ON | OFF | 1 | 0` `[:SENSe]:CCORrection:CSET[:STATe]?`

Example	Select correction 3:
	`:CCOR:CSET:SEL 3`
	Turn correction 3 on:
	`:CCOR:CSET ON`

Dependencies	Changing this from `OFF` to `ON` automatically turns on "Apply Corrections" Grayed-out if Complex Corrections is not supported by the current measurement. A warning or SCPI error is generated if you try to turn it on under these circumstances: “Feature not supported for this measurement”
Preset	Not affected by Preset. Set to `OFF` by **Restore Input/Output Defaults**
State Saved	Saved in instrument state
Annotation	If *any* Complex Correction is turned on, CC in the Meas Bar will display in amber to indicate Complex Corrections are in use

6.5.7.5 Correction Port

Maps one of the sets of corrections to a particular I/O port. This control allows any Input port (including External Mixing, BBIQ, the RF2 input, etc.) to be mapped to a specific Correction, so that the Correction is only applied when that Port is being used by the current Screen. You can also map any internal source Output port to a specific Correction.

When Current Input (CINPut) is selected for **Correction Port**, it chooses the current input port of the current Screen for the selected Correction. In other words, the

Correction applies to whichever input is selected. If the input changes, the correction applies to the new input.

When using the VXT M9410A/11A with Remote Radio Heads (such as the Keysight M1740A mmWave Transceiver for 5G), the choices in the dropdown menu will appear as

Head h RFHD p

For example, if you have two Radio Heads (numbered 1 and 2), each of which have two RF half duplex ports, the choices for these ports will appear as below:

Head and Port	Choice in dropdown	SCPI parameter
Head 1, port RF Tx/Rx 1	Head 1 RFHD 1	RRH1RFHD1
Head 1, port RF Tx/Rx 2	Head 1 RFHD 2	RRH1RFHD2
Head 2, port RF Tx/Rx 1	Head 2 RFHD 1	RRH2RFHD1
Head 2, port RF Tx/Rx 2	Head 2 RFHD 2	RRH2RFHD2

See also the parameters, notes and examples table under "Correction Port" on page 2281.

Remote Command	`[:SENSe]:CCORrection:CSET:PORT CINPut | RFIN | RFIN2 | AIQ | EMIXer | RFOut | RFIO1 | RFIO2 | RFIO3 | RFIO4 | RFHD | RFFD | ANT | GEN | TR | A1 | A2 | A3 | B1 | B2 | B3 | IFIO1 | IFIO2 | RRHnRFHD | ERFIN` `[:SENSe]:CCORrection:CSET:PORT?`

Example	`:CCOR:CSET:SEL 2`
	Select correction 2
	`:CCOR:CSET:PORT RFIN`
	Set correction 2 to RFIN
	`:CCOR:CSET:PORT RRH1RFHD2`
	Set Correction 2 to Radio Head 1, RF Tx/Rx Port 2

Dependencies	RFIN2|AIQ|EMIXer are only available on C/E/M/P/UXA analyzers with the appropriate options loaded RFOut is only available on modular products such as VXT ANT, GEN and TR are only available in VXT and only when the M9470A module is installed, such as in the M8920A. Option “HDX” is required to enable the TR port RFHD and RFFD are only available on VXT, option HDX is required to enable RFHD port and option FDX is required to enable RFFD port, RFFD is not available on M9421A RFIO3 and RFIO4 are only available on EXM with hardware M9431A RFIN and RFOut are not available on EXM with hardware M9431A ERFIN requires option “EXW”
Preset	Not affected by Preset. Set to `CINPut` by **Restore Input/Output Defaults**
State Saved	Saved in State

6.5.7.6 Direction

Selects whether corrections will be applied when the device associated with the specified correction is being used as an input, an output or in both directions. The choices are:

INPut	Correct the port only when the port is used as an Input
OUTPut	Correct the port only when the port is used as an Output
BOTH	Correct the port when the port is used as either an Input or an Output (or both)

Remote Command	[:SENSe]:CCORrection:CSET:DIRection INPut | OUTPut | BOTH [:SENSe]:CCORrection:CSET:DIRection?
Example	:CCOR:CSET:SEL 4 Select correction 4 :CCOR:CSET:DIR INP Set correction 4 to Input
Dependencies	For Inputs, the only choice is INPut, so an empty table cell is displayed. For Outputs, the only choice is OUTPut, so an empty table cell is displayed. If the SCPI command is sent while one of these ports is selected, it is accepted but ignored For a port that can be either an Input or an Output (or both), such as RFHD, RFFD or T/R, all three choices are available
Preset	Not affected by a Preset. Set to BOTH by **Restore Input/Output Defaults**
State Saved	Saved in State
Backwards Compatibility SCPI	The following SCPI will result in the selection of BOTH (included for compatibility with early Multitouch implementations): [:SENSe]:CCORrection:CSET:DIRection BIDirectiona

6.5.7.7 Description

Shows the Description field for the selected Complex Correction. The Description field is loaded from the second line of the .s2p file. (Note that, if line 2 begins with "!", the ! is not displayed in the Description field.)

Remote Command	[:SENSe]:CCORrection:CSET:DESCription "text" [:SENSe]:CCORrection:CSET:DESCription?
Example	:CCOR:CSET:SEL 4 Select correction 4 :CCOR:CSET:DESC "PNA data import 1-1-18"
Notes	45 chars max; may not fit on display if max chars used

Preset	Unaffected by Preset. Set to empty by **Restore Input/Output Defaults**
State Saved	Saved in instrument state

6.5.7.8 Comment

Shows the Comment field for the selected Complex Correction. The Comment field is loaded from the third line of the `.s2p` file. (Note that, if line 3 begins with "!", the ! is not displayed in the Comment field.)

Remote Command	`[:SENSe]:CCORrection:CSET:COMMent "text"` `[:SENSe]:CCORrection:CSET:COMMent?`

Example	`:CCOR:CSET:SEL 4`
	Select correction 4
	`:CCOR:CSET:COMM "this is a comment"`

Notes	60 chars max; may not fit on display if max chars used
Preset	Unaffected by Preset. Set to empty by **Restore Input/Output Defaults**
State Saved	Saved in instrument state

6.5.7.9 File

Shows the file from which the selected correction was loaded. If correction was loaded with a SCPI command (see "Set Data (Remote Command Only)" on page 2298) displays "(SCPI)". If no correction is loaded, displays "(No correction loaded)"

Notes	60 chars max; may not fit on display if max chars used
State Saved	Saved in instrument state

6.5.7.10 Freq Interpolation (Remote Command Only)

Controls how the correction values per-bucket are calculated. We interpolate between frequencies in either the logarithmic or linear scale.

This setting is handled and stored individually per correction set.

VXT models M9410A/11A only support Linear Interpolation.

See "Interpolation" on page 2289 under Corrections.

Remote Command	`[:SENSe]:CCORrection:CSET:X:SPACing LINear | LOGarithmic` `[:SENSe]:CCORrection:CSET:X:SPACing?`
Example	Select correction 4: `:CCOR:CSET:SEL 4` Set linear interpolation:

	`:CCOR:CSET:X:SPAC LIN`
Preset	Unaffected by Preset. Set to Linear by **Restore Input/Output Defaults**
State Saved	Saved in instrument state

6.5.7.11 Set Data (Remote Command Only)

Allows you to set the magnitude part of a complex correction's data via a SCPI command. This is provided for compatibility with the similar command for standard corrections, to allow you to use Complex Corrections as an extension to standard corrections.

Sending this command sets the phase part of the selected correction to 0 for all points.

The command takes an ASCII series of alternating frequency and amplitude points, each value separated by commas.

The values sent in the command will totally replace all existing correction points in the specified set.

A Complex Correction array can contain 30000 points maximum.

Remote Command	`[:SENSe]:CCORrection:CSET:DATA <freq>, <ampl>, ...` `[:SENSe]:CCORrection:DATA?`

Example	`:CCOR:CSET:SEL 4`
	Select correction 4
	`:CCOR:CSET:DATA 10000000,-1.0,20000000,1.0`
	This defines two correction points at (10 MHz, -1.0 dB) and (20 MHz, 1.0 dB) for correction set 4

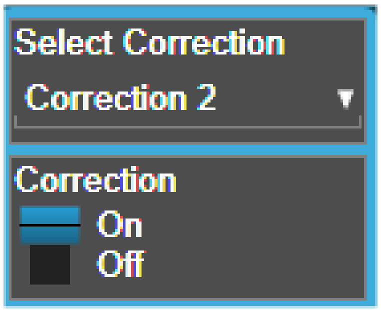
Preset	Empty after Restore Input/Output Defaults. Survives a shutdown or restart of instrument application (including a power cycle)
State Saved	Saved in instrument state
Min	Freq: 0 Hz Amptd: -1000 dBm
Max	Freq: 1 THz Amptd: +1000 dBm

6.5.8 Apply Corrections

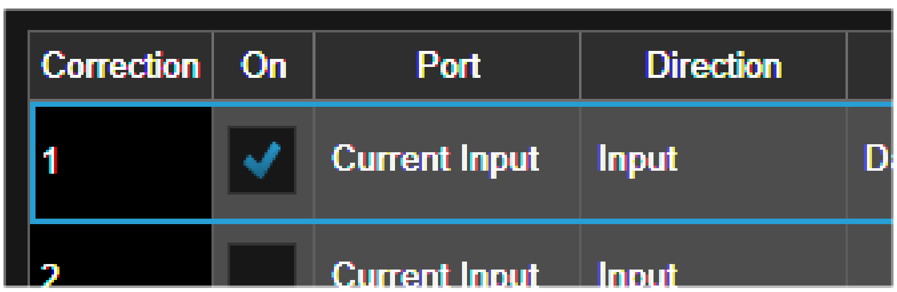
When you turn on Apply Corrections, all of the Corrections that are turned On are applied to the measured data. When you turn off Apply Corrections, no Corrections are applied, even if they are turned On.

With this switch you can turn the entire Corrections system on and off without affecting the settings of any individual Corrections. Turning Apply Corrections On and Off has no effect on the On/Off switches under the individual Corrections.

Apply Corrections affects both normal Corrections and Complex Corrections. Normal Corrections are turned On and Off using the Correction switch under Select Correction:



Complex Corrections are turned On and Off using the checkboxes in the Complex Corrections dialog:



See "Correction On/Off" on page 2281) and "Complex Corrections" on page 2292.

Remote Command	`[:SENSe]:CORRection:CSET:ALL[:STATe] ON | OFF | 1 | 0` `[:SENSe]:CORRection:CSET:ALL[:STATe]?`
Example	`:SENS:CORR:CSET:ALL OFF` This command makes sure that no amplitude corrections are applied, regardless of their individual on/off settings
Couplings	Whenever you turn on any Correction or Complex Correction, **Apply Corrections** is automatically set to ON
Preset	Not affected by Preset. Set to `OFF` by **Restore Input/Output Defaults**
State Saved	Saved in instrument state
Annunciation	When ON, 'CORREC' appears in the Meas Bar as long as at least one of the individual corrections is enabled

6.5.9 Delete All Corrections

Erases all correction values for all Amplitude Correction sets and Complex Corrections.

When this key is pressed a prompt is placed on the screen that says “Please press Enter or OK key to delete all corrections. Press ESC or Cancel to close this dialog.” The deletion is only performed if you press **OK** or **Enter**.

Remote Command	`[:SENSe]:CORRection:CSET:ALL:DELete`
Example	`:CORR:CSET:ALL:DEL`

6.5.10 Correction Group On/Off

Turns the Correction Group on and off. The Correction Group allow you to preload Correction files and associate them with specific frequency ranges, so that they can be switched in and out during a sweep at the appropriate frequencies. Use the control “Edit Correction Group” below to set up your Correction Group.

The state of each Correction will be set dynamically depending on the active measurement frequency. Only the correction selected for the range that matches the active measurement frequency will be turned on, and vice versa.

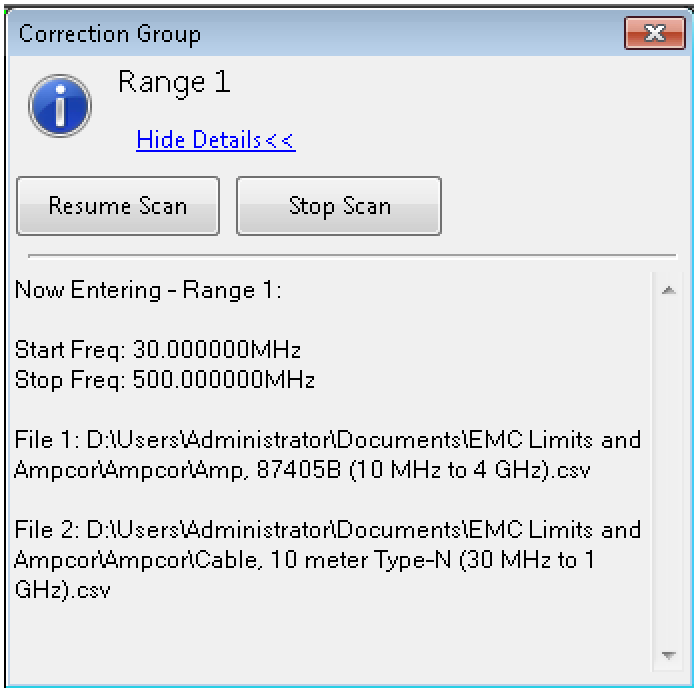
Note that the Corrections in the Correction Group, although they are loaded into memory, are independent of the main Correction registers at the top of the Corrections menu, and will not display under the Select Correction, Correction On/Off or Edit Correction functions.

Remote Command	`[:SENSe]:CORRection:CSET:GROup[:STATe] ON | OFF | 1 | 0` `[:SENSe]:CORRection:CSET:GROup[:STATe]?`
Example	`:SENS:CORR:CSET:GRO ON`
Dependencies	Correction group is supported in EMI Receiver Mode, and in Spectrum Analyzer Mode if option EMC or EMI Receiver Mode is present. If you switch to other measurements or modes, correction group is turned off and the Correction Group functions are not visible
Couplings	When on, Correction 1 through 8 is set to `OFF` and the correction on/off state keys are grayed out. If the grayed-out key is pressed, it generates an advisory message. If sending the SCPI to turn it on, this same message is generated as part of Settings conflict
Preset	Not affected by Preset. Set to OFF by **Restore Input/Output Defaults**
State Saved	Saved in instrument state

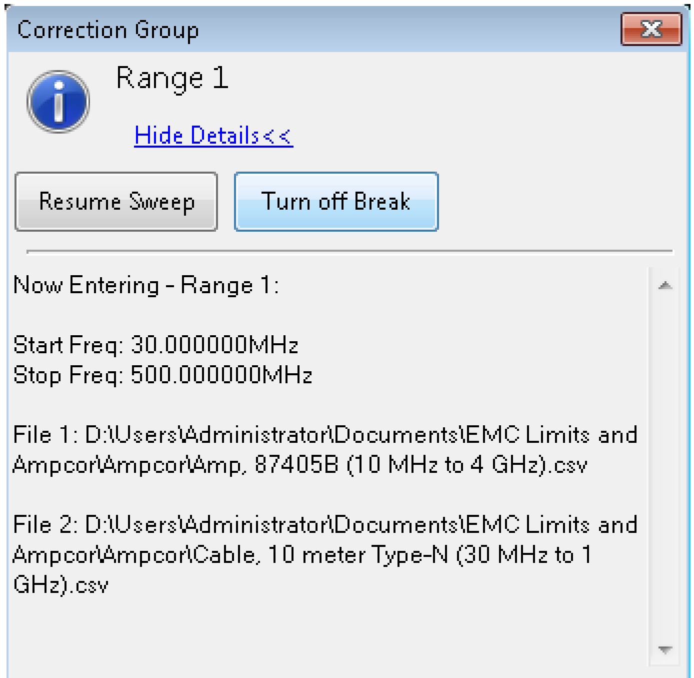
6.5.11 Break

If break is turned on, the scan or sweep will be paused when it reaches the boundary of correction group ranges. At the same time, a window at the size of ~ 6.5cm x 3.5 cm is prompt at the upper right hand corner of the graticule.

When running Frequency Scan measurement of Emi Receiver application, the message prompt is like below. You are given the option to resume the scan or stop the scan.



When running the Swept SA measurement in Spectrum Analyzer Mode, the message prompt is as below. You are given the option to resume the sweep or turn off the break. If in Continuous sweep, the sweep will resume after the break is turned off.



Remote Command	`[:SENSe]:CORRection:CSET:GROup:BReak ON | OFF | 1 | 0` `[:SENSe]:CORRection:CSET:GROup:BReak?`
Example	`:SENS:CORR:CSET:GRO:BR ON`

Notes	When running the Frequency Scan measurement in EMI Receiver Mode, if break is turned on when a SCPI is sent to start the scan, the scan pauses when it reaches the boundary of correction group ranges. Bit 8 (Paused) of status operation register is set to true. To resume, send `:INITiate2:RESume`. To stop the scan, send `:ABORt`
	When running the Swept SA measurement in Spectrum Analyzer Mode, the break state does not affect the operation of sweep when SCPI to control the sweep is sent. Instead, the SCPI commands close the message prompt if it is showing at the point the commands are sent, and the break is turned off. The SCPI includes:
	`:INITitate:IMMEdiate`
	`:INITitate:RESTart`
	`:INITitate:CONTinuous ON | OFF | 1 | 0`
	`:ABORt`

Dependencies	Correction group is supported in EMI Receiver Mode, and in Spectrum Analyzer Mode if option EMC or EMI Receiver mode is present. If you switch to other measurements or modes, correction group is turned off and the Correction Group functions (like Break) are not visible
Preset	Not affected by Preset. Set to `OFF` by **Restore Input/Output Defaults**
State Saved	Saved in instrument state

6.5.12 Reload Corrections From Files

Because the Correction data for the Correction Group is loaded into memory from Correction files at the time the Group is defined, it will be necessary to reload some or all of the data if any of the files changes. This function reloads all of the correction data from all of the correction files defined in all of the ranges in the Correction Group.

Remote Command	`[:SENSe]:CORRection:CSET:GROup:RELoad`
Example	`:MMEM:STOR:CORR:GRO:REL`
Notes	If invalid data is found in the files, the correction group will be set to off and an Execution error is generated. Error icon appears on the status column correction group table
Dependencies	Correction group is supported in EMI Receiver Mode, and in Spectrum Analyzer mode if option EMC or EMI Receiver Mode is present. If you switch to other measurements or modes, correction group is turned off and the Correction Group functions (like Reload Correction From File) are not visible
Annotation	If reload fails, error icons appear in the status column of correction group editor for the range that has the error

6.5.13 Edit Correction Group

Opens the Table Editor for the correction group. The content of correction group table including the correction data loaded from the files is not affected by a Preset, it survives power cycle. You can set it to empty by restore Input/Output Defaults.

Dependencies	Correction group is supported in EMI Receiver Mode, and in Spectrum Analyzer Mode if option EMC or EMI Receiver Mode is present. If you switch to other measurements or modes, correction group is turned off and the Correction Group functions (like Edit Correction Group) are not visible

6.5.13.1 Go to Row

Lets you move through the table to edit the desired point.

Min	1
Max	2000

6.5.13.2 Insert Row Below

Inserts a point below the current point. The new point starts from the current range stop frequency and becomes the current point. The new point is not yet entered into the underlying table, and the data in the row is displayed in light gray.

6.5.13.3 Delete Row

Deletes the currently-selected point, whether or not that point is being edited, and selects the Navigate functionality. The point following the currently-selected point (or the point preceding if there is none) will be selected.

6.5.13.4 Select File

Indicate the correction files in which the specify file and remove file operations will take effect.

Notes	No SCPI. Front panel only
Preset	Unaffected by a Preset. Set to empty by **Restore Input/Output Defaults**

6.5.13.5 Specify File

Displays the file browsing menu. When a file is selected, correction data will be loaded from the file. The correction data remains until the file is removed or the range is deleted.

Notes	If the file is empty, error -250 is reported. If the file does not exist error -256 is reported. If there is a mismatch of data type, error -250 is reported Only one file with antenna unit can be supported per range. If you try to add another file which contains an antenna unit, a Mass Storage error is generated All ranges have to use a common antenna unit. If you try to add a correction file that contains a different antenna unit, a Mass Storage error is generated If you try to add a correction file that contains data that does not cover the range frequency, the file cannot be added, and an Execution error is generated

6.5.13.6 Remove File

Removes the selected file. When a file is removed, correction data for that file will be removed as well.

Dependencies	The key is grayed-out if there the file has not been specified. If the grayed-out key is pressed, an advisory message is generated

6.5.13.7 Correction Trace Display

Enables you to view the correction traces of all corrections that are added to the range currently selected. A 2-column table in the function of frequency and the accumulated amplitude correction is displayed at the left pane.

Notes	No SCPI. Front panel only
Preset	OFF
State Saved	Saved in instrument state

6.5.13.8 Description

Provides a description of up to 60 characters by which you can easily identify the correction group. The descriptions will be stored in the exported file and can be displayed in the active function area by selecting them as the active function, if desired to be in a saved screen dump.

Remote Command	`[:SENSe]:CORRection:CSET:GROup:DESCription "text"` `[:SENSe]:CORRection:CSET:GROup:DESCription?`
Example	`:CORR:CSET:GRO:DESC "Radiated Setup"`
Notes	60 chars max; may not fit on display if max chars used
Preset	Unaffected by a Preset. Set to empty by **Restore Input/Output Defaults**
State Saved	Saved in instrument state

6.5.13.9 Comment

Provides a comment of up to 60 characters by which you can easily identify the correction group. The comments will be stored in the exported file and can be displayed in the active function area by selecting them as the active function, if desired to be in a saved screen dump.

Remote Command	`[:SENSe]:CORRection:CSET:GROup:COMMent "text"` `[:SENSe]:CORRection:CSET:GROup:COMMent?`
Example	`:CORR:CSET:GRO:COMM "For internal only"`
Notes	60 chars max; may not fit on display if max chars used
Preset	Unaffected by a Preset. Set to empty by **Restore Input/Output Defaults**
State Saved	Saved in instrument state

6.5.13.10 Start Frequency

Touching a **Start Frequency** value makes the touched row the current row and lets you edit the start frequency.

Notes	You cannot set the Start Frequency to a value greater than Stop Frequency or equal to Stop Frequency. You cannot set the Start Frequency to a value that would create a span of less than 10 Hz. If you try to do any of these, the Stop Frequency will change to maintain a minimum span of 10 Hz If you change the Start Frequency of the selected range to a value smaller than the previous range's Stop Frequency, the Stop Frequency of the previous range will be changed to the same value

	If you change the Start Frequency of the selected range to a value out of the correction data frequency range, an error icon appears on the status column and an Execution error is generated
Preset	Unaffected by Preset. Set to empty by **Restore Input/Output Defaults**
Min	0
Max	1 THz

6.5.13.11 Stop Frequency

Touching a **Stop Frequency** value makes the touched row the current row and lets you edit the stop frequency.

Notes	You cannot set the Stop Frequency to a value greater than Start Frequency or smaller than Start Frequency. You cannot set the Stop Frequency to a value that would create a span of less than 10 Hz. If you try to do any of these, the Start Frequency will change to maintain a minimum span of 10 Hz If you change the Stop Frequency of the selected range to a value greater the next range's Start Frequency, the Start Frequency of the next range will be changed to the same value If you change the Stop Frequency of the selected range to a value out of the correction data frequency range, an error icon appears on the status column and an Execution error is generated
Preset	Unaffected by Preset. Set to empty by **Restore Input/Output Defaults**
Min	0
Max	1 THz

6.5.14 Merge Correction Data (Remote Command Only)

The command accepts an ASCII series of alternating frequency and amplitude points, each value separated by commas. The difference between this command and **Set Data** is that this merges new correction points into an existing set.

If any new point has the same frequency as an existing correction point, the existing point's amplitude is replaced by that of the new point.

An Ampcor array can contain 2000 total points, maximum.

Remote Command	[:SENSe]:CORRection:CSET[1]|2|...|16:DATA:MERGe <freq>, <ampl>, ...
Example	:CORR:CSET1:DATA:MERGE 15000000,-5.0,25000000,5.0 This adds two correction points at (15 MHz, -5.0 dB) and (25 MHz, 5.0 dB) to whatever values already exist in correction set 1
Preset	Empty after **Restore Input/Output Defaults.** Survives shutdown/restart of instrument application (including power cycle)
Min	Freq: 0 Hz Amptd: -1000 dBm
Max	Freq: 1 THz Amptd: +1000 dBm

6.5.15 Set (Replace) Data (Remote Command Only)

The command accepts an ASCII series of alternating frequency and amplitude points, each value separated by commas.

The values sent in the command totally replace all existing correction points in the specified set.

An Ampcor array can contain 2000 points maximum.

Remote Command	`[:SENSe]:CORRection:CSET[1]|2|...|16:DATA <freq>, <ampl>, ...` `[:SENSe]:CORRection:CSET[1]|2|...|16:DATA?`
Example	`:CORR:CSET1:DATA 10000000,-1.0,20000000,1.0` This defines two correction points at (10 MHz, -1.0 dB) and (20 MHz, 1.0 dB) for correction set 1
Preset	Empty after **Restore Input/Output Defaults.** Survives a shutdown or restart of instrument application (including a power cycle)
State Saved	Saved in instrument state
Min	Freq: 0 Hz Amptd: -1000 dBm
Max	Freq: 1 THz Amptd: +1000 dBm

6.5.16 Correction Group Range Data (Remote Command Only)

The command accepts an ASCII series of alternating start frequency, stop frequency and file names, each value separated by commas.

The values sent in the command replace the content of correction group.

The default path for CSV files is:

`D:\My Documents\amplitudeCorrections\`

Remote Command	`[:SENSe]:CORRection:CSET:GROup[1]|2|...|10:DATA <startFreq>,<stopFreq>,<filename1>,<filename2>,…,<filename8>`
	See Notes below for explanation of the <filenameN> parameters
	`[:SENSe]:CORRection:CSET:GROup[1]|2|...|10:DATA?`

Example	`:CORR:CSET:GRO:DATA 10000000,20000000,"myAmpcor.csv"` "myAmpcor.csv" refers to the Amplitude Correction data from the file myAmpcor.csv in the default path
Notes	`<filename>` is the string containing the path of the correction files <filename2>, <filename3>, <filename4>, <filename5>, <filename6>, <filename7>, <filename8> are optional. You can define only <filename1>. The file name defined is added to corresponding File keys based on the sequence sent in the command. File keys with no file name set in the SCPI will be emptied Data for ranges 1 to 10 must be set in ascending order. If you try to set the data for a correction group

	range that is not connecting to the range currently available, a Data out of range error is generated If the file defined in data is empty, error -250 is reported. If the file does not exist, error -256 is reported. If there is a mismatch of data type, error -250 is reported Only one file with antenna unit can be supported per range. If you try to add another file that contains an antenna unit, a Mass Storage error is generated All ranges have to use a common antenna unit. If you try to add a correction file that contains a different antenna unit, a Mass Storage error is generated
Preset	Reset to Not a Number (9.91e+37) for frequencies and "" for File 1 through File 8 after **Restore Input/Output Defaults**. Survives a shutdown or restart of instrument application (including a power cycle)
State Saved	Saved in instrument state
Min	Start Freq and Stop Freq: 0 Hz
Max	Start Freq and Stop Freq:1 THz

6.5.17 Delete Correction Group Range (Remote Command Only)

Deletes all range values of corrections Group.

Remote Command	`[:SENSe]:CORRection:CSET:GROup:DELete`
Example	`:CORR:CSET:GRO:DEL`
Notes	Sending this command when no range is defined in table is accepted without error

6.6 Freq Ref Input

This tab lets you configure the External Frequency Reference input on the rear panel.

6.6.1 Freq Ref Input

Specifies the frequency reference as being the internal reference, an external reference at the rear panel input labeled EXT REF IN, a 1 pulse per second signal at the EXT REF IN input, or automatically sensing the appropriate reference.

See "More Information " on page 2311

Remote Command	`[:SENSe]:ROSCillator:SOURce:TYPE INTernal | EXTernal | SENSe | PULSe` `[:SENSe]:ROSCillator:SOURce:TYPE?`

Example	`:ROSC:SOUR:TYPE SENS`
	`:ROSC:SOUR:TYPE INT`
	`:ROSC:SOUR:TYPE EXT`
	`:ROSC:SOUR:TYPE PULS`

Dependencies	The PULSe parameter, and support of the 1 pps signal at the EXT REF IN input, are not available in some model numbers. If not available, the choice will not appear, and sending the PULSe parameter via SCPI will generate an error For VXT models M9420A/21A/10A/11A/15A the only available selection is EXTernal, unless M9420A/21A/10A/11A/15A is configured in MIMO mode as Primary module. If configured in MIMO mode as Primary module, the available selection is INTernal|EXTernal|SENSe For EXM the only available selections are INTernal|EXTernal|SENSe For E7760 and M8920A the only available selections are INTernal|EXTernal This control is not available in UXM
Preset	This is unaffected by a Preset but is set to EXTernal for VXT models M9420A/21A/10A/11A/15A, INTernal for E7760, and SENSe for other models, on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved	Saved in instrument state
Annunciation	In the Meas Bar: If you set this to Internal and no external reference is plugged in: Freq Ref: Internal If you set this to Internal and an external reference between 1 and 50 MHz, or a 1 pps signal, IS plugged in: Freq Ref: Internal (in amber, as a warning sign) If you set this to External and an External Reference between 1 and 50 MHz is plugged in: Freq Ref: External If you set this to External and no External Reference is sensed: Freq Ref: External (in amber, as a warning sign)

	When set to Pulse and a 1 pps signal is plugged in: Freq Ref: Pulse If you set this to Pulse and no Pulse Reference is sensed: Freq Ref: Pulse (in amber, as a warning sign) When set to Sense and neither a signal between 1 and 50 MHz nor a 1 pps signal is detected at the EXT REF IN input, "Sense:Int" is displayed: Freq Ref: Sense,Int When set to Sense and a signal within 5 ppm of the External Ref Freq (as set on the Ext Ref Freq control) is detected at the EXT REF IN input: Freq Ref: Sense,Ext When set to Sense and a 1 pps signal is detected at the EXT REF IN input, "Sense:Pulse" is displayed: Freq Ref: Sense,Pls
Status Bits/OPC dependencies	STATus:QUEStionable:FREQuency bit 1 set if unlocked Note: In the EXM, the status bit is not set for non-controlling instances. To determine if the frequency reference is unlocked, the controlling instance must be queried
Backwards Compatibility Notes	Freq Ref In was not saved in state in the legacy instruments. It is a part of state in the X-Series

Remote Command	`[:SENSe]:ROSCillator:SOURce?`
Notes	The query `[:SENSe]:ROSCillator:SOURce?` returns the current switch setting. This means: 1. If it was set to SENSe but there is no external reference nor 1pps signal so the instrument is actually using the internal reference, then this query returns INTernal and not SENSe 2. If it was set to SENSe and there is an external reference present, the query returns EXTernal and not SENSe 3. If it was set to SENSe and there is a 1 pps signal present, the query returns PULSe and not SENSe 4. If it was set to EXTernal, then the query returns "EXTernal" 5. If it was set to INTernal, then the query returns “INTernal” 6. If it was set to PULSe, then the query returns “PULSe” Note: In the EXM, the SCPI query always returns “INTernal” for non-controlling instances
Preset	For VXT models M9420A/21A/10A/11A/15A: `EXTernal` For E7760, M8920A: `INTernal` All other models: `SENSe`
Backwards Compatibility Notes	The query `[:SENSe]:ROSCillator:SOURce?` was a query-only command in ESA which always returned whichever reference the instrument was using. The instrument automatically switched to the ext ref if it was present In PSA (which had no sensing) the command `[:SENSe]:ROSCillator:SOURce` set the reference (INT or EXT), so again its query returned the actual routing

	Thus the query form of this command is 100% backwards compatible with both instruments
Notes	For PSA compatibility the command form is provided and is directly mapped to `[:SENSe]:ROSCillator:SOURce:TYPE` Note: In the EXM, the SCPI command does nothing for non-controlling instances
Backwards Compatibility SCPI	`[:SENSe]:ROSCillator:SOURce INTernal | EXTernal`

More Information

When the frequency reference is set to internal, the internal 10 MHz reference is used even if an external reference is connected.

When the frequency reference is set to external, the instrument will use the external reference. However, if there is no external signal present, or it is not within the proper amplitude range, a condition error message is generated. When the external signal becomes valid, the error is cleared.

When the frequency reference is set to Pulse, the instrument expects a 1 pulse per second signal at the EXT REF IN input. The instrument uses this signal to adjust the frequency of the internal reference.

If Sense is selected, the instrument checks whether a signal is present at the external reference connector. If it senses a signal within 5 ppm of the External Ref Freq (as set on the **External Ref Freq** control), it will automatically switch to the external reference. If it senses a 1 pulse per second signal, it enters Pulse mode, wherein the signal is used to adjust the internal reference. When no signal is present, it automatically switches to the internal reference. No message is generated as the reference switches between pulse, external and internal. The monitoring of the external reference occurs approximately on 1 millisecond intervals, and never occurs in the middle of a measurement acquisition, only at the end of the measurement (end of the request).

If for any reason the instrument's frequency reference is not able to obtain lock, Status bit 1 in the Questionable Frequency register will be true and a condition error message is generated. When lock is regained, Status bit 1 in the Questionable Frequency register will be cleared and the condition error will be cleared.

If an external frequency reference is being used, you must enter the frequency of the external reference if it is not exactly 10 MHz. The **External Ref Freq** key is provided for this purpose.

For VXT models M9420A/21A/10A/11A/15A, there is no internal frequency reference. To work correctly, a 100MHz external frequency reference signal is needed to connect to the front panel of the module. The default Freq Ref In setting is "External" and it cannot be set to any other types.

For VXT models M9410A/11A, External Freq Ref Input controls the “100 MHz In” port on the front panel. For VXT model M9415A, External Freq Ref Input controls the “REF In” port on the front panel.

NOTE

In the EXM, a common frequency reference module serves all instrument instances, but only one instance of the software application can change the reference input type (INT or EXT or SENSE). The software application allowed to change the reference input is called the primary or controlling instance; by default, the leftmost instrument instance is the controlling instance. This can be changed in the config file “E66XXModules.config” located under the folder E:\Keysight\Instrument. For the non-controlling instance(s) the reference input types (in SCPI commands, and in the Virtual Front Panel menus) are blanked and unavailable for use.

Sense

If Sense is selected, the instrument checks whether a signal is present at the external reference connector. If it senses a signal within 5 ppm of the External Ref Freq (as set on the **External Ref Freq** control), it will use this signal as an External Reference. If it senses a 1 pulse per second signal, it will use this signal to adjust the internal reference by adjusting the User setting of the Timebase DAC. When no signal is present, it automatically switches to the internal reference.

If set to SENSe and the instrument senses a 1 pulse per second signal, it sets the System, Alignments, Timebase DAC setting to “User”. This setting survives Preset and Power Cycle but is set to “Calibrated” on a System, Restore Defaults, Align or a System, Restore Defaults, All

Internal

The internal reference is used. A 1 pps signal at the EXT REF IN port, or a signal there between 1 and 50 MHz, will cause a warning triangle to appear in the settings panel next to the word “INTERNAL”, but will otherwise be ignored.

External

The external reference is used.

Pulse

The internal reference continues to be the frequency reference for the instrument in that it determines the reference contribution to the phase noise, but its average frequency is adjusted to follow the 1 pps signal at the EXT REF IN input. Therefore, the instrument frequency accuracy will be dominated by the aging rate of the 1 pps signal instead of the aging rate of the internal reference, except during the time it takes to lock to a new 1 pps signal, approximately 10 minutes.

Sets the System, Alignments, Timebase DAC setting to “User”. This setting survives Preset and Power Cycle but it set to “Calibrated” on a System, Restore Defaults, Align or a System, Restore Defaults, All

When a 1 pps signal is present at the EXT REF IN input, and either **Pulse** or **Sense** is selected, the internal reference frequency is affected by this signal; in effect, it “learns” a new accuracy setting. This setting can be seen by going to the **System, Alignments, Timebase Dac** menu, and looking at the **User** key in that menu. You will note that User has become automatically selected, and that the value shown on the **User** key is the updated value of the timebase DAC as “learned” from the 1 pps signal. Note that this replaces any value the user might have previously set on this key.

Once the setting is learned the user may remove the 1 pps signal; the User setting for the Timebase DAC is retained until you manually select “Calibrated” or execute a System, Restore Defaults, Align or a System, Restore Defaults, All. If you want to make the User setting permanent there is information in the Service Guide that tells you how to change the Calibrated setting of the Timebase DAC.

Note also that if the 1 pps signal is removed when Sense is selected, the instrument will simply switch to the normal state of the Internal reference and display SENSE:INT in the Settings Panel. However, if the 1 pps signal is removed when Pulse is selected, the instrument will generate an error.

The J7203A Atomic Frequency Reference is an accessory for the X-Series Signal Analyzer that provides a highly accurate 1 pps timebase to use in conjunction with the Pulse setting. With the J7203A, the 1 pps signal is guaranteed to meet the input requirements of the EXT REF IN port, and the improved accuracy of the instrument’s internal frequency reference is specified. This is the only 1 pps signal that is guaranteed to function properly with the X-Series.

6.6.2 Ext Ref Freq

This key tells the instrument the frequency of the external reference. When the external reference is in use (either because the reference has been switched to External or because the Reference has been switched to Sense and there is a valid external reference present) this information is used by the instrument to determine the internal settings needed to lock to that particular external reference signal.

For the instrument to stay locked, the value entered must be within 5 ppm of the actual external reference frequency. So it is important to get it close, or you risk an unlock condition.

Note that this value only affects the instrument’s ability to lock. It does not affect any calculations or measurement results. See "Freq Offset" in the Frequency section for information on how to offset frequency values.

Remote Command	`[:SENSe]:ROSCillator:EXTernal:FREQuency <freq>`

	`[:SENSe]:ROSCillator:EXTernal:FREQuency?`

Example	`:ROSC:EXT:FREQ 20 MHz`
	sets the external reference frequency to 20 MHz, but does not select the external reference
	`:ROSC:SOUR:TYPE EXT`
	selects the external reference

Dependencies	Still available with Internal or Pulse selected, to allow setup for when External is in use. However, the setting has no effect if the Internal Reference is in use (Freq Ref In set to Internal, Pulse, or SENSE:INT or SENSE:PULSE) This control is not available in UXM For VXT models M9420A/21A/10A/11A/15A: only 100 MHz is available
Preset	This is unaffected by Mode Preset or "Input/Output Preset" or "Restore Defaults, Input/Output" but is set to 100 MHz for VXT models and 10 MHz for other models, on "Restore Defaults, Misc" or "Restore Defaults, All" or by pressing the “Default External Ref Freq” button
State Saved	Power On Persistent (survives power cycle)
Min	CXA, EXA, N897xB, E7760, M8920A, CXA-m: 10 MHz VXT models: 100 MHz All other models: 1 MHz
Max	CXA, EXA, N897xB, M8920A, CXA-m: 10 MHz EXA with option R13: 20 MHz MXA, PXA, EXM: 50 MHz VXT models M9420A/21A/10A/11A/15A: 100 MHz

6.6.3 Default External Ref Freq

This button restores the External Ref Freq to its default of 10 MHz.

When you set an External Ref Freq value with the Ext Ref Freq control, that Frequency is persistent; is not affected by Mode Preset or Input/Output Preset, and survives shutdown and power cycle. This control allows you to reset the External Ref Freq to its default value.

NOTE **The persistence of the External Ref Freq is a new behavior as of firmware version A.18.00, necessitating the addition of this control. In versions before A.18.00, the frequency reset on a power cycle/restart. Thus you may need to use this command to retain backwards compatibility.**

Remote Command	`[:SENSe]:ROSCillator:EXTernal:FREQuency:DEFault`
Example	`:ROSC:EXT:FREQ:DEF` resets the external ref frequency
Notes	This is command only, there is no query
Dependencies	Grayed out if the Ext Ref Freq is already set to the default This control does not appear in EXM, UXM, VXT models or M8920A

6.6.4 Ref Lock BW

This control lets you adjust the Frequency Reference phase lock bandwidth. This control is available in some models of the X-Series.

It is possible to improve the phase noise of the instrument by several dB, even tens of dB, by using an external reference with excellent phase noise. When an external reference is used the instrument's close-in phase noise improves to match that of the reference.

Normally a narrow loop bandwidth is used to phase lock to the external reference. However, the Ref Lock BW control allows you to choose a wider loop bandwidth to reduce the phase noise at low offset frequencies, especially 4 to 400 Hz offset. The Wide setting represents about a 60 Hz loop bandwidth, the Narrow setting about 15 Hz.

When using an external reference with superior phase noise, Keysight recommends setting the external reference phase-locked-loop bandwidth to Wide to take advantage of that superior performance.

When using an external reference with inferior phase noise performance, Keysight recommends setting the bandwidth to Narrow.

In these relationships, inferior and superior phase noise are with respect to –134 dBc/Hz at 30 Hz offset from a 10 MHz reference. Because most reference sources have phase noise behavior that falls off at a rate of 30 dB/decade, this is usually equivalent to –120 dBc/Hz at 10 Hz offset.

In instruments with EP1 or EP2, this control only affects the external reference loop bandwidth. In instruments with EP0, this control also affects the loop bandwidth used when the Internal reference is selected (reference set manually to Internal or Pulse, or set to Sense and set by sensing to Internal or Pulse).

Remote Command	`[:SENSe]:ROSCillator:BANDwidth WIDE | NARRow` `[:SENSe]:ROSCillator:BANDwidth?`
Example	`:ROSC:BAND WIDE`
Dependencies	In instruments with EP1 or EP2: the control is available (not grayed out) even with Internal or Pulse selected, to allow setup for when External is in use. However, the setting has no effect if the Internal Reference is in use This key only appears in instruments equipped with the required hardware This control does not appear in EXM, UXM, VXT models or the E7760
Preset	This is unaffected by a Preset but is set to Narrow on a "Restore Input/Output Defaults" or "Restore System Defaults -> All"
State Saved	Saved in Input/Output state

6.6.5 Reference Oscillator On/Off (Remote Command Only)

This command is provided for PSA code compatibility. In PSA it turned the Reference Oscillator on and off, however in the X-Series the reference oscillator cannot be turned off, so no hardware is affected when it is received. If queried it returns the state you set with the command, but note that this does not necessarily reflect the actual state of the Reference Oscillator, which is always On.

Example	`:ROSCillator:OUTP ON`
Notes	The query returns the state you set with the command, but note that this does not necessarily reflect the actual state of the Reference Oscillator, which is always `ON`
Preset	This is unaffected by Preset but is set to `ON` by **Restore Input/Output Defaults** or **Restore System Defaults -> All**
Backwards Compatibility SCPI	`[:SENSe]:ROSCillator:OUTPut[:STATe] ON | OFF | 1 | 0` `[:SENSe]:ROSCillator:OUTPut[:STATe]?`

6.7 Output

Accesses controls that configure various output settings, like the frequency reference output, IF outputs and analog output.

Not all measurements support all output functions. For example, the Swept SA Measurement does not support the Digital Bus function or the I/Q Cal Out function under the **Output** tab; although the controls display, the outputs do not function in this measurement.

In addition, if the appropriate license is not present, some controls may not appear. In Modes/Measurements that do not support particular controls, the controls may appear, but no output will be generated if they are selected.

This tab does not appear in EXM or VXT models M9420A/21A.

This tab does not appear in the M9393A or M9391A.

6.7.1 Analog Out

Lets you control which signal is fed to the “Analog Out” connector on the instrument rear panel.

In the Auto state, the Analog Output will automatically be set to the most sensible setting for the current mode or measurement.

If you make a selection manually from the **Analog Out** menu, the manually selected choice will remain in force until you change it (or re-select Auto), even if you switch to a mode or measurement for which the selected output does not apply.

Remote Command	`:OUTPut:ANALog OFF | SVIDeo | LOGVideo | LINVideo | DAUDio`
	For details of options, see "More Information" on page 2318 below
	`:OUTPut:ANALog?`
	`:OUTPut:ANALog:AUTO OFF | ON | 0 | 1`
	`:OUTPut:ANALog:AUTO?`

Example	`:OUTP:ANAL SVIDeo`
	causes the analog output type to be Screen Video
	`:OUTP:ANAL:AUTO ON`

Preset	This is unaffected by Preset but is set to `DAUDio` on **Restore Input/Output Defaults** or **Restore System Defaults->All** `ON`
State Saved	Saved in Input/Output State
Backwards Compatibility Notes	Prior to A.04.00, `OFF` was the default functionality except when in the Analog Demod application or with Tune and Listen, in which case it was `DAUDio`, and there was no selection menu. For backwards compatibility with earlier X-Series firmware versions, Auto (`:OUTP:ANAL:AUTO ON`) duplicates the

prior behavior

The DNWB and SANalyzer parameters, which were legal in PSA but perform no function in the X-Series, are accepted without error

More Information

The Analog Output options are:

Source	Example	Notes
Off	OUTP:ANAL OFF	The Analog Output is off
Screen Video	OUTP:ANAL SVID	Selects the analog output to be the screen video signal. In this mode, the pre-detector data is output to the Analog Out connector. The output looks very much like the trace displayed on the instrument's screen, and depends on the Log/Lin display Scale, Reference Level, and dB per division, but is not influenced by the selected detector or any digital flatness corrections or trace post-processing (like Trace Averaging)
Log Video	OUTP:ANAL LOGV	Selects the analog output to be the log of the video signal. In this mode, the pre-detector data is output to the Analog Out connector with a Log scaling. The output is referenced to the current level at the mixer, does not depend on display settings like Reference Level or dB per division, and it is not influenced by the selected detector or any digital flatness corrections or trace post-processing (like Trace Averaging), but does change with input attenuation
Linear Video	OUTP:ANAL LINV	Selects the analog output to be the envelope signal on a linear (voltage) scale. In this mode, the pre-detector data is output to the Analog Out connector with a Linear scaling. The output is based on the current Reference Level, and is not influenced by the selected detector or any digital flatness corrections or trace post-processing (like Trace Averaging)
Demod Audio	OUTP:ANAL DAUD	Selects the analog output to be the demodulation of the video signal. When Demod Audio is selected, the demodulated audio signal appears at this output whenever the Analog Demod application is demodulating a signal or when **Analog Demod Tune and Listen** is operating in the Swept SA measurement When Analog Out is in the Auto state, this output is auto-selected when in the Analog Demod mode or when **Analog Demod Tune and Listen** is operating in the Swept SA measurement

The table below specifies the range for each output.

Analog Out	Nominal Range exc. (10% overrange)	Scale Factor	Notes
Off	0 V		
Screen Video	0 – 1 V open circuit	10%/division	8566 compatible
Log Video	0 – 1 V terminated	1/(192.66 dB/V)	dB referenced to mixer level, 1V out for –10 dBm at the mixer.
Linear Video	0 – 1 V terminated	100%/V	Linear referenced to Ref Level, 1 V out for RF envelope at the Ref Level.
Demod Audio	(varies with instrument setting)		

Notes about the Analog Outputs:

Screen Video

This mode is similar to the Analog Output of the HP 8566 family and the Video Out (opt 124) capability of the Keysight PSA analyzer (E444x), although there are differences in the behavior.

Screen Video output changes while in FFT Sweeps, so for measurements that use exclusively FFT Sweeps, or if the user manually chooses FFT Sweeps, the Screen Video output will look different than it does in swept mode

Because the Screen Video output uses one of the two IF processing channels, only one detector is available while Screen Video is selected. All active traces will change to use the same detector as the selected trace when Screen Video is activated.

Screen Video output is not available while any EMI Detector is selected (Quasi Peak, RMS Average or EMI Average), because these detectors use both IF processing channels. Consequently, if the user chooses an EMI Detector, there will be no Screen Video output.

The output holds at its last value during an alignment and during a marker count. After a sweep:

- If a new sweep is to follow (as in Continuous sweep mode), the output holds at its last value during the retrace before the next sweep starts. If the instrument is in zero-span, there is no retrace, as the instrument remains tuned to the Center Frequency and does not sweep. Therefore, in zero-span, the output simply remains live between display updates.
- If no new sweep is to follow (as in Single sweep mode), the output remains live, and continues to show the pre-detector data

This function depends on optional capability; the selection is not available and the command will generate an “Option not available” error unless you have Option YAV or YAS licensed in your instrument.

The Screen Video function is intended to be very similar to the 8566 Video Output and the PSA Option 124. However, unlike the PSA, it is not always on; it must be switched on by the Screen Video key. Also, unlike the PSA, there are certain dependencies (detailed above) – for example, the Quasi Peak Detector is unavailable when Screen Video is on.

Furthermore, the PSA Option 124 hardware was unipolar and its large range was padded to be exactly right for use as a Screen Video output. In the X-Series, the hardware is bipolar and has a wider range to accommodate the other output choices. Therefore, the outputs won't match up exactly and users may have to modify their setup when applying the X-Series in a PSA application.

Log Video

Log Video shows the RF Envelope with the Reference equal to the Mixer Level. The output is designed so that full scale (1 V) corresponds to -10 dBm at the mixer. The full range (0-1 V) covers 192.66 dB ; thus, 0 V corresponds to -202.66 dBm at the mixer.

Because the Log Video output uses one of the two IF processing channels, only one detector is available while Screen Video is selected. All active traces will change to use the same detector as the selected trace when Log Video is activated.

Log Video output is not available while any EMI Detector is selected (Quasi Peak, RMS Average or EMI Average), because these detectors use both IF processing channels. Consequently, if the user chooses an EMI Detector, there will be no Log Video output.

The output holds at its last value during an alignment, during a marker count, and during retrace (after a sweep and before the next sweep starts).

This function depends on optional capability. The choice will not appear and the command will generate an "Option not available" error unless you have Option YAV licensed in your instrument.

Log Video output changes while in FFT Sweeps, so for measurements that use exclusively FFT Sweeps, or if the user manually chooses FFT Sweeps, the Log Video output will look different than it does in swept mode.

Linear Video

Linear Video shows the RF Envelope with the Reference equal to the Ref Level. The scaling is set so that 1 V output occurs with an instantaneous video level equal to the reference level, and 0 V occurs at the bottom of the graticule. This scaling gives you the ability to control the gain without having another setup control for the key. But it requires you to control the look of the display (the reference level) in order to control the analog output.

This mode is ideal for looking at Amplitude Modulated signals, as the linear envelope effectively demodulates the signal.

Because the Linear Video output uses one of the two IF processing channels, only one detector is available while Linear Video is selected. All active traces will change to use the same detector as the selected trace when Log Video is activated.

Linear Video output is not available while any EMI Detector is selected (Quasi Peak, RMS Average or EMI Average), because these detectors use both IF processing channels. Consequently, if the user chooses an EMI Detector, there will be no Linear Video output.

The output holds at its last value during an alignment and during a marker count and during retrace (after a sweep and before the next sweep starts).

This function depends on optional capability; the choice will not appear and the command will generate an “Option not available” error unless you have Option YAV licensed in your instrument.

Linear Video output changes while in FFT Sweeps, so for measurements that use exclusively FFT Sweeps, or if the user manually chooses FFT Sweeps, the Linear Video output will look different than it does in swept mode.

Demod Audio

When Analog Out is in the Auto state, this output is auto-selected when in the Analog Demod mode or when **Analog Demod Tune and Listen** is operating in the Swept SA measurement.

If any other Analog Output is manually selected when in the Analog Demod mode or when **Analog Demod Tune and Listen** is operating in the Swept SA measurement, a condition warning message appears.

This choice only appears if the Analog Demod application (N9063A), the N6141A or W6141A application, or Option EMC is installed and licensed, otherwise the choice will not appear and the command will generate an “Option not available” error.

The output holds at its last value during an alignment and during a marker count. It is not held between sweeps, in order for Tune and Listen to work properly.

When Demod Audio is the selected Analog Output, all active traces are forced to use the same detector, and the CISPR detectors (QPD, EMI Avg, RMS Avg) are unavailable

6.7.2 Screen Video Level

Lets you control the amplitude of the Analog Output when Screen Video is selected.

- The 1V (`NORMal`) setting provides a nominal output of 1V peak-to-peak into an open circuit. This matches the traditional behavior of X-series instruments
- The 2V (`COMPatible`) setting provides a nominal output of 2V peak-to-peak into an open circuit. This matches the legacy behavior of PSA and earlier analyzers

Remote Command	`:OUTPut:ANALog:SVIDeo NORMal | COMPatible` `:OUTPut:ANALog:SVIDeo?`
Example	`:OUTP:ANAL:SVID COMP` causes the Screen Video level to be 2V

Dependencies	Only appears if Screen Video is the selected Analog Output
Preset	This is unaffected by Preset but is set to `NORM` on **Restore Input/Output Defaults** or **Restore System Defaults->All**
State Saved	Saved in Input/Output State

6.7.3 Digital Bus Out

Turns on the LVDS Digital Output port for outputting digital acquisition data.

- When Bus Out is `ON`, all acquisitions are streamed to the output port including acquisitions for internal purposes such as Alignment. The internal processing and routing of acquisitions continues as usual and is unaffected by the state of Bus Out
- When Bus Out is `OFF`, no signal appears on the LVDS port

Remote Command	`:OUTPut:DBUS[1][:STATe] ON | OFF | 1 | 0` `:OUTPut:DBUS[1][:STATe]?`
Example	`:OUTP:DBUS ON`
Dependencies	Requires option RTL or control is not displayed Digital Bus and Wideband Digital Bus cannot be on at the same time, so: – When Wideband Bus is turned `ON`, if Digital Bus is already `ON`, an advisory message is displayed, “Wideband Digital Bus On, Digital Bus (narrow band) forced to Off” – When Digital Bus is turned `ON`, if Wideband Digital Bus is already `ON`, an advisory message is displayed, “Digital Bus (narrow band) On, Wideband Digital Bus forced to Off”
Preset	`OFF` (set by Restore Input/Output Defaults)
State Saved	Saved in Input/Output State

6.7.4 Wideband Digital Bus

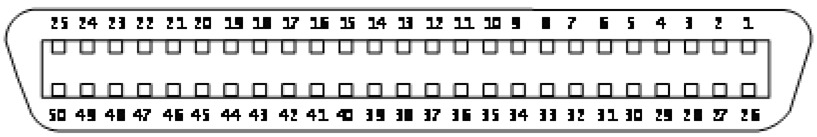
Turns on the LVDS port on the Wideband IF, which causes the I/Q pairs from the current measurement to be sent to this port. The control is grayed-out unless in the RTSA Mode, which has the only measurement that supports wideband streaming.

- When Wideband Digital Bus is `ON`, the internal processing and routing of acquisitions continues as usual and the display of measurement data is unaffected
- When Wideband Digital Bus is `OFF`, no signal appears on the LVDS port

Remote Command	`:OUTPut:DBUS2[:STATe] OFF | ON | 0 | 1` `:OUTPut:DBUS2[:STATe]?`

Example	`:OUTP:DBUS2 ON`
Notes	If this command is sent while running a measurement that does not support Wideband Digital Bus, the message "Settings conflict; Feature not supported for this measurement" is displayed
Dependencies	Requires option RTS or control is not displayed Digital Bus and Wideband Digital Bus cannot be on at the same time, so: – When Wideband Bus is turned ON, if Digital Bus is already ON, an advisory message is displayed, "Wideband Digital Bus On, Digital Bus (narrow band) forced to Off" – When Digital Bus is turned ON, if Wideband Digital Bus is already ON, an advisory message is displayed, "Digital Bus (narrow band) On, Wideband Digital Bus forced to Off"
Preset	OFF (set by Restore Input/Output Defaults)
State Saved	Saved in Input/Output State

Here is the Wideband LVDS connector as viewed from the rear panel. The pin assignments are listed below:



I-Cable

Connection	"-" pin #	"+" pin #
GND	1	26
N/C	2	27
Stream_I[00]	3	28
Stream_I[01]	4	29
Stream_I[02]	5	30
Stream_I[03]	6	31
GND	7	32
Stream_I[04]	8	33
Stream_I[05]	9	34
Stream_I[06]	10	35
Stream_I[07]	11	36
GND	12	37
Stream_I[08]	13	38
Stream_I[09]	14	39
Stream_I[10]	15	40
Stream_I[11]	16	41
GND	17	42
Stream_I[12]	18	43
Stream_I[13]	19	44

Connection	"-" pin #	"+" pin #
Stream_I[14]	20	45
Stream_I[15]	21	46
GND	22	47
GND	23	48
Stream_VALID	24	49
Stream_CLK	25	50

Q-Cable

Connection	"-" pin #	"+" pin #
GND	1	26
Stream_ALT	2	27
Stream_Q[00]	3	28
Stream_Q[01]	4	29
Stream_Q[02]	5	30
Stream_Q[03]	6	31
GND	7	32
Stream_Q[04]	8	33
Stream_Q[05]	9	34
Stream_Q[06]	10	35
Stream_Q[07]	11	36
GND	12	37
Stream_Q[08]	13	38
Stream_Q[09]	14	39
Stream_Q[10]	15	40
Stream_Q[11]	16	41
GND	17	42
Stream_Q[12]	18	43
Stream_Q[13]	19	44
Stream_Q[14]	20	45
Stream_Q[15]	21	46
GND	22	47
GND	23	48
Stream_MARK_1	24	49
Stream_MARK_2	25	50

Stream_I	16 bit "I" Data
Stream_Q[15:0]	16 bit "Q" Data

Stream_VALID	Data valid, when '1' then I/Q data is valid
Stream_CLK	150 MHz DDR clock
Stream_MARK_1	Stream Mark Bit 1
Stream_MARK_2	Stream Mark Bit 2
Stream_ALT	currently unused.

6.7.5 Data Stream

Lets you choose data or a test pattern to output to the Wideband IF LVDS port. This can help you set up your streaming target devices.

Remote Command	`:OUTPut:DBUS2:DATA MEASure | TEST` `:OUTPut:DBUS2:DATA?`
Example	`:OUTP:DBUS2:DATA TEST`
Notes	Selecting `TEST` routes a test pattern to the Wideband Digital Bus stream output
Preset	`MEAS` (set by Restore Input/Output Defaults)
State Saved	Saved in Input/Output State

6.7.6 I/Q Cal Out

The Baseband I/Q "Cal Out" port can be turned on with either a 1 kHz or a 250 kHz square wave. This can be turned on independent of the input selection. Preset resets this to `OFF`.

Remote Command	`:OUTPut:IQ:OUTPut IQ1 | IQ250 | OFF` `:OUTPut:IQ:OUTPut?`
Example	`:OUTP:IQ:OUTP IQ1`
Dependencies	Only available with Option BBA
Couplings	An I/Q Cable Calibration or an I/Q Probe Calibration will change the state of the Cal Out port as needed by the calibration routine. When the calibration is finished the I/Q Cal Out is restored to the pre-calibration state
Preset	`OFF`
State Saved	Saved in instrument state
Range	1 kHz Square Wave|250 kHz Square Wave|Off

6.7.7 Aux IF Out

Controls the signals that appear on the SMA output on the rear panel labeled “AUX IF OUT”

NOTE — Aux IF Out is valid for the RF Input and for the External Mixer input. In external mixing, the Aux IF output level is set by factory default to accommodate expected IF levels for the RF path. When using the External Mixing path, the Aux IF Out levels (for all three options CR3, CRP and ALV) will therefore be uncalibrated.

Remote Command	`:OUTPut:AUX SIF | AIF | LOGVideo | OFF`
	For details of the options, see "More Information" on page 2326 and "Notes on the Aux IF Outputs" on page 2327 below
	`:OUTPut:AUX?`

Dependencies	Does not appear in models that do not support the Aux IF Out
Preset	This is unaffected by Preset but is set to `OFF` by **Restore Input/Output Defaults** or **Restore System Defaults->All**
State Saved	Saved in Input/Output state
Backwards Compatibility Notes	In the PSA, the IF output has functionality equivalent to the "Second IF" function in the X-Series' Aux IF Out menu. In the X-Series, it is necessary to switch the Aux IF Out to “Second IF” to get this functionality, whereas in PSA it is always on, since there are no other choices. Hence a command to switch this function to “Second IF” will have to be added by customers migrating from PSA who use the IF Output in PSA

More Information

The Aux IF Output options are:

Source	Example	Notes
Off	`OUTP:AUX OFF`	In this mode nothing comes out of the “AUX IF OUT” connector on the rear panel. The connector appears as an open-circuit (that is, it is not terminated in any way)
Second IF	`OUTP:AUX SIF`	In this mode the 2nd IF output is routed to the rear panel connector. Annotation on the menu panel shows the current 2nd IF frequency in use in the instrument
Arbitrary IF	`OUTP:AUX AIF`	In this mode the 2nd IF output is mixed with a local oscillator and mixer to produce an arbitrary IF output between 10 MHz and 75 MHz with 500 kHz resolution. The phase noise in this mode will not be as good as in Second IF mode The IF output frequency is adjustable, through an active function which appears on the menu panel, from 10 MHz to 75 MHz with 500 kHz resolution Note that, in instruments with Options B2X or B5X, the Arbitrary IF Output is only practical when the IF Bandwidth is <= 40 MHz, IF Path is <= 40 MHz, or FFT Width is <= 40 MHz
Fast Log Video	`OUTP:AUX LOGV`	In this mode the 2nd IF output is passed through a log amp and the log envelope of the IF signal is sent to the rear panel. The open circuit output level varies by about 25 mV per dB, with a top-of-screen signal producing about 1.6 Volts. The output impedance is nominally 50 ohms

Source	Example	Notes
		This mode is intended to meet the same needs as Option E4440A-H7L Fast Rise Time Video Output on the Keysight E4440A PSA Series, allowing you to characterize pulses with fast rise times using standard measurement suites on modern digital scopes

Notes on the Aux IF Outputs

Second IF

The frequency of the 2nd IF depends on the current IF signal path as shown in the table below:

IF Path Selected	Frequency of "Second IF" Output
10 MHz	322.5 MHz
25 MHz	322.5 MHz
40 MHz	250 MHz
85-160 MHz	300 MHz
255 MHz	750 MHz
510 MHz	877.1484375 MHz

The signal quality, such as signal to noise ratio and phase noise, are excellent in this mode.

The Second IF choice does not appear unless Option CR3 is installed.

Arbitrary IF

The bandwidth of this IF output varies with band and center frequency, but is about 40 MHz at the -3 dB width. When the output is centered at lower frequencies in its range, signal frequencies at the bottom of the bandwidth will "fold". For example, with a 40 MHz bandwidth (20 MHz half-bandwidth), and a 15 MHz IF center, a signal -20 MHz relative to the spectrum analyzer center frequency will have a relative response of about -3 dB with a frequency 20 MHz below the 15 MHz IF center. This -5 MHz frequency will fold to become a +5 MHz signal at the IF output. Therefore, lower IF output frequencies are only useful with known band-limited signals.

The Arbitrary IF choice does not appear unless Option CRP is installed.

Fast Log Video

The output is off during an alignment but not during a marker count, and is not blanked during retrace (after a sweep and before the next sweep starts).

The Fast Log Video choice does not appear unless Option ALV is installed.

6.7.8 Arbitrary IF Freq

Sets the frequency of the Arbitrary IF when Aux IF Out is set to Arbitrary IF.

NOTE	In instruments with Options B2X or B5X, the Arbitrary IF Output is only practical when the IF Bandwidth is <= 40 MHz, IF Path is <= 40 MHz, or FFT Width is <= 40 MHz.

Remote Command	`:OUTPut:AUX:AIF <value>` `:OUTPut:AUX:AIF?`
Example	`:OUTP:AUX:AIF 50 MHZ`
Dependencies	Only appears if Arbitrary IF is the selected Aux IF Output
Preset	This is unaffected by a Preset but is set to 70 MHz on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved	Saved in Input/Output State
Min	10 MHz
Max	75 MHz

6.7.9 Ext/Wide IF Out

The **Ext/Wide IF Out** switch causes the signal which is normally routed to the IF to be routed instead to the Ext IF Out connector on the rear panel (N9041B) or Wide IF Out connector on the front panel (N9042B) or rear panel (N9032B). This is available in the N9041B when RF Input 2 is the selected input port and in the N9032B/N9042B on RF Input and, when V3050A is attached, External RF Input.

Only one IF output (Ext/Wide IF Out, IF2 Out, or Aux IF Out) can be selected at a time, so switching Ext/Wide IF Out to On will change IF2 Out and Aux IF Out to Off, and setting Aux IF Out to something other than Off or IF2 Out to On will force Ext/Wide IF Out to Off.

Remote Command	`:OUTPut:EIF ON | OFF | 1 | 0` `:OUTPut:EIF?`
Example	`:OUTP:EIF ON`
Dependencies	Only appears in N9041B, N9032B, and N9042B For N9041B, enabled when RF Input 2 is the selected input. When RF Input 2 is not selected, the control is grayed out and forced to Off and attempting to set it On will result in an error message For N9032B/N9042B, enabled on RF Input and on External RF Input when V3050A is attached When this switch is ON, no measurement is displayed, and the error “No result; meas invalid with Ext/Wide IF Out set to On” appears in the Status bar
Preset	Off (not affected by Mode Preset but set to Off by Input/Output Preset)
State Saved	Saved in Input/Output state
Annotation	None (but error message appears when on)
Status Bits/OPC dependencies	STATus:QUEStionable:INTegrity bit 1 is set when Ext/Wide IF Out is On. This shows as an error because no valid data is on the screen or available via SCPI. However, the signal out the Ext/Wide IF Out port is still valid given the other settings

6.7.10 IF2 Out

The **IF2 Out** switch causes the signal which is normally routed to the IF, when the 1 GHz IF Path is selected, to be routed instead to the IF2 Out connector on the rear panel.

Only one IF output (Ext IF Out, IF2 Out, or Aux IF Out) can be selected at a time, so switching IF2 Out to On will change Ext IF Out and Aux IF Out to Off, and setting Aux IF Out to something other than Off or Ext IF Out to On will force IF2 Out to Off.

This control only appears if Option H1G is installed. It is only available when the 1 GHz IF Path is chosen, either directly or indirectly; in all other paths it is visible but grayed out and forced to Off. Attempting to set it On when the 1GHz path is not selected will result in an error.

- Direct selection of the 1 GHz path: Measurements that directly support the 1 GHz path have a 1 GHz selection in the IF Path menu in Meas Setup
- Indirect selection of the 1 GHz path: certain measurements, like CCDF, always choose the widest available path, and so will choose the 1 GHz path if it is available, even if there is no IF Path menu in the measurement. IF2 Out will be visible when this results in the 1 GHz path being selected, even if there is no control or readout indicating that the 1 GHz path is chosen

Remote Command	`:OUTPut:IF2 ON | OFF | 1 | 0` `:OUTPut:IF2?`
Example	`:OUTP:IF2 ON`
Dependencies	Only appears in UXA and only when HIG is installed When this switch is `ON`, no measurement is displayed, and the error “No result; meas invalid with IF2 Out set to On” appears in the Status bar
Preset	`OFF` (not affected by Mode Preset but set to `OFF` by Input/Output Preset)
State Saved	Saved in Input/Output state
Annotation	None (but error message appears when on)
Status Bits/OPC dependencies	STATus:QUEStionable:INTegrity bit 1 is set when IF2 Out is `ON`. This shows as an error because no valid data is on the screen or available via SCPI. However, the signal out the IF2 Out port is still valid given the other settings

6.8 Trigger Output

Accesses controls that configure the **Trigger Output** settings.

6.8.1 Trig 1 Out

Selects the type of output signal that will be output from the Trig 1 Out connector.

Although the **Trig 1 Out** control applies only to the Trig 1 output, the SCPI command (detailed in the table below) can be used for any of the Trig Out connectors by using the appropriate TRIGGER parameter (e.g. TRIG1, TRIG2, etc.).

See "More Information" on page 2330

Remote Command	`:TRIGger[1]|2|...|4[:SEQuence]:OUTPut HSWP | MEASuring | MAIN | GATE | GTRigger | OEVen | SPOint | SSWeep | SSETtled | S1Marker | S2Marker | S3Marker | S4Marker | PARB | FSYNc | OFF` `:TRIGger[1]|2|...|4[:SEQuence]:OUTPut?`
Example	`:TRIG:OUTP HSWP` `:TRIG2:OUTP GATE`
Dependencies	You can only send TRIG parameters for the hardware you have; for example you cannot send a `TRIG3` parameter if your hardware does not support `TRIG3`. Sending the SCPI command for an output you do not have generates an error, “Hardware missing; Not available for this model number” . Querying a nonexistent output returns `OFF` For VXT models M9410A/11A: – When the Trig Out Device is `Analyzer`, only `MEASuring`, `MAIN` and `OFF` are available – When the Trig Out Device is `Source`, only `S1Marker`, `S2Marker`, `S3Marker`, `S4Marker`, `PARB`, `FSYNc` and `OFF` are available
Preset	Trigger 1: Sweeping (HSWP) Trigger 2: Gate Trigger 3: Sweeping (HSWP) (on models that support Trigger 3) Trigger 4: Gate (on models that support Trigger 4) This is unaffected by a Preset but is preset to the above values on a “Restore Input/Output Defaults” or “Restore System Defaults->All”
State Saved	Saved in instrument state

More Information

Here are details of the Trigger Output options:

Source	Example	Notes
Off	TRIG1:OUTP OFF TRIG2:OUTP OFF	Selects no signal to be output to the Trig 1 or Trig 2 Out connector
Sweeping (HSWP)	TRIG1:OUTP HSWP	Selects the Sweeping Trigger signal to be output to the Trig 1 Out connector when a measurement is made. This signal has historically been known as "HSWP" (High = Sweeping), and is 5 V TTL level with 50 ohm output impedance
Measuring	TRIG1:OUTP MEAS	Selects the Measuring trigger signal to be output to the Trig 1 Out connector. This signal is true while the Measuring status bit is true
Main Trigger	TRIG1:OUTP MAIN	Selects the current instrument trigger signal to be output to the Trig 1 Out connector
Gate Trigger	TRIG1:OUTP GTR	Selects the gate trigger signal to be output to the Trig 1 Out connector. This is the source of the gate timing, not the actual gate signal
Gate	TRIG1:OUTP GATE	Selects the gate signal to be output to the Trig 1 Out connector. The gate signal has been delayed and its length determined by delay and length settings. When the polarity is positive, a high on the Trig Out connector represents the time the gate is configured to pass the signal
Odd/Even Trace Point	TRIG1:OUTP OEV	Selects either the odd or even trace points as the signal to be output to the Trig 1 Out connector when performing swept spectrum analysis. When the polarity is positive, this output goes high during the time the instrument is sweeping past the first point (Point 0) and every other following trace point. The opposite is true if the polarity is negative
Source Point Trigger	TRIG1:OUTP SPO	Selects the gate signal to be output to the Trig 1 Out connector for use as the Point Trigger when operating an external source in Tracking mode. When Ext Trigger 1 is selected as the Point Trigger under Source, the Source Point Trigger under Trig1 Out automatically gets selected. A similar pattern is used for the other Ext Trigger inputs; for example, when Ext Trigger 2 is selected as the Point Trigger under Source, the Source Point Trigger under Trig 2 Out automatically gets selected
Source Marker 1	TRIG2:OUTP S1M	Selects the Trigger Output at Marker 1 in the Waveform file which is currently playing. Only available in VXT: for M9420/21A only for Trigger Output 2, for M9410A/11A available for both Trigger Output 1/2
Source Marker 2	TRIG2:OUTP S2M	Selects the Trigger Output at Marker 2 in the Waveform file which is currently playing. Only available in VXT: for M9420/21A only for Trigger Output 2, for M9410A/11A available for both Trigger Output 1/2
Source Marker	TRIG2:OUTP S3M	Selects the Trigger Output at Marker 3 in the

Source	Example	Notes
3		Waveform file which is currently playing. Only available in VXT: for M9420/21A only for Trigger Output 2, for M9410A/11A available for both Trigger Output 1/2
Source Marker 4	`TRIG2:OUTP S4M`	Selects the Trigger Output at Marker 4 in the Waveform file which is currently playing. Only available in VXT: for M9420/21A only for Trigger Output 2, for M9410A/11A available for both Trigger Output 1/2
PerArb	`TRIG2:OUTP PARB`	Selects the Trigger Output as PerArb. PerArb is a synchronization trigger which is generated by the ARB at the beginning of each repetition of playing the signal. Only available in VXT Models M9410A/11A
FSYNc	`:TRIG:FRAM:SYNC EXT1` `TRIG2:OUTP FSYNc`	Selects the Trigger Output as FSYNc. The FSYNc parameter means route the Periodic Timer Sync Source signal to the specified Trigger output. That is, the signal selected with the :TRIGger [:SEQuence]:FRAMe:SYNC EXTernal1|EXTernal2|RFBurst|PXI|OFF command will be routed to the specified trigger output The example code means that the External 1 trigger will be used as the Periodic Timer Sync Source, and this signal will then be routed to the Trigger 2 output Only available in VXT Models M9410A/11A.

6.8.2 Trig 1 Out Polarity

Sets the output to the Trig 1 Out connector to trigger on either the positive or negative polarity.

Although the Trig 1 Polarity control applies only to the Trig 1 output, the SCPI command (detailed in the table below) can be used for any of the Trig Out connectors by using the appropriate TRIGGER parameter (e.g. `TRIG1`, `TRIG2`, etc.).

Remote Command	`:TRIGger[1]|2|...|4[:SEQuence]:OUTPut:POLarity POSitive | NEGative` `:TRIGger[1]|2|...|4[:SEQuence]:OUTPut:POLarity?`
Example	`:TRIG1:OUTP:POL POS`
Dependencies	You can only send TRIG parameters for the hardware you have; for example you cannot send a `TRIG3` parameter if your hardware does not support `TRIG3`. Sending the SCPI command for an output you do not have generates an error, “Hardware missing; Not available for this model number” Note that a query of a nonexistent output returns `OFF`
Preset	This is unaffected by a Preset but is set to POSitive on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved	Saved in instrument state

6.8.3 Trig 1 Out Device

Sets the output to the Trig 1 Out connector to trigger on either ANALyzer or SOURce.

Although the Trig 1 Direction control applies only to the Trig 1 output, the SCPI command (detailed in the table below) can be used for any of the Trig Out connectors by using the appropriate TRIGGER parameter (e.g. TRIG1, TRIG2, etc.).

Remote Command	`:TRIGger[1]|2|...|4[:SEQuence]:OUTPut:DIRection ANALyzer | SOURce` `:TRIGger[1]|2|...|4[:SEQuence]:OUTPut:DIRection?`
Example	`:TRIG1:OUTP:DIR ANAL`
Dependencies	Only available on VXT models M9410A/11A
Preset	This is unaffected by a Preset but is set to ANALyzer on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved	Saved in instrument state

6.8.4 Trig 2 Out

Selects the type of output signal that will be output from the Trig 2 Out connector.

Although the Trig 2 Out control applies only to the Trig 2 output, the SCPI command (detailed in the table under Trig 1 Out) can be used for any of the Trig Out connectors by using the appropriate TRIGGER parameter (e.g. TRIG1, TRIG2, etc.).

Example	`:TRIG2:OUTP HSWP` `:TRIG2:OUTP GATE`
Notes	Trig 2 Out is used as the source trigger out in EXM and VXT The available choices in EXM and VXT are S1Marker, S2Marker, S3Marker, S4Marker and OFF
Dependencies	The second Trigger output (Trig 2 Out) does not appear in all models; in models that do not support it, the Trig 2 Out control is blanked, and sending the SCPI command for this output generates an error, “Hardware missing; Not available for this model number” In models that do not support the Trigger 2 output, this error is returned if trying to set Trig 2 Out and a query of Trig 2 Out returns OFF

6.8.5 Trig 2 Out Polarity

Sets the output to the Trig 2 Out connector to trigger on either the positive or negative polarity.

Although the Trig 2 Out Polarity control applies only to the Trig 2 output, the SCPI command (detailed in the table under Trig 1 Out Polarity) can be used for any of the Trig Out connectors by using the appropriate TRIGGER parameter (e.g. TRIG1, TRIG2, etc.).

Example	:TRIG2:OUTP:POL POS
Dependencies	This control does not appear in EXM or VXT
Preset	This is unaffected by a Preset but is set to POSitive on a "Restore Input/Output Defaults" or "Restore System Defaults->All"

6.8.6 Trig 2 Out Device

Sets the output to the Trig 2 Out connector to trigger on either the Analyzer or Source.

Although the Trig 2 Direction control applies only to the Trig 2 output, the SCPI command (detailed in the table under Trig 1 Direction) can be used for any of the Trig Out connectors by using the appropriate TRIGGER parameter (e.g. `TRIG1`, `TRIG2`, etc.).

Example	:TRIG2:OUTP:DIR SOUR
Dependencies	Only available on VXT models M9410A/11A
Preset	This is unaffected by a Preset but is set to Source on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved	Saved in instrument state

6.8.7 Src PXI Trig Out

Selects which signal will be routed to the backplane Source PXI Trigger Output Line.

See "More Information" on page 2334

Remote Command	:TRIGger:PXIE:SOURce[:SEQuence]:OUTPut S1Marker | S2Marker | S3Marker | S4Marker | PARB | OFF :TRIGger:PXIE:SOURce[:SEQuence]:OUTPut?
Example	:TRIG:PXIE:SOUR:OUTP S1M :TRIG:PXIE:SOUR:OUTP?
Dependencies	This control only appears in EXM and VXT
Preset	OFF
State Saved	Saved in instrument state

More Information

Here are details of the Source PXI Trigger Output options:

Source	Example	Notes
Off	TRIG:PXIE:SOUR:OUTP	Selects no signal to be output to the Source PXI

Source	Example	Notes
	`OFF`	backplane line
Source Marker 1	`TRIG:PXIE:SOUR:OUTP S1M`	Selects the Trigger Output at Marker 1 in the Waveform file which is currently playing to be output to the Source PXI backplane line
Source Marker 2	`TRIG:PXIE:SOUR:OUTP S2M`	Selects the Trigger Output at Marker 2 in the Waveform file which is currently playing to be output to the Source PXI backplane line
Source Marker 3	`TRIG:PXIE:SOUR:OUTP S3M`	Selects the Trigger Output at Marker 3 in the Waveform file which is currently playing to be output to the Source PXI backplane line
Source Marker 4	`TRIG:PXIE:SOUR:OUTP S4M`	Selects the Trigger Output at Marker 4 in the Waveform file which is currently playing to be output to the Source PXI backplane line
PerArb	`TRIG:PXIE:SOUR:OUTP PARB`	PerArb is a synchronization trigger which is generated by the ARB at the beginning of each repetition of playing the signal. This selection causes the PerArb Trigger Output which is currently playing to be output to the Source PXI backplane line. Only available in VXT Models M9410A/11A

6.8.8 Src Trig Out Polarity

Sets the output to the Source PXI backplane trigger line to trigger on either the positive or negative polarity.

Remote Command	`:TRIGger:PXIE:SOURce[:SEQuence]:OUTPut:POLarity POSitive | NEGative` `:TRIGger:PXIE:SOURce[:SEQuence]:OUTPut:POLarity?`
Example	`:TRIG:PXIE:SOUR:OUTP:POL POS`
Dependencies	This control only appears in EXM and VXT
Preset	This is unaffected by a Preset but is set to POSitive on a "Restore Input/Output Defaults" or "Restore System Defaults->All" `POSitive`
State Saved	Saved in instrument state

6.8.9 Select Src PXI Line

Controls which backplane trigger line TRIG[0..7] is used for the Source Trigger Output.

Remote Command	`:TRIGger:PXIE:SOURce[:SEQuence]:OUTPut:LINE <line>` `:TRIGger:PXIE:SOURce[:SEQuence]:OUTPut:LINE?`

Example	`:TRIGger:PXIE:SOURce:OUTPut:LINE 0`
Dependencies	This control only appears in EXM and VXT
Preset	4
State Saved	Saved in instrument state
Range	[0,7]

6.8.10 Analyzer PXI Trig Out

Selects the signal that will be output from Analyzer PXI Trigger Line (Backplane Trigger Line 0~3).

See "More Information" on page 2336

Remote Command	`:TRIGger:PXIE:ANALyzer[:SEQuence]:OUTPut HSWP | MEASuring | MAIN | GATE | GTRigger | OEVen | OFF` `:TRIGger:PXIE:ANALyzer[:SEQuence]:OUTPut?`
Example	`:TRIG:PXIE:ANAL:OUTP HSWP`
Dependencies	This is only available on certain modular analyzers, such as CXA-m and VXT models M9410A/11A Only `OFF`, `MEASuring` and `MAIN` are available for VXT models M9410A/11A
Preset	This is unaffected by **Preset** but is preset to `OFF` on **Restore Input/Output Defaults** or **Restore System Defaults->All**
State Saved	Saved in instrument state

More Information

Here are details of the Analyzer PXI Trigger Output options:

Source	Example	Notes
Off	`TRIG:PXIE:ANAL:OUTP OFF` `TRIG:PXIE:ANAL:OUTP OFF`	Selects no signal to be output to the Analyzer PXI backplane trigger line
Sweeping (HSWP)	`TRIG:PXIE:ANAL:OUTP HSWP`	Selects the Sweeping Trigger signal to be output to the Analyzer PXI backplane trigger line when a measurement is made. This signal has historically been known as "HSWP" (High = Sweeping), and is 5 V TTL level with 50 ohm output impedance
Measuring	`TRIG:PXIE:ANAL:OUTP MEAS`	Selects the Measuring trigger signal to be output to the Analyzer PXI backplane trigger line. This signal is true while the Measuring status bit is true
Main Trigger	`TRIG:PXIE:ANAL:OUTP MAIN`	Selects the current instrument trigger signal to be output to the Analyzer PXI backplane trigger

Source	Example	Notes
		line
Gate Trigger	`TRIG:PXIE:ANAL:OUTP GTR`	Selects the gate trigger signal to be output to the Analyzer PXI backplane trigger line. This is the source of the gate timing, not the actual gate signal
Gate	`TRIG:PXIE:ANAL:OUTP GATE`	Selects the gate signal to be output to the Analyzer PXI backplane trigger line. The gate signal has been delayed and its length determined by delay and length settings. When the polarity is positive, a high on the Trig Out connector represents the time the gate is configured to pass the signal
Odd/Even Trace Point	`TRIG:PXIE:ANAL:OUTP OEV`	Selects either the odd or even trace points as the signal to be output to the Analyzer PXI backplane trigger line when performing swept spectrum analysis. When the polarity is positive, this output goes high during the time the instrument is sweeping past the first point (Point 0) and every other following trace point. The opposite is true if the polarity is negative

6.8.11 Analyzer Trig Out Polarity

Sets the output to the Analyzer PXI backplane trigger line to trigger on either the positive or negative polarity.

Remote Command	`:TRIGger:PXIE:ANALyzer[:SEQuence]:OUTPut:POLarity POSitive | NEGative` `:TRIGger:PXIE:ANALyzer[:SEQuence]:OUTPut:POLarity?`
Example	`:TRIG:PXIE:ANAL:OUTP:POL POS`
Dependencies	This is only available on certain modular analyzers, such as CXA-m and VXT models M9410A/11A
Preset	This is unaffected by a Preset but is set to POSitive on a "Restore Input/Output Defaults" or "Restore System Defaults->All" `POSitive`
State Saved	Saved in instrument state

6.8.12 Select Analyzer PXI Line

Controls which PXI_TRIG[0..3] is used for the Analyzer Trigger Output.

Remote Command	`:TRIGger:PXIE:ANALyzer[:SEQuence]:OUTPut:LINE <line>` `:TRIGger:PXIE:ANALyzer[:SEQuence]:OUTPut:LINE?`
Example	`:TRIGger:PXIE:ANALyzer:OUTPut:LINE 0`

Dependencies	This is only available on certain modular analyzers, such as CXA-m and VXT models M9410A/11A
Preset	0
State Saved	Saved in instrument state
Range	[0,3]

6.8.13 Source Internal Trig Out

Selects the signal which will be output from Source Internal Trigger Line.

NOTE In some software released in 2018 and 2019, the SCPI command for this function was as below:

:TRIGger:SOURce:INTernal[:SEQuence]:OUTPut S1Marker|S2Marker|S3Marker|S4Marker|OFF

It was necessary to change this SCPI in release A.24.00 due to internal conflicts in the software. User code written for the A.22.xx or A.23.xx instrument software which used the old form must be rewritten to use the form below.

Remote Command	`:TRIGger[:SEQuence]:INTernal:SOURce:OUTPut S1Marker | S2Marker | S3Marker | S4Marker | PARB | OFF` `:TRIGger[:SEQuence]:INTernal:SOURce:OUTPut?`
Example	`:TRIG:INT:SOUR:OUTP S1M`
Notes	`PARB` - PerArb is a synchronization trigger, which is generated by the ARB at the beginning of each repetition of playing the signal
Dependencies	This is only available on VXT models M9420A, M9410A and M9411A
Preset	This is unaffected by a Preset but is preset to OFF on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved	Saved in instrument state

6.8.14 Source Internal Trig Out Polarity

Sets the output to the Source Internal trigger line to trigger on either the positive or negative polarity.

NOTE In some software released in 2018 and 2019, the SCPI command for this function was as below:

:TRIGger:SOURce:INTernal[:SEQuence]:OUTPut:POLarity POSitive|NEGative

It was necessary to change this SCPI in release A.24.00 due to internal conflicts in the software. User code written for the A.22.xx or A.23.xx instrument software which used the old form must be rewritten to use the form below.

Remote Command	`:TRIGger[:SEQuence]:INTernal:SOURce:OUTPut:POLarity POSitive | NEGative` `:TRIGger[:SEQuence]:INTernal:SOURce:OUTPut:POLarity?`
Example	`:TRIG:INT:SOUR:OUTP:POL POS`
Dependencies	This is only available on VXT models
Preset	This is unaffected by **Preset** but is set to `POSitive` by **Restore Input/Output Defaults** or **Restore System Defaults->All** `POSitive`
State Saved	Saved in instrument state

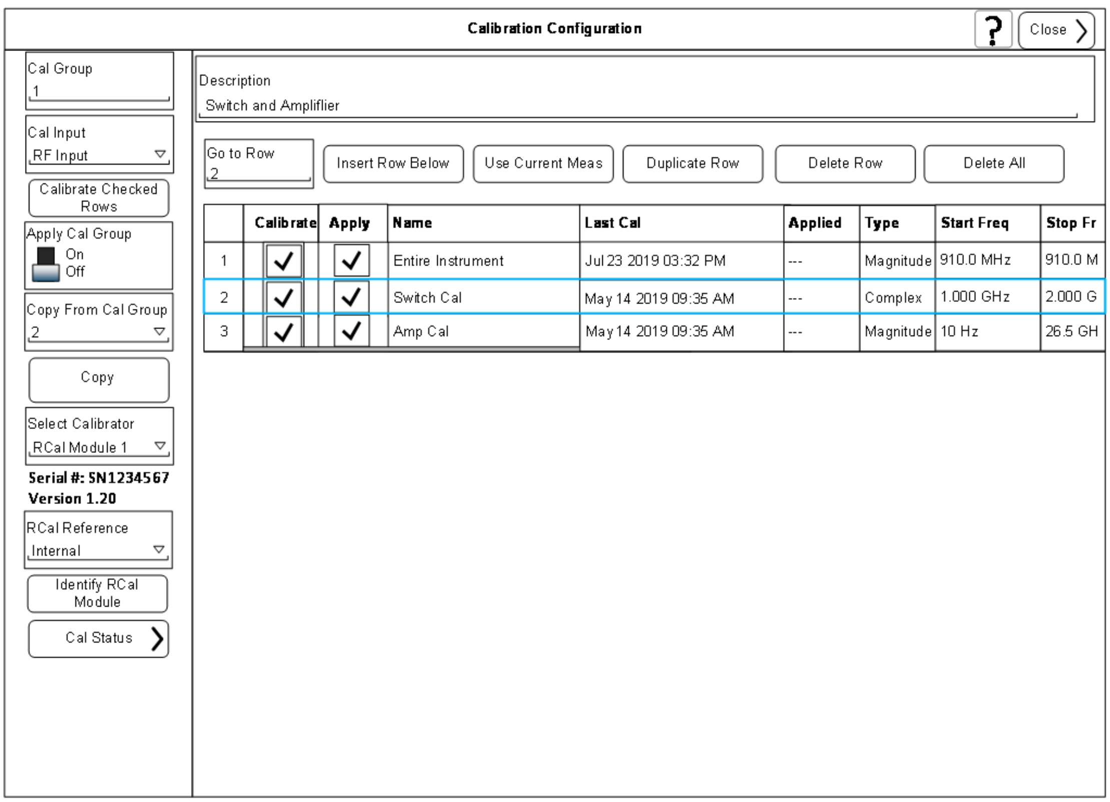
6.9 Calibration

Allows you to configure the Comb Calibrator. This tab only appears when an RCal license is installed. Settings associated with the Calibrator are configured here.

6.9.1 Configuration

Opens the dialog shown below. This is a full screen dialog. Configuring of Cals is done using this dialog. The table consists of rows of Cals and Columns of Cal settings. Users can scroll or swipe vertically or horizontally to view Cal's or settings not currently shown on the screen.

Dialog with Example Table entries:



Full Cal Group Table with Example entries:

RCal Calibrations Table

Table will scroll vertically and horizontally

	Calibrate	Apply	Name	Last Cal	Applied	External Mixer	Cal Type
1	✓	✓	Entire Instrument	Aug 30 2018 03:32 PM	Yes	11970A : Normal	Vector
2	✓	✓	Wednesday with remote head	Sep 1 2018 02:27 PM	No	Custom : Normal	Vector
3	✓	✓	20190119 3:54pm	---	---	11970U : Normal	Vector
4			1 GHz – 3 GHz	---	---	11970V : Normal	Scalar
5			2 GHz – 4 GHz	---	---	K Band Single Harmonic No Doubler : Normal	Scalar
6			External Preamp	---	---	W Band Single Harmonic No Doubler : Normal	Scalar
7			(None)				
8			(None)				
9			(None)				
10			(None)				

Only shows when External Mixer is the selected Cal Input

Scalar
Vector

Start Freq	Stop Freq	Freq Step	Freq Points	Mech Atten	Mech Atten Start	Mech Atten Stop	Mech Atten Step	Elec Atten	Elec Atten Start
910.0 MHz	910.0 MHz	0 Hz	1	Step	0 dB	10 dB	2 dB	Step	0 dB
1.000 GHz	2.000 GHz	100.000 MHz	100	Reference	10 dB	10 dB	0 dB	Bypass	0 dB
10 Hz	26.5 GHz	0 Hz	3	All	0 dB	70 dB	2 dB	All	0 dB
1.000 GHz	3.000 GHz	100.00 MHz	20	Step	10 dB	50 dB	10 dB	Step	10 dB
2.000 GHz	4.000 GHz	10.000 MHz	200	Bypass	0 dB	70 dB	2 dB	All	0 dB
2.000 GHz	2.000 GHz	0 Hz	1	Reference	10 dB	10 dB	0 dB	Reference	10 dB

Step
All
Bypass

Step
All
Bypass

Elec Atten Stop	Elec Atten Step	Full Atten	Full Atten Start	Full Atten Stop	Freq Ext Atten	Freq Ext Atten Start	Freq Ext Atten Stop	IF Path
10 dB	5 dB	Step	0 dB	6 dB	Step	0 dB	6 dB	10 MHz
0 dB	0 dB	All	0 dB	0 dB	All	0 dB	0 dB	510 MHz
24 dB	1 dB	All	0 dB	20 dB	All	0 dB	20 dB	25 MHz
20 dB	2 dB	Step	6 dB	20 dB	Step	6 dB	20 dB	10 MHz
24 dB	1 dB	All	0 dB	24 dB	All	0 dB	24 dB	25 MHz
10 dB	0 dB	All	10 dB	10 dB	All	10 dB	10 dB	40 MHz

Step
All

Step
All

10 MHz
25 MHz
40 MHz
510 MHz
1 GHz
2 GHz
4 GHz

IF Gain	Preamp	LNA	uW Path Ctrl	Coupling	Ph Noise Opt	Mixer Mode	Match State
All	Off	On	On	AC	Best Wide Offset	Normal	True
High Gain	Off	On	On	AC	Best Close-In Ø	Normal	True
Low Gain	Low Band	Off	Off	DC	Best Spurs	Alternative	True
Low Gain	Full Range	Off	Off	AC	Best Close-In Ø	Normal	True
All	Off	On	On	DC	Fast Tuning	Alternative	False
High Gain	Off	On	On	DC	Best Wide Offset	Normal	True

High Gain
Low Gain
All

Off
Low Band
Full Range

AC
DC

Best Close-In Ø Noise [offset < 600 kHz]
Balance Noise and Spurs [offset < 600 kHz]
Best Spurs [offset < 600 kHz]
Best Wide-Offset Ø Noise [offset > 800 kHz]
Fast Tuning

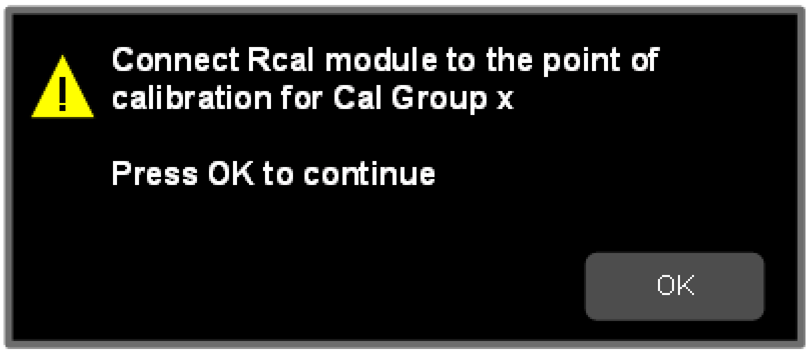
6.9.1.1 Cal Group

This is the same as Cal Group from the Calibration tab.

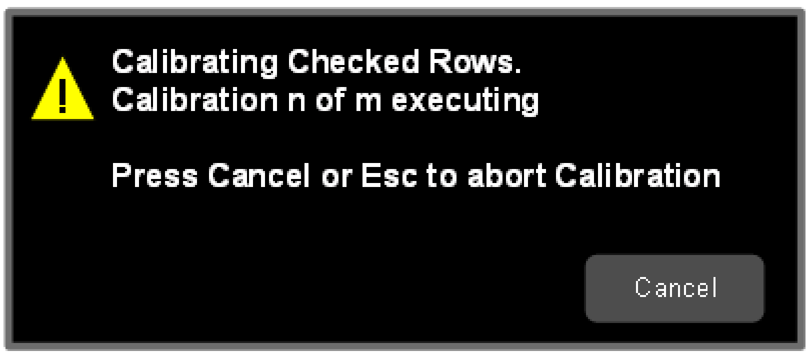
6.9.1.2 Calibrate Checked Rows

This key executes the Cals within the currently selected Cal Group that have the Calibrate box checked in the RCal Configuration Table.

Once selected, the following dialog box is displayed;



When you click **OK**, the following dialog is displayed;



If there are multiple Cals being executed in a Cal Group, this dialog advises you when each Cal is complete. It also provides the ability to abort the Execute Cal Request.

If you choose to abort, Cal's that have completed use the new Cal data and update the Last Cal field. Cal's that have not completed retain the existing Cal data and Last Cal timestamp, or show "---" if the Cal had never been executed.

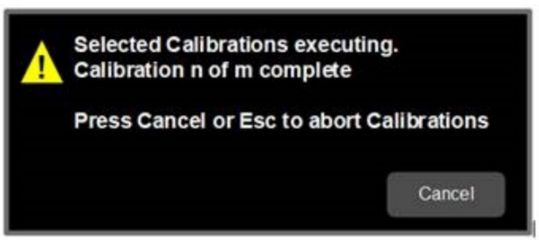
Remote Command	`:SYSTem:CALibration:INITiate:SELected`
Example	`:SYST:CAL:INIT:SEL`
Notes	Cals cannot be applied until they have been calibrated. Once a Cal has been calibrated, the Last Cal field in the table displays the date and time the Cal was last calibrated
Dependencies	This command is applied to the currently selected Cal Group
Couplings	Calibrate Selected control is disabled if there are no Calibrate checkboxes checked. If the disabled control is selected, the advisory message "Check the Calibrate box for the Cals you want to calibrate" is displayed

6.9.1.3 Apply Cal Group

This is the same as Apply Cal Group from the Calibration tab.

6.9.1.4 Abort Calibration

Aborts the Calibration routine of the currently selected Cal Group

Remote Command	`:SYSTem:CALibration:ABORt`
Example	`:SYST:CAL:ABOR`
Dependencies	This command aborts the currently running calibration. The previously ran calibrations will still be available, but the current calibration is halted, and next calibrations selected are not executed. Once the calibration starts, the modal dialog pops up, and the abort can be executed by selecting Cancel button 

6.9.1.5 Copy From Cal Group

Determines the Cal Group from which existing rows are copied when using the Copy Group feature.

Remote Command	`:SYSTem:CALibration:CGRoup:COPY:FROM <integer>` `:SYSTem:CALibration:CGRoup:COPY:FROM?`
Example	`:SYST:CAL:CGR:COPY:FROM 2` `:SYST:CAL:CGR:COPY:FROM?`
Preset	1
Min	1
Max	100

6.9.1.6 Copy

Allows you to copy the settings in the Cal Group specified by the **Copy From Cal Group** parameter.

All the rows in the table are copied to the selected Cal Group. The columns Apply, Last Cal and Applied are set to their default values.

The group level parameters are also copied, with the exception of **Apply Cal Group** and **Copy From Cal Group**.

Remote Command	`:SYSTem:CALibration:CGRoup:COPY`
Example	`:SYST:CAL:CGRoup:COPY`
Dependencies	This command is applied to the currently selected Cal Group
Couplings	Copy control is disabled if Copy From Cal Group is the same as the currently selected Cal Group. If the disabled control is selected, the advisory message "Unable to Copy from same Cal Group" is displayed, and the same message is returned remotely as a Settings Conflict If user attempts to Copy From a Cal Group that is empty the advisory message "Copy From Cal Group is empty" is displayed, and the same message is returned remotely as a Settings Conflict

6.9.1.7 Cal Input

Maps the currently selected Cal Group to a particular I/O port. This control allows any Input port (including External Mixing, the RF2 input, etc.) to be mapped to a specific Cal Group

Remote Command	`:SYSTem:CALibration:INPut RFIN | RFIN2 || EMIXer | ERFIN` `:SYSTem:CALibration:INPut?`
Example	`:SYST:CAL:INPut RFIN2`
Dependencies	`RFIN2|EMIXer` are only available on C/E/M/P/UXA analyzers with the appropriate options loaded `ERFIN` is only available if the V3050A unit is connected
State Saved	Saved in State

Parameters, notes and examples. Note that the presence of these ports is highly hardware dependent.

Cal Input	Example	Note
RF Input	`:SYST:CAL:INPut RFIN`	Main RF Port Not available on EXM with hardware M9431A
RF Input 2	`:SYST:CAL:INPut RFIN2`	Second RF Port, labeled RF Input 2 Only available on certain instruments.
External Mixer	`:SYST:CAL:INPut EMIX`	Requires option EXM
External RF	`:SYST:CAL:INPut ERFIN`	Only available if the V3050A unit is connected

6.9.1.8 Freq Offset

Specifies any frequency offset that is to be applied to the currently selected Cal Group. This can be used when using an external mixer.

Remote Command	`:SYSTem:CALibration:FREQuency:OFFSet <freq>` `:SYSTem:CALibration:FREQuency:OFFSet?`
Example	`:SYST:CAL:FREQ:OFFS 1e9`

Dependencies	For SCPI, this query applies to the currently selected Cal Group
Preset	All 0 Hz
State Saved	Saved in instrument state
Min	0 Hz
Max	100.0 GHz

6.9.1.9 Select Calibrator

Selects the calibrator for the currently selected Cal Group to use for executing the calibration when multiple modules are connected.

Remote Command	`:SYSTem:CALibration:MODule:SELect NONE | RCM1 | RCM2 | RCM3 | RCM4 | RCM5 | RCM6 | RCM7 | RCM8 | RCM9 | RCM10` `:SYSTem:CALibration:MODule:SELect?`
Example	`:SYST:CAL:MODule:SELect RCM1`
Notes	Details of the RCal module are displayed beneath the control. If there are no modules connected, the text states “No Modules Connected” For SCPI , if the parameter sent is for a module that is not currently connected to the instrument, the message “Selected RCal module not connected” is generated
Dependencies	For SCPI, this command is applied to the currently selected Cal Group
State Saved	Saved in instrument state
Range	All connected RCal modules

6.9.1.10 Identify RCal Module

Control to connect to the RCal module of the currently selected Cal Group and blink its identity light

Remote Command	`:SYSTem:CALibration:IDENtify`
Example	`:SYST:CAL:IDEN`
Dependencies	For SCPI, this command is applied to the currently selected Cal Group Requires you to select an RCal module using **Select RCal Module**

6.9.1.11 RCal Module Serial Number (Remote Query Only)

SCPI query to obtain the serial number of the specified module

Remote Command	`SYSTem:CALibration:MODule[1]|2|...|10:SNUMber?`
Example	`:SYST:CAL:MOD:SNUM?`
Notes	If there is no module associated with the specified module number, the empty string is returned

6.9.1.12 RCal Reference

Determines the reference type used by the RCal module of the currently selected Cal Group

Remote Command	`:SYSTem:CALibration:REFerence INTernal | EXTernal` `:SYSTem:CALibration:REFerence?`
Example	`:SYST:CAL:REF EXT`
Dependencies	For SCPI, this command is applied to the currently selected Cal Group
Preset	`EXTernal`
State Saved	Saved in instrument state
Range	`INTernal|EXTernal`

6.9.1.13 RCal Status

Opens a dialog that is used to provide the status of all active rows in all groups. Status can be one of the following; Calibrated, Applied, Calibration Failed or Apply Failed.

If a Calibration Fails, an error icon will be shown in the Calibrate column of the row(s) that failed with a message indicating the nature of the failure. If the failure cannot be addressed by the user, the error message “Calibration Failed. See Error Log” will be shown and details of the failure will be written to the SA Event Log.

Applying the Calibration can result in a warning if there is a mismatch between the currently executing instrument state and any of the following parameter settings;

- Cal Input
- Frequency
- IF Path
- IF Gain
- Phase Noise Optimization
- Preamp
- Coupling
- Mechanical Attenuator
- Electrical Attenuator
- Full Range Attenuator

– uW Path Control

– Mixing Mode

– External Mixer

When there is a mismatch a warning icon will be shown in the Applied column of the row(s) that had the mismatch with details in the format “<Parameter Name> does not match meas state”.

The Status dialog provides you with the group and row of a Calibration and its current state and any error details if the status is not ok. Table format shown below:

RCal Status

This query only SCPI commands returns a comma separated list of the status of an individual row status in the format “Group”, “Row”, ‘Status’, “Details”

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:STATus?`
Example	`:SYST:CAL:ROW2:STAT?` Returns a comma separated list of the status of an individual row status in the format “Group”, “Row”, ‘Status’, “Details”
Dependencies	For SCPI, this command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group

	If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated

All RCal Status

This query only SCPI commands returns a comma separate list of all entries in the Cal Status table in the format "Group", "Row", 'Status', "Details" which is repeated for each row in the table. If there are no entries in the table, the empty string is returned.

Remote Command	`:SYSTem:CALibration:STATus:ALL?`
Example	`:SYST:CAL:STAT:ALL?` Returns a comma separate list of all entries in the Cal Status table in the format "Group", "Row", 'Status', "Details" which are repeated for each row in the table

6.9.1.14 Go to Row

Sets the selected row in the Cal table for the currently selected Cal Group.

Notes	You can only Go To a row that has already been added
Preset	1
State Saved	Saved in instrument state
Min	1
Max	32

6.9.1.15 Insert Row Below

Adds a new row, to the currently selected Cal Group, under the currently selected row in the table or after the sub opcode used in the SCPI command. The default values for each of the settings in the row is used.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:INSert`
Example	`:SYST:CAL:ROW2:INSert`
Dependencies	For SCPI, this command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated

6.9.1.16 Description

Provides a description for the currently selected Cal Group from which the operator can easily identify the Cal Group.

Remote Command	`:SYSTem:CALibration:DESCription "Description"` `:SYSTem:CALibration:DESCription?`
Example	`:SYST:CAL:DESC "Description"`
Notes	The Cal Group Description is also shown on the **Calibration** menu panel, but is limited to the first 18 characters
Dependencies	For SCPI, this command is applied to the currently selected Cal Group
State Saved	Saved in instrument state

6.9.1.17 Use Current Meas

Takes the settings from the current running measurement state to populate the Cal Row settings of the currently selected Cal Group.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:UCMeas`
Example	`:SYST:CAL:ROW2:UCM`
Dependencies	For SCPI, this command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group If the group table is empty and subopcode is omitted or 1, a new row is created and populated using the current running measurement If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221,Settings conflict; Subopcode does not reference an existing Cal row" is generated -221, Settings conflict; Feature not supported for this measurement

6.9.1.18 Duplicate Row

Creates a new row the currently selected row, and populates the new row with the settings from the selected row of the currently selected Cal Group

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:DUPLicate`
Example	`:SYST:CAL:ROW2:DUPL`
Dependencies	For SCPI, this command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221,Settings conflict; Subopcode does not reference an existing Cal row" is generated

6.9.1.19 Delete Row

Deletes the settings from the selected row of the currently selected Cal Group

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:DELete`
Example	`:SYST:CAL:ROW2:DEL`

Notes	This control is disabled if the Cal Group contains no Cal rows
Dependencies	For SCPI, this command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated

6.9.1.20 Delete All

Deletes all the Cals in the currently selected Cal Group

Remote Command	`:SYSTem:CALibration:DELete:ALL`
Example	`:SYST:CAL:DEL:ALL`
Notes	This control is disabled if the Cal Group contains no Cal rows
Dependencies	For SCPI, this command is applied to the currently selected Cal Group

6.9.1.21 Calibrate

Determines whether the Cal row should be included when Calibrate Selected is executed.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:CALibrate:STATe ON | OFF | 1 | 0` `:SYSTem:CALibration:ROW[1]|2|…|100:CALibrate:STATe?`
Example	`:SYST:CAL:ROW2:CAL:STAT ON` `:SYST:CAL:ROW2:CAL:STAT?`
Dependencies	For SCPI, this command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	All OFF
State Saved	Saved in instrument state
Range	`ON|OFF`

6.9.1.22 Apply

Determines the Cal that is applied.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:APPLy:STATe ON | OFF | 1 | 0` `:SYSTem:CALibration:ROW[1]|2|…|100:APPly:STATe?`
Example	`:SYST:CAL:ROW2:APPL:STAT ON` `:SYST:CAL:ROW2:APPL:STAT?`
Dependencies	For SCPI, this command is applied to the currently selected Cal Group. The subopcode is used to

	identify the Cal row in the Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated You can only check the **Apply** checkbox for a Cal that has been executed. If you attempt to select the **Apply** checkbox for Cal's that have not been executed, the advisory message "Cal must be executed before it can be applied" is displayed If Apply Cal is on, and you attempt to check the **Apply** checkbox for a Cal that is invalid for use with the current measurement state, the error "Cal invalid with current measurement settings is shown, and the checkbox remains unchecked
Couplings	When the Apply check box is checked, if the Apply Cal Group setting is Off it will be turned on. Calibrations are only applied when the Apply Cal Group is on
Preset	All OFF
State Saved	Saved in instrument state
Range	`ON|OFF`
Annotation	If *any* Cal check box in any group is checked and Apply Cal Group for that group is turned on, RCal in the Meas Bar will display as amber to indicate Calibrations are in use

6.9.1.23 Name

Sets an ASCII text field allowing you to name the selected Cal

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:NAME <string>` `:SYSTem:CALibration:ROW[1]|2|…|100:NAME?`
Example	`:SYST:CAL:ROW2:NAM "Monday AM Cal"`
Notes	45 chars max; may not fit on display if max chars used
Dependencies	For SCPI, this command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	"Cal #", where # is corresponding Cal number
State Saved	Saved in instrument state

6.9.1.24 Last Cal

Displays the date and time the selected Cal was last executed. Read only field.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:LAST?`
Example	`:SYST:CAL:ROW2:LAST?` Returns data and time Cal 2 was last executed
Notes	SCPI query returns a string containing the date and time the Cal was executed. If the Cal has never been executed, or any of the settings are changed, SCPI returns an empty string and the front panel displays "---"

Dependencies	For SCPI, this query applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated

6.9.1.25 Cal Applied

Displays the status of a Cal once it is applied. Is either Yes or No, depending on if the Cal was successfully applied or not. See RCalStatus for more details. If it is not being applied the field shows "---". Read only field.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:CAPPlied?`
Example	`:SYST:CAL:ROW2:CAPP?` Returns Cal Stats of Cal 2
Notes	SCPI query returns a string containing the date and time the Cal was executed. If the Cal has never been executed, or any of the settings are changed, SCPI returns an empty string and the front panel displays "---"
Dependencies	For SCPI, this query applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated

6.9.1.26 Cal Type

Specifies how the calibration is to be performed on the selected Cal. Choices are;

- `MAGNitude`: A single CW tone is measured at the center of the screen for each frequency point
- `COMPlex`: A comb signal is measured across the full IF passband at each frequency point. Magnitude and Phase are measured

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:TYPE MAGNitude | COMPlex` `:SYSTem:CALibration:ROW[1]|2|…|100:TYPE?`
Example	`:SYST:CAL:ROW2:TYPE COMP`
Dependencies	**Cal Type** is only available if the selected RCal module has a license for complex calibrations. If it does not this control is disabled For SCPI, this query applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	`MAGNitude`
State Saved	Saved in instrument state
Range	`MAGNitude|COMPlex`

6.9.1.27 Start Freq

Specifies the start frequency of the selected Cal.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:STARt <freq>` `:SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:STARt?`
Example	`:SYST:CAL:ROW2:FREQ:STAR 1e9`
Notes	Max values depend on Hardware Options (503, 507, 508, 513, 526)
Dependencies	For SCPI; This query applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated By direct entry: You cannot set the Start Frequency > Stop Frequency. You can set the Start frequency = Stop frequency. If you set Start Frequency = Stop Frequency, Frequency Step is adjusted to 0, and Frequency Points is adjusted to 1 With the knob or step keys: If you set Start Frequency = Stop Frequency, Frequency Step is adjusted to 0, and Frequency Points is adjusted to 1
Couplings	If you change the start frequency of the selected range to a value > the range's stop frequency the stop frequency of the previous range is changed to the same value. The Freq step is set to 0 Hz and Freq Points is set to 1 If you change the start frequency <=min frequency of the instrument, the start frequency of the selected range is set to the minimum frequency of the instrument If you change the start frequency >=maximum frequency of the instrument, the start frequency of the selected range is set to the maximum frequency of the instrument and the stop frequency of selected range is set to the maximum frequency of the instrument. The Freq step is set to 0 Hz and Freq Points is set to 1
Preset	Depends on the instrument maximum frequency
State Saved	Saved in instrument state
Min	If Scale Type is set to Lin, the min Start Frequency is changed to -80 MHz
Max	Depends on the instrument maximum frequency – 10 Hz minimum span

6.9.1.28 Stop Freq

Specifies the stop frequency of the selected Cal.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:STOP <freq>` `:SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:STOP?`
Example	`:SYST:CAL:ROW2:FREQ:STOP 1e9`
Notes	Max values depend on Hardware Options (503, 507, 508, 513, 526)

Dependencies	For SCPI; This query applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated By direct entry: You cannot set the Stop frequency < the Start frequency. You cannot set the Start frequency = the Stop frequency. You can set the Start frequency = Stop frequency. If you set Start Frequency = Stop Frequency, Frequency Step is adjusted to 0, and Frequency Points is adjusted to 1 With the knob or step keys: If you set Start Frequency = Stop Frequency, Frequency Step is adjusted to 0, and Frequency Points is adjusted to 1
Couplings	If you change the stop frequency of the selected range to a value < the range's start frequency the start frequency of the range is changed to the same value. The Freq step is set to 0 Hz and Freq Points is set to 1 If you change the stop frequency >=the maximum frequency of the instrument, the stop frequency of the selected range is set to the maximum frequency of the instrument If you change the stop frequency <=the minimum frequency of the instrument, the stop frequency of the selected range is set to the minimum frequency of the instrument and the start frequency of the selected range is set to the minimum frequency of the instrument. The Freq step is set to 0 Hz and Freq Points is set to 1
Preset	Depends on the instrument maximum frequency
State Saved	Saved in instrument state
Min	If Scale Type is set to Lin, the min Stop Frequency is changed to -79.999990 MHz
Max	Depends on the instrument maximum frequency

6.9.1.29 Freq Step

Specifies the step frequency of the selected Cal. This determines the points between the start and stop frequencies to use for Calibration.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:STEP <freq>` `:SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:STEP?`
Example	`:SYST:CAL:ROW2:FREQ:STEP 1e9`
Notes	Max values depend on Hardware Options (503, 507, 508, 513, 526)
Dependencies	For SCPI, this query applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated You cannot set the Freq Step > Stop frequency - Start frequency Attempts to set Freq Step > Stop frequency - Start frequency results in Freq Step being set to Stop frequency - Start frequency
Couplings	This parameter is coupled to Freq Points. Changing the Freq Step adjusts the Freq Points using (((Stop Freq – Start Freq) / Freq Step) + 1) and clips to the next integer value, which may result in the Freq Step being clipped too

	If the Freq Step is set to a value > Stop Freq – Start Freq the Stop Freq is increased and Freq Points are set to 1
Preset	All 10 kHz
State Saved	Saved in instrument state
Min	1 Hz
Max	Depends on the instrument maximum frequency

6.9.1.30 Freq Points

Specifies the frequency points of the selected Cal. This determines the points between the start and stop frequencies to use for Calibration.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:POINts` `:SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:POINts?`
Example	`:SYST:CAL:ROW2:FREQ:POIN 100`
Couplings	This parameter is coupled to Freq Step. Changing the Freq Points adjusts the Freq Step using (Stop Freq – Start Freq) / (Freq Points – 1) and clips to the next integer value, which may result in the Freq Step being clipped
Preset	1
Min	1
Max	100000

6.9.1.31 Mech Atten Type

Specifies the Mech Atten type to use:

- `STEP`: Use multiple Mech Atten states determined by Mech Atten Start, Mech Atten Stop and Mech Atten Step
- `ALL`: Use all the attenuator states
- `BYPass`: Bypasses the attenuator

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:TYPE STEP	ALL	BYPass` `:SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:TYPE?`
Example	`:SYST:CAL:ROW3:ATT:TYPE STEP`
Dependencies	For SCPI, this query applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221,Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	`STEP`
State Saved	Saved in instrument state
Range	`STEP|ALL|BYPass`

6.9.1.32 Mech Atten Start

Determines the first Mechanical Attenuator to be used in the Calibration

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:STARt <rel_ampl>` `:SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:STARt?`
Example	`:SYST:CAL:ROW3:ATT:STARt 20`
Dependencies	The Mech Atten Start control is disabled unless Mech Atten Type is Step For SCPI, this query applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221,Settings conflict; Subopcode does not reference an existing Cal row" is generated
Couplings	This parameter is coupled to Mech Atten Stop. Mech Atten Start must be <= Mech Atten Stop. If Mech Atten Start > Mech Atten Stop, Mech Atten Stop = Mech Atten Start
Preset	10 dB
State Saved	Saved in instrument state
Min	0 dB The attenuation set by this control cannot be decreased below 6 dB with the knob or step keys. To get to a value below 6 dB it must be directly entered from the keypad or via SCPI. This protects from adjusting the attenuation to a dangerously small value which can put the instrument at risk of damage to input circuitry. However, if the current mechanical attenuation is below 6 dB it can be increased with the knob and step keys, but not decreased
Max	CXA Option 503 or 507: 50 dB EXA: 60 dB All other models: 70 dB Note that, in the single attenuator configuration, the total of ATT and EATT cannot exceed 50 dB, so if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and is reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB

6.9.1.33 Mech Atten Stop

Determines the last Mechanical Attenuator to be used in the Calibration

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:STOP <rel_ampl>` `:SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:STOP?`
Example	`:SYST:CAL:ROW3:ATT:STOP 30`
Dependencies	The Mech Atten Stop control is disabled unless Mech Atten Type is Step For SCPI, this query applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221,Settings conflict; Subopcode does not reference an existing Cal row" is generated
Couplings	This parameter is coupled to Mech Atten Start. Mech Atten Stop must be >= Mech Atten Start. If Mech Atten Stop < Mech Atten Start, Mech Atten Start = Mech Atten Stop

Preset	10 dB
State Saved	Saved in instrument state
Min	0 dB The attenuation set by this control cannot be decreased below 6 dB with the knob or step keys. To get to a value below 6 dB it must be directly entered from the keypad or via SCPI. This protects from adjusting the attenuation to a dangerously small value which can put the instrument at risk of damage to input circuitry. However, if the current mechanical attenuation is below 6 dB it can be increased with the knob and step keys, but not decreased
Max	CXA Option 503 or 507: 50 dB EXA: 60 dB All other models: 70 dB Note that, in the single attenuator configuration, the total of ATT and EATT cannot exceed 50 dB, so if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and is reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB

6.9.1.34 Mech Atten Step

Determines the Mech Attenuation Step. This determines the points between the Mechanical Attenuation min and max to use for Calibration.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:STEP <rel_ampl>` `:SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:STEP?`
Example	`:SYST:CAL:ROW2:ATT:STEP 2dB`
Dependencies	The Mech Atten Step control is disabled unless Mech Atten Type is Step For SCPI, this query applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	2 dB
State Saved	Saved in instrument state
Min	2 dB
Max	70 dB

6.9.1.35 Elec Atten Type

Specifies the Elec Atten type to use:

- `STEP`: Use multiple Elec Atten states determined by Elec Atten Start, Elec Atten Stop and Elec Atten Step
- `ALL`: Use all the attenuator states
- `BYPass`: Bypasses the attenuator

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:TYPE STEP | ALL | BYPass` `:SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:TYPE?`
Example	`:SYST:CAL:ROW3:EATT:TYPE STEP`
Dependencies	For SCPI, this query applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	`STEP`
State Saved	Saved in instrument state
Range	`STEP|ALL|BYPass`

6.9.1.36 Elec Atten Start

Determines the first Electronic Attenuator to be used in the Calibration

Remote Command	:SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:STARt <rel_ampl> :SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:STARt?
Example	`:SYST:CAL:ROW3:EATT:STARt 0`
Dependencies	This control only appears in Dual Attenuator models with an Electronic Attenuator installed and licensed. It does not appear in models with the Single Attenuator configuration, as in the single attenuator configuration there is no "electronic attenuator" there is only a single integrated attenuator (which has both a mechanical and electronic stage) The Elec Atten Start control is disabled unless Elec Atten Type is Step The electronic attenuator is unavailable above the low band (0-3.6 GHz, 0-3.4 GHz, or 0-3 GHz, depending on the model). If the low band ranges from 0-3.6 GHz, and Stop Frequency of the Calibration is > 3.6 GHz, then this parameter is grayed out If the Internal Preamp is on, meaning it is set to Low Band or Full, or the electronic attenuator is unavailable, then this parameter is grayed-out If either of the above is true, and if the SCPI command is sent, an error indicating that the electronic attenuator is unavailable is sent If both of the above are true, pressing the control generates error message -221, in other words, the frequency range lockout takes precedence For SCPI, this query applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Couplings	This parameter is coupled to Elec Atten Stop. Elec Atten Start must be <= Elec Atten Stop. If Elec Atten Start > Elec Atten Stop, Elec Atten Stop = Elec Atten Start
Preset	0 dB
State Saved	Saved in instrument state
Min	0 dB
Max	24 dB

6.9.1.37 Elec Atten Stop

Determines the last Electrical Attenuator to be used in the Calibration

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:STOP <rel_ampl>` `:SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:STOP?`
Example	`:SYST:CAL:ROW3:EATT:STOP 10`
Dependencies	This control only appears in Dual Attenuator models with an Electronic Attenuator installed and licensed. It does not appear in models with the Single Attenuator configuration, as in the single attenuator configuration there is no “electronic attenuator” there is only a single integrated attenuator (which has both a mechanical and electronic stage) The Elec Atten Stop control is be disabled unless Elec Atten Type is Step The electronic attenuator is unavailable above the low band (0-3.6 GHz, 0-3.4 GHz or 0-3 GHz, depending on the model). If the low band ranges from 0-3.6 GHz, and Stop Frequency of the Calibration is > 3.6 GHz, then this parameter is grayed out If the Internal Preamp is on, meaning it is set to Low Band or Full, the electronic attenuator is unavailable, then this parameter is grayed out If either of the above is true, and if the SCPI command is sent, an error indicating that the electronic attenuator is unavailable is sent If both of the above are true, pressing the control generates error message -221, in other words, the frequency range lockout takes precedence For SCPI, this query applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated
Couplings	This parameter is coupled to Elec Atten Start. Elec Atten Stop must be >= Elec Atten Start. If Elec Atten Stop < Elec Atten Start, Elec Atten Start = Elec Atten Stop
Preset	0 dB
State Saved	Saved in instrument state
Min	0 dB
Max	24 dB

6.9.1.38 Elec Atten Step

Determines the Elec Attenuation Step. This determines the points between the Electric Attenuation min and max to use for Calibration.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:STEP <rel_ampl>` `:SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:STEP?`
Example	`:SYST:CAL:ROW2:EATT:STEP 2dB`
Dependencies	The Elec Atten Step control is disabled unless Elec Atten Type is Step For SCPI, this query applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221,

	Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	1 dB
State Saved	Saved in instrument state
Min	1 dB
Max	24 dB

6.9.1.39 Full Range Atten Type

Specifies the Full Range Atten type to use. The Full Range Attenuator adds a second input attenuator at the beginning of the RF Input 2, which enhances the protection and optimizes the performance of the extra internal mixers used by RF Input 2.

- STEP: Use multiple Full Range Atten states determined by Full Range Atten Start and Full Range Atten Stop
- ALL: Use all the attenuator states

Remote Command	:SYSTem:CALibration:ROW[1]|2|…|100:FATTenuation:TYPE STEP | ALL | :SYSTem:CALibration:ROW[1]|2|…|100:FATTenuation:TYPE?
Example	:SYST:CAL:ROW3:FATT:TYPE STEP
Dependencies	This control only appears if input RF is selected and RF Input Port 2 is selected and the Full Range Attenuator exists For SCPI, this query applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	STEP
State Saved	Saved in instrument state
Range	STEP|ALL|

6.9.1.40 Full Range Atten Start

Determines the first Full Range Attenuator to be used in the Calibration

Remote Command	:SYSTem:CALibration:ROW[1]|2|…|100:FATTenuation:STARt <rel_ampl> :SYSTem:CALibration:ROW[1]|2|…|100:FATTenuation:STARt?
Example	:SYST:CAL:ROW3:FATT:STARt 0
Dependencies	The Full Range Atten Start control only appear in the N9041B, when the RF input is selected and the RF Input Port is set to RF Input 2, and the Full Range Attenuator is installed The Full Range Atten Start control is disabled unless Full Range Atten Type is Step For SCPI, this query applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated

Couplings	This parameter is coupled to Full Range Atten Stop. Full Range Atten Start must be <= Full Range Atten Stop. If Full Range Atten Start > Full Range Atten Stop, Full Range Atten Stop = Full Range Atten Start
Preset	20 dB
State Saved	Saved in instrument state
Min	0 dB
Max	Only valid values are 0, 6, 14, 20 dB

6.9.1.41 Full Range Atten Stop

Determines the last Full Range Attenuator to be used in the Calibration

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:FATTenuation:STOP <rel_ampl>` `:SYSTem:CALibration:ROW[1]|2|…|100:FATTenuation:STOP?`
Example	`:SYST:CAL:ROW3:FAT:PT:STOP 10`
Dependencies	The Full Range Atten Stop control only appears in the N9041B, when the RF input is selected and the RF Input Port is set to RF Input 2, and the Full Range Attenuator is installed The Full Range Atten Stop control is disabled unless Full Range Atten Type is Step For SCPI, this query applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Couplings	This parameter is coupled to Full Range Atten Start. Full Range Atten Stop must be >= Full Range Atten Start. If Full Atten Stop < Full Range Atten Start, Full Range Atten Start = Full Range Atten Stop
Preset	20 dB
State Saved	Saved in instrument state
Min	0 dB
Max	Only valid values are 0, 6, 14, 20 dB

6.9.1.42 Frequency Extender Attenuation Type

Specifies the Frequency Extender Attenuation type to use. Frequency Extender Attenuation is applied to the frequency extender's high frequency input signal path (for example, with a V3050A frequency extender, the high frequency path is 50 GHz to 110 GHz).

- `STEP`: Use multiple Frequency Extender Attenuation states determined by Frequency Extender Attenuation Start and Frequency Extender Attenuation Stop
- `ALL`: Use all the attenuator states

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:FEATtenuation:TYPE STEP | ALL` `:SYSTem:CALibration:ROW[1]|2|…|100: FEATtenuation:TYPE?`

Example	:SYST:CAL:ROW3:FEAT:TYPE STEP
Dependencies	This control only applies, and is only visible, when the External RF (ERFIN) input is selected For SCPI, this query applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated
Preset	STEP
State Saved	No
Range	STEP|ALL|REFerence

6.9.1.43 Frequency Extender Attenuation Start

Determines the first Frequency Extender Attenuator to be used in the Calibration.

Remote Command	:SYSTem:CALibration:ROW[1]|2|…|100:FEATtenuation:STARt <rel_ampl> :SYSTem:CALibration:ROW[1]|2|…|100:FEATtenuation:STARt?
Example	:SYST:CAL:ROW3:FEAT:STARt 0
Dependencies	This control only applies, and is only visible, when the External RF (ERFIN) input is selected The Frequency Extender Attenuation Start control is disabled unless Frequency Extender Attenuation Type is Step For SCPI, this query applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated
Couplings	This parameter is coupled to Frequency Extender Attenuation Stop. Frequency Extender Attenuation Start must be <= Frequency Extender Attenuation Stop. If Frequency Extender Attenuation Start > Frequency Extender Attenuation Stop, Frequency Extender Attenuation Stop = Frequency Extender Attenuation Start
Preset	0 dB
State Saved	Saved in instrument state
Min	0 dB
Max	V3050A: 26 dB

6.9.1.44 Frequency Extender Attenuation Stop

Determines the last Frequency Extender Attenuation to be used in the Calibration.

Remote Command	:SYSTem:CALibration:ROW[1]|2|…|100:FEATtenuation:STOP <rel_ampl> :SYSTem:CALibration:ROW[1]|2|…|100:FEATtenuation:STOP?
Example	:SYST:CAL:ROW3:FEAT:PT:STOP 26
Dependencies	This control only applies, and is only visible, when the External RF (ERFIN) input is selected The Frequency Extender Attenuation Stop control is disabled unless Frequency Extender Attenuation Type is Step

	For SCPI, this query applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Couplings	This parameter is coupled to Frequency Extender Attenuation Start. Frequency Extender Attenuation Stop must be >= Frequency Extender Attenuation Start. If Frequency Extender Attenuation Stop < Frequency Extender Attenuation Start, Frequency Extender Attenuation Start = Frequency Extender Attenuation Stop
Preset	26 dB
State Saved	Saved in instrument state
Min	0 dB
Max	V3050A: 26 dB

6.9.1.45 Frequency Extender Atten Step

Determines the Frequency Extender Attenuation Step. This determines the points between the Frequency Extender Attenuation min and max to use for Calibration.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:FEATtenuation:STEP <rel_ampl>` `:SYSTem:CALibration:ROW[1]|2|…|100:FEATtenuation:STEP?`
Example	`:SYST:CAL:ROW2:FEAT:STEP 2dB`
Dependencies	This control only applies, and is only visible, when the External RF (`ERFIN`) input is selected For SCPI, this query applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	1 dB
State Saved	No
Min	1 dB
Max	V3050A: 26 dB

6.9.1.46 IF Path

Determines the IF Path to be used in the Calibration.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:IF:PATH B10M | B25M | B40M | B85M | B125M | B140M | B160M | B255M | B510M | B1G | B1500M | B2G | B4G | EXT` `:SYSTem:CALibration:ROW[1]|2|…|100:IF:PATH?`
Example	`:SYST:CAL:ROW2:IF:PATH B25M`
Notes	– B10M = 10 MHz – B25M = 25 MHz

	– B40M = 40 MHz – B85M = 85 MHz – B125M = 125 MHz – B140M = 140 MHz – B160M = 160 MHz – B255M = 255 MHz – B510M = 510 MHz – B1G = 1 GHz – B1500M = 1.5 GHz – B2G = 2 GHz – B4G = 4 GHz – EXT = Depends on the hardware In cases where the path is not available but is selected from SCPI, it generates an error -241,"Hardware missing; Option not installed"
Dependencies	The 25 MHz path is available only when 25 MHz or wider IF Bandwidth option is installed The 40 MHz path is available only when 40 MHz or wider IF Bandwidth option is installed The 85 MHz path is available only when 85 MHz or wider IF Bandwidth option is installed The 125 MHz path is available only when 125 MHz or wider IF Bandwidth option is installed The 140 MHz path is available only when Option B1X is installed The 160 MHz path is available only when Option B1Y is installed. There cannot be a B1Y option without a B1X option The 255 MHz path is available only when Option B2X or wider IF Bandwidth option is installed The 510 MHz path is available only when Option B5Y or wider IF Bandwidth option is installed The 1 GHz path is available only when Option H1G/B1G or wider IF Bandwidth option is installed The 2 GHz path is available only when Option B2G(R20) or wider IF Bandwidth option is installed The 4 GHz path is available only when Option B4G(R40) or wider IF Bandwidth option is installed The 1.5 GHz path is available only when license R15 option is installed If Option B85 is installed, and also B1A or B1X is installed, the 85 MHz key does not show up and the B85M SCPI selection is disabled. When the B85M SCPI is selected in this case, the instrument generates an error -221, "Settings Conflict; Use wider bandwidth selection" If Option B1A is installed, and also B1X is installed, the 125 MHz key does not show up and the B125M SCPI selection is disabled. When the B125M SCPI is selected in this case, the instrument generates an error -221, "Settings Conflict; Use wider bandwidth selection" In cases where the path is not available, but is selected from SCPI, error -241,"Hardware missing; Option not installed" is generated The preset value depends on the Digital IF BW setting of the default measurement
Preset	If the 25 MHz path is not available, it presets to 10 MHz

State Saved	No
Range	B10M | B25M | B40M | B85M | B125M | B140M | B160M | B255M | B510M | B1G | B1500M | B2G | B4G | EXT

6.9.1.47 IF Gain

Determines the IF Gain to be used in the Calibration

Remote Command	:SYSTem:CALibration:ROW[1]|2|…|100:IF:GAIN[:STATe]HIGH|LOW|ALL :SYSTem:CALibration:ROW[1]|2|…|100:IF:GAIN[:STATe]?
Example	:SYST:CAL:ROW3:IF:GAIN ALL
Dependencies	For SCPI, this query applies to the current selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	DEF
State Saved	Saved in instrument state
Range	High Gain | Low Gain | All

6.9.1.48 Preamp

Determines if the Preamp is to be used in the Calibration

Remote Command	:SYSTem:CALibration:ROW[1]|2|…|100:POWer:GAIN:BAND OFF | LOW | FULL :SYSTem:CALibration:ROW[1]|2|…|100:POWer:GAIN:BAND?
Example	:SYST:CAL:ROW2:POWer:GAIN:BAND OFF
Dependencies	For SCPI, this query applies to the current selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	OFF
State Saved	Saved in instrument state
Range	OFF|LOW|FULL

6.9.1.49 Low Noise Amplifier (LNA)

Determines if the LNA is to be used in the Calibration.

Remote Command	:SYSTem:CALibration:ROW[1]|2|…|100:POWer[:RF]:GAIN:LNA[:STATe] ON | OFF | 1 | 0 :SYSTem:CALibration:ROW[1]|2|…|100:POWer[:RF]:GAIN:LNA[:STATe]?
Example	:SYST:CAL:ROW2:POW:GAIN:LNA ON

	:SYST:CAL:ROW2:POW:GAIN:LNA?
Dependencies	For SCPI, this command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated
Preset	OFF
State Saved	No
Range	ON|OFF

6.9.1.50 µW Path Control

Determines the µW Path Control to be used in the Calibration.

Remote Command	:SYSTem:CALibration:ROW[1]|2|…100POWer[:RF]:MW:PATH STD | LNPath | MPBypass | FULL :SYSTem:CALibration:ROW[1]|2|…100:POWer[:RF]:MW:PATH?
Example	:SYST:CAL:ROW2:POW:MW:PATH FULL
Dependencies	For SCPI, this query applies to the current selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated This column is not shown in the table unless option MPB is present and licensed or option LNB is present and licensed The Low Noise Path selection does not show unless option LNP is present and licensed The uW Presel Bypass selection does not show unless option MPB is present and licensed The Full Bypass selection does not show unless options LNP, MPB and FBP are installed and licensed In any of these cases, if the required options are not present and the SCPI command is sent, error -241, "Hardware missing; Option not installed" is generated
Preset	STD
State Saved	Saved in instrument state
Range	STD|LNPath|MPBypass|FULL

6.9.1.51 Coupling

Determines the Coupling to be used in the Calibration

Remote Command	:SYSTem:CALibration:ROW[1]|2|…|100:COUPling AC | DC :SYSTem:CALibration:ROW[1]|2|…|100:COUPling?
Example	:SYST:CAL:ROW3:COUP AC
Dependencies	For SCPI, this query applies to the current selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated

Preset	AC
State Saved	Saved in instrument state
Range	AC|DC

6.9.1.52 Phase Noise Optimization

Selects the LO (local oscillator) phase noise behavior for various desired operating conditions.

For full details, see "Parameter Options & Installed Options" on page 2368 below.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:SYNThesis[:STATe] 1 | ... | 5`
	For the meaning of each numeric option value, see "Parameter Options & Installed Options" on page 2368 below
	`:SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:SYNThesis[:STATe]?`

Example	`:SYST:CAL:ROW1:FREQ:SYNT 2` selects optimization for best wide offset phase noise
Dependencies	For SCPI, this query applies to the current selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated
Couplings	This parameter is coupled with Phase Noise Optimization All. When Phase Noise Optimization All is set to ON, it will select all available LO mappings, and Phase Noise Optimization parameter will display All in the Configuration table. SCPI Query is still available to see which parameter will be displayed when Phase Noise Optimization All is set to OFF
Preset	2
State Saved	Yes
Range	See "Ranges" on page 2373 below
Min	1
Max	5

Parameter Options & Installed Options

The Phase Noise Optimization control lets you optimize the setup and behavior of the Local Oscillator (LO) depending on your specific measurement conditions. You may wish to trade off noise and speed, for example, to make a measurement faster without regard to noise or with optimum noise characteristics without regard to speed.

Parameter Values Summary

Option	#	Description
"Balanced" on	1	– In instruments with EP0, balances close-in phase noise with spur

Option	#	Description
page 2370		avoidance – In instruments without EP0 optimizes phase noise for small frequency offsets from the carrier
"Best Wide-offset" on page 2370	2	Optimizes phase noise for wide frequency offsets from the carrier
"Fast Tuning" on page 2370	3	Optimizes LO for tuning speed
"Best Close-in" on page 2369	4 or 1*	– In instruments with EP0, emphasizes close-in phase noise performance without regard to spur avoidance – In instruments without EP0, this setting is accepted but no action is taken
"Best Spurs" on page 2370	5	– In instruments with EP0, emphasizes spur avoidance over close-in phase noise performance – In instruments without EP0, this setting is accepted but no action taken
Auto	-	Automatically selects LO (local oscillator) phase noise behavior to optimize dynamic range and speed for various instrument operating conditions

*Dependent on Option EP0 installation. See "Best Close-in" on page 2369 below.

The actual behavior varies somewhat depending on model number and option; for example, you always get Fast Tuning by choosing Option #3, but in some models, "Fast Tuning" on page 2370 is identical in effect to "Best Close-in" on page 2369.

Best Close-in

Without option EP0

`:FREQ:SYNT 1`

The LO phase noise is optimized for smaller offsets from the carrier, at the expense of phase noise farther out.

The actual frequency offset within which noise is optimized is shown with in square brackets, as this can vary depending on the hardware set in use. For example, in some instruments this annotation appears as [offset <20 kHz]

With option EP0

`:FREQ:SYNT 4`

In instruments with Option EP0, the LO is configured for the best possible close-in phase noise (offsets up to 600 kHz from the carrier), regardless of spurious products that occur with some center frequencies. Because this is generally less desirable for close-in measurements than the "Balanced" on page 2370 setting, parameter 1 selects "Balanced" on page 2370 in EP0 instruments, in the interests of optimizing code compatibility across the family. Parameter 4 selects "Best Close-in" on page 2369, which is usually not as good a choice as "Balanced" on page 2370.

Balanced

`:FREQ:SYNT 1`

In instruments with EP0, the LO is configured for the best possible phase noise at offsets up to 600 kHz from the carrier whenever there are no significant spurs within the span observed with an on-screen carrier. When there will be such a spur, the LO is reconfigured in a way that allows the phase noise to increase by 7 dB mostly within ±1 octave around 400 kHz offset. The spurs will always be below –70 dBc.

Best Spurs

`:FREQ:SYNT 5`

In instruments with EP0, the LO is configured for better phase noise than the "Best Wide-offset" on page 2370 case close to the carrier, but the configuration has 11 dB worse phase noise than the "Best Close-in" on page 2369 case mostly within ±1 octave around 300 kHz offset. Spurs are even lower than in the "Balanced" on page 2370 case at better than –90 dBc, whether or not the carrier is on-screen.

This setting is never selected when Phase Noise Optimization is in Auto, you must select it manually.

Best Wide-offset

`:FREQ:SYNT 2`

The LO phase noise is optimized for wider offsets from the carrier. Optimization is especially improved for offsets from 70 kHz to 300 kHz. Closer offsets are compromised and the throughput of measurements (especially remote measurements where the center frequency is changing rapidly), is reduced.

The actual frequency offset beyond which noise is optimized is shown with in square brackets, as this can vary depending on the hardware set in use. For example, in some instruments this annotation appears as [offset >30 kHz]

In instruments with Option EP0, the LO is configured for the best possible phase noise at offsets up to 600 kHz from the carrier whenever there are no significant spurs within the span observed with an on-screen carrier. When there will be such a spur, the LO is reconfigured in a way that allows the phase noise to increase by 7 dB mostly within ±1 octave around 400 kHz offset. The spurs will always be below –70 dBc.

Fast Tuning

`:FREQ:SYNT 3`

In this mode, the LO behavior compromises phase noise at many offsets from the carrier in order to allow rapid measurement throughput when changing the center frequency or span. The term "Fast Tuning" on page 2370 refers to the time it takes to move the local oscillator to the start frequency and begin a sweep; this setting does not impact the actual sweep time in any way.

In instruments with EP1, the LO behavior compromises phase noise at offsets below 4 MHz in order to improve measurement throughput. The throughput is especially affected when moving the LO more than 2.5 MHz and up to 10 MHz from the stop frequency to the next start frequency.

In instruments with Option EP0, this is the same configuration as "Best Spurs" on page 2370. It is available with the "Fast Tuning" on page 2370 label for convenience, and to make the user interface more consistent with other X-Series instrument family members.

(In models whose hardware does not provide for a "Fast Tuning" on page 2370 option, the settings for "Best Close-in" on page 2369 are used if "Fast Tuning" on page 2370 is selected. This gives the fastest possible tuning for that hardware set.)

Auto

```
:FREQ:SYNT:AUTO ON
```

Selects the LO (local oscillator) phase noise behavior to optimize dynamic range and speed for various instrument operating conditions. The selection rules are as follows.

Auto Optimization Rules

X-Series instruments have several grades of LO, offering different configurations when in the Auto Mode. The rules for Auto selection are as follows:

Models with Option	Conditions	Selection
EP0 Models with option EP0 have a two stage local oscillator, which switches to a single loop for fast tuning (available in UXA)	Center frequency is < 699.9 kHz	"Balanced" on page 2370
	Span > 114.1 MHz, *or* RBW > 800 kHz	"Fast Tuning" on page 2370
	RBW > 290 kHz, *or* Span > 4.2 MHz	"Best Wide-offset" on page 2370
	Other conditions	"Balanced" on page 2370
EP1 Models with option EP1 have a two-loop local oscillator, which switches to a single loop for fast tuning (available in PXA)	Span > 44.44 MHz, *or* RBW > 1.9 MHz, *or* Source Mode is set to "Tracking"	"Fast Tuning" on page 2370
	Center frequency is < 195 kHz, *or* CF >= 1 MHz *and* Span <= 1.3 MHz *and* RBW <= 75 kHz	"Best Close-in" on page 2369
	All other conditions	"Best Wide-

Models with Option	Conditions	Selection
		"Best Wide-offset" on page 2370
EP2 Models with option EP2 use a different loop bandwidth for the fast-tuning choice, which is a compromise between tuning speed and phase noise, giving good tuning speed at all offsets. Although not as good as for "Best Close-in" on page 2369; this is useful when you have to look across a wide range of spans (available, for example, in MXA for excellent phase noise)	CF < 130 kHz , *or* CF > 12 MHz *and* Span < 495 kHz *and* RBW < 40 kHz	"Best Close-in" on page 2369
	Span > 22 MHz, *or* RBW > 400 kHz, *or* CF ≤ 12 MHz *and* Span < 495 kHz *and* RBW < 23 kHz	"Fast Tuning" on page 2370
	All other conditions	"Best Wide-offset" on page 2370
EP4 (available in CXA for improved phase noise)	Span > 101 MHz *or* RBW > 1.15 MHz *or* Source Mode is set to "Tracking"	"Fast Tuning" on page 2370
	CF is < 109 kHz *or* CF >= 4.95 MHz *and* Span <= 666 kHz *and* RBW < 28 kHz	"Best Close-in" on page 2369
	All other conditions	"Best Wide-offset" on page 2370
All Other Models Note that in these models, the hardware does not actually provide for an extra-fast tuning option, so the settings for "Fast Tuning" on page 2370 are actually the same as "Best Close-in" on page 2369, but the rules are implemented this way so that the user who doesn't care about phase noise but does care about tuning speed doesn't have to remember which of the other two settings gives faster tuning	Span > 12.34 MHz, *or* RBW > 250 kHz, *or* Source Mode is set to "Tracking"	"Fast Tuning" on page 2370
	Center frequency is < 25 kHz, *or* CF >= 1 MHz *and* Span <= 141.4 kHz *and* RBW <= 5 kHz	"Best Close-in" on page 2369
	All other conditions	"Best Wide-offset" on page 2370

In all the above cases:

- The RBW to be used in the calculations is the equivalent –3 dB bandwidth of the current RBW filter
- The rules apply whether in swept spans, zero span, or FFT spans

Ranges

Option	Option #	Phase Noise Option	Range
No EPx Option	1	Best Close-in	[offset < 20 kHz]
	2	Best Wide-offset	[offset > 30 kHz]
	3	Fast Tuning	[same as Best Close-In]
EP0	4	Best Close-in	[offset < 600 kHz]
	1	Balanced	[offset < 600 kHz]
	5	Best Spurs	[offset < 600 kHz]
	2	Best Wide-offset	[offset > 800 kHz]
	3	Fast Tuning	[same as Best Close-In]
EP1	1	Best Close-in	[offset < 140 kHz]
	2	Best Wide-offset	[offset > 160 kHz]
	3	Fast Tuning	[single loop]
EP2, EP3, EP5	1	Best Close-in	[offset < 70 kHz]
	2	Best Wide-offset	[offset > 100 kHz]
	3	Fast Tuning	[medium loop bw]
EP4	1	Best Close-in	[offset < 90 kHz]
	2	Best Wide-offset	[offset > 130 kHz]
	3	Fast Tuning	[same as Best Close-In]

6.9.1.53 Phase Noise Optimization All Option

Selects all available LO settings

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:SYNThesis:ALL[:STATe] ON	OFF	1	0` `:SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:SYNThesis[:STATe]?`
Example	`:SYST:CAL:ROW1:FREQ:SYNT:ALL ON`
Notes	When this parameter is `ON`, it overrides the Phase Noise Optimization parameter, and selects all available LO settings
Dependencies	For SCPI, this query applies to the current selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated
Couplings	This parameter is coupled with Phase Noise Optimization. When this parameter is `ON`, it selects all available LO mappings, and Phase Noise Optimization parameter displays All in the Configuration table. When this parameter is `OFF`, the Phase Noise Optimization parameter displays its previously set value in the Configuration table
Preset	`OFF`
State Saved	Saved in instrument state
Range	`ON|OFF`

6.9.1.54 Mixing Mode

Determines the LO Mixing Mode to be used.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:LO:MMODe NORMal	ALTernate` `:SYSTem:CALibration:ROW[1]|2|…|100:LO:MMODe?`
Example	`:SYST:CAL:ROW3:LO:MMOD NORM`
Dependencies	For SCPI, this query applies to the current selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221,Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	`NORMal`
State Saved	Saved in instrument state
Range	`NORMal|ALTernate`

6.9.1.55 Match State

Determines if the Cal settings must match exactly when applying the correction. If not, the system may find the closest matching state or interpolate between states.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:MATCh[:STATe] ON	OFF	1	0` `:SYSTem:CALibration:ROW[1]|2|…|100:MATCh[:STATe]?`
Example	`:SYST:CAL4:MATC ON` `:SYST:CAL4:MATC?`
Dependencies	For SCPI, this command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	All True
State Saved	Saved in instrument state
Range	True | False

6.9.2 Cal Group

Specifies the selected Calibration Group. You can use different Cal Groups for different external hardware configurations. The Cal Group is also an important concept when sending SCPI commands to the Calibration System, because in each case the SCPI command is directed to the currently-selected Cal Group, which is the Cal Group that is modified by the SCPI command.

Remote Command	`:SYSTem:CALibration:CGRoup <integer>`

	`:SYSTem:CALibration:CGRoup?`
Example	`:SYST:CAL:CGR 2` `:SYST:CAL:CGR?`
Preset	1
Min	1
Max	100

6.9.3 Apply Cal Group

Controls whether or not the checked Apply rows of the currently selected Cal Group are applied.

Remote Command	`:SYSTem:CALibration:CGRoup:APPLy <bool>` `:SYSTem:CALibration:CGRoup:APPLy?`
Example	`:SYST:CAL:CGR:APPL ON` `:SYST:CAL:CGR:APPL?`
Dependencies	This command is applied to the currently selected Cal Group You can only turn on Apply Cal Group if at least one Cal for the currently selected group has been executed. If you attempt to select the Apply Cal Group before any Cals have been executed, the advisory message "At least one Row must be calibrated before it can be applied" is displayed
Preset	`OFF`
State Saved	Saved in instrument state
Range	`ON|OFF`
Annotation	If *any* Cal Group is turned on, RCal in the Meas Bar will display as amber to indicate Calibrations are in use

6.9.4 All Apply Cal Group Off

Turns Apply Cal Group off in all groups.

Remote Command	`:SYSTem:CALibration:CGRoup:APPLy:AOFF`
Example	`:SYST:CAL:CGR:APPL:AOFF`

6.9.5 Connection

Opens the Connection Dialog, which provides step-by-step instructions.

6.10 Calibrator Control

Allows you to select a calibrator and control the calibrator settings.

6.10.1 Select Cal Source

Allows you to select the calibrator to control.

Remote Command	`:SYSTem:CALibration:TUNE[:SELected] NONE | REF50 | REF4800 | TUNAble | CALOUT | RCM1 | RCM2 | RCM3 | RCM4 | RCM5 | RCM6 | RCM7 | RCM8 | RCM9 | RCM10` `:SYSTem:CALibration:TUNE[:SELected]?`
Example	`:SYST:CAL:TUNE:SEL TUNABLE` `:SYST:CAL:TUNE?`
Notes	The values translate as follows: `NONE`: No calibrator selected `TUNAble`: Tunable internal calibrator present in N9042B `CALOUT`: Tunable calibrator available through CALOUT front panel port in N9042B `REF50`: 50 MHz calibrator `REF4800`: 4.8 GHz calibrator `RCM1` – RCM10: RCal module
Dependencies	If the selected calibrator is not available, it will not appear in the dropdown. If sending SCPI to select a calibrator that is not available, the instrument will generate an error
Couplings	Selecting `REF50` sets the RF Calibrator to `REF50` Selecting `REF4800` sets the RF Calibrator to `REF4800` Selecting a calibrator source other than `REF50` or `REF4800` sets RF Calibrator to `OFF`
Preset	This setting is unaffected by a Mode Preset. It is set to None on a "Restore Input/Output Defaults" or "Restore System Defaults->All"

6.10.2 Cal Output

Allows you to set the selected calibrator's RF power output state.

Remote Command	`:SYSTem:CALibration:TUNE:OUTput[:STATe] ON | OFF | 1 | 0` `:SYSTem:CALibration:TUNE:OUTput[:STATe]?`
Example	`:SYST:CAL:TUNE:OUTP ON` `:SYST:CAL:TUNE:OUTP?`
Preset	This setting is unaffected by a Mode Preset. It is set to Off on a "Restore Input/Output Defaults" or "Restore System Defaults->All"

6.10.3 Cal Frequency

Allows you to set the selected calibrator's frequency.

Remote Command	`:SYSTem:CALibration:TUNE:FREQuency <freq>` `:SYSTem:CALibration:TUNE:FREQuency?`

Example	`:SYST:CAL:TUNE:FREQ 150000000`
	Sets source frequency to 150 MHz
	`:SYST:CAL:TUNE:FREQ?`

Preset	This setting is unaffected by **Mode Preset.** Set to 1 GHz by **Restore Input/Output Defaults** or **Restore System Defaults->All**
Min	Dependent on the selected calibrator
Max	Dependent on the selected calibrator

6.10.4 Cal Signal Type

Allows you to set the selected calibrator's signal type.

Remote Command	`:SYSTem:CALibration:TUNE:TYPE CW | COMB` `:SYSTem:CALibration:TUNE:TYPE?`
Example	`:SYST:CAL:TUNE:TYPE CW` `:SYST:CAL:TUNE:TYPE?`
Dependencies	If the selected calibrator does not support a signal type, then it will be disabled in the dropdown Changing the signal type to a disabled option will generate an error
Preset	Unaffected by Mode Preset. Set to `CW` by Restore Input/Output Defaults or Restore System Defaults->All

6.10.5 Cal Comb Spacing

Allows you to set the calibrator's comb spacing, when the signal type is Comb.

Remote Command	`:SYSTem:CALibration:TUNE:SPACing <freq>` `:SYSTem:CALibration:TUNE:SPACing?`

Example	`:SYST:CAL:TUNE:SPAC 1000000`
	Sets comb spacing to 1 MHz
	`:SYST:CAL:TUNE:SPAC?`

Dependencies	Only appears when Comb is selected as Cal Signal Type If the selected calibrator does not support the Comb signal, attempting to set the spacing will generate an error

Preset	Unaffected by Mode Preset. It is set to 0 Hz by Restore Input/Output Defaults or Restore System Defaults->All
Min	Dependent on the selected calibrator
Max	Dependent on the selected calibrator

6.10.6 Calibrator Reference

Determines the frequency reference type used by the RCal module of the currently selected Cal Group

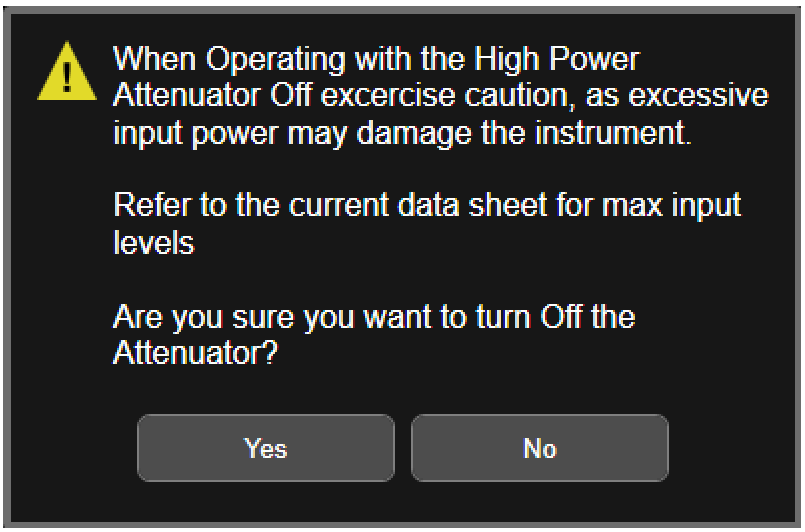
Remote Command	`:SYSTem:CALibration:TUNE:REFerence INTernal | EXTernal` `:SYSTem:CALibration:TUNE:REFerence?`
Example	`:SYSTem:CALibration:TUNE:REFerence INTERNAL` Sets the calibrator frequency reference to Internal
Dependencies	Only displayed when a RCal module is the selected calibrator
Preset	This setting is unaffected by **Mode Preset.** Set to preset value by **Restore Input/Output Defaults** or **Restore System Defaults->All**
Range	`INTernal|EXTernal`

6.11 Advanced

Controls whether additional attenuation is added at the T/R Port. The T/R port has twoinput paths, one that provides a 16 dB attenuator, and the other that bypasses this attenuator.

- When this control is ON, the path includes the 16 dB attenuator, so the max input level for this path is +47 dBm (50 W)
- When this control is OFF, the 16 dB attenuator is bypassed, so the max input level for this path is +33 dBm (2 W)

If the attenuator is turned OFF, the following warning message is displayed and confirmation that the attenuator is to be turned OFF is required;



Whenever the attenuator is bypassed (OFF), a warning appears in the status bar: “Input caution; T/R unprotected"

In the case of an input overload at the T/R input, (>2 W with Attenuator off, or >50 W with attenuator on), or an over-temperature at the T/R input, the input is disconnected, and a dialog is displayed, stating:

“CAUTION! Excessive power has been detected at the T/R Port. The input has been disconnected. Remove the high signal power and press OK”

Or:

“CAUTION! Over temperature has been detected at the T/R Port. The input has been disconnected. Remove the signal, allow to cool & press OK”

Until you press **OK**, the input remains disconnected, and no measurement can be made.

Remote Command	`[:SENSe]:FEED:RF:PORT:TR:HPOWer:ATTenuator[:STATe] ON | OFF`

	[:SENSe]:FEED:RF:PORT:TR:HPOWer:ATTenuator[:STATe]?
Example	:FEED:RF:PORT:TR:HPOW:ATT ON :FEED:RF:PORT:TR:HPOW:ATT?
Dependencies	Only appears in modular analyzers and only when the M9470A module is installed, such as in the M8920A. Option HDX is required to enable the T/R port
Preset	ON
State Saved	Saved in instrument state

6.12 Aux I/O Control

This menu is only available with option LSN, indicating that the LISN IO board is installed. It is used to control each of the eight control lines out of the rear panel connector independently. There are eight bits of control lines. The LISN Control (Mode setup) of the EMI Receiver application affects the AUX I/O Control settings. Whenever you change the LISN Control in Mode Setup, the corresponding AUX I/O Control data lines will also be changed. The selection at the AUX I/O Control, will not affect the LISN Control (Mode Setup) setting.

6.12.1 Data 0 – Data 7

Sets the value for Data 0 through Data 7 respectively.

Remote Command	`:OUTPut:AUX:IO:DATA<n> OFF | ON | 0 | 1` where `<n>` in an integer 0 - 7
Example	`:OUTPut:AUX:IO:DATA0 OFF`
Notes	The current value is persistent upon **Mode Preset**, but **Input/Output Preset** presets the value to ON for all 8 data lines
Preset	ON
Range	OFF|ON

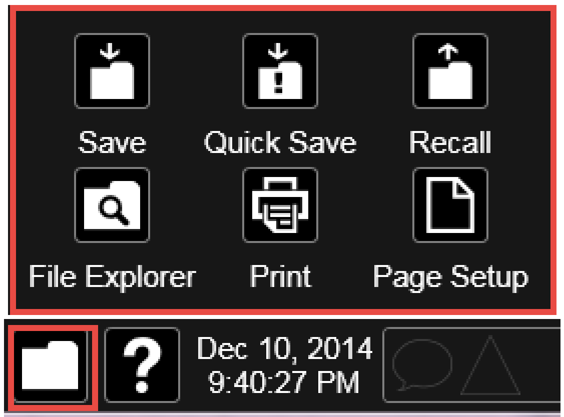
6.12.2 Aux IO Control (Remote Command Only)

Sets/Queries the value for all 8 data lines.

Remote Command	`:OUTPut:AUX:IO <Value>` `:OUTPut:AUX:IO?`
Example	`:OUTPut:AUX:IO 31`
Notes	The current value is persistent upon **Mode Preset**, but **Input/Output Preset** presets the value to ON for all 8 data lines
Couplings	The states of Data 0 to Data 7 under the AUX I/O Control panel (Input/Output menu) change according to the keyed-in AUX IO value
Preset	31
Min	0
Max	255
Backwards Compatibility SCPI	`:OUTPut:UPORt <Value>`

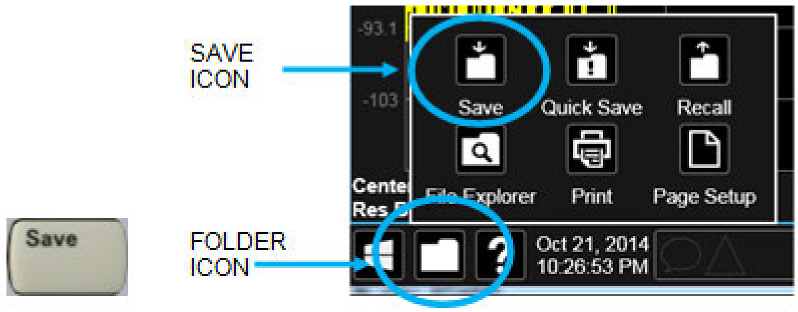
7 Save/Recall/Print

This section describes the functions that can be accessed via the front panel **Save**, **Quick Save**, and **Recall** hardkeys, as well as via the controls in the front-panel folder icon, as shown below.

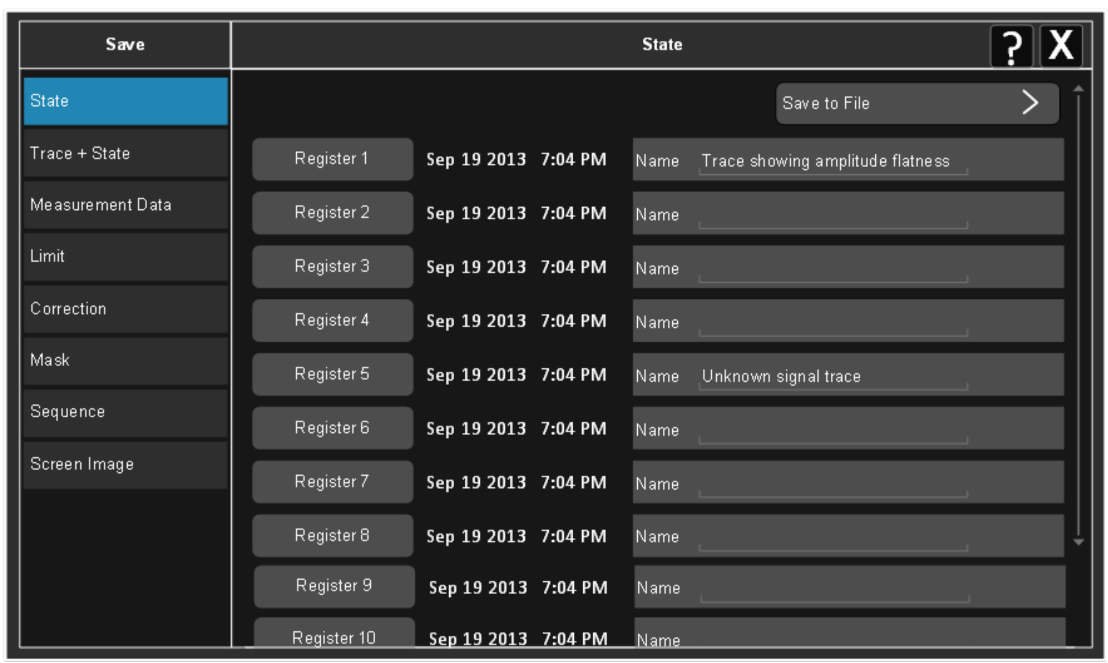


7.1 Save

The **Save** dialog lets you save states, traces, screen images and other items from the instrument to files on the instrument's internal storage, to removable devices, and to directories on the network. You access the dialog by pressing the **Save** hardkey, or by pressing the folder icon at the bottom of the display and then pressing the **Save** icon.



The dialog has tabs running down the left side, which you use to specify what you want to save.



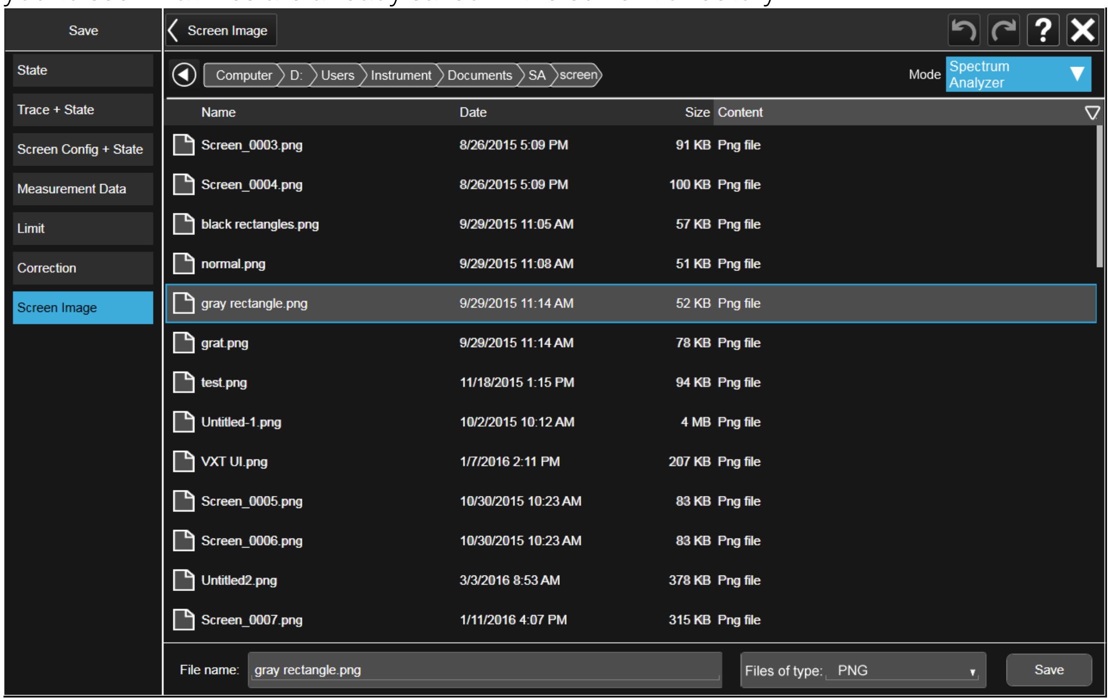
You choose the save item and then complete the save by choosing a register or file location to which to save the item.

Notes	No remote command for this key specifically, but `:MMEM:STORe` is available for specific file types Example: `:MMEM:STOR:STATe <filename>`

7.1.1 Save to File / Save As

For every Save type, a control appears labeled **Save to File** or **Save As**. **Save to File** appears for save types that also include registers (like State and Trace+State), and **Save As** appears for all other save types.

When you press **Save to File** or **Save As**, a dialog slides in from the right that allows you to see what files are already saved in the current directory.



The default directory is the internal directory for the current Mode and save type, on the D: drive. You may also change to another Mode's state directory by pressing the dropdown in the upper right corner labeled **Mode**. Once you have chosen a directory, the files in that directory whose extension matches the current data type (for example, `.state` or `.trace`) are displayed in the right hand window of the dialog. You can sort this list by name, date, file size or extension by tapping the Name, Date, Size, or Content header at the top of each column. A second tap toggles the sort order between Ascending and Descending.

Also displayed is a path depiction showing the path to the current directory. In the example above, the path is `D:\Users\Instrument\Documents\SA\screen`. Tapping any element of this path lets you select an alternate route. Tapping the **Computer** arrow lets you select a different drive.

Tapping the "Back" arrow navigates to the previously selected directory.

Note: Using the C: drive is strongly discouraged, due to the risk of data being overwritten during an instrument software upgrade.

If you plug in a removable drive (for example, a thumb drive), the browser immediately navigates to the root of that drive. Furthermore, if you had a thumb drive in and you were in a directory on the thumb, and then you exit the browser, when you come back in you are still in the same directory on that removable drive. If you remove the thumb drive, you return to the directory you had been in before the thumb drive was plugged in.

Note that for each data type there is a "current" directory and it is the last directory used by either Save or Recall for that Mode. For example if in SA Mode you save a Corrections file to a particular directory, then when you go to recall a Correction in SA Mode, you should be pointing at that directory. Or if in EMC Mode you recall a Limit from a particular directory then when in EMC Mode you go to save a Limit, it should be pointing at that same directory. There is one "current" directory for each data type for each Mode (not one for Save and one for Recall).

The Filename field, just below the Path field, shows the filename that will be used. The **File Name** field is initially loaded with an automatically generated filename specific to the appropriate Save Type. The automatically generated filename is guaranteed not to conflict with any filename currently in the directory. You may edit the filename by tapping it, which brings up the onscreen alpha keyboard. Press the "Done" button on this keyboard when you are done editing.

Select a file to overwrite, type in a file name, or use the name suggested by the instrument (guaranteed not to conflict with any file in the current directory), and press Save. If the file specified already exists, a dialog will appear that allows you to replace the existing file by selecting **OK,** or you can Cancel the request.

After a successful save, a message "File <filename> saved" or "State Register <register number> saved" is displayed in an info box for a few seconds.

See "Quick Save" on page 2433 for details of the automatic file naming algorithm.

7.1.2 State

Selects a register or file for saving the state.

State files contain essentially all the information required to return the instrument to the measurement and settings that were in effect at the time of the save. State files are in a proprietary binary form (for speed) and cannot be read or edited by PC software, but can be loaded back into the instrument to restore the state.

State files contain all of the settings of the **Input/Output** system as well, even though **Input/Output** variables are outside of the Mode's state and unaffected by **Mode Preset,** because these are needed to restore the complete setup.

Persistent System settings (for example, GPIB address) are affected by neither Mode Preset nor Restore Mode Defaults, nor are they included in a saved State file.

For rapid saving, the State menu lists 16 registers to which you can save states. Pressing a Register button initiates the save. You can also select a file to which to save by pressing **Save to File**.

The default path for all State Files is:

`My Documents\<mode name>\state`

where `<mode name>` is the parameter used to select the Mode with `:INST:SEL` (for example, `SA` for Spectrum Analyzer Mode).

State files have the extension `.state`. The default filename is `State_0000.state`, where the 4-digit number is the lowest number that does not conflict with any filename in the current directory.

NOTE: **In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so take care not to overwrite files and/or registers from one instance which were saved by another instance.**

Remote Command	`:MMEMory:STORe:STATe <filename>`
Example	`:MMEM:STOR:STATe "MyStateFile.state"` This stores the current instrument state data in the file `MyStateFile.state` in the default directory
Notes	Both single and double quotes are supported for any filename parameter over remote After saving to a register, that register's menu key is updated with the date the time, unless a custom label has been entered for that key After saving to a register, you remain in the **Save State** menu, so that you can see the Register key update. After saving to a file, the instrument automatically returns to the previous menu and any Save As dialog goes away
Backwards Compatibility	`:MMEMory:STORe:STATe 1,<filename>`

SCPI	For backwards compatibility, the above syntax is supported. The "1" is simply ignored. The command is sequential

7.1.2.1 Register 1 thru Register 16

Selecting any one of these register buttons causes the State of the currently active Mode to be saved to the specified Register. The registers are provided for rapid saving and recalling, since you do not need to specify a filename or navigate to a file. Each of the register menu keys annotates whether it is empty or at what date and time it was last modified. In addition, you can edit any of the register names to enter custom names for any register.

Although these 16 registers are the only registers available from the front panel, there are 128 state registers available in the instrument. Registers 17-128 are only available from the SCPI interface, using the *SAV command.

There is one set of 128 state registers in the instrument, not one set for each Mode. When a state is saved, the Mode it was saved from is saved with it; then when it is recalled, the instrument switches to that Mode.

NOTE: In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so take care not to overwrite files and/or registers from one instance which were saved by another instance.

The date displayed follows the format specified in the **Date Format** setting under the Control Panel. The time shows hours and minutes.

After the save completes, the corresponding register menu key annotation is updated with the date and time and the message "Register <register number> saved" is displayed.

Example	`*SAV 1`
Range	1-16 from front panel, 1-128 from SCPI

7.1.2.2 Edit Register Names

You may enter a custom name for any of the Registers, to help you remember what you are using that state to save. To do this, press the **Name** field for the register you want to rename, which brings up the onscreen alpha keyboard. Press the “Done” button on this keyboard when you are done editing.

The maximum number of characters for a register name is 30. If you delete all the characters in the custom name, it restores the default (time and date).

The register names are stored within the state files, but they are not part of the instrument state; that is, once you have edited a register name, loading a new state will not change that register name.Another consequence of this is that the names will be persistent through a power cycle. Also, if a named state file is transferred to another instrument, it will bring its custom name along with it.

If you try to edit the name of an empty register, the instrument will first save the state to have a file to put the name in. If you load a named state file into an instrument with older firmware it will ignore the metadata.

The *SAV and *RCL commands will not be affected by the custom register names, nor will the :MMEM commands.

Remote Command	:MMEMory:REGister:STATe:LABel <reg number>,"label" :MMEMory:REGister:STATe:LABel? <reg number>
Example	:MMEM:REG:STAT:LAB 1,"my label"
Notes	<reg number> is an integer from 1 to 16. If the SCPI specifies an invalid register number an error message is generated, -222, "Data out of range; Invalid register label number" "label" is a string from 0 to 30 characters in length. If a label exceeds 30 characters, an error message is generated, -150,"String data error;Label clipped to 30 characters" "label" of zero length erases the custom label and restores the default (time and date) label. For example, :MMEM:REG:STAT:LAB 1,""
Preset	The names are unaffected by **Preset** or power cycle but are set to the default label (time and date) on **Restore System Defaults>Misc**

7.1.3 Trace+State

Selects a register or file for saving selected traces and the state.

Trace+State files contain essentially all the information required to return the instrument to the measurement and settings that were in effect at the time of the save, as well as the data for one or all traces. Trace+State files are in a proprietary binary form (for speed) and cannot be read or edited by PC software, but can be loaded back into the instrument to restore the state and trace(s).

Trace+State files contain all of the settings of the **Input/Output** system as well, even though **Input/Output** variables are outside of the Mode's state and unaffected by **Mode Preset**, because these are needed to restore the complete setup.

Persistent **System** settings (for example, GPIB address) are affected by neither Mode Preset or Restore Mode Defaults, nor are they included in a saved Trace+State file.

For rapid saving, the **Trace+State** menu lists 16 registers to which you can save trace+state files. The **Trace+State** registers are separate registers from the **State** registers. Pressing a Register button initiates the save. You can also select a file to which to save by pressing "Save to File".

The default path for all Trace+State files is the same as that for State files:

```
My Documents\<mode name>\state
```

where <mode name> is the parameter used to select the mode with :INST:SEL (for example, Basic for IQ Analyzer Mode).

NOTE	In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so take care not to overwrite files and/or registers from one instance which were saved by another instance.

Trace+State files have the extension `.trace`. The default filename is `State_0000.trace`, where the 4-digit number is the lowest number that does not conflict with any filename in the current directory.

The **Trace+State** selection only appears for measurements that support trace saves. It is blanked for modes that do not support trace saves. Saving Trace is identical to saving State except a `.trace` extension is used on the file instead of `.state`, and internal flags are set in the file indicating which trace was saved.

See "More Information" on page 2390.

Remote Command	`:MMEMory:STORe:TRACe TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6 | ALL,<filename>` `:MMEMory:STORe:TRACe:REGister TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6 | ALL,<integer>`

Example	`:MMEM:STOR:TRAC TRACE1,“myState.trace”`
	saves the file `myState.trace` on the default path and flags it as a “single trace” file with Trace 1 as the single trace (even though all of the traces are in fact stored)
	`:MMEM:STOR:TRAC ALL,“myState.trace”`
	saves the file `myState.trace` on the default path and flags it as an “all traces” file
	`:MMEM:STOR:TRAC:REG TRACE1,2`
	stores trace 1 data in trace register 2

Notes	This command actually performs a Save State, which in the Swept SA measurement includes the trace data. However it flags it (in the file) as a “save trace” file of the specified trace (or all traces)
	Some modes and measurements do not have available all 6 traces. The Phase Noise mode command, for example, is:
	`:MMEMory:STORe:TRACe TRACE1 | TRACE2 | TRACE3 | ALL,<filename>`
	Some modes and measurements have more than 6 traces available. The Realtime SA mode command, for example, is:
	`:MMEMory:STORe:TRACe TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6 | TRACE7 | TRACE8 | TRACE9 | TRACE10 | TRACE11 | TRACE12 | ALL,<filename>`
	The range for the register parameter is 1-5
	When you initiate a save, if the file already exists, a dialog will appear that allows you to replace the existing file by selecting **OK** or you can Cancel the request. If you select **OK**, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade
	Both single and double quotes are supported for any filename parameter over remote
	After saving to a register, that register’s menu key is updated with the date and time of the save

After saving to a register, you remain in the **Save Trace** menu, so that you can see the Register key update. After saving to a file, the instrument automatically returns to the previous menu and any Save As dialog goes away

More Information

In measurements that support saving Traces, for example, Swept SA, the Trace data is saved along with the State in the State file. When recalling the State, the Trace data is recalled as well. Traces are recalled exactly as they were stored, including the writing mode and update and display modes. If a Trace was updating and visible when the State was saved, it will come back updating and visible,and its data will be rewritten right away. When you use State to save and recall traces, any trace whose data must be preserved should be placed in View or Blank mode before saving.

The following table describes the Trace Save and Recall possibilities:

You want to recall state and one trace’s data, leaving other traces unaffected	Save Trace+State from 1 trace. Make sure that no other traces are updating (they should all be in View or Blank mode) when the save is performed	On Recall, specify the trace you want to load the one trace’s data into. This trace will load in View. All other traces’ data will be unaffected, although their trace mode will be as it was when the state save was performed
You want to recall all traces	Save Trace+State from ALL traces	On Recall, all traces will come back in View (or Blank if they were in Blank or Background when saved)
You want all traces to load exactly as they were when saved	Save State	On recall, all traces’ mode and data will be exactly as they were when saved. Any traces that were updating will have their data immediately overwritten

7.1.3.1 Save From Trace

Selects the trace to be saved. The default is the currently selected trace, selected in this this or any other menu with Trace selection. If you have chosen All then it remains chosen until you specifically change it to a single trace, regardless of the trace selected in the **Trace** menu.

When you select a trace, it makes that trace the current trace, so it displays on top of all of the other traces.

7.1.3.2 Register 1 thru Register 16

Selecting any one of these register buttons causes the specified trace(s) and the state of the currently active mode to be saved to the specified Register. The registers are provided for rapid saving and recalling, since you do not need to specify a filename or navigate to a file. Each of the register menu keys annotates whether it is empty or at what date and time it was last modified. In addition, you can edit any of the register names to enter custom names for any register.

There is one set of 16 trace+state registers in the instrument, not one set for each Mode. When trace+state is saved, the Mode it was saved from is saved with it; then when it is recalled, the instrument switches to that Mode.

NOTE **In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so take care not to overwrite files and/or registers from one instance which were saved by another instance.**

The date displayed follows the format specified in the **Date Format** setting under the Control Panel. The time shows hours and minutes.

After the save completes, the corresponding register menu key annotation is updated with the date and time and the message "Register <register number> saved" is displayed.

Example	`*SAV 1`
Range	1-16

7.1.3.3 Edit Register Names

You may enter a custom name for any of the Registers, to help you remember what you are using that trace+state to save. To do this, press the **Name** field for the register you want to rename, which brings up the onscreen alpha keyboard. Press the “Done” button on this keyboard when you are done editing.

The maximum number of characters for a register name is 30. If you delete all the characters in the custom name, it restores the default (time and date).

The register names are stored within the trace+state files, but they are not part of the instrument state; that is, once you have edited a register name, loading a new state will not change that register name.Another consequence of this is that the names will be persistent through a power cycle. Also, if a named state file is transferred to another instrument, it will bring its custom name along with it.

If you try to edit the name of an empty register, the instrument will first save the trace+state to have a file to put the name in. If you load a named state file into an instrument with older firmware it will ignore the metadata.

Remote Command	`:MMEMory:REGister:TRACe:LABel <reg number>,”label”` `:MMEMory:REGister:TRACe:LABel? <reg number>`
Example	`:MMEM:REG:TRAC:LAB 1,”my label”`
Notes	`<reg number>` is an integer from 1 to 16. If the SCPI specifies an invalid register number an error message is generated, -222, "Data out of range; Invalid register label number" `“label”` is a string from 0 to 30 characters in length. If a label exceeds 30 characters, an error

	message is generated, -150, “String data error; Label clipped to 30 characters” `“label”` of zero length erases the custom label and restores the default (time and date) label, e.g., `:MMEM:REG:TRAC:LAB 1,””`
Preset	The names are unaffected by **Preset** or power cycle but are set to the default label (time and date) on **Restore System Defaults>Misc**

7.1.4 Screen Config + State

Saves the complete configuration of all your screens to a file. You choose a file to which to export the data.

Remote Command	`:MMEMory:STORe:SCONfig <filename>`
Example	`:MMEM:STOR:SCON "myScreenConfig.screen"` This stores the current screen configuration in the file `myScreenConfig.screen` in the default directory

7.1.5 Measurement Data

Specifies a data type (for example, trace data) and choose a file to which to export the data.

Measurement Data files are Comma-Separated Value (CSV) files, and contain the requested data in a form that can be imported into Excel or other spreadsheets, as well as header data that gives information on relevant instrument settings at the time the save occurred.

The main application of **Measurement Data** files is for importing data to a PC for analysis, but in some cases **Measurement Data** files can also be imported back into the instrument to recreate the data object that existed at the time of the save. For example, most Trace data files can be imported back into the instrument.

The default path for **Measurement Data** Files is:

`My Documents\<mode name>\data`

with the subdirectory reflecting the data type and where `<mode name>` is the parameter used to select the Mode with `:INST:SEL` (for example, `SA` for Spectrum Analyzer Mode) and `<measurement name>` is the parameter used to select the measurement with `:CONF` (for example, `SAN` for Swept SA). For example, a Peak Table file from Swept SA would be stored in:

`My Documents\SA\data\SAN\results`

Measurement Data files have extension `.csv`. The default filename is `Prefix_0000.csv`, where the 4-digit number is the lowest number that does not conflict with any filename in the current directory, and “Prefix” is dependent on the data type:

Type	Default Prefix
Traces	`Trace_`
Measurement Result	`MeasR_`
Capture Buffer	`CapBuf_`

For example, the default filename for a trace data file in an empty directory would be `Trace_0000.csv`

7.1.5.1 Save From

Selects the specific item to be saved, for example, if you are exporting trace data you may specify Trace 1, Trace 2, etc.

The default for traces is the currently selected trace, selected in this this or any other menu with Trace selection. If you have chosen All then it remains chosen until you specifically change it to a single trace, regardless of the trace selected in the Trace menu. The **All** selection saves all six traces in one .csv file with the x-axis data in the first column and the individual trace data in succeeding columns. The header data and x-axis data in this file reflect the current settings of the measurement. Note that any traces which are in View or Blank may have different x-axis data than the current measurement settings; but this different x-axis data will not be output to the file.

Preset	Not part of **Preset**, but is reset to by **Restore Mode Defaults** Survives shutdown

7.1.5.2 Data Type

You choose the data type to save by using the radio button selection box. Below are the specifications for Data files for each measurement.

Notes	There is no SCPI command for Data Type, as the type is implied in the SCPI command for each item
Dependencies	The Data Type menu for any given measurement only contains data types that are supported by that measurement

Meas Results

Meas Results files contain information that describes the current state of the instrument. It is detailed in the Meas Result File Contents below.

This command is only available in certain measurements, such as:

- Power Suite: Channel Power, OBW, ACP, Spectrum Emissions Mask, Spurious Emissions, Power Stat CCDF, Transmit Power, Monitor Spectrum, IQ Waveform
- IQ Analyzer: Complex Spectrum
- Phase Noise: Log Plot and Spot Frequency
- WCDMA: Code Domain, Mod Accuracy, Power Control, and QPSK EVM
- Analog Demod: AM, FM, PM and FM Stereo
- Noise Figure
- Pulse

In general, the data in the Meas Results file matches the data which is returned to a measurement data query (`:FETCh?/:READ?/:MEASure?`). These queries and the results they return are documented for each measurement, and can be found in the Help for that measurement (or in the manual for that measurement) in the section titled “Remote Command Results”.

For example, for the Complex Spectrum measurement, go to the Help heading called “Complex Spectrum Measurement” and you will see a section called “Remote Command Results for Complex Spectrum”.

The table in that section lists a number of return values for the `:FETCh` query (in this case, the `:FETCh:SPECtrum` query), which depend on the specified subopcode (`n`).

In the MeasResults file, you will see a column for each value of n. Each column contains the value for the corresponding value of n in the Remote Command Results table.

For example, Complex Spectrum allows values of n up to 17, and the MeasResults file for Complex Spectrum has 17 columns. So the data returned when you send

`:FETCh:SPECtrum1?` matches the data in the column labelled "MeasResult1" of the Meas Results file. See the example below:

Response to FETCh:SPECtrum1?:

2.125444221E+01,6.487077992E+07,2.050000000E+02,6.004725051E+07,3.921568627E+04,2.370000000E+02,0.000000000E+00,1.000000000E-07,1.000000000E+00,2.360000000E-05,2.500000000E+01

MeasResult1 column from Meas Results file:

MeasResult1
-21.25444221
64870779.92
205
60047250.51
39215.68627
237
0
1.00E-07
1
2.36E-05
25

In addition, examples of the Meas Results files are given for each data type in the Help below.

Remote Command	`:MMEMory:STORe:RESults <string>`
Example	`:MMEM:STOR:RES "MeasR_0000.csv"`
Notes	If the save is initiated via SCPI and the file already exists, the file will be overwritten The SCPI command exports measurement results to the file specified as the parameter in the current path. The default path is: `My Documents\<current mode>\data\<measurement name>\results` where `<mode name>` is the parameter used to select the mode with the `:INST:SEL` command (for example, `SA` for the Spectrum Analyzer Mode) and `<measurement name>` is the parameter used to select the measurement with the `:CONF`: command (for example, `SAN` for the Swept SA measurement) Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade The SCPI parameter is a quoted string, which specifies the filename. Both single and double quotes are supported for any filename parameter over SCPI
Annotation	After the save is complete, an advisory is displayed in the window so that the user can confirm which file was saved
Status Bits/OPC dependencies	Sequential – waits for the previous measurement to complete

CHP Meas Results File Contents

A CHP Meas Results File contains measurement results with the following header information.

- File ID string, which is "MeasResult"
- Measurement ID following Mode ID, which is "SA:CHP" for example.
- Firmware rev and model number
- Option string
- Auto Sweep Time Rules
- Average Mode
- Average Number
- Average State
- Center Frequency
- Detector
- Electrical Atten
- Electrical Atten State
- IFGain
- IFGainAuto
- Impedance
- Integ BW
- Internal Preamp
- Internal Preamp Band
- Mechanical Atten
- MechanicalAttenStepEnum
- PSD Unit
- Resolution Band Width
- Resolution Bandwidth Shape

- RRC Filter Alpha
- RRC Filter BW
- RRC Filter State
- Span
- Sweep Points
- Sweep Time
- Sweep Time Auto
- TriggerSource
- Video Bandwidth
- Y Axis Unit

The file contains this data followed by MeasResult1 and MeasResult2 that flag the start of the measurement results. Each line of Measurement Results consists of two comma separated values, MeasResult1 value and MeasResult2 value. MeasResult1 contains the same results as `:MEAS/:READ/:FETCh:CHPower1`; MeasResult2, `:MEAS/:READ/:FETCh:CHPower2`.

Exported file is in CSV format. The Meas Results file, when imported into Excel, will show the following data:

MeasResult	
SA:CHP	
A.10.53	N9030A
526 ALV ATP B1X B1Y B25 B40 BBA CR3 CRP DCF DDA DP2 DRD EA3 EDP EMC EP1 ERC ESC ESP EXM FSA LFE LNP MAT MPB NFE NUL P26 PFR PNC RTL RTS S40 SB1 SEC SM1 TVT YAS YAV	1
Auto Sweep Time Rules	Normal
Average Mode	Exponential
Average Number	10
Average State	TRUE
Center Frequency	13255000000
Detector	Average
IFGain	FALSE
IFGainAuto	FALSE
Impedance	50
Integ BW	2000000
Internal Preamp	FALSE
Internal Preamp Band	Low

PSD Unit	DbmHz
Resolution Band Width	27000
Resolution Bandwidth Shape	Gaussian
RRC Filter Alpha	0.22
RRC Filter BW	3840000
RRC Filter State	FALSE
Span	3000000
Sweep Points	1001
Sweep Time	0.004933333
Sweep Time Auto	TRUE
TriggerSource	Free
Video Bandwidth	270000
Y Axis Unit	DecibelMilliwatt
MeasResult1	MeasResult2
-76.8141133132837	-95.29174
-139.824413269924	-94.99601
	-94.95281
	-95.17146

OBW Meas Results File Contents

The first lines in the OBW Meas results file consist of header information, as follows.

- File ID string, which is “MeasResult”
- Measurement ID following Mode ID, which is “SA:OBW” for example.
- Firmware rev and model number
- Option string
- Auto Sweep Time Rules
- Average Mode
- Average Number
- Average State
- Center Frequency
- Detector
- Electrical Atten

- Electrical Atten State
- IFGain
- IFGainAuto
- Internal Preamp
- Internal Preamp Band
- Limit
- Limit State
- Max Hold
- Mechanical Atten
- MechanicalAttenStepEnum
- OBW Percent Pwr
- Resolution Band Width
- Resolution Bandwidth Shape
- Span
- Sweep Points
- Sweep Time
- Sweep Time Auto
- TriggerSource
- Video Bandwidth
- x DB

The data above is followed in the file by a line containing “MeasResult1” and “MeasResult2”. This line forms a header for each set of measurement results, which appear in subsequent lines. Each line of Measurement Results consists of two comma-separated values, for MeasResult1 and MeasResult2 respectively.

The MeasResult1 set in the file corresponds to the data returned by `:MEAS|:READ|:FETCh:OBWidth`1, and the MeasResult2 set corresponds to the data returned by `:MEAS|:READ|:FETCh:OBWidth2`.

The exported file is in CSV format, with a `.csv` extension.

Meas Results File Example

When imported into Microsoft Excel, a typical Meas Results CSV file appears as shown in the example below.

MeasResult	
SA:OBW	
A.10.53	N9030A
526 ALV ATP B1X B1Y B25 B40 BBA CR3 CRP DCF DDA DP2 DRD EA3 EDP EMC EP1 ERC ESC ESP EXM FSA LFE LNP MAT MPB NFE NUL P26 PFR PNC RTL RTS S40 SB1 SEC SM1 TVT YAS YAV	1
Auto Sweep Time Rules	Normal
Average Mode	Exponential
Average Number	10
Average State	TRUE
Center Frequency	1.33E+10
Detector	Average
IFGain	FALSE
IFGainAuto	FALSE
Internal Preamp	FALSE
Internal Preamp Band	Low
Limit	5000000
Limit State	FALSE
Max Hold	FALSE
OBW Percent Pwr	99
Resolution Band Width	27000
Resolution Bandwidth Shape	Gaussian
Span	3000000
Sweep Points	1001
Sweep Time	0.004933
Sweep Time Auto	TRUE
TriggerSource	Free
Video Bandwidth	270000
x DB	-26
MeasResult1	MeasResult2
2971020.10835045	-94.3702543927405
-74.9741251886604	-94.1447790390963

ACP Meas Results File Contents

An ACP Meas Results File contains measurement results with the following header information, columns A and B unless otherwise stated:

- File ID string, which is “MeasResult”
- Measurement ID following Mode ID, which is “SA:ACP” for example.
- Firmware rev and model number
- Option string
- Auto Scaling
- Auto Sweep Time Rules
- Automatic Trigger Time
- Automatic Trigger Time State
- Average Mode
- Average Number
- Average State
- Bar Graph
- Carrier Coupling (columns A thru S, TRUE or FALSE)
- Carrier Pwr Present (columns A thru S, Yes or No)
- Carrier Spacing (columns A thru S, in Hz)
- Carriers
- Center Frequency
- Center Frequency Step
- Center Frequency Step State
- Detector Auto
- Detector Selection
- Electrical Atten
- Electrical Atten State
- External Array Trigger Delay (columns A thru E)
- External Array Trigger Delay State (columns A thru E)
- External Array Trigger Level (columns A thru E)
- External Array Trigger Slope (columns A thru E)

- Filter Alpha (columns A thru S)
- Filter BW
- Filter Type
- Internal Preamp
- Internal Preamp Band
- Limit Test
- Line Trigger Delay
- Line Trigger Delay State
- Line Trigger Slope
- Meas Method
- Meas Type
- Measurement Noise Bandwidth (columns A thru S, in Hz)
- Mechanical Atten
- MechanicalAttenStepEnum
- Method (columns A thru S)
- Noise Correction
- Offset Abs Limit (columns A thru G)
- Offset Fail (columns A thru G)
- Offset Filter Alpha
- Offset Filter BW (columns A thru G)
- Offset Filter Type (columns A thru G)
- Offset Freq (columns A thru G)
- Offset Freq State (columns A thru G)
- Offset Integ BW (columns A thru G)
- Offset Method
- Offset Rel Lim (Car) (columns A thru G)

- Offset Rel Lim (PSD) (columns A thru G)
- Offset Res BW (columns A thru G)
- Offset Res BW Mode (columns A thru G)
- Offset Video BW (columns A thru G)
- Offset Video BW Mode (columns A thru G)
- Periodic Timer Period
- Periodic Timer Sync Source
- Periodic Timer Trigger Delay
- Periodic Timer Trigger Delay State
- Points
- Power Ref
- Power Ref State
- Preselector Adjust
- PSD Ref
- PSD Unit
- Ref Car Freq
- Ref Car Freq State
- Ref Carrier
- Ref Carrier Mode
- Ref Position
- Ref Value
- Res BW
- Res BW Mode
- RFBurst Trigger Delay
- RFBurst Trigger Delay State
- RFBurst Trigger Level Abs
- RFBurst Trigger Level Rel

- RFBurst Trigger Level Type
- RFBurst Trigger Slope
- Scale/Div
- Span
- Sweep Time
- Sweep Time Auto
- Trigger Holdoff
- Trigger Holdoff State
- Trigger Source
- Video BW
- Video BW Auto

The file contains this data followed by MeasResult1, MeasResult2, and MeasResult3 that flag the start of the measurement results. Each line of Measurement Results consists of three comma separated values, MeasResult1 value, MeasResult2 value, and MeasResult3 value. MeasResult1 contains the same result as MEAS/READ/FETCh:ACPower1; MeasResult2, MEAS/READ/FETCh:ACPower2; MeasResult3, MEAS/READ/FETCh:ACPower3.

Exported file is .csv file. The Meas Results file, when imported into Excel, will show the header information above followed by the data. A sample of what the data rows look like appears below:

MeasResult1	MeasResult2	MeasResult3
-76.8058517744559	0	1
0.084790019950006	-76.8058517744559	0
0.0283929128313787	-999	1
	-999	0
	-999	1

SPUR Meas Results File Contents

A Spurious Emissions Meas Results File contains measurement results with the following header information, columns A and B unless otherwise stated:

- File ID string, which is “MeasResult”
- Measurement ID following Mode ID, which is “SA:SPUR” for example.

- Firmware rev and model number
- Option string
- Abs Start Limit (columns A thru K)
- Abs Stop Limit (columns A thru K)
- Abs Stop Limit Mode (columns A thru K, TRUE or FALSE)
- Auto Scaling
- Auto Sweep Time Rules
- Automatic Trigger Time
- Automatic Trigger Time State
- Average Mode
- Average Number
- Average State
- Detector 1 (columns A thru K)
- Detector 2 (columns A thru K)
- Electrical Atten
- Electrical Atten State
- External Array Trigger Delay (columns A thru E)
- External Array Trigger Delay State (columns A thru E)
- External Array Trigger Level (columns A thru E)
- External Array Trigger Slope (columns A thru E)
- Filter Type (columns A thru K)
- IF Gain Auto (columns A thru K, TRUE or FALSE)
- IF Gain State (columns A thru K, TRUE or FALSE)
- Internal Preamp
- Internal Preamp Band
- Line Trigger Delay
- Line Trigger Delay State

- Line Trigger Slope
- Meas Type
- Mechanical Atten
- MechanicalAttenStepEnum
- Peak Excursn (columns A thru K)
- Periodic Timer Period
- Periodic Timer Sync Source
- Periodic Timer Trigger Delay
- Periodic Timer Trigger Delay State
- Pk Threshold (columns A thru K)
- Points (columns A thru K)
- Points Mode (columns A thru K)
- Range State (columns A thru K)
- Ref Value
- Res BW (columns A thru K)
- Res BW Mode (columns A thru K)
- RFBurst Trigger Delay
- RFBurst Trigger Delay State
- RFBurst Trigger Level Abs
- RFBurst Trigger Level Rel
- RFBurst Trigger Level Type
- RFBurst Trigger Slope
- Scale/Div
- Spurious Report Mode
- SpurRangeStartFrequecnyArray (columns A thru K)
- SpurRangeStopFrequencyArray (columns A thru K)

- Sweep Time (columns A thru K)
- Sweep Time Mode (columns A thru K)
- Trigger Holdoff
- Trigger Holdoff State
- TriggerSource
- Video BW (columns A thru K)
- Video BW Mode (columns A thru K)

The data above is followed in the file by a line containing “MeasResult1” to “MeasResult42”. This line forms a header for each set of measurement results, which appear in subsequent lines. Each line of Measurement Results consists of 42 comma-separated values, from the MeasResult1 value to the MeasResult42 value.

The MeasResult1 set in the file corresponds to the data returned by MEAS/READ/FETCh:SPURious1; the MeasResult2 set corresponds to the data returned by MEAS/READ/FETCh:SPURious2, and so on.

The exported file is in CSV format, with a .csv extension.

Meas Results File Example

When imported into Excel, a typical Meas Results file will show the header information above followed by the data. A sample of what the data rows look like appears below. Only the columns for Meas Result 1 through 6 are shown, due to lack of space:

MeasResult1	MeasResult2	MeasResult3	MeasResult4	MeasResult5	MeasResult6
19	-80.27209	-80.87862	-90.94577	-89.27086	-76.77856
1	-78.28497	-80.93996	-91.00485	-90.56063	-76.33968

SEM Meas Results File Contents

An SEM Meas Results File contains measurement results with the following header information, columns A and B unless otherwise stated:

- File ID string, which is “MeasResult”
- Measurement ID following Mode ID, which is “SA:SEM” for example.
- Firmware rev and model number
- Option string
- Automatic Trigger Time

- Automatic Trigger Time State
- Center Frequency
- ChanIntegBW
- ChannelDetector
- ChannelDetectorState
- ChanPwrRefAuto
- ChanResBW
- ChanResBWAuto
- ChanSpan
- ChanSweepTime
- ChanSweepTimeAuto
- ChanVbwRbwRatio
- ChanVbwRbwRatioAuto
- ChanVideoBW
- ChanVideoBWAuto
- Electrical Atten
- Electrical Atten Bypass
- Electrical Atten State
- External1 Trigger Delay
- External1 Trigger Delay State
- External1 Trigger Level
- External1 Trigger Slope
- External2 Trigger Delay
- External2 Trigger Delay State
- External2 Trigger Level
- External2 Trigger Slope

- FilterAlpha
- Internal Preamp
- Internal Preamp Band
- Line Trigger Delay
- Line Trigger Delay State
- Line Trigger Slope
- Mechanical Atten
- Mechanical Atten Auto
- OffsetDetector
- OffsetDetectorState
- OffsetLimitAbsStartBTS (columns A thru G)
- OffsetLimitAbsStartMS (columns A thru G)
- OffsetLimitAbsStopBTS (columns A thru G)
- OffsetLimitAbsStopMS (columns A thru G)
- OffsetLimitFailMaskBTS (columns A thru G)
- OffsetLimitFailMaskMS (columns A thru G)
- OffsetLimitRelStartBTS (columns A thru G)
- OffsetLimitRelStartMS (columns A thru G)
- OffsetLimitRelStopBTS (columns A thru G)
- OffsetLimitRelStopMS (columns A thru G)
- OffsetMeasBWBTS (columns A thru G)
- OffsetMeasBWMS (columns A thru G)
- OffsetResolutionBWAutoBTS (columns A thru G)
- OffsetResolutionBWAutoMS (columns A thru G)
- OffsetResolutionBWBTS (columns A thru G)
- OffsetResolutionBWMS (columns A thru G)
- OffsetSideBTS (columns A thru G)

- OffsetSideMS (columns A thru G)
- OffsetStartFrequencyBTS (columns A thru G)
- OffsetStartFrequencyMS (columns A thru G)
- OffsetStateBTS (columns A thru G)
- OffsetStateMS (columns A thru G)
- OffsetStopFrequencyBTS (columns A thru G)
- OffsetStopFrequencyMS (columns A thru G)
- OffsetSweepTimeAutoBTS (columns A thru G)
- OffsetSweepTimeAutoMS (columns A thru G)
- OffsetSweepTimeBTS (columns A thru G)
- OffsetSweepTimeMS (columns A thru G)
- OffsetVbwRbwRatioAutoBTS (columns A thru G)
- OffsetVbwRbwRatioAutoMS (columns A thru G)
- OffsetVbwRbwRatioBTS (columns A thru G)
- OffsetVbwRbwRatioMS (columns A thru G)
- OffsetVideoBWAutoBTS (columns A thru G)
- OffsetVideoBWAutoMS (columns A thru G)
- OffsetVideoBWBTS (columns A thru G)
- OffsetVideoBWMS (columns A thru G)
- PeakReference
- Periodic Timer Period
- Periodic Timer Sync Source
- Periodic Timer Trigger Delay
- Periodic Timer Trigger Delay State
- PowerReference
- PSDReference

- Radio Device
- RFBurst Trigger Delay
- RFBurst Trigger Delay State
- RFBurst Trigger Level Abs
- RFBurst Trigger Level Rel
- RFBurst Trigger Level Type
- RFBurst Trigger Slope
- RrcFilter
- SemAverageNumber
- SemAverageState
- TotalAtten
- Trigger Holdoff
- Trigger Holdoff State
- TriggerSource
- Video Trigger Delay
- Video Trigger Delay State
- Video Trigger Level
- Video Trigger Slope
- ViewSelection

The file contains this data followed by MeasResult1 to MeasResult12 that flag the start of the measurement results. Each line of Measurement Results consists of twelve comma separated values from MeasResult1 value to MeasResult12 value. MeasResult1 contains the same results as MEAS/READ/FETCh:SEMask1; MeasResult2, MEAS/READ/FETCh:SEMask2; MeasResult3, MEAS/READ/FETCh:SEMask3;... (continues in the same manner)

When imported into Excel, a typical Meas Results file will show the header information above followed by the data. A sample of what the data rows look like appears below. Only the columns for Meas Result 1 through 6 are shown, due to lack of space:

MeasResult1	MeasResult2	MeasResult3	MeasResult4	MeasResult5	MeasResult6
-999	-78.89359	-13	999	-73.6966334099879	-999
-73.6966334099879	-78.95235	-13	999	-999	-999

CCDF Meas Results File Contents

A CCDF Meas Results File contains measurement results with the following header information:

- File ID string, which is “MeasResult”
- Measurement ID following Mode ID, which is “SA:PST” for example.
- Firmware rev and model number
- Option string
- Automatic Trigger Time
- Automatic Trigger Time State
- CcdfCurrentCounts
- Center Frequency
- Center Frequency Step
- Center Frequency Step State
- Counts
- Electrical Atten
- Electrical Atten State
- External Array Trigger Delay
- External Array Trigger Delay State
- External Array Trigger Level
- External Array Trigger Slope
- Gaussian Line

- IF Gain Auto
- IF Gain State
- Info BW
- Internal Preamp
- Internal Preamp Band
- Line Trigger Delay
- Line Trigger Delay State
- Line Trigger Slope
- Meas Cycles
- MeasInterval
- Mechanical Atten
- MechanicalAttenStepEnum
- Periodic Timer Period
- Periodic Timer Sync Source
- Periodic Timer Trigger Delay
- Periodic Timer Trigger Delay State
- Preselector Adjust
- Ref Trace
- RFBurst Trigger Delay
- RFBurst Trigger Delay State
- RFBurst Trigger Level Abs
- RFBurst Trigger Level Rel
- RFBurst Trigger Level Type
- RFBurst Trigger Slope
- Scale/Div
- Trigger Holdoff
- Trigger Holdoff State

– TriggerSource

The data above is followed in the file by a line containing “MeasResult1” to “MeasResult4”. This line forms a header for each set of measurement results, which appear in subsequent lines. Each line of Measurement Results consists of 4 comma-separated values, from the MeasResult1 value to the MeasResult4 value.

The MeasResult1 set in the file corresponds to the data returned by MEAS|READ|FETCh:PSTatistic1; the MeasResult2 set corresponds to the data returned by MEAS|READ|FETCh:PSTatistic2, and so on.

The exported file is in CSV format, with a .csv extension.

Meas Results File Example

When imported into Microsoft Excel, a typical Meas Results CSV file appears as shown in the example below.

MeasResult		
SA:PST		
A.10.53	N9030A	
526 ALV ATP B1X B1Y B25 B40 BBA CR3 CRP DCF DDA DP2 DRD EA3 EDP EMC EP1 ERC ESC ESP EXM FSA LFE LNP MAT MPB NFE NUL P26 PFR PNC RTL RTS S40 SB1 SEC SM1 TVT YAS YAV	1	
Automatic Trigger Time	0.1	
Automatic Trigger Time State	FALSE	
CcdfCurrentCounts	6087500	
Center Frequency	1.33E+10	
Center Frequency Step	5000000	
Center Frequency Step State	TRUE	
Counts	10000000	
Electrical Atten	0	
Electrical Atten State	FALSE	
External Array Trigger Delay	1.00E-06	1.00E-06
External Array Trigger Delay State	FALSE	FALSE
External Array Trigger Level	1.2	1.2
External Array Trigger Slope	Positive	Positive
Gaussian Line	TRUE	
IF Gain AUto	FALSE	
IF Gain State	FALSE	

Info BW	5000000		
Internal Preamp	FALSE		
Internal Preamp Band	Low		
Line Trigger Delay	1.00E-06		
Line Trigger Delay State	FALSE		
Line Trigger Slope	Positive		
Meas Cycles	1600		
MeasInterval	0.001		
Mechanical Atten	10		
MechanicalAttenStepEnum	S2dB		
Periodic Timer Period	0.02		
Periodic Timer Sync Source	None		
Periodic Timer Trigger Delay	1.00E-06		
Periodic Timer Trigger Delay State	FALSE		
Preselector Adjust	0		
Ref Trace	FALSE		
RFBurst Trigger Delay	1.00E-06		
RFBurst Trigger Delay State	FALSE		
RFBurst Trigger Level Abs	-20		
RFBurst Trigger Level Rel	-6		
RFBurst Trigger Level Type	Absolute		
RFBurst Trigger Slope	Positive		
Scale/Div	2		
Trigger Holdoff	0.1		
Trigger Holdoff State	FALSE		
TriggerSource	Free		
MeasResult1	MeasResult2	MeasResult3	MeasResult4
-73.0651058869747	36.9712197125257	36.7879441171442	
36.9712197125257	36.8850431211499	36.7032368203129	

IQ Waveform Meas Results File Contents

An IQ Waveform Meas Results File contains measurement results with the following header information:

- File ID string, which is “MeasResult”
- Measurement ID following Mode ID, which is “WCDMA:WAV” for example.
- Firmware rev and model number

– Option string
– Center Frequency
– Input Port
– Info BW
– Capture Time

The data above is followed in the file by a line containing “MeasResult0”, “MeasResult1” and “MeasResult2”. This line forms a header for each set of measurement results, which appear in subsequent lines. Each line of Measurement Results consists of 3 comma-separated values.

The MeasResult0 set in the file corresponds to the data returned by MEAS|READ|FETCh:WAVeform0; the MeasResult1 set corresponds to the data returned by `:MEAS|READ|FETCh WAVeform1`, and the MeasResult2 set corresponds to the data returned by `:MEAS|READ|FETCh WAVeform2`. See the IQ Waveform documentation under “Remote Command Results for the Waveform Measurement” for details.

The exported file is in CSV format, with a `.csv` extension.

Meas Results File Example

When imported into Microsoft Excel, a typical Meas Results CSV file appears as shown in the example below.

MeasResult		
WCDMA:WAV		
A.20.10_P0003	N9040B	
503 508 513 526 AKT ALV ATP B1A B1X B1Y B25 B2X B40 B85 CR3 CRP DP2 EA3 EDC EDP EMC EP0 ERC ESC ESP EXM FBP FP1 FP2 FS1 FS2 FSA FT2 LFE LNP MPB NF2 NUL P26 PFR RBE RT2 RTL RTS TDS YAV	1	
Center Frequency	1000000000	
Input Port	RF	
WAV_InfoBw	100000	
WAV_Used_CaptureTime	0.002	
MeasResult0	MeasResult1	MeasResult2
3.24E-06	8.00E-06	-99.79862
7.28E-08	-96.51288923	-95.87017
2.43E-06	-96.51288923	-101.4529
-4.47E-06	251	-94.5003
7.65E-07	7.796300857	-95.8662
-2.56E-06	-88.71658837	-97.78934
4.79E-07	-125.5631137	-101.0861

5.94E-06	-97.72218
4.71E-06	-96.72934
1.93E-06	-100.7464
4.04E-07	-99.8119

(rows continue until all data is displayed)

Capture Buffer

Allows you to store captured data for reuse in demod measurements using 'Save/Recall' functionality for 'Capture Buffer.' 'Capture Buffer' is saved and loaded as IQ Data with properties which show Sample Rate, Length, IF BW, etc.

This function is only available in WCDMA Code Domain and Mod Accuracy measurements. Use Capture Buffer to perform analysis of the same captured data using 'Code Domain' and 'Mod Accuracy' measurements, or to playback previously saved captured data.

Example	`:MMEM:STOR:CAPT "MyCaptureData.bin"` This stores the capture data in the file `MyCaptureData.bin` in the default directory
Dependencies	Capture buffer functionality is available for the Code Domain and Modulation Accuracy measurements. In other measurements, this key is grayed-out

7.1.6 Limit

Lets you choose a file to which to export the Limit data.

Limit files are CSV files, and contain the limit data in a form that can be imported into Excel or other spreadsheets, as well as header data that gives information on the limit.

The default path for most Limits Files is:

`My Documents\<mode name>\data\limits`

where `<mode name>` is the parameter used to select the mode with the `:INST:SEL` command (for example, `SA` for the Spectrum Analyzer). Hence a Limit file from any measurement in the Spectrum Analyzer Mode would be stored in:

`My Documents\SA\data\limits`

The default path for Limit files from the Log Plot measurement in the Phase Noise Mode is:

`My Documents\PNOISE\data\LPL\limits`

The default filename is `Limit_0000.csv`, where the 4-digit number is the lowest number that does not conflict with any filename in the current directory.

For backwards compatibility, older limit files with the extension `.lim` can be read into the instrument, but you can only save limits as `.csv` files.

Remote Command	:MMEMory:STORe:LIMit LLINE1 | LLINE2 | LLINE3 | LLINE4 | LLINE5 | LLINE6,<filename>
Example	:MMEM:STOR:LIM LLINE2,"myLimitLine2.csv" Saves the 2nd Limit Line to the file myLimitLine2.csv in the current path
Notes	If the save is initiated via SCPI, and the file already exists, the file will be overwritten Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade Both single and double quotes are supported for any filename parameter over SCPI
Dependencies	This key only appears if you have the proper option installed in your instrument In the Log Plot measurement in the Phase Noise Mode, there are only three Limit Lines, so the valid parameters are LLINE1 | LLINE2 | LLINE3
Preset	1 Not part of Preset, but is reset by **Restore Mode Defaults** Survives power cycles
State Saved	The selected Limit number is saved in instrument state
Status Bits/OPC dependencies	Sequential - waits for previous measurement to complete

Limit File Contents

Limits may be exported into a data file with a .csv extension. They may be imported from that data file; they may also be imported from a legacy limit file with a .lim extension. The .lim files meet the specification for limit files contained in the EMI measurement guide, HP E7415A.

.csv file format

Except for information in quotes, limit line files are not case sensitive. Information in bold is required verbatim; other text is example text, and italic text is commentary which should not be present in the file.

The first five lines are system-required header lines, and must be in the correct order:

Limit	*Data file type name*
"FCC Part 15"	*File Description*
"Class B Radiated"	*Comment*
A.01.00.R0001,N9020A	*Instrument Version, Model Number*
P13 EA3 UK6 ,01	*Option List, File Format Version*

The next few lines describe the parameters; on export they will be in the order shown, on import they can be in any order. If some parameters are missing, they will revert to the default.

Type, Upper	*Upper|Lower*
X Axis Unit, MHz	*MHz|S; other units should be converted; this also specifies the domain*
Amplitude Unit, dBm	*dBm|V; all other units should be converted appropriately*
Frequency Interpolation, Linear	*Logarithmic|Linear*
Amplitude Interpolation, Logarithmic	*Logarithmic|Linear*
X Control, Fixed	*Fixed|Relative; on input we consider only the first three characters*
Y Control, Fixed	*Fixed|Relative; on input we consider only the first three characters*
Margin, 0	*Always in dB. A 0 margin is equivalent to margin off*
X Offset, 10	*Expressed in the X axis units*
Y Offset, 5	*Expressed in the Amplitude units*

The Amplitude Unit line in the limits file may contain a transducer (formerly "antenna") factor unit, for example:

Amplitude Unit=dBuV/m

Transducer factor units are dBuV/m, dBuA/m, dBpT, and dBG. In this case, the unit is treated exactly as though it were dBuV, meaning that all of the limits are interpreted to have units of dBuV. The box does NOT change Y Axis Units when such a limit is loaded in.

The X-Axis unit also specifies the domain (time or frequency). It is not possible to have both time-domain lines and frequency-domain lines at the same time; if a time-domain line is imported while the other lines are in the frequency domain (or vice-versa), all limit lines will be deleted prior to import.

If the sign of the margin is inappropriate for the limit type (for example a positive margin for an upper limit), the sign of the margin will be changed internally so that it is appropriate.

The remaining lines describe the data. Each line in the file represents an X-Y pair. The X values should be monotonically non-decreasing, although adjacent lines in the file can have the same X value as an aid to building a stair-stepped limit line. To specify a region over which there is no limit, use +1000 dBm for upper limits or –1000 dBm for lower limits.

The data region begins with the keyword `DATA`:

```
DATA
200.000000,–10.00
300.000000,–10.00
300.000000,–20.00
500.000000,–20.00
```

.lim file format

This is a legacy format which allows files saved from older instruments to be loaded into the X-Series. *Design of files in this format is not recommended.*

Except for name and description text (which is taken verbatim), limit line files are not case sensitive.

The file may optionally start with a description block, consisting of the single line `[DESCRIPTION]` followed by arbitrary text. If there is no Limit Line Name header, the description text will be used as the limit line description in the GUI. If there is a Limit Line Name header, the Limit Line Name will be used instead.

Arbitrary text

The header block begins with the single line `[HEADER]`, followed by some or all of the following fields, each with `<parameter name>=<parameter value>`. Excess white space around the "=" is ignored. If a field is not present or the data is invalid, the value is not changed when the limit line is loaded. Ordering of the fields is unimportant.

Limit Line Name="FCC Part 15;Class B Radiated"	
Type=Upper	Upper|Lower
Frequency Unit=MHz	For time domain limits, this should say "Time Unit"
Amplitude Unit=dBm	
Frequency Interpolation=Lin	Log|Lin; on input we consider only the first three characters
Amplitude Interpolation=Log	Log|Lin; on input we consider only the first three characters
Mode=Fixed	Fixed|Relative
Margin=0	Always in dB. A 0 margin is equivalent to margin off
Domain=Frequency	Frequency|Time
Delimiter=TAB	

The data block begins with the line `[DATA]`, and consists of any number of segments.

The Data lines represent segments – X1, Y1, X2, Y2. If the list of segments includes a gap in the middle on input, the space inside the gap will be set to ensure the limit does not fail: for upper limits maxtracevalue, for lower limits mintracevalue. If two segments overlap on input, the stricter of the two segments is used – for upper limits the lower segment, for lower limits the upper segment.

Thus, the following segments indicate into a –5 dB limit from 10 MHz to 20 MHz and 30 MHz to 40MHz:

10	–5	20	–5
30	–5	40	–5

If this was an upper limit, this would be translated into the following set of limit points:

10	–5
20	–5
20	maxtracevalue

30	maxtracevalue
30	-5
40	-5

30	-29.5	88	-29.5	
88	-33	216	-33	note that we are stair-stepping the line
230	-35.6	960	-35.6	The gap between 216 MHz and 230 MHz will never fail
960	-43.5	5000	-43.5	

7.1.6.1 Select Limit

Selects the specific Limit to be saved, for example, Limit 1.

Preset	Not part of Preset, but is reset to `LLINE1` by **Restore Mode Defaults** Survives shutdown

7.1.7 Correction

Selecting **Correction** allows you to export Amplitude Corrections files in the PC-readable .csv format.

Amplitude Correction files are Comma-Separated-Value (CSV) files, and contain the correction data in a form that can be imported into Excel or other spreadsheets, as well as header data that gives information on the correction.

The default filename is `Ampcor_0000.csv`, where the 4 digit number is the lowest number that does not conflict with any filename in the current directory.

The default path for Corrections files is:

`\My Documents\amplitudeCorrections`

For backwards compatibility, older limit files with the extension .amp, .cbl, .ant and .oth can be read into the instrument, but you can only save corrections as .csv files.

See "Correction Data File " on page 2422

Remote Command	`:MMEMory:STORe:CORRection 1 | ... | 8, <filename>`
Example	`:MMEM:STOR:CORR 2 "myAmpcor.csv"` saves Correction 2 to the file `myAmpcor.csv` on the current path
Notes	If the save is initiated via SCPI, and the file already exists, the file will be overwritten Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade

	Both single and double quotes are supported for any filename parameter over SCPI
Dependencies	Corrections are not supported by all Measurements. If in a Mode in which some Measurements support it, this key will be grayed out in measurements that do not. The key will not show at all if no measurements in the Mode support it This key does not appear unless you have the proper option installed in your instrument
Annotation	After save is complete, an advisory is displayed in the message bar confirming which file was saved
Backwards Compatibility SCPI	`:MMEMory:STORe:CORRection ANTenna | CABLe | OTHer | USER, <filename>` For backwards compatibility, `ANTenna` maps to 1, `CABle` maps to 2, `OTHer` maps to 3, and `USER` maps to 4

Correction Data File

A Corrections Data File contains a copy of one of the analyzer correction tables. Corrections provide a way to adjust the trace display for predetermined gain curves (such as for cable loss).

The format for Corrections files is as follows.

Line #	Type of field	Example	Notes
1	File type, must be "Amplitude Correction"	Amplitude Correction	May not be omitted
2	File Description (in quotes)	"Correction Factors for 11966E"	60 characters max; may be empty but may not be omitted If exceeds 60 characters, error -233 Too much data reported
3	Comment (in quotes)	"Class B Radiated"	60 characters max; may be empty but may not be omitted If exceeds 60 characters, error -233 Too much data reported
4	Instrument Version, Model #	A.02.06,N9020A	May be empty but may not be omitted
5	Option List, File Format Version	K03 LFE EXM ,01	May be empty but may not be omitted
6	Freq Unit to be used for all frequency values in the file	Frequency Unit,MHz	assumed to be Hz if omitted
7	Transducer Unit	Antenna Unit,None	If omitted leaves the Transducer unit unchanged. The amplitude unit in the Transducer Unit field is a conversion factor that is used to adjust the Y Axis Units of the current mode, if the mode supports Transducer Units. For more details on transducer correction

Line #	Type of field	Example	Notes
			data, refer to the Input/Output,Corrections key description. Allowable values: dBuv/m, dBuA/m, dBG, dBpT, None
8	Freq Interpolation	Frequency Interpolation,Linear	if omitted leaves the Freq Interpolation unchanged. Allowable values: Linear, Logarithmic
9	Bias value in mA	Bias,0.00	If omitted leaves the Bias value unchanged (added as of A.08.50)
10	Bias State	Bias State,On	If omitted leaves the Bias State unchanged. Allowable values: On, Off (added as of A.08.50)
11	Overlap, two values, Freq1 and Freq2, separated by commas.	Overlap,33500,40000	Uses Freq Unit from line 6. Thus, in this example Freq1=33.5 GHz, Freq2= 40.0 GHz (see note below). If omitted leaves the overlap unchanged (added as of A.08.50)
12	DATA marker	DATA	Corrections data begins in the next line

Lines 2 through 5 can be empty, but must appear in the file. Lines 6 through 11 are optional, the lines can be left out of the file altogether.

The Overlap row and the two Bias rows apply only to external mixing. Both are read-only, they are never written by the analyzer. The only way to insert or modify these rows is to edit the file with a text editor or a spreadsheet editor. These rows are intended for use by mixer manufacturers, as they allow the manufacturer to insert data about how the mixer corrections were generated and how they should be applied. The Bias rows allow you to specify whether to turn Bias on or off when the Correction is turned on and to specify a Bias value (turning off the Correction does not change the Bias, but turning it back on again sets it to the value specified in the file). The Overlap row allows you to specify an overlap region in which two different corrections may be applied. It is expected that in the corrections data itself, there will be TWO corrections values exactly at Max Freq, otherwise Overlap is ignored. The way the overlap is processed is as follows: if at any given time the current analyzer Start Freq is greater than Freq 1 and lower than Freq 2, and the current Stop Freq is greater than Freq 2, extend the first correction point at or above Freq 2 down to Freq 1, rather than using the correction data between Freq1 and Freq2.

Only one Transducer unit can be on at any given time. Note that this means that if a correction file with a Transducer Unit is loaded into a particular Correction, all other Corrections are set to that same Transducer unit. Note that the legacy term “Antenna Unit” is still used in the correction file, even though the more modern term “Transducer Unit” is used in the user interface.

Similarly, the Bias rows can only be used in Correction register 1, because there can only be one setting for Bias at any given time. If a Correction file with a Bias or Bias State row is loaded into any Correction register but 1, an error is generated: Mass storage error; Can only load Bias Settings into Correction 1

The data follows the DATA row, as comma-separated X, Y pairs; one pair per line.

For example, suppose you have an Antenna to correct for on an N9020A version A.02.06 and the correction data is:

- 0 dB at 200 MHz
- 17 dB at 210 MHz
- 14.8 dB at 225 MHz

Then the file will look like:

- Amplitude Correction
- "Correction Factors for 11966E"
- "Class B Radiated"
- A.02.06,N9020A
- P13 EA3 UK6,01
- Frequency Unit,MHz
- Antenna Unit,dBuV/m
- Frequency Interpolation,Linear
- DATA
- 200.000000,0.00
- 210.000000,17.00
- 225.000000,14.80

The choices for the 1 of N fields in the metadata are as follows:

- Frequency Unit: Hz, kHz, MHz, GHz
- Antenna Unit: dBuv/m, dBuA/m, dBG, dBpT, None
- Frequency Interpolation: Logarithmic, Linear

7.1.7.1 Select Correction

Selects the specific Correction to be saved, for example, Correction 1.

Preset	Not part of a Preset, but is reset to Correction 1 by **Restore Input/Output Defaults** Survives a shutdown

7.1.8 Correction Group

Selects **Correction Group** as the data type to be exported with a save request. The next step is to select the **Save As** key in the **Save Data** menu.

Remote Command	`:MMEMory:STORe:CORRection:GROup <filename>`
Example	`:MMEM:STOR:CORR:GRO "D:\myAmpcorGroup.csv"` saves Correction Group to the file `myAmpcorGroup.csv`
Notes	If the save is initiated via SCPI, and the file already exists, the file and the directory will be overwritten Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade Both single and double quotes are supported for any filename parameter over SCPI
Dependencies	This file type is supported in EMI Receiver and Spectrum Analyzer Modes, if option EMC or EMI Receiver mode is present
Annotation	After save is complete, an advisory is displayed in the message bar confirming which file was saved

Correction Group File

A Correction Group file contains the correction group settings (that is, Antenna unit, break, description and comment) range table and correction files data. Corrections files are text files in `.csv` (Comma-Separated Value) format, to make them importable into Excel or other spreadsheet programs.

7.1.9 Mask

The **Mask** data type is used to import and export Mask files for measurements that use masks, such as cellular comms and real-time measurements.

7.1.10 Waveform Sequence

Saves waveform sequences from the ARB memory of an Internal Source. When you open the Save **Waveform Sequence** dialog and press **Save**, the current waveform sequence is saved to the selected directory.

Notes	No remote command, front panel only
Dependencies	Only appears if your hardware includes an Internal Source, such as in VXT

7.1.11 Screen Image

Selects a file for saving the contents of the display.

Screen Image files are PNG (Portable Network Graphics) files with the same resolution as the data display. They contain the image that was on the screen before you opened the **Save** dialog. When the **Screen Image** key is pressed, a "thumbnail" of the captured image is displayed, with the note “This is the image that will be saved” below it.

After you have completed the save, a message “File image.png saved” (assuming `image.png` was the filename you used).

NOTE: As of firmware release A.17.50, sending `*CLS` (Clear Status) removes any message displayed on the screen. If you do not want to see the “File saved” message after sending `:MMEM:STOR:SCR` (described below), send the following sequence (substituting your file name for `filename.png`): `:MMEM:STOR:SCR “filename.png”;*CLS`

NOTE: As of firmware release A.19.50, saving a screen image will remove any informational message displayed on the screen before it captures the screen. This is useful if you are sending “save image” commands in rapid sequence, as it keeps the “File saved” message from one screen capture from appearing in the next screen capture. Error messages will still be captured.

If you send a succession of screen image commands *too* rapidly, the system may not have time to remove the previous message before the next screen capture. Sending screen image commands more rapidly than twice per second is not advised.

The default path for State Files is:

`My Documents\<mode name>\screen`

where `<mode name>` is the parameter used to select the mode with `:INST:SEL`, for example, `SA` for Spectrum Analyzer Mode.

Screen Image files have extension `.png`. The default filename is `Screen_0000.png`, where the 4-digit number is the lowest number that does not conflict with any filename in the current directory.

After you have completed the save, the **Quick Save** front-panel key lets you quickly repeat the last save performed, using an auto-named file, with new current screen data.

Remote Command	`:MMEMory:STORe:SCReen <filename>`
Example	`:MMEM:STOR:SCR "myScreen.png"` This stores the current screen image in the file `MyScreenFile.png` in the default directory
Backwards Compatibility SCPI	`:HCOPy:SDUMp:DATA?` returns the screen image in a `<DEFINITE LENGTH ARBITRARY RESPONSE DATA>` element. The response data is IEEE Block format; the controlling computer can strip the header and store the result as a `.png` file

7.1.11.1 Theme

Accesses a menu of functions that enable you to choose the theme to be used when saving the screen image. You can choose between themes to be used when saving the screen image.

See "More Information" on page 2427 for examples of the themes.

Remote Command	`:MMEMory:STORe:SCReen:THEMe FILLed | OUTLine` `:MMEMory:STORe:SCReen:THEMe?`
Example	`:MMEM:STOR:SCR:THEM OUTL`
Preset	`FILLed`; not part of Preset, but is reset by **Restore Misc Defaults** or **Restore System Defaults All**
Backwards Compatibility SCPI	`:MMEMory:STORe:SCReen:THEMe TDColor | TDMonochrome | FCOLor | FMONochrome`

Backwards Compatibility Notes	To permit code compatibility with A-model X-Series Signal Analyzer instruments, the command parameters from the A-models will be mapped as follows:
	`TDColor` and `TDMonochrome` are both mapped to `FILLed`
	(exact full color representation of what is on the screen)
	`FCOLor` and `FMONochrome` are both mapped to `OUTLine`
	(uses color for traces and other items, but most filled areas are white)
	There is no Monochrome theme in the B-models so the A-models monochrome commands yield color
	The query `:MMEM:STOR:SCR:THEM?` always returns `FILLed` or `OUTLine`, never `FCOLor`, `FMONochrome`, `TDColor`, or `TDMonochrome`
	There is no monochrome theme in the X-Series Touch UI

More Information

- The `FILLed` theme is an exact representation of the information on the display
- The `OUTLine` theme eliminates most of the filled areas, in order to save ink when the image is printed. In addition, the yellow trace color is changed to be more orange, to improve visibility against a white background. Note that some objects remain filled. In particular, the selected marker remains filled with the green marker color, in order to distinguish it from the other markers. This is important, as it is the selected marker whose readout appears in the upper right corner of the display

7.1.12 Uncertainty Results [Mode: NFIGURE] (GUI Only)

Saves the sweep uncertainty results for external viewing. The saved results *cannot* be recalled.

7.1.13 Remote Only Commands

The following commands execute file system operations such as move, copy and transfer data from a file.

7.1.13.1 Mass Storage Catalog (Remote Command Only)

Remote Command	`:MMEMory:CATalog? [<directory_name>]`
Example	`:MMEM:CAT? "C:\"`

Notes	The string `<directory_name>` must be a valid logical path. If no string then it uses the current directory
	Queries disk usage information (drive capacity, free space available) and obtains a list of files and directories in a specified directory in the following format:
	`<numeric_value>,<numeric_value>,{<file_entry>}`
	It returns two numeric parameters and as many strings as there are files and directories
	The first parameter indicates the total amount of storage currently used in bytes
	The second parameter indicates the total amount of storage available, also in bytes. `<file_entry>` is a string. Each `<file_entry>` indicates the name, type, and size of one file in the directory list:
	`<file_name>,<file_type>,<file_size>`
	As the Windows file system has an extension that indicates file type, `<file_type>` is always empty. `<file_size>` provides the size of the file in bytes. For directories, `<file_entry>` is surrounded by square brackets and both `<file_type>` and `<file_size>` are empty

7.1.13.2 Mass Storage Change Directory (Remote Command Only)

Remote Command	`:MMEMory:CDIRectory [<directory_name>]` `:MMEMory:CDIRectory?`
Example	`:MMEM:CDIR “C:\Program Files”`
Notes	The string must be a valid logical path Changes the current directory for a mass memory file system. The `<directory_name>` parameter is a string. If no parameter is specified, the directory is set to the `*RST` value At `*RST`, this value is set to the default user data storage area, that is defined as System.Environment.SpecialFolder.Personal Query returns full path of the current directory as a quoted string

7.1.13.3 Mass Storage Copy (Remote Command Only)

Remote Command	`:MMEMory:COPY <string>,<string>[,<string>,<string>]`

Example	`:MMEM:COPY "C:\TEMP\Screen_0000.png","C:\"`
Notes	The string must be a valid logical path Copies an existing file to a new file or an existing directory to a new directory If no directory is specified, uses the current directory Two forms of parameters are allowed. The first form has two parameters. In this form, the first parameter specifies the source, and the second parameter specifies the destination The second form has four parameters. In this form, the first and third parameters specify the source. The second and fourth parameters specify the directories. The first pair of parameters specifies the source. The second pair specifies the destination. An error is generated if the source doesn't exist or the destination file already exists This command will generate an "access denied" error if the destination is a restricted folder (e.g., `C:\Windows`) and you do not have Power User or Administrator privileges

7.1.13.4 Mass Storage Device Copy (Remote Command Only)

Transfers data to/from a file and a peripheral device.

Remote Command	`:MMEMory:COPY:DEVice <source_string>,<dest_string>`
Notes	The strings must be a valid logical path or a valid device keyword. If the dest_string is a device keyword, the data is copied from the source file to the device. If the source_string is a device keyword, the data is copied to the source file from the device Valid device keywords are: `SNS` (smart noise source) An error is generated if the file or device is not found

7.1.13.5 Mass Storage Delete (Remote Command Only)

Remote Command	`:MMEMory:DELete <file_name>[,<directory_name>]`
Example	`:MMEM:DEL "Screen_0000.png"`
Notes	The string must be a valid logical path If no directory is specified, uses the current directory Removes a file from the specified directory. `<file_name>` specifies the file name to be removed. This command will generate an "access denied" error if the file is in a restricted folder (e.g., `C:\Windows`) and you do not have Power User or Administrator privileges

7.1.13.6 Mass Storage Data (Remote Command Only)

Creates a file containing the specified data *or* queries the data from an existing file.

Remote Command	`:MMEMory:DATA <file_name>, <data>` `:MMEMory:DATA? <file_name>`

Example	`:MMEM:DATA? "MyFile.txt"`
Notes	The string must be a valid logical path If no directory is specified, uses the current directory The command form is `:MMEMory:DATA <file_name>,<data>`. It loads `<data>` into the file `<file_name>`. `<data>` is in 488.2 block format. `<file_name>` is string data The query form is `:MMEMory:DATA? <file_name>` with the response being the associated `<data>` in block format

7.1.13.7 Mass Storage Make Directory (Remote Command Only)

Remote Command	`:MMEMory:MDIRectory <directory_name>`
Example	`:MMEM:MDIR "C:\TEMP\NewDir"`
Notes	The string must be a valid logical path Creates a new directory. The `<directory_name>` parameter specifies the name to be created This command generates an "access denied" error if the new directory would be in a restricted folder (e.g., `C:\Windows`) and you do not have Power User or Administrator privileges

7.1.13.8 Mass Storage Move (Remote Command Only)

Remote Command	`:MMEMory:MOVE <string>,<string>[,<string>,<string>]`
Example	`:MMEM:MOVE "C:\TEMP\Screen_0000.png","C:\"`
Notes	The string must be a valid logical path Moves an existing file to a new file or an existing directory to a new directory Two forms of parameters are allowed. The first form has two parameters. In this form, the first parameter specifies the source, and the second parameter specifies the destination The second form has four parameters. In this form, the first and third parameters specify the source. The second and fourth parameters specify the directories. The first pair of parameters specifies the source. The second pair specifies the destination. An error is generated if the source doesn't exist or the destination file already exists This command generates an "access denied" error if the destination is a restricted folder (e.g., `C:\Windows`) and you do not have Power User or Administrator privileges

7.1.13.9 Mass Storage Remove Directory (Remote Command Only)

Remote Command	`:MMEMory:RDIRectory <directory_name>`
Example	`:MMEM:RDIR "C:\TEMP\NewDir"`
Notes	The string must be a valid logical path Removes a directory. The <directory_name> parameter specifies the directory name to be removed. All

	files and directories under the specified directory shall also be removed This command generates an “access denied” error if the folder is a restricted folder (e.g., `C:\Windows`) or is in a restricted folder and you do not have Power User or Administrator privileges

7.1.13.10 Mass Storage Determine Removable Media (Remote Command Only)

Used to determine whether any removable media devices are connected to the instrument. Primarily, these are USB memory devices plugged-in to the front panel or rear panel USB ports. On instruments with PC6 or PC7 CPUs, one SD card slot is available for removable media. The instrument’s primary disk drive is *not* a removable media device.

Remote Command	`:MMEMory:RMEDia:LIST?`
Example	`:MMEM:RMED:LIST?`
Notes	The return value is a string containing a list of partition identifiers, which are removable media devices. Each identifier will be separated by a comma. If no removable media is present, an empty string is returned Examples: – One removable device present results in a return string of “F:” – Two removable devices present results in a return string of “F:,G:” No removable devices present results in a return string of “”

7.1.13.11 Mass Storage Determine Removable Media Label (Remote Command Only)

Used to set or query a removable media device’s label.

Remote Command	`:MMEMory:RMEDia:LABel <partition>,<string>` `:MMEMory:RMEDia:LABel? <partition>`
Example	`:MMEM:RMED:LAB “F:”,”My Device”`
Notes	If the `<partition>` specified does not exist or is not a removable media device the error -252, ”Missing Media” is generated Setting the removable media label requires Administrative privileges. If the currently logged-in user does not have appropriate privileges, the error “-221, Settings conflict; Administrator privileges required” is generated

7.1.13.12 Mass Storage Determine Removable Media Write-protect status (Remote Command Only)

Used to query a removable media device’s write-protect status.

Remote Command	`:MMEMory:RMEDia:WPRotect? <partition>`

Example	:MMEM:RMED:WPR? “F:”
Notes	The return value is 1 if the device is write-protected, and 0 if the device is write-enabled If the <partition> specified does not exist or is not a removable media device the error -252, ”Missing Media” is generated
Preset	The return value will be depending on SD card installed

7.1.13.13 Mass Storage Determine Removable Media size (Remote Command Only)

Used to query a removable media device’s total memory size (not available memory size).

Remote Command	:MMEMory:RMEDia:SIZE? <partition>
Example	:MMEM:RMED:SIZE? “F:”
Notes	The return value is integer value in GBytes. Any device that is less than 1 GB will return 0 GB If the <partition> specified does not exist or is not a removable media device the error -252,”Missing Media” is generated

7.1.13.14 :SYSTem:SET (Remote Command Only)

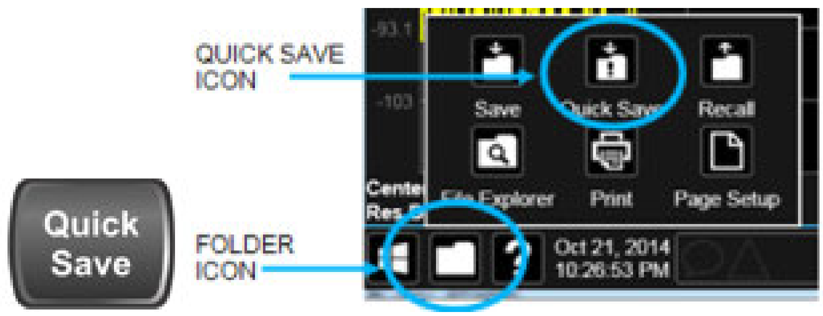
Obtains the state of the currently active mode in a form that can then be loaded back into the instrument quickly.

Remote Command	:SYSTem:SET <instrument state in IEEE Block> :SYSTem:SET?
Notes	The query returns current instrument state of the active mode in IEEE Block data format. The state is in a machine readable format only. Sending the query returns the following format: <syst set preamble><state block data> Where: <syst set preamble> is the format: #NMMM – N = number of digits that comprise MMM – MMM = length in bytes of following data <state block data> is machine readable state data Example response: #42016<state data> The state is recalled by sending the :SYST:SET? response data to the instrument. From example above::SYST:SET #42016<state data>

7.2 Quick Save

Quick Save repeats the previous Save at the touch of a single button. Whatever you saved before gets saved again to the same directory, and with a filename derived from the previous filename.

You access Quick Save by pressing the **Quick Save** hardkey, or by pressing the folder icon at the bottom of the display and then pressing the **Quick Save** icon. In addition, if you have a PC keyboard plugged in, the sequence `CTL-Q` will perform a Quick Save.



The **Quick Save** front-panel key repeats the most recent save that was performed from the **Save** menu, with the following exceptions:

- Register saves are not remembered as Saves for the purpose of the Quick Save function
- If the current measurement does not support the last non-register save that was performed, an informational message is generated, “File type not supported for this measurement”

Quick Save repeats the last type of qualified save (that is, a save qualified by the above criteria) in the last save directory by creating a unique filename using the Auto File Naming algorithm described below.

If the previous save was a Screen Image save, Quick Save saves a Screen Image when the Quick Save button is pressed. This image is *exactly* what is on the screen when the **Quick Save** button is pressed. Quick Save does *not* force a dialog exit or navigate in any way, it simply snaps the image on the screen and saves it. This lets you save images of dialogs and setup screens that would be impossible to save using the **Save** dialog.

NOTE

When **Quick Save** is pressed the display theme changes to the theme specified by the **Screen Image Theme** control in order to take the screen shot, and then changes back to the Display Theme, but no navigation is performed and no dialogs are exited.

If **Quick Save** is pressed after startup and before any qualified Save has been performed, the Quick Save function performs a Screen Image save using the current settings for Screen Image saves (current theme, current directory), which then becomes the "last save" for the purpose of subsequent Quick Saves.

The Auto File Naming feature automatically generates a file name for use when saving a file. The filename consists of a prefix and suffix separated by a dot, as is standard for the Windows file system. A default prefix exists for each of the available file types:

Type	Default Prefix	Menu
State	`State_`	(Save/Recall)
Trace + State	`State_`	(Save/Recall)
Screen	`Screen_`	(Save/Recall)
Amplitude Corrections	`Ampcor_`	(Import/Export)
Traces	`Trace_`	(Import/Export)
Limit Lines	`Limit_`	(Import/Export)
Measurement Result	`MeasR_`	(Import/Export)
Capture Buffer	`CapBuf_`	(Import/Export)

A four digit number is appended to the prefix to create a unique file name. The numbering sequence starts at 0000 within each Mode for each file type and updates incrementally to 9999, then wraps to 0000 again. It remembers where it was through a Mode Preset and when leaving and returning to the Mode. It is reset by Restore Misc Defaults and Restore System Defaults and subsequent running of the instrument application. So, for example, the first auto file name generated for State files is `State_0000.state`. The next is `State_0001`, and so forth.

One of the key features of Auto File Name is that we guarantee that the Auto File Name will never conflict with an existing file.The algorithm looks for the next available number. If it gets to 9999, then it looks for holes. If it find no holes, that is no more numbers are available, it gives an error.

For example, if when we get to State_0010.state there is already a State_0010.state file in the current directory, it advances the counter to State_0011.state to ensure that no conflict will exist (and then it verifies that State_0011.state also does not exist in the current directory and advances again if it does, and so forth).

If you enter a file name for a given file type, then the prefix becomes the filename you entered instead of the default prefix, followed by an underscore. The last four letters (the suffix) are the 4-digit number.

For example, if you save a measurement results file as "`fred.csv`", then the next auto file name chosen for a measurement results save will be `fred_0000.csv`.

NOTE **Although 0000 is used in the example above, the number that is used is actually the current number in the Meas Results sequence, that is, the number that would have been used if you had not entered your own file name.**

NOTE If the filename you entered ends with _dddd, where d=any digit, making it look just like an auto file name, then the next auto file name picks up where you left off with the suffix being dddd + 1.

Quick Save Mode

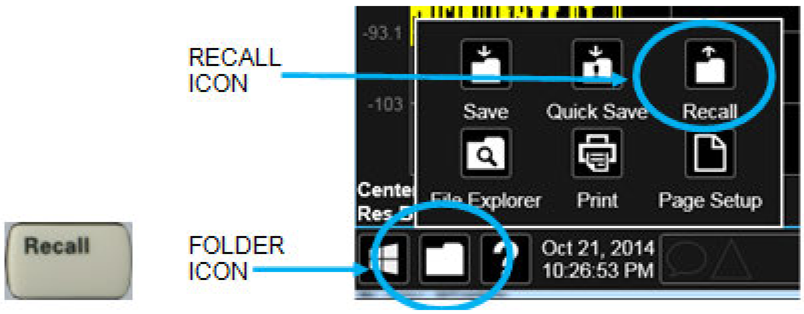
Quick Save can be operated in the Normal mode and in a special “Prompt” mode. There is a switch on the User Interface page of the System menus that lets you control this.

When Quick Save Mode is in Normal (the default setting), the instrument does an immediate save of a new file of the same type and to the same directory as the previous Save action. When Quick Save Mode is in the Prompt state, instead of immediately performing a Save, the Alpha Keyboard pops up with the proposed auto-filename in the entry area. The user can then press Enter to accept the auto filename, or edit the name and press Enter. This allows you to easily save a file with a custom file name.

Notes	No remote command for this key specifically

7.3 Recall

The **Recall** dialog lets you recall previously saved states, traces and other items to the instrument from files on the instrument's internal storage, from removable devices, and from directories on the network. You access the Recall dialog by pressing the **Recall** hardkey, or by pressing the folder icon at the bottom of the display and then pressing the **Recall** icon.



The dialog has section tabs running down the left side, which you use to specify what you want to recall, similar to the **Save** dialog. You choose the recall item and then complete the recall by choosing a register or file location from which to recall the item.

Notes	No remote command for this key specifically, but `:MMEM:LOAD` is available for specific file types. For example: `:MMEM:LOAD:STATe <filename>` If you try to recall a State file for a mode that is not licensed or not available in the instrument, an error message will occur and the state will not change
Backwards Compatibility Notes	In legacy analyzers, it was possible to load a state without affecting the trace data, limit lines or correction data. Similarly (since User Preset is actually loading a state), it was possible to do a User Preset without affecting the trace data, limit lines or correction data In the X-Series, "state" always includes all of this data; so whenever state is loaded, all of the traces, limit lines and corrections are affected. Although this differs from previous behavior, it is desirable behavior, and should not cause adverse issues for users Recall for the X-Series supports backward compatibility in the sense that you can recall a state file from any X-Series model number and any version of X-Series software. This is only possible if part of the recalling process goes through a limiting step after recalling the mode settings, at least for settings that may vary with version number, model number, option and license differences. If you try to recall a state file onto an instrument with less capability than what was available on the instrument during the save, the recall will ignore the state it doesn't support and it will limit the recalled setting to what it allows Example: if the saved state includes preamp ON, but the recalling instrument does not have a preamp; the preamp is limited to OFF. Conversely, if you save a state without a preamp, the preamp is OFF in the state file. When this saved file is recalled on an instrument with a licensed preamp, the preamp is changed to OFF. Another example is if the saved state has center frequency set to 20 GHz, but the instrument recalling the saved state is a different model and only supports 13.5 GHz. In this case, the center frequency is limited along with any other frequency based settings. Since the center frequency can't be preserved in this case, the recall limiting tries to at least preserve span to keep the measurement setup as intact as possible

Note that there is no state file compatibility outside of the X-Series. For example, you cannot recall a state file from ESA or PSA

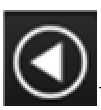
7.3.1 Recall From File / Open

For every Recall type, a button appears called **Recall From File** or **Open**. "Recall From File" appears for recall types that also include registers (like State and Trace+State), and "Open" appears for all other recall types.

When you push the "Recall From File" or "Open" button, a dialog slides in from the right which allows you to see what files are saved in the current directory. See the "Save to File/Save As" section (3.1) for a depiction of this screen for the Save menu, which is similar to Recall.

The default directory is the internal directory for the current Mode and save type, on the D: drive. You may also change to another Mode's state directory by pressing the dropdown in the upper right corner labeled "Mode". Once you have chosen a directory, the files in that directory whose extension matches the current data type (e.g., .state or .trace) are displayed in the right hand window of the dialog. You can sort this list by name, date, file size or extension by tapping the Name, Date, Size, or Content header at the top of each column. A second tap toggles the sort order between Ascending and Descending.

Also displayed is a path depiction showing the path to the current directory. In the example shown, the path is D:\Users\Instrument\Documents\SA\screen. Tapping any element of this path lets you select an alternate route. Tapping the "Computer" arrow lets you select a different drive.

Tapping the "back" arrow navigates to the previously selected directory.

If you plug in a removable drive (e.g., a thumb drive), the browser immediately navigates to the root of that drive. Furthermore, if you had a thumb drive in and you were in a directory on the thumb, and then you exit the browser, when you come back in you are still in the same directory on that removable drive. If you remove the thumb drive, you return to the directory you had been in before the thumb drive was plugged in.

Note that for each data type there is a "current" directory and it is the last directory used by either Save or Recall for that Mode. For example if in SA Mode you save a Corrections file to a particular directory, then when you go to recall a Correction in SA Mode, you should be pointing at that directory. Or if in EMC Mode you recall a Limit from a particular directory then when in EMC Mode you go to save a Limit, it should be pointing at that same directory. There is one "current" directory for each data type for each Mode (not one for Save and one for Recall).

The Filename field, just below the Path field, shows the filename that will be used. The **File Name** field is loaded with the name of the selected file. You may edit the filename by tapping it, which brings up the onscreen alpha keyboard. Press the "Done" button on this keyboard when you are done editing.

Select a file to load and press Recall. After a successful recall, a message "File <filename> recalled" or "State Register <register number> recalled" is displayed in an info box for a few seconds.

The **Files of Type** field shows the file suffix for the type of file you have selected to recall. This field only appears for files which have multiple file types that can be recalled. These file types are:

Amplitude Corrections:

- Amplitude Corrections (`*.csv`)
- Legacy Cable Corrections (`*.cbl`)
- Legacy User Corrections (`*.amp`)
- Legacy Other Corrections (`*.oth`)
- Legacy Antenna Corrections (`*.ant`)

Limits:

- Limit Data (`*.csv`)
- Legacy Limit Data (`*.lim`)

7.3.2 State

Lets you choose a register or file from which to recall the state.

See the Save State description for information on state files and their contents and the default paths. State files have the extension ".state".

For rapid recall, the State menu lists 16 registers from which you can recall states. Pressing a Register button initiates the recall. You can also select a file from which to recall by pressing "Recall From File".

Since each state file is only for one Mode, the settings for other Modes are unaffected when it is loaded. Recall State will cause a mode switch if the state being recalled is not from the current active mode.

NOTE: **In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so make sure you know from what instance a file or register was saved before recalling it.**

Remote Command	`:MMEMory:LOAD:STATe <filename>`
Example	`:MMEM:LOAD:STAT "MyStateFile.state"`

	This loads the state file data (on the default file directory path) into the instrument state
Notes	When you pick a file to recall, the instrument first verifies that the file is recallable in the current instrument by checking the software version and model number of the instrument. If there is a mismatch between the file and the instrument, the recall functiontries to recall as much as possible. It may limit settings that differ based on model number, licensing or version number. In general, variables in the instrument which are not contained in the state file will be unaffected, and variables in the state file which are not contained in the instrument will be ignored The recall proceeds by aborting the currently running measurement, clearing any pending operations, and then loading the State from the saved state file. You can open state files from any Mode, so recalling a State file switches to the Mode that was active when the save occurred. After switching to the Mode of the saved state file, Mode settings and data (if any for the Mode) become those from the saved file. The active measurement becomes the measurement which was running when the state file was saved and the data relevant to the measurement (if there is any) is recalled After recalling the state, the Recall State function does the following: – Clears the input and output buffers – Status Byte is set to 0 – Executes a `*CLS` If the file specified is empty an error is generated. If the specified file does not exist, another error is generated. If there is a mismatch between the file and the proper file type, an error is generated. If there is a mismatch between file version or model number or instrument version or model number, a warning is displayed. Then it returns to the State menu and File Open dialog goes away After the Recall, the instrument exits the Recall menu and returns to the previous menu
Backwards Compatibility SCPI	`:MMEMory:LOAD:STATe 1,<filename>` For backwards compatibility, the above syntax is supported. The "1" is simply ignored

7.3.2.1 Recall Type

If you have a built-in Source in your instrument, you may wish, when recalling State, to recall only the part of the State file that applies to the instrument, and leave the Source unaffected. Or you may wish to recall only the part of the State file that applies to the Source, and leave the instrument unaffected.

Lets you choose whether you wish to recall the entire Analyzer + Source state (`ALL`), just the Analyzer State `ANALyzer`), or just the Source State (`SOURce`).

Remote Command	`:MMEMory:LOAD:RTYPe ALL | ANALyzer | SOURce`
Example	`:MMEM:LOAD:RTYP ALL`
Dependencies	This control is only available in models with a built-in source, such as VXT models
Preset	`ALL`
Range	`ALL|ANALyzer|SOURce`

7.3.2.2 Register 1 thru Register 16

Selecting any one of these register buttons causes the State to be recalled from the specified Register. The registers are provided for rapid saving and recalling, since you do not need to specify a filename or navigate to a file. Each of the register menu keys annotates whether it is empty or at what date and time it was last modified. In addition, you can edit any of the register names to enter custom names for any register.

Although these 16 registers are the only registers available from the front panel, there are 128 state registers available in the instrument. Registers 17–128 are only available from the SCPI interface, using the `*RCL` command.

There is one set of 128 state registers in the instrument, not one set for each Mode. When a state is saved, the Mode it was saved from is saved with it; then when it is recalled, the instrument switches to that Mode.

NOTE	In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so make sure you know from what instance a file or register was saved before recalling it.

The date displayed follows the format specified in the **Date Format** setting in the Control Panel. The time shows hours and minutes.

After the recall completes, the message "Register <register number> recalled" is displayed.

If you are in the Spectrum Analyzer Mode, and you are recalling a register that was saved in the Spectrum Analyzer Mode, then after the recall, you will still be in the Recall Register menu. If the Recall causes you to switch modes, then after the Recall, you will be in the Frequency menu.

If a requested register is empty an error is generated.

Example	`*RCL 1`
Range	1–16 from front panel, 1–128 from SCPI

7.3.2.3 Edit Register Names

You may enter a custom name on any of the Register keys, to help you remember what you are using that state to recall. To do this, press the **Name** field for the register you want to rename, which brings up the onscreen alpha keyboard. Press the “Done” button on this keyboard when you are done editing.

The maximum number of characters for a register name is 30. If you delete all the characters in the custom name, it restores the default (time and date).

For more information and the SCPI command, see Edit Register Names under the **Save, State** function.

7.3.3 Trace+State

Lets you choose a register or file for recalling the state.

See the Save State description for information on state files and their contents and the default paths. State files have the extension "`.state`".

For rapid recall, the Trace+State menu lists 16 registers from which you can recall trace+state files. Pressing a Register button initiates the recall. You can also select a file from which to recall by pressing "Recall From File".

Since each trace+state file is only for one Mode, the settings for other Modes are unaffected when it is loaded. **Recall Trace+State** will cause a mode switch if the trace+state being recalled is not from the current active mode.

NOTE	**In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so make sure you know from what instance a file or register was saved before recalling it.**

Trace+State files have the extension `.trace`.

The Trace+State selection only appears for measurements that support trace saves. It is blanked for modes that do not support trace saves. Saving **Trace** is identical to saving State except a .trace extension is used on the file instead of .state, and internal flags are set in the file indicating which trace was saved.

Remote Command	`:MMEMory:LOAD:TRACe TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6,<filename>`
	
	`:MMEMory:LOAD:TRACe:REGister TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6,<integer>`

Example	`:MMEM:LOAD:TRAC TRACE2,"MyTraceFile.trace"`
	
	This loads the trace file data (on the default file directory path) into the specified trace; if it is a "single trace" save file, that trace is loaded to trace 2, andis set to be not updating.
	
	`:MMEM:LOAD:TRAC:REG TRACE1,2`
	
	restores the trace data in register 2 to Trace 1

Notes	When you perform the recall, the recalling Trace function must first verify the file is recallable in this instrument by checking instrument software version and model number, since it includes State. If everything matches, a full recall proceeds by aborting the currently running measurement, and loading the state from the saved state file to as close as possible to the context in which the save occurred. You can open .trace files from any mode that supports them, so recalling a Trace file switches to the mode that was active when the save occurred. After switching to the mode of the saved state file, mode settings and data (if any for the mode) are loaded with values from the saved file and the saved measurement of the mode becomes the newly active measurement, and the data relevant to the measurement (if there is any) is recalled Once the state is loaded, the trace data must be loaded. The internal flags are consulted to see which

trace to load and the "To Trace" setting to see where to load it. Trace data is always loaded with the specified trace set to View, so that the data is visible and not updating(so as not to erase the recalled data). If the file is an "all trace" file, all traces are loaded with the saved data(to the original trace the data was saved from) and set to View. Traces whose data is not loaded are restored to the update state that existed when they were saved

After the Recall the instrument exits the Recall menu and returns to the previous menu

Some modes and measurements do not have available all 6 traces. Phase Noise mode command, for example, is: `:MMEMory:LOAD:TRACe TRACE1|TRACE2|TRACE3,<filename>`

Some modes and measurements have more than 6 traces available. The Realtime SA mode command, for example, is: `:MMEMory:STORe:TRACe TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6 | TRACE7 | TRACE8 | TRACE9 | TRACE10 | TRACE11 | TRACE12 | ALL,<filename>`

7.3.3.1 Recall To Trace

Lets you select which Trace to recall to. Not all Modes have the same number of traces available. The default is the currently selected trace, selected in this or any other menu with Trace selection. If you have selected `ALL`, then that remains selected until you specifically change it to a single trace, regardless of the trace selected in the Trace menu.

If the `.trace` file is an "all trace" type, "To Trace" is ignored, and the traces each go back to the trace from which they were saved.

7.3.3.2 Register 1 thru Register 16

Selecting any one of these register buttons causes the specified trace(s) and the state of the currently active mode to be recalled from the specified Register. The registers are provided for rapid saving and recalling, since you do not need to specify a filename or navigate to a file. Each of the register menu keys annotates whether it is empty or at what date and time it was last modified. In addition, you can edit any of the register names to enter custom names for any register.

There is one set of 16 trace+state registers in the instrument, not one set for each Mode. When trace+state is saved, the Mode it was saved from is saved with it; then when it is recalled, the instrument switches to that Mode.

NOTE **In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so make sure you know from what instance a file or register was saved before recalling it.**

The date displayed follows the format specified in the Date Format setting under the Control Panel. The time shows hours and minutes.

After the recall completes, the message "Register <register number> recalled" is displayed. If a requested register is empty an error is generated.

Recalling state from a Register is the same as recalling state from a Trace+State File.

Example	`*RCL 1`
Range	1-16

7.3.3.3 Edit Register Names

You may enter a custom name on any of the Register keys, to help you remember what you are using that state to recall. To do this, press the **Name** field for the register you want to rename, which brings up the onscreen alpha keyboard. Press the “Done” button on this keyboard when you are done editing

The maximum number of characters for a register name is 30. If you delete all the characters in the custom name, it restores the default (time and date).

For more information and the SCPI command, see Edit Register Names under the **Save, State** function.

7.3.4 Screen Config + State

Lets you load the complete configuration of all your screens from a file which you specify.

Note that recalling a screen config file will wipe out your current screen configuration; you don’t get a warning before it loads but there is a note on the Recall page letting you know what is going to happen.

The filenames are of the form:

`State_0001.screen`

Remote Command	`:MMEMory:LOAD:SCONfig <filename>`
Example	`:MMEM:LOAD:SCON "myScreenConfig.screen"` This loads the screen configuration from the file `MyScreenConfig.screen` in the default directory

7.3.5 Measurement Data

Lets you specify a data type (for example, trace data) and choose a file from which to import the data.

Measurement Data files are Comma-Separated Value (CSV) files, and contain the requested data in a form that can be imported into Excel or other spreadsheets, as well as header data that gives information on relevant instrument settings at the time the save occurred.

For more on Measurement Data files, see "Measurement Data" on page 2392 under **Save**.

Since the commonly exported data files are in `.csv` format, you can edit the data prior to importing it. This allows youto export a data file, manipulate the data in Excel (for example) and then import it.

7.3.5.1 Data Type

Lets you select the data type to recall.

Notes	There is no SCPI command for Data Type, as the type is implied in the SCPI command for each item
Dependencies	The Data Type menu for any given measurement only contains data types that are supported by that measurement. Data Types which are not importable will not appear, even if they do appear in the corresponding **Save** menu

Trace

Allows you to import Trace files in the PC-readable .csv format.

Trace data files have the extension `.csv`. The trace file contains a “metadata” header which describes the state of the instrument when the file was saved. This metadata is compared to the current state of the instrument when the file is recalled; if it doesn’t match the current state, the “invalid data indicator” (*) is displayed.

The metadata is detailed in Trace File Contents in the **Save** section.

Remote Command	`:MMEMory:LOAD:TRACe:DATA TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6,<filename>`
Example	`:MMEM:LOAD:TRAC DATA TRACE2,"myTrace2.csv"` Imports the 2nd trace from the file myTrace2.csv in the current path. For SA mode, the default path is My Documents\SA\data\traces
Dependencies	For SA measurements, a trace cannot be recalled from a trace file that was exported with `ALL` traces selected A trace cannot be imported if the number of trace points in the file do not match the number of sweep points currently set for the measurement. If this happens, an error message is generated Errors are reported if the file is empty or missing, or if the file type does not match, or if there is a mismatch between the file type and the destination data type
Couplings	When a trace is imported, **Trace Update** is always turned `OFF` for that trace and **Trace Display** is always turned `ON`
Annotation	After recall is complete, an advisory is displayed in the message bar confirming which trace file was loaded
Status Bits/OPC dependencies	Sequential - aborts the current measurement

Capture Buffer

This functionality is available only in the WCDMA Code Domain and Modulation Accuracy measurements. The captured data is raw (unprocessed).

Example	`:MMEM:LOAD:CAPT "MyCaptureData.bin"` Loads the specified capture data file (in the default file directory path) into the instrument
Dependencies	Only available for Code Domain and Modulation Accuracy measurements

7.3.6 Limit

Lets you choose a file from which to import the Limit data.

Limit files are `.csv` files, and contain the limit data in a form that can be imported into Excel or other spreadsheets, as well as header data that gives information on the limit.

See the **Save Limit** description ("Limit" on page 2417) for information on Limit files and their contents and the default paths. **Limit** files have the extension `.csv`.

For backwards compatibility, older limit files with the extension `.lim` can be read into the instrument, but you can only save limits as `.csv` files.

A set of preloaded Limits files can be found in the directory:

`My Documents/EMC Limits and Ampcor/Limits`

Remote Command	`:MMEMory:LOAD:LIMit LLINE1 | LLINE2 | LLINE3 | LLINE4 | LLINE5 | LLINE6,<filename>`
Example	`:MMEM:LOAD:LIM LLINE2,"myLimitLine2.csv"` Imports the 2nd Limit Line from the file myLimitLine2.csv in the current path
Dependencies	Errors are reported if the file is empty or missing, or if the file type does not match, or if there is a mismatch between the file type and the destination data type In the Log Plot measurement in Phase Noise Mode, there are only three Limit Lines, so the valid parameters are `LLINE1|LLINE2| LLINE3` This key only appears if you have the proper option installed in your instrument
Couplings	When a limit line is loaded from mass storage, it is automatically turned on. This allows the user to see it, thus confirming the load. The Margin settings will match those when the limit was saved The instrument cannot mix Limits domains (X Axis Unit must be Frequency or Time for both Limits). So when a Limits file is loaded, the instrument will set the Limits domain (X Axis Unit) to match that of the file. If this changes the Limits domain from what it was before the file was loaded, all Limits data in all Limits sets will be erased before the data loads. If this operation is over the remote interface there will be no warning if this occurs, so care should be taken to know the domain of the file you are loading
Annotation	After recall is complete, an advisory is displayed in the message bar confirming which limit file was loaded
Status Bits/OPC dependencies	Sequential - aborts the current measurement

7.3.6.1 Select Limit

Selects the Limit register into which the recalled Limit will be placed, for example, Limit 1.

Preset	Not part of **Preset**, but is reset to LLINE1 by **Restore Mode Defaults** Survives shutdown

7.3.7 Correction

Allows you to import Amplitude Corrections files in the PC-readable `.csv` format.

Amplitude Correction files are CSV files, and contain the correction data in a form that can be imported into Excel or other spreadsheets, as well as header data that gives information on the correction.

For backwards compatibility, older limit files with the extension .amp, .cbl, .ant and .oth can be read into the instrument.

A set of preloaded Corrections files can be found in the directory:

`My Documents\EMC Limits and Ampcor\Ampcor`

The default path for CSV files is:

`My Documents\amplitudeCorrections\`

Antenna corrections are a particular kind of Amplitude Corrections – they are distinguished in the corrections file by having the Antenna Unit set to a value other than None. When the Amplitude Correction is an Antenna correction and the Antenna Unit in the file is not **None**, the Y-Axis Unit setting changes to match the Antenna (Transducer) Unit in the file.

Remote Command	`:MMEMory:LOAD:CORRection 1 | ... | 8, <filename>`
Example	`:MMEM:LOAD:CORR 2, "myAmpcor.csv"` recalls the Amplitude Correction data from the file myAmpcor.csv in the current directory to the 2nd Amplitude Correction table, and turns on Correction 2
Dependencies	Only one Transducer units can be on at any given time. Note that this means that if a correction file with a Transducer Unit is loaded into a particular Correction, all other Corrections are set to that same Transducer unit Corrections are not supported by all Measurements. If in a Mode in which some Measurements support it, this key is grayed-out in measurements that do not. The key does not show at all if no measurements in the Mode support it Errors are reported if the file is empty or missing, or if the file type does not match, or if there is a mismatch between the file type and the destination data type This key does not appear unless you have the proper option installed in your instrument This command will generate an “Option not available” error unless you have the proper option installed in your instrument

Couplings	When a correction file is loaded from mass storage, it is automatically turned on (**Correction**ON) and **Apply Corrections** is set ON. This allows you to see its effect, thus confirming the load
Annotation	After recall is complete, an advisory is displayed in the message bar confirming which file was recalled
Backwards Compatibility SCPI	`:MMEMory:LOAD:CORRection ANTenna | CABLe | OTHer | USER, <filename>` For backwards compatibility, `ANTenna` maps to 1, `CABle` maps to 2, `OTHer` maps to 3 and `USER` maps to 4

7.3.7.1 Select Correction

Selects the register into which the recalled Correction will be placed, for example, Correction 1.

Preset	Not part of a **Preset**, but is reset to Correction 1 by **Restore Input/Output Defaults** Survives a shutdown

7.3.8 Complex Correction

Imports Complex Corrections files in the PC-readable `.s2p` format.

Complex Correction files contain amplitude and phase correction data in a form that can be imported into Excel or other spreadsheets, as well as header data that gives information on the correction.

The default path for Complex Corrections files is:

`My Documents\complexCorrections\`

Remote Command	`:MMEMory:LOAD:CCORrection <integer>, <filename>`
Example	`:MMEM:LOAD:CCOR 2, "mycor.s2p"` recalls the Complex Correction data from the file `mycor.s2p` in the current directory to the 2nd Complex Correction table, and turns on Complex Correction 2
Dependencies	Complex Corrections are not supported by all Measurements. The tab does not show at all if no measurements in the Mode support it Errors are reported if the file is empty or missing, or if the file type does not match, or if there is a mismatch between the file type and the destination data type
Couplings	When a complex correction file is loaded from mass storage, it is automatically turned ON and **Apply Corrections** is set ON. This allows you to see its effect, thus confirming the load
Annotation	After recall is complete, an advisory is displayed in the message bar confirming which file was recalled

7.3.8.1 Select Complex Correction

Selects the register into which the recalled Complex Correction will be placed, for example, Complex Correction 1.

Preset	Not part of a **Preset**, but is reset to Correction 1 by **Restore Input/Output Defaults**

	Survives a shutdown

7.3.9 Correction Group

Selects the Correction Group as the data type to be imported. The next step is to press **Recall From** to open the file dialog. When recalling a correction group, the correction group settings, range table and correction files data will be loaded.

If there are values defined in the correction group range, and you accessed this function from the front panel, there will be a message prompt that asks for your confirmation, because the values will be overwritten during the recall.

Remote Command	`:MMEMory:LOAD:CORRection:GROup <filename>`
Example	`:MMEM:LOAD:CORR:GRO "D:\myCorrGroup.csv"` Imports the Correction Group and the corresponding correction tables from the file `myCorrGroup.csv`
Notes	Errors are reported if the file is empty or missing, or if the file type does not match, or if there is a mismatch between the file type and the destination data type When recall is completed, the correction group will be turned ON. If any of the correction data loaded is found out of the frequency range, Execution error is generated. Error icon appears on the status column correction group table
Dependencies	This file type is supported in EMI Receiver Mode, and in Spectrum Analyzer Mode if option EMC or EMI Receiver mode is present
Annotation	After recall is complete, display an advisory in the message bar
Status Bits/OPC dependencies	Sequential - aborts the current measurement

7.3.10 Mask

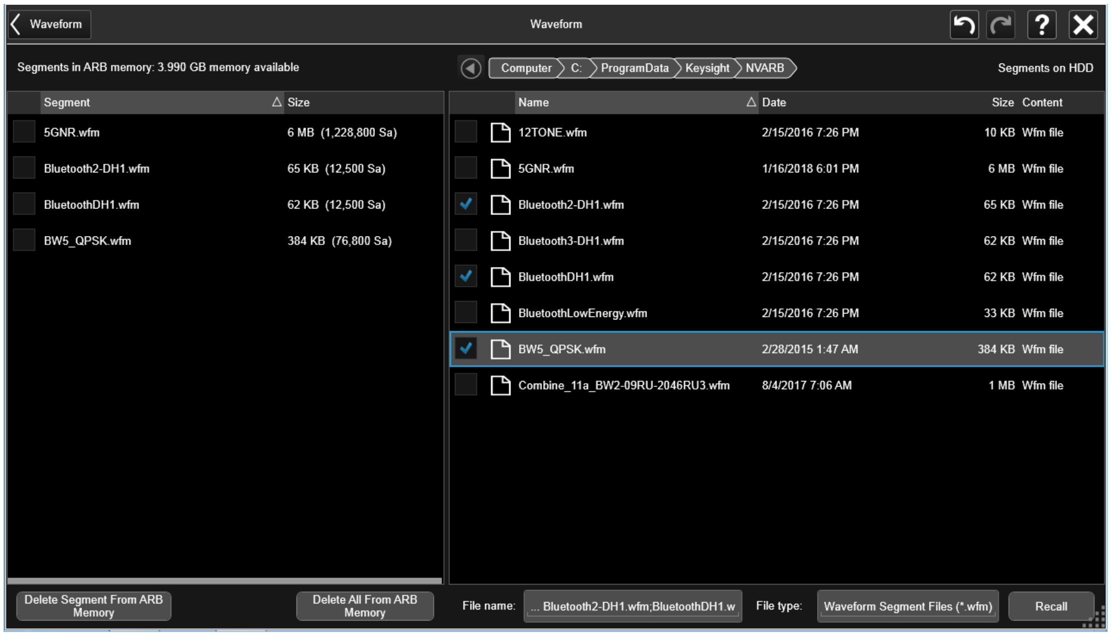
The **Mask** data type is used to import and export Mask files for measurements that use masks, such as cellular comms and real-time measurements.

7.3.11 Waveform

Recalls waveforms into the ARB memory of an Internal Source.

When you select the **Waveform** tab in the **Save** dialog,, a hint appears saying "Recalls files from Mass Storage to the ARB and lets you manage the ARB memory at the same time."

You then tap **Recall From File** to display the **Recall Waveform** dialog.



The left hand window shows the files in ARB memory. The right hand window shows the files on the hard drive.

You can select one or more waveform files in the right hand window. Each file selected has a blue check box in it. To select a single file, tap that file’s row. To select additional files, tap the check box in the row of the desired additional files.

When you have selected the file or files that you wish to recall, tap Recall. The file(s) are recalled into the ARB memory, and appear in the left hand window.

If a file of the same name already exists within ARB memory, it is overwritten. If you wish to load two segments of the same name, you must rename one of the segments before loading it into ARB memory. To rename a segment, you can either use Windows File Explorer, or `:MMEMory:COPY`.

You can select one or more segments in the left hand window and tap “Delete Segments from ARB memory” to delete the selected files. You can also delete all files in ARB memory by tapping “Delete All from ARB memory.

You can change the current directory by tapping on an element of the file path at the top of the screen and selecting the desired subdirectory in the list that appears, and repeating until you have the path you want. The current directory is used for manually loading waveform segments into ARB memory for playback, and as a search location for waveform segments that are required to be loaded into ARB memory for playback of a waveform sequence or a list sequence.

File Type allows you to specify a waveform format. The available file types are listed below:

– Waveform Files - *.wfm. These are Keysight Signal Studio files

– Binary Files - *.bin. These are interleaved IQ data files. They could be single precision or double precision customer created files. One-byte marker may be added

- CSV Files - *csv. This comma separated value file could be generated by Microsoft Excel
- Text Files - *txt
- Matlab Files - *.mat. A *.mat waveform should be Level 4, Level 5 or HDF5 MAT-files (only Level 5 Matlab file is supported in X24)

Waveforms formatted in *.csv, *.txt and *.mat are supported by models with a built-in source, such as VXT and EXM.

*.txt files are formatted according to the following rules:

1. Text files only contain the IQ information. Data on the right column represents the amplitude of real(I) points, Data on the left column represents the amplitude of imaginary(Q) points
2. The amount of data should be multiple of two (IQ pairs)
3. The data range is from -1e10 to1e10, the data type should be int, float or double. 16 digits or fewer for every data is acceptable
4. The values are separated by comma or tab. Extra comma or tabs will be ignored
5. Use Enter to separate IQ pairs

Example for text file data:

```
0.46425922,-0.57411048
0.47184454,-0.58435995
0.48107329,-0.59014958
0.49223323,-0.58998679
0.50419607,-0.58558843
0.51679158,-0.57721768
0.53005322,-0.56481976
0.54373011,-0.54879346
0.55759183,-0.52950807
0.57141409,-0.50732489
```

Rules 1-3 above also apply to `.csv` data.

Dependencies	Only appears if your hardware includes an Internal Source, such as in VXT.

7.3.11.1 Load Segment to ARB Memory

Loads a single segment to ARB memory. Same as pressing the **Recall** button with a single waveform selected.

Remote Command	`:SOURce:RADio:ARB:LOAD <string>`

Example	`:SOUR:RAD:ARB:LOAD “D:\NVARB\testwaveform.bin”`
	or
	`:SOUR:RAD:ARB:LOAD “NVWFM:testwaveform.bin”`

Notes	Because loading the file involves a delay of unpredictable length, this command should be followed by `*OPC?`, which holds off subsequent commands until the loading operating is complete `<string>` - specifies the path name of the file to load from the HDD into ARB memory. It could be a <full path + filename>, or <“NVWFM” MSUS + colon + filename> If you specify a file over SCPI, but the file is not at the specified location, an error is generated If you try to load a waveform file but the file contains less than 500 IQ samples, an error is generated VXT models M9410A/11A/15A: If you try to load a waveform file but the file contains less than 1024 IQ samples, an error is generated If you try to load a Signal Studio waveform “*.wfm” which contains invalid waveform header, an error is generated If the ARB is ON when you load a file to ARB memory or delete a file from ARB memory, the playing waveform segment may not keep phase continuity during the ARB memory operation. The waveform will be replayed after the ARB operation is finished ARB can be loaded into ARB memory even if required licenses are not present on the instrument. In this case, a GUI only warning message -800, “Operation complete; Loaded <filename> successfully, but no license <required licenses> installed”. User can install required licenses according to <required licenses> string to license it, or multi-pack license it Sequence Analyzer Mode: When in Sequence Analyzer mode, and Include Source is Yes, an attempt to load a file to ARB memory will be rejected with an error. When Include Source is No and if there is insufficient free ARB memory to load the selected waveform, an error is generated

Remote Command	`:SOURce:RADio:ARB:LOAD:ALL <string>`
Example	`:SOUR:RAD:ARB:LOAD:ALL “D:\nvarb”`
Notes	Loads all the segment files within the currently selected directory into ARB memory. If a file of the same name already exists within ARB memory, it is overwritten. If you wish to load two segments of the same name, you must rename one of the segments before loading it into ARB memory. To rename a segment, you can either use Windows File Explorer, or `:MEMory:COPY` `<string>` specifies the directory on the HDD to load the files into ARB memory from If you specify a directory over SCPI, but the directory does not exist, an error is generated If the ARB is ON, and you then load or delete a file to ARB memory, the playing waveform segment may not keep phase continuity during the ARB memory operation. The waveform will be replayed after the ARB operation is finished Sequence Analyzer Mode: When in Sequence Analyzer mode, and Include Source is Yes, an attempt to load all files from a directory to ARB memory is rejected with an error. When Include Source is No and there is insufficient free ARB memory to load all the waveforms, when the ARB memory is full, the copy ceases, and an error is generated

7.3.11.2 Delete Segment From ARB Mem

Deletes a segment from ARB memory.

Remote Command	`:SOURce:RADio:ARB:DELete <string>`
Example	`:SOUR:RAD:ARB:DEL "testwaveform.bin"`
Notes	`<string>` specifies the waveform to be deleted from the ARB playback memory It is possible to delete files from within the ARB memory when the ARB is ON. However, if you attempt to delete the file that is currently playing an error is generated It is possible to delete a file from within the ARB memory when the sequencer state is ON and the file is not being used by the List Sequencer. If you attempt to delete a file which is being used by the list sequencer, an error is generated When the Sequencer state of the List Sequencer is On, even if ARB state is On, the selected waveform will not be played. In this case, if the selected waveform is not used in List Sequence, it can be deleted and the ARB state is turned Off If the ARB is ON and you load a file to ARB memory or delete a file from ARB memory, the playing waveform segment may not keep phase continuity during the ARB memory operation. The waveform will be replayed after the ARB operation is finished Sequence Analyzer Mode: When in Sequence Analyzer mode and Include Source is Yes, an attempt to delete a file from ARB memory is rejected with an error . When Include Source is No and you specify a file that does not exist within ARB memory, an error is generated

7.3.11.3 Delete All From ARB Memory

Removes all segments from ARB memory.

Remote Command	`:SOURce:RADio:ARB:DELete:ALL`
Example	`:SOUR:RAD:ARB:DELete:ALL`
Notes	If you attempt to delete all files from ARB memory when there are waveform files used in the Sequencer function of the List Sequencer and the Sequencer state is ON, all files except the files currently being used in list sequencer are deleted, and an error is generated If the ARB is ON and you load a file to ARB memory or delete a file from ARB memory, the playing waveform segment may not keep phase continuity during the ARB memory operation. The waveform will be replayed after the ARB operation is finished Sequence Analyzer mode: When in Sequence Analyzer mode and Include Source is Yes, an attempt to delete all files from ARB memory is rejected with an error. When Include Source is No and you attempt to delete all files from ARB memory when the ARB is currently playing a file, all files except the one playing are deleted and an error is generated

7.3.11.4 Set Default Directory (Remote Command Only)

Sets the default directory for loading ARB files from SCPI.

Remote Command	`:SOURce:RADio:ARB:DEFault:DIRectory <string>` `:SOURce:RADio:ARB: DEFault:DIRectory?`
Example	`:SOUR:RAD:ARB:DEF:DIR “D:\ArbFiles”` `:SOUR:RAD:ARB:DEF:DIR?`
Notes	Sets the default directory to be used as a search location for waveform segments that are required to be loaded into ARB memory for playback of a waveform sequence, and as a search location for selecting waveforms using SCPI
State Saved	Persistent, survives a power cycle and a preset but not saved in the instrument state

7.3.11.5 Query ARB Memory File List (Remote Command Only)

Queries the instrument for the list of waveform segments in the ARB memory.

NOTE This query returns a string for waveform segment names in ARB memory. If you want a string list of waveform segments in the ARB memory, use "Query ARB Memory Full File List (Remote Command Only)" on page 2453.

Remote Command	`:SOURce:RADio:ARB:CATalog?`
Example	`:SOUR:RAD:ARB:CATalog?`
Notes	The return data is in the following format:

`<integer>`	memory used
`<integer>`	memory free
`<string>…`	comma separated list of waveform segments within ARB memory

7.3.11.6 Query ARB Memory Full File List (Remote Command Only)

Queries the instrument for the string list of waveform segments in the ARB memory. It returns a string list for waveform segment names in the ARB memory.

Remote Command	`:SOURce:RADio:ARB:FCATalog?`
Example	`:SOUR:RAD:ARB:FCATalog?`
Notes	The return data is in the following format:

`<integer>`	Memory used

`<integer>`	Memory free
`<integer>`	File count in ARB memory
`<string>,<string>, … <string>`	Comma-separated string list of waveform segments within ARB memory

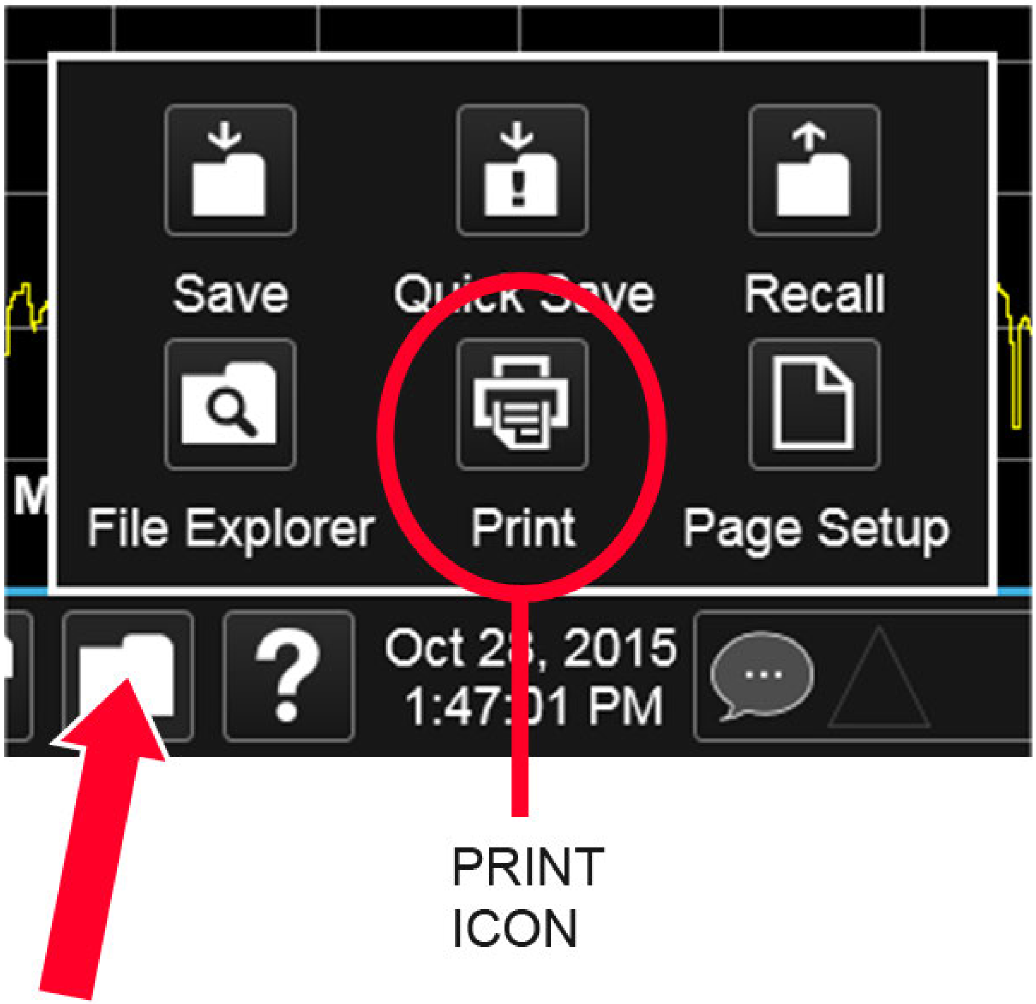
Example:

`:SOUR:RAD:ARB:FCAT?`

EXT returns: 27499,2069653,3,"c2k.wfm","gsm.wfm","wcdma.wfm"

7.4 Print

Print is found under the File Functions icon.



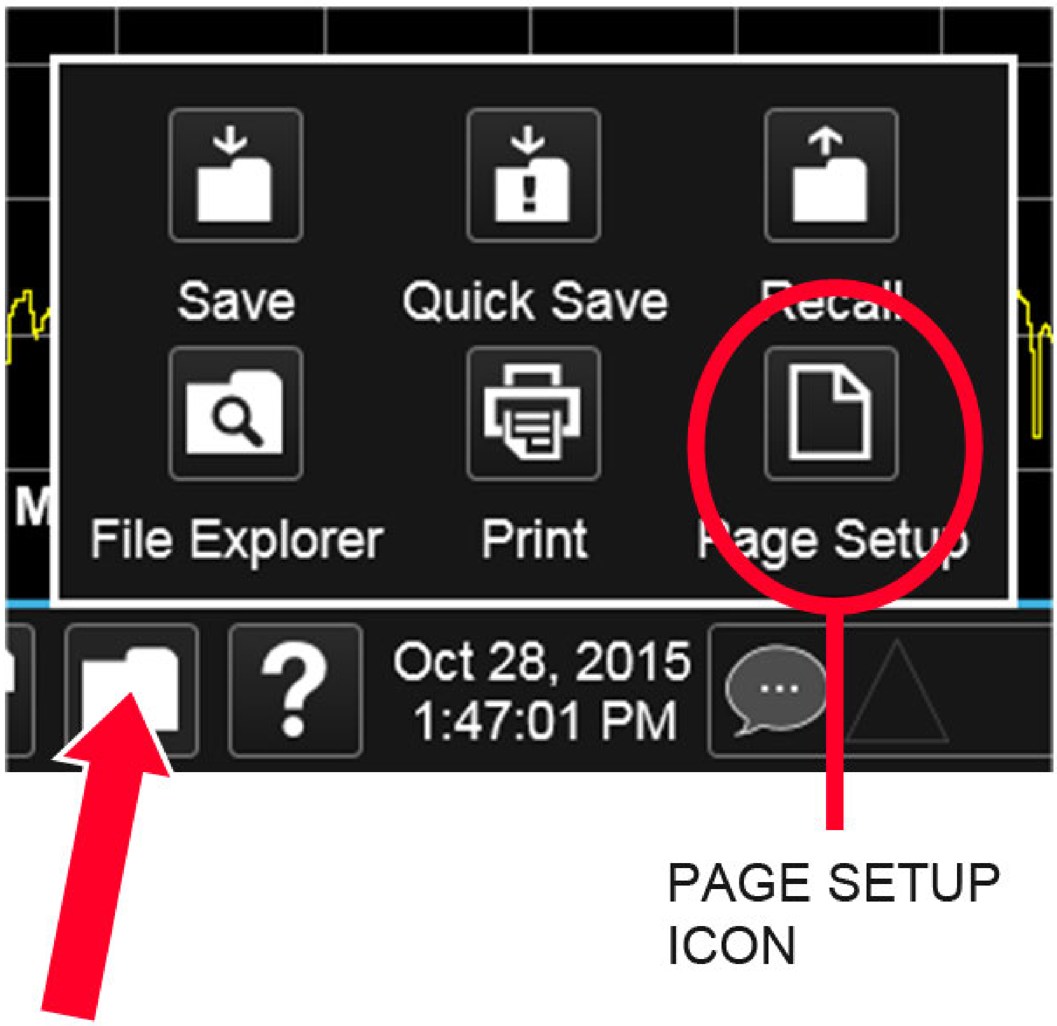
Opens a dialog for configuring printing (for example, to the printer of your choice).

The `:HCOPy` command is equivalent to pressing the **PRINT** key.

Remote Command	`:HCOPy[:IMMediate]`
	`:HCOPy:ABORt` can be used to abort a print that is already in progress. Sending `:HCOPy:ABORt` causes the instrument to stop sending data to the printer, although the printer may continue or even complete the print, depending on how much data was sent to the printer before you sent the `:ABORt` command.
Remote Command	`:HCOPy:ABORt`

7.5 Page Setup

This control is under the File Functions icon.



Page Setup opens a Windows Page Setup dialog that allows you to control aspects of the pages sent to the printer when the **PRINT** hardkey is pressed.

Depending on the abilities of the attached printer, paper size, paper source, page orientation and margins may all be set. There are no SCPI commands for controlling these parameters.

Also in this dialog is a dropdown control that lets you select the display Theme to use when printing. Page Setup themes are the same as those available for Screen Image "Theme" on page 2427.

The **Theme** control has a corresponding SCPI command:

Remote Command	`:SYSTem:PRINt:THEMe FILLed | OUTLine` `:SYSTem:PRINt:THEMe?`
Example	`:SYST:PRIN:THEM OUTL`
Preset	`OUTL`; not part of Preset, but is reset by **Restore Misc Defaults** or **Restore System Defaults All** and survives subsequent running of the modes
State Saved	No
Backwards Compatibility SCPI	`:SYSTem:PRINt:THEMe TDColor | TDMonochrome | FCOLor | FMONochrome`

Backwards Compatibility Notes	To permit code compatibility with A-model X-Series Signal Analyzer instruments, the command parameters from the A-models are mapped as follows:
	`TDColor` and `TDMonochrome` are both mapped to `FILLed`
	(exact full color representation of what is on the screen)
	`FCOLor` and `FMONochrome` are both mapped to `OUTLine`
	(uses color for traces and other items, but most filled areas are white)
	There is no Monochrome theme in the B-models, so the A-models monochrome commands yield color
	The query `:SYST:PRINT:THEM?` always returns `FILLed` or `OUTLine`; never `FCOLor`, `FMONochrome`, `TDColor`, or `TDMonochrome`

8 Trigger

Controls the **Trigger** system of the instrument. In general, these are functions associated with internal triggers or trigger inputs. Trigger Output functions are configured under **Input/Output**.

Trigger functions are common across multiple Modes and Measurements, although some controls appear only in certain Modes and/or certain Measurements. Additionally, some of the tabs on the **Trigger** menu are only available in certain Modes.

Many of the Trigger functions can be set graphically using the Trigger Setting Diagram. For more information see: "Trigger Optimization" on page 2500

In general, each Measurement can have a different Trigger, and each Measurement remembers its previous-trigger setting.

8.1 Trigger

Contains controls that let you select the trigger source, and setup of each of the trigger sources. The instrument is designed to allow triggering from many sources, for example, Free Run, Video, External, RF Burst, etc.

In general, each Measurement can have a different Trigger Source, and each Measurement remembers its previous-Trigger Source.

8.1.1 Select Trig Source

Specifies the trigger source for the currently selected instrument input (RF or I/Q). If you change inputs, the new input remembers the trigger source it was last programmed to for the current measurement, and uses that trigger source. When in External Mixing, the instrument uses the RF trigger source. You can directly set the trigger source for the RF Input and for the I/Q input using SCPI commands; see "Trigger Source Presets" on page 2466 and "I/Q Trigger Source (Remote Command Only)" on page 2470.

In general, each Measurement can have a different Trigger Source, and each Measurement remembers its previously-set Trigger Source. Not every Trigger Source is available for every Measurement, so the available choices for Select Trig Source may vary from Mode to Mode and Measurement to Measurement. The trigger sources that are available for each measurement are shown in the “List of Available Trigger sources” dropdown below.

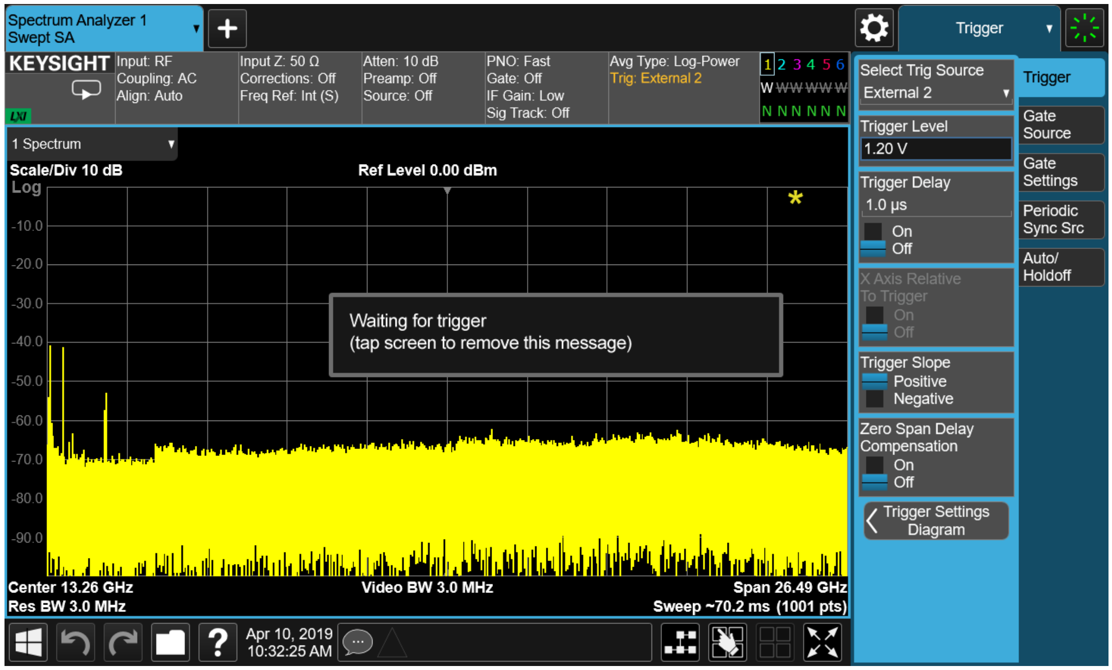
Note that the controls available on the Trigger Tab change depending on which trigger source is selected. Tap each trigger source in the table in the “List of Available Trigger sources” dropdown to see what parameters are available for that trigger source.

Note that most measurements require the inclusion of a <measurement> parameter in the Trigger Source command. However, for the Swept SA measurement and RTSA this is not the case; for backwards compatibility, no <measurement> parameter is used when setting the Trigger Source for the Swept SA measurement or RTSA.

Waiting for Trigger

After you select a trigger source, the instrument will start its next measurement when that trigger source is satisfied. For example, if you choose External 1, the next measurement will start when the appropriate signal appears at the Trigger 1 In connector.

If the trigger source is not satisfied (for example, if no signal at the appropriate level appears at the Trigger 1 In connector), after approximately 2 seconds a popup message will appear that says “Waiting for trigger”. The trigger annotation in the Meas Bar will also turn amber, as shown below:



Tap anywhere on the screen (except on the message itself) to clear the popup. The annotation will remain amber until the trigger conditions are satisfied.

List of available Trigger sources

The tables show which Trigger sources are available for which Modes and Measurements, with the following exceptions:

- the Noise Figure Mode does not support Triggering at all
- the Disturbance Analyzer measurement in the EMI Mode does not support Triggering
- the Tx Band Spur measurement in the GSM/EDGE Mode does not support Triggering
- For some models (like N9042B) with ADC trigger: some IF Paths do not support Video trigger, instead they support ADC trigger

"Free Run" on page 2471	`IMMediate`	All Modes and measurements, except those measurements that support no triggers at all
"Video/ADC" on page 2472	`VIDeo`	All Modes except RTSA and Pulse In Spectrum Analyzer Mode, all measurements except ACP and List Sweep In WCDMA, MSR, Short Range Comms, VMA and LTE, all measurements except ACP In WLAN, all measurements In Phase Noise, all measurements except Log Plot and

		Spot Frequency
ADC	`ADC`	All Modes and measurements supporting Video, except Spectrum Analyzer mode Only supported in certain model's IF Paths
"Line" on page 2472	`LINE`	All Modes except EMI, Avionics and Analog Demod In Spectrum Analyzer, all measurements except List Sweep In WLAN and GSM/EDGE, all measurements except Power vs. Time In LTE and 5G NR, all measurements except Transmit On/Off Power In Short Range Comms, all measurements except Modulation Analysis In MSR, all measurements
Level [Mode: RTSA, PULSEX]	`LEVel`	RTSA and Pulse Modes only
FMT [Mode: RTSA, PULSEX]	`FMT`	RTSA and Pulse Modes only
"External 1" on page 2473	`EXTernal1`	All Modes and measurements
"External 2" on page 2474	`EXTernal2`	All Modes and measurements
"External 3" on page 2474	`EXTernal3`	See "External 3 Support" on page 2462
"RF Burst" on page 2476	`RFBurst`	All Modes except EMI In Spectrum Analyzer, all measurements except List Sweep
"Periodic" on page 2476	`FRAMe`	All Modes except EMI In Spectrum Analyzer, all measurements except List Sweep
TV [Mode: SA]	`TV`	Spectrum Analyzer Mode only, and only in the Swept SA measurement

I/Q Triggers:

"I/Q Mag" on page 2478	`IQMag`	All Modes except EMI, Avionics, RTSA, Analog Demod and Pulse In Spectrum Analyzer, only in Power Stat CCDF and Burst Power In WCDMA, only in Power Stat CCDF and IQ Waveform In GSM/EDGE, only in EVM, GMSK Phase & Freq Error, Transmit Power and IQ Waveform In Phase Noise, only in IQ Waveform In Bluetooth, only in Transmit Analysis In LTE, only in Power Stat CCDF, Modulation Analysis,

"Input I" on page 2479	`IINPut`	Conformance EVM, and IQ Waveform In WLAN, only in Power Stat CCDF, Modulation Analysis, Spectral Flatness, and IQ Waveform In Short Range Comms, only in Power Stat CCDF and Modulation Analysis In VMA, only in Power Stat CCDF, Digital Demod and IQ Waveform In CQM, only in Group Delay, Power Stat CCDF, and IQ Waveform
"Input Q" on page 2479	`QINPut`	
"I (Demodulated)" on page 2479	`IDEMod`	
"Q (Demodulated)" on page 2480	`QDEMod`	
"Aux I/Q Mag" on page 2480	`AIQMag`	
"PXI" on page 2481	`PXI`	All Modes and measurements (only found in modular analyzers)
"Internal" on page 2481	`INTernal`	All Modes and measurements (only found in modular analyzers)
Audio External	`AEXTernal`	Via the TRIG IN connector on the M9260A Audio Analyzer module
"Prot Channel Detection" on page 2482	`PRTChandet`	Base Station Emulation; valid UL signal detected (PUSCH/PUCCH/PRACH/SRS)
"Prot Frame Aligned" on page 2483	`PRTFrame`	Base Station Emulation; periodic technology format radio frame with data frame aligned to the BSE timing
"Prot Event" on page 2483	`PRTEvent`	Base Station Emulation events

External 3 Support

Trigger Source External 3 is available only in certain Modes and measurements, as follows:

`5GNR`	Transmit On|Off, Modulation Analysis, Power Stat CCDF, and IQ Waveform measurements only
`ADEMOD`	Not supported
`AVIONICS`	Not supported
`BT`	Not supported
`CQM`	Group Delay, Power Stat CCDF, and IQ Waveform measurements only
`EMI`	Not supported
`GSMEDGE`	IQ Waveform and Transmit Power measurements only
`LTEAFDD`, `LTEATDD`	Power Stat CCDF, IQ Waveform, and Transmit On|Off measurements only
`MSR`	Power Stat CCDF, and IQ Waveform measurements only
`PA`	Power Amplifier measurement
`PNOISE`	IQ Waveform measurement only

PULSEX	Pulse measurement only
SA	Power Stat CCDF and Burst Power measurements only
SRCOMMS	Modulation Analysis, Power Stat CCDF, and IQ Waveform measurements only
VMA	Digital Demod, Custom OFDM, IQ Waveform, and Power Stat CCDF measurements only
WCDMA	QPSK EVM, Power Stat CCDF, and IQ Waveform measurements only
WLAN	Spectral Flatness, Modulation Analysis, Power Vs Time, Power Stat CCDF, and IQ Waveform measurements only

Backwards Compatibility SCPI

The following SCPI commands are provided for Backwards Compatibility:

Backwards Compatibility SCPI

`:TRIGger[:SEQuence]:SOURce EXTernal`

For backward compatibility, the parameter `EXTernal` is mapped to `EXTernal1`

`[:SENSe]:<measurement>:TRIGger:SOURce`

This backwards compatibility alias command is provided for ESA/PSA compatibility

This backwards compatibility command does not apply to the Swept SA measurement, for that just use `:TRIGger:SOURCe`

This backwards compatibility command does not apply to the monitor spectrum, log plot and spot frequency measurements

`[:SENSe]:<measurement>:TRIGger:SOURce IF`

In earlier instruments, the parameter IF was used by apps for the video trigger, so using the IF parameter selects `VIDeo` triggering. Sending IF in the command causes `VID` to be returned to a query

`[:SENSe]:ACPR:TRIGger:SOURce`

This backwards Compatibility SCPI command is provided to support the same functionality as `[:SENSe]:ACPr:TRIGger:SOURce` (PSA W-CDMA, PSA cdma2000 and PSA 1xEVDO) due to the fact that the ACPr node conflicts with the `ACPower` node

The legacy command:

`:TRIGger[:SEQuence]:RFBurst:FSELectivity[:STATe] OFF | ON | 0 | 1`

is not supported in the X-Series, as the hardware to do Frequency Selective burst triggers does not exist in X-Series

More Information

The **Trigger** menus let you select the trigger source and trigger settings for a sweep or measurement. In triggered operation (basically, any trigger source other than Free Run), the instrument will begin a sweep or measurement only when the selected trigger conditions are met, generally when your trigger source signal meets the specified trigger level and polarity requirements. (In FFT measurements, the trigger controls when the data acquisition begins for FFT conversion.)

For each of the trigger sources, you may define a set of operational parameters or settings, which will be applied when that source is selected as the current trigger source. Examples of these settings are Trigger Level, Trigger Delay, and Trigger

Slope. You may apply different settings for each source; so, for example, you could have a Trigger Level of 1v for External 1 trigger and -10 dBm for Video trigger.

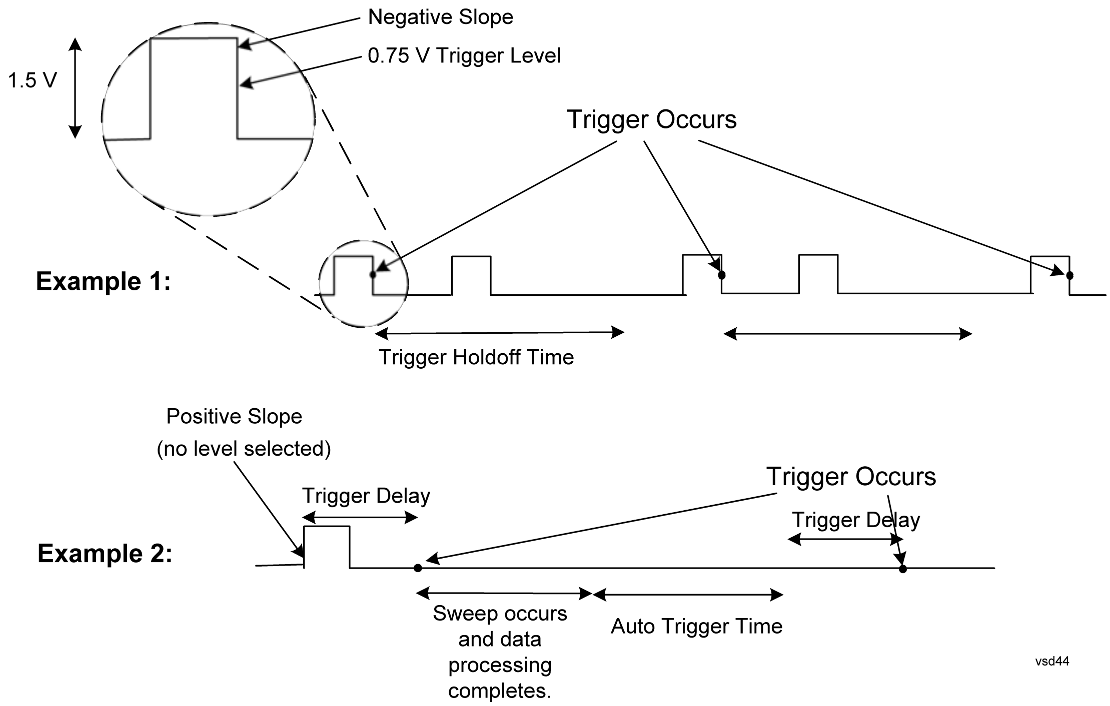
Once you have established the settings for a given trigger source, they generally will remain unchanged for that trigger source as you go from measurement to measurement within a Mode (although the settings can change as you go from Mode to Mode). Furthermore, the trigger settings within a Mode are the same for the **Trigger** menu, the **Gate Source** menu, and the **Periodic Sync Src** menu. That is, if **Ext1** trigger level is set to 1v in the **Trigger** menu, it will appear as 1v in both the **Gate Source** and the **Periodic Sync Src** menus. For these reasons the trigger settings commands are not qualified with the measurement name, the way the trigger source commands are.

Trigger Setup Parameters:

The following examples show trigger setup parameters using an external trigger source.

Example 1 illustrates the trigger conditions with negative slope and no trigger occurs during trigger Holdoff time.

Example 2 illustrates the trigger conditions with positive slope, trigger delay, and auto trigger time.



Remote Command	Swept SA and RTSA measurements:
	`:TRIGger[:SEQuence]:SOURce EXTernal1 | EXTernal2 | EXTernal3 |`

	`IMMediate | LINE | FRAMe | RFBurst | VIDeo | TV | PXI | INTernal`
	`:TRIGger[:SEQuence]:SOURce?`
	All other measurements
	`:TRIGger:<measurement>[:SEQuence]:SOURce EXTernal1 | EXTernal2 | EXTernal3 | AEXTernal | IMMediate | LEVel | FMT | LINE | FRAMe | RFBurst | VIDeo | IQMag | IDEMod | QDEMod | IINPut | QINPut | AIQMag | PXI | INTernal | PRTChandet | PRTFrame | PRTEvent`
	`:TRIGger:<measurement>[:SEQuence]:SOURce?`

Example	The following commands set the External 1 trigger input for various measurements
	Swept SA and RTSA measurements:
	`:TRIG:SOUR EXT1`
	Other Spectrum Analyzer Mode measurements:
	Harmonics:
	`:TRIG:HARM:SOUR EXT1`
	Power Suite measurements (appear in many Modes):
	Channel Power:
	`:TRIG:CHP:SOUR EXT1`
	Occupied BW, Output Spectrum BW:
	`:TRIG:OBW:SOUR EXT1`

Notes	For some of the trigger parameters, the tie-in to the parameter is not obvious. These are: `IMMediate`, selects Free Run `FRAMe` , selects Periodic Trigger `FMT`, selects Frequency Mask Trigger `AEXTernal`, selects Audio External trigger, using the TRIG IN connector on the M9260A Audio Analyzer module For most measurements, the `<measurement>` keyword follows `TRIGger`. For Swept SA and RTSA Modes, do *not* use the `<measurement>` keyword. Using the wrong command form will result in an Undefined Header error Other trigger-related commands are found in the `:INITiate` and `:ABORt` SCPI command subsystems `*OPC` should be used after requesting data. This will hold off any subsequent changes to the selected trigger source, until after the sweep is completed and the data is returned Available ranges and presets can vary from mode to mode **For FMT (Pulse and RTSA apps):** The amplitude resolution of the Frequency Mask is coupled to the Scale/Division. There are 256 vertical points therefore the amplitude resolution is computed using the algorithm: (10 * Scale/Div) / # Vertical Points
Dependencies	Not all trigger sources are available for each input. See the "RF Trigger Source (Remote Command Only)" on page 2469 and "I/Q Trigger Source (Remote Command Only)" on page 2470 commands for detailed information on which trigger sources are available for each input In some models, there is no second External input. In these models, the External 2 selection is not shown and the `EXTernal2` parameter will generate a “Hardware missing; Not available for this model

	number" message EXTernal3 is available only when Option H1G is installed For the E7760 the only available selections are: EXTernal1|IMMediate|INTernal|RFBurst|VIDeo For UXM the only available selections are: EXTernal1|IMMediate|PRTChandet|PRTFrame|PRTEvent In the Pulse app, when Option B2X and H1G are installed and Digital IF BW is greater than 255.176 MHz, only three trigger sources, IMMediate, LEVel, and EXTernal3 are available **Level Trigger (Pulse and RTSA apps):** Level trigger is allowed in average detector mode When Level Trigger is the selected Trigger Source in the Spectrum measurement, Spectrum minimum Acquisition Time is limited to the PVT minimum Acquisition Time. If the Spectrum Acquisition Time changed as a result of going into Level Trigger, a message is posted "Min Acq Time is 200 usec when Level Trigger is ON". When Level Trigger is no longer the selected Trigger Source, Spectrum minimum Acquisition Time is restored **FMT (Pulse and RTSA apps):** If you were not in Free Run when you entered the FMT Setup View, you can change Trigger Source to Free Run while in the editor. This will allow you to configure the mask with a continually updating trace. When exiting FMT Setup View, the Trigger Source will be changed back to FMT
Couplings	**FMT (Pulse and RTSA apps):** A remote user can enter or access FMT data via :TRIGger[:SEQuence]:FMT[1]|2:DATA The upper and lower masks can have different freq/ampl pairs therefore subop code 1 is for the upper mask and subop code 2 is for the lower mask
Preset	See "Trigger Source Presets" below
Status Bits/OPC dependencies	The Status Operation Register bit 5 "Waiting for Trigger" is set at the same time as the Sweeping or Measuring bit is set. It is cleared when the trigger actually occurs (that is, after the trigger event occurs and all the applicable trigger criteria have been met). A corresponding pop-up message ("Waiting for trigger") is generated if no trigger signal appears after approximately 2 sec. This message goes away when a trigger signal appears

Trigger Source Presets

The following Trigger Source presets are used for these measurements after a Mode Preset or Meas Preset:

Meas	Mode	Preset for RF	Preset for IQ
Swept SA	SA	IMM	IQ not supported
CHP	SA, WCDMA, MSR,SRCOMMS, 5GNR, WLAN	IMM	IQ not supported
OBW	SA, WCDMA, LTEAFDD, LTEATDD, BT, 5GNR, WLAN	1xEVDO: EXT1 Others: IMM	IQ not supported

Meas	Mode	Preset for RF	Preset for IQ
Transmit Analysis	BT	RFB	IQM
Adjacent Channel Power	BT	IMM	IQ not supported
LE In-band Emissions	BT	IMM	IQ not supported
EDR In-band Spurious Emissions	BT	RF Burst	IQ not supported
CCDF	SA, WCDMA, LTEAFDD, LTEATDD, MSR,SRCOMMS, 5GNR, WLAN, CQM	LTEATDD: – BTS: External 1 – MS: Periodic Timer Others: IMM	LTEATDD: - BTS: EXT1 - MS: FRAM Others: IMM
ACP	SA, WCDMA, LTEAFDD, LTEATDD, MSR,SRCOMMS, 5GNR	IMM	IQ not supported
Tx Power	SA, GSM	RFBurst	IMM
SPUR	SA, WCDMA, MSR, LTEAFDD, LTEATDD, 5GNR, WLAN	IMM	IQ not supported
SEM	SA, WCDMA, MSR, LTEAFDD, LTEATDD, SRCOMMS, 5G NR, WLAN	IMM	IQ not supported
CDP	WCDMA	IMM	IMM
RHO	WCDMA	IMM	IMM
PCON	WCDMA	IMM	IMM
QPSK	WCDMA	EXT1	IMM
MON	All except: SA, BASIC	IMM	IQ not supported
WAV	All except: SA	LTEATDD: – BTS: External 1 – MS: Periodic Timer GSM/EDGE: RFBurst All others: IMM	LTEATDD: - BTS: EXT1 - MS: FRAM GSM/EDGE: IQM All others: IMM
EVM	LTEAFDD, LTEATDD, SRCOMMS, 5GNR, WLAN	IMM	IMM
PVT	WLAN	RFB	IQ not supported

Meas	Mode	Preset for RF	Preset for IQ
Spectral Flatness	WLAN	IMM	IMM
SPEC	BASIC	IMM	IMM
LOG Plot	PN	IMM	IQ not supported
Spot Freq	PN	IMM	IQ not supported
GMSK PVT	EDGE/GSM	RFB	IMM
GMSK PFER	EDGE/GSM	RFB	IQM
GMSK ORFS	EDGE/GSM	RFB	IQ not supported
EDGE PVT	EDGE/GSM	RFB	IMM
EDGE EVM	EDGE/GSM	RFB	IQM
EDGE ORFS	EDGE/GSM	Periodic Timer	IQ not supported
Combined WCDMA	WCDMA	IMM	IQ not supported
Combined GSM	EDGE/GSM	RFB	IQ not supported
List Power Step	WCDMA, EDGE/GSM	IMM	IQ not supported
Transmit On/Off Power	LTETDD, LTEATDD, 5GNR	BTS: External 1 MS: Periodic Timer	BTS: EXT1 MS: FRAM
Transmit Analysis	BLUETOOTH	RFB	IQ not supported
Adjacent Channel Power	BLUETOOTH	IMM	IQ not supported
LE In-band Emissions	BLUETOOTH	IMM	IQ not supported
EDR In-band Spurious Emissions	BLUETOOTH	Periodic Timer	IQ not supported
Conformance EVM	LTEAFDD, LTEATDD, MSR	IMM	IMM
Spectrum & PvT	RTSA	IMM	IQ not supported
Pulse	PULSEX	IMM	IQ not supported
AM, FM, PM, FM Stereo	ADEMOD	IMM	IQ not supported
PAvT	SA, 5GNR, VMA	IMM	IMM
Group Delay	CQM	IMM	IMM

RF Trigger Source (Remote Command Only)

Selects the trigger to be used for the specified measurement when RF is the selected input. The RF trigger source can be queried and changed even while another input is selected, but it is inactive until RF becomes the selected input.

Note the inclusion of the <measurement> parameter in the command below. Because each measurement remembers its own Trigger Source, the command must be qualified with the measurement name. Note that for the Swept SA measurement this is not the case; for backwards compatibility, no <measurement> parameter is used when setting the Trigger Source for the Swept SA measurement.

Remote Command	`:TRIGger:<measurement>[:SEQuence]:RF:SOURce EXTernal1 | EXTernal2 | IMMediate | LEVel | FMT | LINE | FRAMe | RFBurst | VIDeo | IF | TV | PXI | INTernal | PRTChandet | PRTFrame | PRTEvent`
	`:TRIGger:<measurement>[:SEQuence]:RF:SOURce?`
	Note that the available parameters are model number and hardware dependent

Example	Select the external 1 trigger input for the ACP measurement and the RF input:
	`:TRIG:ACP:RF:SOUR EXT1`
	Select video triggering for the `SANalyzer` measurement and the RF input. For `SAN`, do not use the `<measurement>` keyword:
	`:TRIG:RF:SOUR VID`

Notes	Not all measurements have all the trigger sources available to them. Check the trigger source documentation for your specific measurement to see what sources are available Note that not all trigger sources are available for each input, and that the available parameters are model number and hardware dependent For the **RF Trigger Source,** the following trigger sources are available:

`IMMediate`	free run triggering
`VIDeo`	triggers on the video signal level
`LEVel`	triggers on the video signal level with time qualified triggering
`FMT`	triggers on the amplitude spectrum with frequency mask triggering
`LINE`	triggers on the power line signal
`EXTernal1` or `EXTernal`	triggers on an externally connected trigger source marked “Trigger 1 In” on the rear panel of standalone instruments, “Trigger 3” on the front panel of EXM and VXT models M9420A/21A, and “Trigger 1” on the front panel of VXT models M9410A/11A
`EXTernal2`	triggers on an externally connected trigger source marked “Trigger 2 In” on the front panel of standalone instruments, and “Trigger 1” on the front panel of EXM and VXT models M9420A/21A, and “Trigger 2” on the front panel of VXT models M9410A/11A. In some models, there is no second External input. In these models, the External 2 selection is not shown and the `EXTernal2` parameter will generate a “Hardware missing; Not available for this model number” message

	RFBurst	triggers on the bursted frame
	FRAMe	triggers on the periodic timer
	IF (video)	same as video, for backwards compatibility only
	PRTChandet	triggers on Base Station Emulation detecting a valid UL signal (PUSCH/PUCCH/PRACH/SRS)
	PRTFrame	triggers on the Base Station Emulation periodic technology format radio frame with data frame aligned to the BSE timing
	PRTEvent	triggers on the Base Station Emulation events
	INTernal	triggers on the internal source trigger output, for models with an internal source such as VXT
	PXI trigger	only supported in PXI (modular) instruments
	*OPC should be used after requesting data. This will hold off any subsequent changes to the selected trigger source, until after the sweep is completed and the data is returned Available ranges, and presets can vary from mode to mode	
Dependencies	The available choices for VXT are: Free Run, Video, Internal, External 1, External 2, RF Burst, Periodic and PXI In VXT, Internal is only in VXT models M9410A/11A, not in models M9420/21A, and Internal and Periodic are not available in Spectrum Analyzer Mode PXI is only found in VXT The available choices for EXM are Free Run, Video, Internal, External 1, External 2, RF Burst, and Periodic The available choices for UXM are Free Run, External 1, Prot Channel Detection, Prot Frame Aligned, and Prot Event Prot Channel Detection, Prot Frame Aligned, and Prot Event are only available in UXM The available choices for E7760 are Free Run, External 1, Internal, Video and RF Burst In some models, there is no second External input. In these models, the External 2 selection is not shown and the EXTernal2 parameter will generate a “Hardware missing; Not available for this model number” error	
Status Bits/OPC dependencies	The Status Operation Register bit 5 "Waiting for Trigger" is set at the same time as the Sweeping or Measuring bit is set. It is cleared when the trigger actually occurs (that is, after the trigger event occurs and all the applicable trigger criteria have been met). A corresponding pop-up message ("Waiting for trigger") is generated if no trigger signal appears after approximately 2 seconds. This message goes away when a trigger signal appears	

I/Q Trigger Source (Remote Command Only)

Selects the trigger to be used for the specified measurement when I/Q (which requires option BBA) is the selected input. The I/Q trigger source can be queried and changed even while another input is selected, but it is inactive until I/Q becomes the selected input.

Remote Command	:TRIGger:<measurement>[:SEQuence]:IQ:SOURce EXTernal1 | EXTernal2 | IMMediate | IQMag | IDEMod | QDEMod | IINPut | QINPut | AIQMag

	`:TRIGger:<measurement>[:SEQuence]:IQ:SOURce?`
Example	`:TRIG:WAVeform:SOUR IQM` Selects I/Q magnitude triggering for the IQ Waveform measurement and the I/Q input
Notes	Not all measurements have all the trigger sources available to them. Check the trigger source documentation for your specific measurement to see what sources are available Note that not all trigger sources are available for each input, and that the available parameters are model number and hardware dependent For the **I/Q Trigger Source,** the following trigger sources are available:

`IMMediate`	free run triggering
`EXTernal1` or EXTernal	triggers on an externally connected trigger source on the rear panel
`EXTernal2`	triggers on an externally connected trigger source on the front panel
`IQMag`	triggers on the magnitude of the I/Q signal
`IDEMod`	triggers on the I/Q signal's demodulated I voltage
`QDEMod`	triggers on the I/Q signal's demodulated Q voltage
`IINPut`	triggers on the I channel's ADC voltage
`QINPut`	triggers on the Q channel's ADC voltage
`AIQMag`	triggers on the magnitude of the auxiliary receiver channel I/Q signal

`*OPC` should be used after requesting data. This will hold off any subsequent changes to the selected trigger source, until after the sweep is completed and the data is returned

Available ranges, and from mode to mode presets can vary

Status Bits/OPC dependencies	The Status Operation Register bit 5 "Waiting for Trigger" is set at the same time as the Sweeping or Measuring bit is set. It is cleared when the trigger actually occurs (that is, after the trigger event occurs and all the applicable trigger criteria have been met). A corresponding pop-up message ("Waiting for trigger") is generated if no trigger signal appears after approximately 2 sec. This message goes away when a trigger signal appears

8.1.1.1 Free Run

Free Run triggering occurs immediately after the sweep/measurement is initiated.

Example	Swept SA measurement:
	`:TRIG:SOUR IMM`
	Measurements other than Swept SA:
	`:TRIG:<meas>:SOUR IMM`

Annunciation	Free Run (in the Meas Bar)

8.1.1.2 Video/ADC

The Video trigger condition is met when the video signal at the left edge of the graticule (the filtered and detected version of the input signal, including both RBW and VBW filtering) crosses the video trigger level with the chosen slope.

The Video trigger level is shown as a labeled line on the display. The line is displayed as long as Video is the selected trigger source. The Trigger Level line can be adjusted using the step keys, knob, or numeric keypad. It can also be dragged on the display with your finger or with a mouse.

When the detector selected for all active traces is the average detector, the video signal for triggering does not include any VBW filtering.

Log Plot and Spot Frequency measurements, in the Phase Noise Mode, do not support Video Trigger.

The **Trigger** tab contains the following Trigger Source dependent controls when Video Trigger is selected:

– "Prot Frame Aligned" on page 2483
– "Trigger Delay" on page 2485
– "Trigger Slope" on page 2489

Additional controls are also present, which are not dependent on the selected Trigger Source.

Note that Video Trigger is a software trigger of the acquired trace for some measurements and a hardware trigger of the IF envelope for others. Most measurements support one method or the other, although some (like ACP) don't support Video Trigger at all. For those measurements that support Video Trigger as a software trigger, the Trigger Level units will be dependent on the current Y Axis Unit for the measurement; for those that support Video Trigger as an IF Envelope trigger, the units are typically in dBm.

Example	`:TRIG:SOUR VID`
	Swept SA measurement
	`:TRIG:<meas>:SOUR VID`
	Measurements other than Swept SA

Annunciation	Video (in the Meas Bar)

8.1.1.3 Line

When **Line** is selected, start of a new sweep/measurement will be synchronized with the next cycle of the line voltage.

Line trigger is not available when operating from a "dc power source", for example, when the instrument is powered from batteries.

Line trigger is not available when using modular instruments like the VXT.

The **Trigger** tab contains the following Trigger Source dependent controls when **Line** Trigger is selected:

– "Trigger Delay" on page 2485

– "Trigger Slope" on page 2489

Additional controls are also present that are not dependent on the selected Trigger Source.

Example	`:TRIG:SOUR LINE`
	Swept SA measurement
	`:TRIG:<meas>:SOUR LINE`
	Measurements other than Swept SA

Annunciation	LINE (in the Meas Bar)

8.1.1.4 External 1

When **External 1** is selected, a new sweep/measurement starts when the external trigger condition is met using the TRIGGER 1 IN input connector on the rear panel.

Grayed-out if Ext 1 is in use by Point Trigger in the Source Setup menu of Swept SA.

Forced to "Free Run" on page 2471 if already selected and Point Trigger is set to External 1.

The **Trigger** tab contains the following Trigger Source dependent controls when External 1 Trigger is selected:

– "Prot Frame Aligned" on page 2483

– "Trigger Delay" on page 2485

– "Trigger Slope" on page 2489

Additional controls are also present that are not dependent on the selected Trigger Source.

Example	`:TRIG:SOUR EXT1`
	Swept SA measurement
	`:TRIG:<meas>:SOUR EXT1`
	Measurements other than Swept SA

Annunciation	External 1 (in the Meas Bar)

8.1.1.5 External 2

When **External 2** is selected, a new sweep/measurement starts when the external trigger condition is met using the TRIGGER 2 IN input connector on the rear panel.

Grayed-out if Ext 2 is in use by Point Trigger in the Source Setup menu of Swept SA.

Forced to "Free Run" on page 2471 if already selected and Point Trigger is set to External 2.

The **Trigger** tab contains the following Trigger Source dependent controls when External 2 Trigger is selected:

– "Prot Frame Aligned" on page 2483

– "Trigger Delay" on page 2485

– "Trigger Slope" on page 2489

Additional controls are also present that are not dependent on the selected Trigger Source.

Example	`:TRIG:SOUR EXT2`
	Swept SA measurement
	`:TRIG:<meas>:SOUR EXT2`
	Measurements other than Swept SA

Annunciation	External 2 (in the Meas Bar)

8.1.1.6 External 3

When **External 3** is selected, a new sweep/measurement starts when the external trigger condition is met using the TRIGGER 3 IN input connector on the rear panel.

This control only appears in certain instrument and option combinations, as follows.

– For N9042B, selects the Precision External Trigger, but available only when IF Path is 255 MHz or wider. The resolution will be within one sample count of the 4.8 GHz ADC sampling rate for 255 ~ 2 GHz IF Paths, and within one sample count of the 10.2 GHz sampling rate for the 4 GHz IF Path

– For all other instruments, available only if Option H1G is installed. It is only available when the 1 GHz path is chosen, either directly or indirectly; in all other paths it is visible but grayed-out. Direct and indirect selection of the 1 GHz path occurs as follows:

  – **Direct**: Measurements that directly support the 1 GHz path have a 1 GHz selection in the **IF Path** menu in **Meas Setup**

– **Indirect**: Certain measurements, such as Power Statistics CCDF (`PST`), always choose the widest available path, and so will choose the 1 GHz path if it is available, even if there is no **IF Path** menu for the measurement. **External 3** will be visible when this results in the 1 GHz path being selected, even if there is no control or readout indicating that the 1 GHz path has been selected

For a full list of Modes and measurements that support **External 3**, see "External 3 Support" on page 2462 in the section "Select Trig Source" on page 2459.

When **External 3** is set, and then becomes disabled because you switched away from the 1 GHz path, the Trigger Source selection reverts to the default ("Free Run" on page 2471).

When **External 3** Trigger is selected, the **Trigger** tab displays the following Trigger Source dependent controls:

– "Prot Frame Aligned" on page 2483

– "Trigger Delay" on page 2485

– "Trigger Slope" on page 2489

Additional controls are also present that are not dependent on the selected Trigger Source.

Example	`:TRIG:SPEC:SOUR EXT3` Sets **External 3** as the trigger source for the Complex Spectrum measurement
Annunciation	External 3 (in the Meas Bar)

8.1.1.7 Audio External

When **Audio External** is selected, a new sweep/measurement starts when the external trigger condition is met using the TRIG IN input connector on the front panel of the M9260A Audio Analyzer module. This is a TTL level input (not analog) that supports both rising edge and falling edge triggers.

Only appears in modular instruments, and only when the M9260A Audio Analyzer module is installed, such as in M8920A.

The **Trigger** tab contains the following Trigger Source dependent controls when Audio External Trigger is selected:

– "Trigger Delay" on page 2485

– "Trigger Slope" on page 2489

Additional controls are also present that are not dependent on the selected Trigger Source.

Example	`:TRIG:RTES:SOUR AEXT`

	Sets Audio External as the trigger source for the Radio Test measurement
Annunciation	Audio Ext (in the Meas Bar)

8.1.1.8 RF Burst

When **RF Burst** is selected, a new sweep/measurement starts when an RF burst envelope signal is identified from the signal at the RF Input connector.

In some models, a variety of burst trigger circuitry is available, resulting in various available burst trigger bandwidths. The instrument automatically chooses the appropriate trigger path based on the hardware configuration and other settings of the instrument.

The **Trigger** tab contains the following Trigger Source dependent controls when RF Burst is selected:

– "Trigger Level Absolute/Relative" on page 2490

– "Absolute Trigger Level" on page 2490

– "Relative Trigger Level" on page 2491

– "Trigger Delay" on page 2485

– "Trigger Slope" on page 2489

Additional controls are also present that are not dependent on the selected Trigger Source.

Example	`:TRIG:SOUR RFB`
	Swept SA measurement
	`:TRIG:<meas>:SOUR RFB`
	Measurements other than Swept SA

Annunciation	RF Burst (in the Meas Bar)

8.1.1.9 Periodic

When **Periodic** is selected, the instrument uses a built-in periodic timer signal as the trigger. Trigger occurrences are set by the **Periodic Timer** parameter, which is modified by the **Offset** and Periodic Sync Src.

Use this trigger when there is a periodic signal but no reliable signal on which to trigger. You can synchronize the periodic signal with outside events (using the Periodic Sync Src) to get closer to a reliable trigger signal (see "More Information" on page 2477 below).

If you do not have a sync source selected (`OFF`), then the internal timer will not be synchronized with any external timing events.

The **Trigger** tab contains the following Trigger Source dependent controls when Periodic Trigger is selected:

– "Period" on page 2493
– "Offset" on page 2493
– "Reset Offset Display" on page 2494
– "Sync Source" on page 2495
– "Trigger Delay" on page 2485

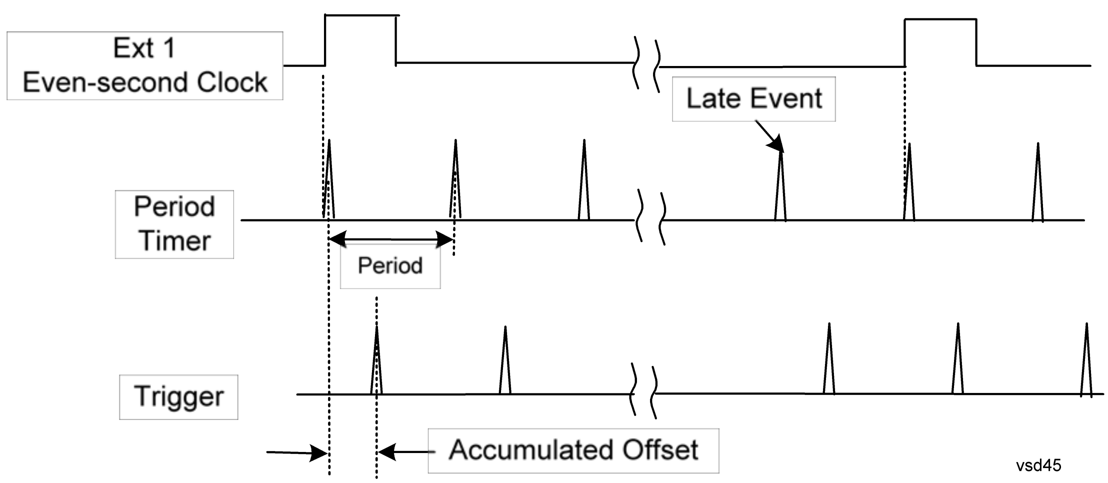
Additional controls are also present that are not dependent on the selected Trigger Source.

Example	`:TRIG:SOUR FRAM`
	Swept SA measurement
	`:TRIG:<meas>:SOUR FRAM`
	Measurements other than Swept SA

Annunciation	Periodic (in the Meas Bar)

More Information

The graphic below shows the action of the periodic timer trigger.



A common application is measuring periodic burst RF signals for which a trigger signal is not easily available. For example, we might be measuring a TDMA radio that bursts every 20 ms. Let’s assume that the 20 ms period is very consistent. Let’s also assume that we do not have an external trigger source available that is synchronized with the period, and that the signal-to-noise ratio of the signal is not high enough to provide a clean RF burst trigger at all of the analysis frequencies. For example, we might want to measure spurious transmissions at an offset from the carrier that is larger than the bandwidth of the RF burst trigger. In this application, we can set the

Periodic Timer to a 20.00 ms period and adjust the offset from that timer to position our trigger just where we want it. If we find that the 20.00 ms is not exactly right, we can adjust the period slightly to minimize the drift between the period timer and the signal to be measured.

A second way to use this feature would be to use **Sync Source** temporarily, instead of **Offset**. In this case, we might tune to the signal in a narrow span and use the RF Burst trigger to synchronize the periodic timer. Then we would turn the sync source off so that it would not miss-trigger. Miss-triggering can occur when we are tuned so far away from the RF burst trigger that it is no longer reliable.

A third example would be to synchronize to a signal that has a reference time element of much longer period than the period of interest. In some CDMA applications, it is useful to look at signals with a short periodicity, by synchronizing that periodicity to the "even-second clock" edge that happens every two seconds. Thus, we could connect the even-second clock trigger to Ext1 and use then Ext1 as the sync source for the periodic timer.

The figure below illustrates this third example. The top trace represents the even-second clock. It causes the periodic timer to synchronize with the leading edge shown. The instrument trigger occurs at a time delayed by the accumulated offset from the period trigger event. The periodic timer continues to run, and triggers continue to occur, with a periodicity determined by the instrument time base. The timer output (labeled "late event") will drift away from its ideal time due to imperfect matching between the time base of the signal being measured and the time base of the instrument, and also because of imperfect setting of the period parameter. But the synchronization is restored on the next even-second clock event. ("Accumulated offset" is described in the in the **Offset** function section.)

8.1.1.10 I/Q Mag

When **I/Q Mag** is selected, the trigger condition is met when the I/Q magnitude crosses the I/Q magnitude trigger level. The magnitude is measured at the output of the main I/Q digital receiver.

This trigger type is only valid for measurements that support the I/Q inputs.

The **Trigger** tab contains the following Trigger Source dependent controls when I/Q Mag Trigger is selected:

– "Prot Frame Aligned" on page 2483

– "Trigger Delay" on page 2485

– "Trigger Slope" on page 2489

Additional controls are also present that are not dependent on the selected Trigger Source.

Example	`:TRIG:<meas>:SOUR IQM`
Annunciation	I/Q Mag (in the Meas Bar)

8.1.1.11 Input I

When **Input I** is selected, the condition is met when the voltage at the I Input crosses the trigger level.

This trigger type is only valid for measurements that support the I/Q inputs.

The **Trigger** tab contains the following Trigger Source dependent controls when Input I Trigger is selected:

– "Prot Frame Aligned" on page 2483

– "Trigger Delay" on page 2485

– "Trigger Slope" on page 2489

Additional controls are also present that are not dependent on the selected Trigger Source.

Example	`:TRIG:<meas>:SOUR IINP`
Annunciation	Input I (in the Meas Bar)

8.1.1.12 Input Q

When **Input Q** is selected, the condition is met when the voltage at the I Input crosses the trigger level.

This trigger type is only valid for measurements that support the I/Q inputs.

The **Trigger** tab contains the following Trigger Source dependent controls when Input Q Trigger is selected:

– "Prot Frame Aligned" on page 2483

– "Trigger Delay" on page 2485

– "Trigger Slope" on page 2489

Additional controls are also present that are not dependent on the selected Trigger Source.

Example	`:TRIG:<meas>:SOUR QINP`
Annunciation	Input Q (in the Meas Bar)

8.1.1.13 I (Demodulated)

When **I (Demodulated)** is selected, the trigger condition is met when the I voltage crosses the I voltage trigger level.

This trigger type is only valid for measurements that support the I/Q inputs.

The **Trigger** tab contains the following Trigger Source dependent controls when I (Demodulated) Trigger is selected:

– "Prot Frame Aligned" on page 2483
– "Trigger Delay" on page 2485
– "Trigger Slope" on page 2489

Additional controls are also present that are not dependent on the selected Trigger Source.

Example	`:TRIG:<meas>:SOUR IDEM`
Annunciation	I (Demod) (in the Meas Bar)

8.1.1.14 Q (Demodulated)

When **Q (Demodulated)** is selected, the trigger condition is met when the Q voltage crosses the Q voltage trigger level.

This trigger type is only valid for measurements that support the I/Q inputs.

The **Trigger** tab contains the following Trigger Source dependent controls when Q (Demodulated) Trigger is selected:

– "Prot Frame Aligned" on page 2483
– "Trigger Delay" on page 2485
– "Trigger Slope" on page 2489

Additional controls are also present that are not dependent on the selected Trigger Source.

Example	`:TRIG:<meas>:SOUR QDEM`
Annunciation	Q (Demod) (in the Meas Bar)

8.1.1.15 Aux I/Q Mag

When **Aux I/Q Mag** is selected, the trigger condition is met when the auxiliary receiver's I/Q magnitude output crosses the Auxiliary I/Q magnitude trigger level.

This trigger type is only valid for measurements that support the I/Q inputs.

The **Trigger** tab contains the following Trigger Source dependent controls when Aux I/Q Mag Trigger is selected:

– "Prot Frame Aligned" on page 2483
– "Trigger Delay" on page 2485

– "Trigger Slope" on page 2489

– "Trigger Center Frequency" on page 2498

– "Trigger BW" on page 2498

Additional controls are also present that are not dependent on the selected Trigger Source.

Example	`:TRIG:<meas>:SOUR AIQM`
Annunciation	Aux I/Q Mag (in the Meas Bar)

8.1.1.16 PXI

When **PXI** is selected, a new sweep/measurement will start when detecting the signal from the PXI backplane trigger line.

This trigger type is only found in the modular instrument products.

The **Trigger** tab contains the following Trigger Source dependent controls when PXI Trigger is selected:

– "Select PXI Line" on page 2500

– "Trigger Delay" on page 2485

– "Trigger Slope" on page 2489

Additional controls are also present that are not dependent on the selected Trigger Source.

Example	Swept SA measurement:
	`:TRIG:SOUR PXI`
	Measurements other than Swept SA:
	`:TRIG:<meas>:SOUR PXI`

Annunciation	PXI (in the Meas Bar)

8.1.1.17 Internal

When **Internal** is selected, the trigger condition is met when detecting the signal from the internal RF Source module.

This trigger type is only found in the modular instrument products.

The **Trigger** tab contains the following Trigger Source dependent controls when Aux I/Q Mag Trigger is selected:

– "Prot Frame Aligned" on page 2483

– "Trigger Delay" on page 2485

– "Trigger Slope" on page 2489

Additional controls are also present that are not dependent on the selected Trigger Source.

For an Internal trigger to occur, there must be a trigger output from the internal RF source. This means that you must configure the Source Trigger Output before selecting Internal as the Trigger Source. To enable the Source Trigger Output, output trigger should not be off if internal source works as list sequence mode and Trig 2 Out should not be off if internal source works as MXG mode. Otherwise, no trigger occurs and measurement does not start.

Example	Swept SA measurement:
	`:TRIG:SOUR INTernal`
	Measurements other than Swept SA:
	`:TRIG:<meas>:SOUR INTernal`

Annunciation	Internal (in the Meas Bar)

8.1.1.18 Prot Channel Detection

Selects a protocol channel detection Base Station Emulation as the trigger. When Prot Channel Detection is selected, a new sweep/measurement will start when the protocol channel detection trigger condition is met.

Protocol Channel Detection Trigger is defined as the Base Station Emulation protocol channel detection event of PUSCH, PUCCH, PRACH or SRS. With this trigger, the IQ data, and therefore the measurement, is aligned at the beginning of the LTE sub-frame where the particular event was detected. Channel transmission is aligned to the sub-frame boundary; therefore, the measurement is aligned with its transmission with the exception of SRS, which might not start at the beginning of the sub-frame containing the SRS as it might have an offset from the start of the sub-frame base on the SRS configuration, In this case, the trigger and measurement are aligned to the beginning of the sub-frame containing SRS as defined by this trigger type (which is not the beginning of the SRS itself due to the offset).

This trigger type is only available in UXM.

Example	`:TRIG:<meas>:SOUR PRTC`
Annunciation	Prot Chan Det (in the Meas Bar)

8.1.1.19 Prot Frame Aligned

Selects a protocol frame aligned Base Station Emulation as the trigger. When Prot Frame Aligned is selected, a new sweep/measurement will start when the protocol frame aligned data trigger condition is met.

Prot Frame Aligned Trigger is aligned with the Base Station Emulation Protocol uplink frame timing boundary. It depends on the technology format of the base station call processing.

This trigger type is only available in UXM.

Example	`:TRIG:<meas>:SOUR PRTF`
Annunciation	Prot Frame (in the Meas Bar)

8.1.1.20 Prot Event

Selects a protocol frame aligned Base Station Emulation as the trigger. When Prot Frame Aligned is selected, a new sweep/measurement will start when the protocol frame aligned data trigger condition is met.

Prot Event Trigger is defined as the Base Station Emulation protocol internal event such as the starting of a predefined uplink pattern for a relative power control ramp. With this trigger, the IQ data, and therefore the measurement, is aligned with the start of the desired uplink pattern.

This trigger type is only available in UXM.

Example	`:TRIG:<meas>:SOUR PRTF`
Annunciation	Prot Frame (in the Meas Bar)

8.1.2 Trigger Level

Sets the amplitude level for Trigger and Gate sources that use level triggering. When the video signal crosses this level, with the chosen slope, the trigger occurs.

For any given Trigger, Gate, or Periodic Sync Src, the same Trigger Level is used for the Trigger source in the Trigger menu, for the Gate source in the Gate Source menu, and for the Periodic Sync source in the Periodic Sync Src menu.

If Video is the selected trigger source, the trigger level displays as a green horizontal line with the label TRIG LVL just above it on the right:

If the value of trigger level is off screen low this line displays along the bottom of the graticule. If the value of trigger level is off screen high this line displays above the graticule but no farther above than 1.5 % of the graticule height (the same as the trace itself). Note that the TRIG LVL label cannot display above the graticule so the label itself stops at the top of the graticule.

For the I/Q Triggers, the I/Q reference impedance is used for converting between power and voltage.

Trigger Level Parameters

Source	Example	Min	Max	Preset	Resolution	Step Key Incr.	Knob Incr.
Video	`TRIG:VID:LEV -40 dBm`	-170 dBm	+30 dBm	-25 dBm	.01 dB	Scale/Div (Log), 1 dB (Lin)	Step/10, but never < 0.1 dB
Level	`TRIG:LEV:LEV -40 dBm`	-170 dBm	+30 dBm	-25 dBm	.01 dB	Scale/Div (Log), 1 dB (Lin)	Step/10, but never < 0.1 dB
External 1|2	`TRIG:EXT1:LEV 0.4 V`	-5 V VXT models M9410A/11A: 0 V	5 V VXT models M9410A/11A: 2.5 V	1.2 V	10 mV	0.5 V	0.1 V
I/Q Mag	`TRIG:IQM:LEV -30 dBm`	-200 dBm	100 dBm	-25 dBm	.1 dB	Scale/Div (Log), 1 dB (Lin)	Step/10, but never < 0.1 dB
I (Demod)	`TRIG:IDEM:LEV 0.5 V`	-1 V	1 V	0.25 V	4 significant digits	Scale/Div	Step/100, but never < 1 µV
Q (Demod)	`TRIG:QDEM:LEV 0.5 V`	-1 V	1 V	0.25 V	4 significant digits	Scale/Div	Step/100, but never < 1 µV
Input I	`TRIG:IINP:LEV 0.5 V`	-1 V	1 V	0.25 V	4 significant digits	Scale/Div	Step/100, but never < 1 µV
Input Q	`TRIG:QINP:LEV 0.5 V`	-1 V	1 V	0.25 V	4 significant digits	Scale/Div	Step/100, but never < 1 µV
Aux Chan I/Q Mag	`TRIG:AIQM:LEV -30 dBm`	-200 dBm	100 dBm	-25 dBm	.1 dB	Scale/Div (Log), 1 dB (Lin)	Step/10, but never < 0.1 dB
Internal	`TRIG:INT:LEV 1.2 V`	-5 V VXT models M9410A/11A: 0 V	5 V VXT models M9410A/11A: 2.5 V	1.2 V	10 mV	.5 V	.1 V

More Information

For Video Trigger Level, when sweep type = FFT, the video trigger uses the amplitude envelope in a bandwidth wider than the FFT width as a trigger source. This can be useful, but does not have the same relationship between the displayed trace and the trigger level as in swept triggering.

For Video Trigger Level the settable resolution of the function is 0.01 dB, even when the Y Axis Unit is linear. In Linear Y Axis Unit (for example, Volts) this requires 4 significant digits to display on the control.

For the Level trigger source, used in RTSA and other measurements, External Gain and Ref Level Offset modify the actual trace data as it is taken and are taken into account by Trig Level.

Remote Command	`:TRIGger[:SEQuence]:<trig_source>:LEVel <ampl>`
	`:TRIGger[:SEQuence]:<trig_source>:LEVel?`
	where `<trig_source>` is one of:
	`EXTernal1 | EXTernal2 | VIDeo | LEVel | IQMag | IDEMod | QDEMod | IINPut | QINPut | AIQMag | INTernal`

Example	`:TRIG:VID:LEV -40 dBm`
Dependencies	Only appears when Video, External 1|2, or an I/Q trigger is selected as the Trigger Source
State Saved	Saved in instrument state

Backwards Compatibility SCPI	`:TRIGger[:SEQuence]:IF:LEVel`
	taken as video trigger level
	`:TRIGger[:SEQuence]:IF:LEVel?`
	taken as video trigger level query
	`:TRIGger[:SEQuence]:EXTernal:LEVel`
	the parameter EXTernal is mapped to EXTernal1
	`:TRIGger[:SEQuence]:FRAMe:EXTernal1:LEVel`

8.1.3 Trigger Delay

Controls a time delay that the instrument will wait to begin a sweep after meeting the trigger criteria, for Trigger and Gate sources that support Trigger Delay.

For any given Trigger, Gate, or Periodic Sync source, the same Trigger Delay is used for the Trigger source in the Trigger menu, for the Gate source in the Gate Source menu, and for the Periodic Sync source in the Periodic Sync Src menu.

Negative trigger delays can be used. Negative trigger delay makes intuitive sense in time domain and works well in FFT mode where the bandwidth of the filter before the video trigger is about 1.25 span. You can use negative delay to pre-trigger the instrument in the time domain or FFT, but not in swept spans. Video trigger delay may be set to negative values, in time domain, FFT and even swept, but in swept spans, negative settings of Trig Delay are treated as a zero setting within the internal hardware and the advisory message "Neg. Trig Delay unavailable in Swept Mode, zero delay used." is generated when such a delay is set.

Remote Command	`:TRIGger[:SEQuence]:<trig_source>:DELay <time>`
	`:TRIGger[:SEQuence]:<trig_source>:DELay?`
	where `<trig_source>` is one of:
	`LINE | EXTernal1 | EXTernal2 | AEXTernal | VIDeo | RFBurst | FRAMe | LEVel | FMT | IQMag | IDEMod | QDEMod | IINPut | QINPut | AIQMag | PXI | INTernal`
	`:TRIGger[:SEQuence]:<trig_source>:DELay:STATe OFF | ON | 0 | 1`
	`:TRIGger[:SEQuence]:<trig_source>:DELay:STATe?`

	where <trig_source> is one of: `LINE | EXTernal1 | EXTernal2 | VIDeo | LEVel | FMT | RFBurst | FRAMe | IQMag | IDEMod | QDEMod | IINPut | QINPut | AIQMag`
Example	`:TRIG:VID:DEL:STAT ON` `:TRIG:VID:DEL 100 ms`
Dependencies	Only appears when Video, Line, External 1|2, RF Burst, Periodic Timer or an I/Q trigger is selected as the Trigger Source
Couplings	When FMT Trigger Criteria is `INSIDE` or `OUTSIDE`, FMT Trigger Delay State is forced to `OFF` FMT Trigger Delay MaxValue is dependent on the current AcquisitionTime. The equation is: MaxValue = 2^16 x AcqTime, but never to exceed 70 sec. Ex: In PVT View with a min PVT Acq Time of 200 us, this Trigger Delay MaxValue is 13.26 sec. In RT Spectrum and Spectrogram with a min Acq Time of 100 us, this Trigger Delay MaxValue is 6.55 sec. When the Acq Time is increased, this MaxValue also increases
Preset	`OFF`
State Saved	Saved in instrument state
Annotation	Trig Delay (in the Measurement Bar)

Backwards Compatibility Notes	For backward compatibility with VSA/PSA comms apps
	`:TRIGger[:SEQuence]:IF:DELay`
	`:TRIGger[:SEQuence]:DELay`
	The legacy `:TRIGger[:SEQuence]:DELay` command affects the delay for the VID, LINE, EXT1, EXT2, and RFB triggers

Example	`:TRIG:DEL 1 ms`
Preset	1 us
State Saved	Saved in instrument state

Backwards Compatibility SCPI	`:TRIGger[:SEQuence]:DELay <time>`
	`:TRIGger[:SEQuence]:DELay?`
	`:TRIGger[:SEQuence]:DELay:STATe OFF | ON | 0 | 1`
	`:TRIGger[:SEQuence]:DELay:STATe?`

Remote Command	`:TRIGger[:SEQuence]:OFFSet:STATe OFF | ON | 0 | 1` `:TRIGger[:SEQuence]:OFFSet:STATe?`
Example	`:TRIG:OFFS ON` `:TRIG:OFFS -100 ms`
Notes	These are ESA commands for trigger offset that allowed you to use a positive or negative delay when in zero span and in a Res BW >= 1 kHz. For ESA compatibility, X-series instruments keep track of this offset and adds it to the Trigger Delay for VIDeo, LINE, EXTernal1 or EXTernal2 whenever the value is sent to the hardware, if in Zero Span and RBW >= 1 kHz

Preset	Off, 0 s `OFF`
State Saved	Saved in instrument state
Min	-11 s
Max	+11 s
Backwards Compatibility SCPI	`:TRIGger[:SEQuence]:OFFSet <time>` `:TRIGger[:SEQuence]:OFFSet?`

Trigger Delay Parameters

Note: in Swept SA, when transitioning from Zero Span to Swept spans, the trigger delay is clipped to -150 ms if it had been longer in Zero Span.

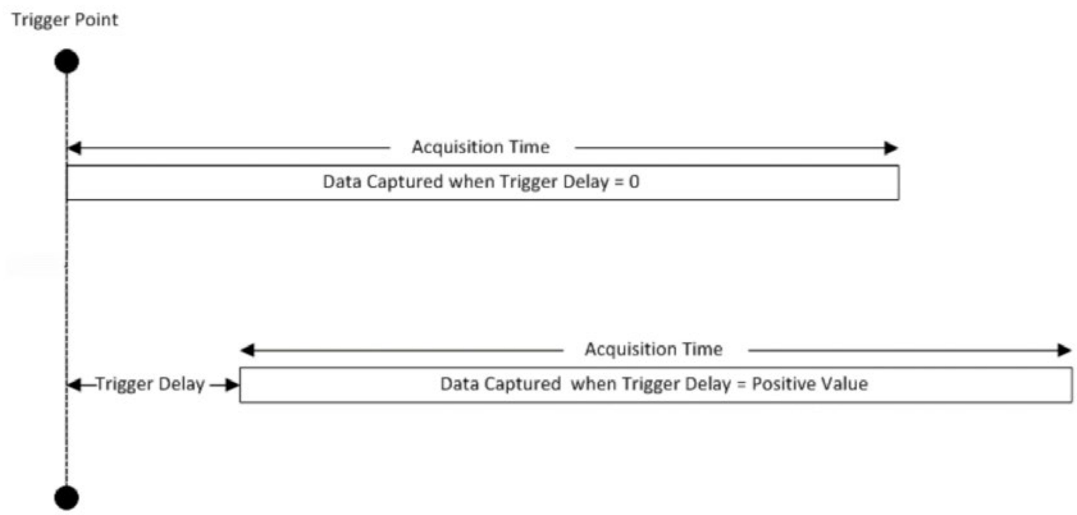
Source	Example	Preset	Min	Max	Resolution
Video	`TRIG:VID:DEL:STAT ON` `TRIG:VID:DEL 100 ms`	Off, 1 us	-150 ms (-10s in Swept SA Zero Span)	+500 ms	100 ns
Level	`TRIG:LEV:DEL:STAT ON` `TRIG:LEV:DEL 100 ms`	Off, 30 ms	0 ms	70 sec (but dependent on Acq Time like FMT)	Multiple of Acq Time (as is FMT)
FMT	`TRIG:FMT:DEL:STAT ON` `TRIG:FMT:DEL 100 ms`	Off, 30 ms	0 ms	70 sec (but dependent on Acq Time like FMT)	Multiple of Acq Time (as is FMT)
External 1|2	`TRIG:EXT1:DEL:STAT ON` `TRIG:EXT2:DEL 100 ms`	Off, 1 us	-150 ms (-10s in Swept SA Zero Span)	+500 ms	100 ns
Line	`TRIG:LINE:DEL:STAT ON` `TRIG:LINE:DEL 100 ms`	Off, 1 us	-150 ms (-10s in Swept SA Zero Span)	+500 ms	100 ns
RF Burst	`TRIG:RFB:DEL:STAT ON` `TRIG:RFB:DEL 100 ms`	Off, 1 us	-150 ms (-10s in Swept SA Zero Span)	+500 ms	100 ns
Periodic Timer	`TRIG:FRAM:DEL:STAT ON` `TRIG:FRAM:DEL 100`	Off, 1 us	-150 ms (-10s in Swept	+500 ms	100 ns

Source	Example	Preset	Min	Max	Resolution
	ms		SA Zero Span)		
I/Q Mag	TRIG:IQM:DEL:STAT ON TRIG:IQM:DEL 10 ms	Off, 1 us	-2.5 s	+10 s	10 ns
I (Demod)	TRIG:IDEM:DEL:STAT ON TRIG:IDEM:DEL 10 ms	Off, 1 us	-2.5 s	+10 s	10 ns
Q (Demod)	TRIG:QDEM:DEL:STAT ON TRIG:QDEM:DEL 10 ms	Off, 1 us	-2.5 s	+10 s	10 ns
Input I	TRIG:IINP:DEL:STAT ON TRIG:IINP:DEL 10 ms	Off, 1 us	-2.5 s	+10 s	10 ns
Input Q	TRIG:QINP:DEL:STAT ON TRIG:QINP:DEL 10 ms	Off, 1 us	-2.5 s	+10 s	10 ns
Aux Chan I/Q Mag	TRIG:AIQM:DEL:STAT ON TRIG:AIQM:DEL 10 ms	Off, 1 us	-2.5 s	+10 s	10 ns
PXI	TRIG:PXI:DEL:STAT ON TRIG:PXI:DEL 10 ms	Off, 1 us	-150 ms	+500 ms	100 ns
Internal	TRIG:INT:DEL:STAT ON TRIG:INT:DEL 10 ms	Off, 1 us	-150 ms	+500 ms	100 ns
Prot Channel Detection	TRIG:PRTC:DEL:STAT ON TRIG:PRTC:DEL 1 ms	Off, 1 ms	-10 ms	+10 ms	100 ns
Prot Frame Aligned	TRIG:PRTF:DEL:STAT ON TRIG:PRTF:DEL 1 ms	Off, 1 ms	-10 ms	+10 ms	100 ns
Prot Event	TRIG:PRTE:DEL:STAT ON TRIG:PRTE:DEL 1 ms	Off, 1 ms	-10 ms	+10 ms	100 ns

Note: in Bluetooth Mode, the preset value of Trigger Delay is always (On, -20us).

More Information

Here is the diagram for Frequency Mask Trigger (FMT) Trigger Delay:



8.1.4 Trigger Slope

Sets the trigger polarity for Trigger and Gate sources that support Trigger Slope. It is set positive to trigger on a rising edge and negative to trigger on a falling edge.

For any given Trigger, Gate, or Periodic Sync source, the same Trigger Slope is used for the Trigger source in the Trigger menu, for the Gate source in the Gate Source menu, and for the Periodic Sync source in the Periodic Sync Src menu.

Remote Command	`:TRIGger[:SEQuence]:<trig_source>:SLOPe POSitive | NEGative`
	`:TRIGger[:SEQuence]:<trig_source>:SLOPe?`
	where `<trig_source>` is one of:
	`LINE | EXTernal1 | EXTernal2 | AEXTernal | VIDeo | RFBurst | IQMag | IDEMod | QDEMod | IINPut | QINPut | AIQMag | PXI | INTernal`

Example	`:TRIG:VID:SLOP NEG`
	`:TRIG:VID:SLOP?`
	`:TRIG:EXT1: SLOP NEG`

Dependencies	Only appears when Video, Line, External 1|2, RF Burst or an I/Q trigger is selected as the Trigger Source
Preset	`POSitive`
State Saved	Saved in instrument state
Backwards	`:TRIGger[:SEQuence]:IF:SLOPe NEGative | POSitive`

Compatibility SCPI	`:TRIGger[:SEQuence]:IF:SLOPe?`
	For backward compatibility with VSA/PSA comms apps
	`:TRIGger[:SEQuence]:EXTernal:SLOPe`
	For backward compatibility, the parameter `EXTernal` is mapped to `EXTernal1`
	`:TRIGger[:SEQuence]:FRAMe:EXTernal1:SLOPe`
	`:TRIGger[:SEQuence]:FRAMe:EXTernal2:SLOPe`

Example	`:TRIG:SLOP NEG`
Preset	`POSitive`
State Saved	Saved in instrument state
Backwards Compatibility SCPI	`:TRIGger[:SEQuence]:SLOPe POSitive | NEGative` `:TRIGger[:SEQuence]:SLOPe?`

Note: when transitioning from Zero Span to Swept spans, the trigger delay is clipped to -150 ms if it had been longer in Zero Span.

8.1.5 Trigger Level Absolute/Relative

Selects either Absolute or Relative Burst Triggering.

Remote Command	`:TRIGger[:SEQuence]:RFBurst:LEVel:TYPE ABSolute | RELative` `:TRIGger[:SEQuence]:RFBurst:LEVel:TYPE?`
Example	`:TRIG:RFB:LEV:TYPE REL` sets the trigger level type of the RF burst trigger to Relative
Dependencies	Only appears when RF Burst is selected as the Trigger Source
Preset	`ABSolute`
State Saved	Saved in instrument state

8.1.6 Absolute Trigger Level

Sets the absolute trigger level for the RF burst envelope.

NOTE: When using the External Mixing path, the Absolute Trigger Level is uncalibrated because the factory default was set to accommodate the expected IF levels for the RF path.

Remote Command	`:TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute <ampl>` `:TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute?`

Example	`:TRIG:RFB:LEV:ABS 10 dBm` sets the trigger level of the RF burst envelope signal to the absolute level of 10 dBm
Notes	Sending this command does not switch the setting from relative to absolute; to switch it you need to send `:TRIGger[:SEQuence]:RFBurst:LEVel:TYPE` For Bluetooth Mode, the default value is -50 dBm
Dependencies	Only appears when RF Burst is selected as the Trigger, Gate or Periodic Sync Source
Couplings	This same level is used for the RF Burst trigger source in the Trigger menu, for the RF Burst selection in the Gate Source menu, and also for the RF Burst selection in the Periodic Sync Src menu
Preset	LTEA FDD/TDD modes: -40 dBm or -50 dBm depending on the hardware 5G NR mode: -40 dBm All other modes: -20 dBm
State Saved	Saved in instrument state
Min	-200 dBm
Max	100 dBm
Backwards Compatibility SCPI	`:TRIGger[:SEQuence]:FRAMe:RFBurst:LEVel:ABSolute`

8.1.7 Relative Trigger Level

Sets the relative trigger level for the RF burst envelope.

In some models, the relative burst trigger function is implemented in hardware. In other models, without the advanced triggering hardware required, the relative burst trigger function is implemented in software in some measurements, and is unavailable in other measurements.

When implemented in software, the relative RF Burst trigger function is implemented as follows:

1. The measurement starts with the absolute RF Burst trigger setting. If it cannot get a trigger with that level, auto trigger fires and the acquisition starts anyway. After the acquisition, the measurement searches for the peak in the acquired waveform and saves it

2. In the next cycle of the measurement, the measurement determines a new absolute RF Burst level based on the peak value from the first measurement and the Relative RF Burst Trigger Level (always 0 or negative dB) set by the user. The following formula is used: absolute RF Burst level = peak level of the previous acquisition + relative RF Burst level

3. If the new absolute RF Burst level differs from the previous by more than 0.5 dB, the new level is sent to the hardware; otherwise it is not updated (to avoid slowing down the acquisition)

Steps 2 and 3 repeat for subsequent measurements.

Remote Command	`:TRIGger[:SEQuence]:RFBurst:LEVel:RELative <rel_ampl>` `:TRIGger[:SEQuence]:RFBurst:LEVel:RELative?`
Example	`:TRIG:RFB:LEV:REL -10 dB` sets the trigger level of the RF burst envelope signal to the relative level of -10 dB
Notes	Sending this command does not switch the setting from absolute to relative; to switch it you need to send `:TRIGger[:SEQuence]:RFBurst:LEVel:TYPE` The relative trigger level is not available in some measurements. In those measurements the `RELative` parameter, and `:TRIGger[:SEQuence]:RFBurst:LEVel:TYPE` generates an error if sent
Dependencies	This control is grayed-out and Absolute Trigger Level selected if the required hardware is not present in your instrument and the current measurement does not support Relative triggering Only appears when RF Burst is selected as the Trigger Source
Preset	-6 dB GSM: -25 dB
State Saved	Saved in instrument state
Min	-45 dB
Max	0 dB
Backwards Compatibility SCPI	`:TRIGger[:SEQuence]:RFBurst:LEVel` This legacy command is aliased to `:TRIGger[:SEQuence]:RFBurst:LEVel:RELative` because the PSA had *only* relative burst triggering

In some models, a variety of burst trigger circuitry is available, resulting in various available burst trigger bandwidths. The instrument automatically chooses the appropriate trigger path based on the hardware configuration and other settings of the instrument. Here is the RF Burst Trigger Bandwidth table for Swept SA Measurement in SA mode:

Model	Option	Span	Swp Type	FFT Width	Trigger BW, –10 dB	Notes
EXA	any	All	all	all	16 MHz	
MXA	w/o B25	All	all	all	16 MHz	
MXA	B25	Zero	N/A	N/A	16 MHz	
MXA	B25	All	Swept	N/A	16 MHz	
MXA	B25	<8 MHz	FFT	all	16 MHz	
MXA	B25	≥8 MHz	FFT	25 MHz	30 MHz	
PXA	any	all	all	all	>80 MHz	Exceptions(*)

(*) Exceptions: When the RF Burst Trigger Level Type is Absolute, the start frequency is below 300 MHz, and the sweep type is either Swept or FFT with an FFT width of less than 25 MHz, then the RF Burst Trigger Bandwidth is not >80 MHz. It would be 16 MHz except in the subcase of Sweep Type = FFT and FFT Width between 8 and 25 MHz inclusive, where it would be 30 MHz.

8.1.8 Period

Sets the period of the internal periodic timer clock. For digital communications signals, this is usually set to the frame period of your current input signal. In the case that sync source is not set to OFF, and the external sync source rate is changed for some reason, the periodic timer is synchronized at the every external synchronization pulse by resetting the internal state of the timer circuit.

Remote Command	`:TRIGger[:SEQuence]:FRAMe:PERiod <time>` `:TRIGger[:SEQuence]:FRAMe:PERiod?`
Example	`:TRIG:FRAM:PER 100 ms`
Dependencies	The invalid data indicator turns on when the period is changed, until the next sweep/measurement completes Only appears when Periodic Timer is selected as the Trigger or Gate Source
Couplings	The same period is used in the Gate Source selection of the period timer
Preset	20 ms unless noted below: GSM: 4.615383 ms 5G NR: 10 ms
State Saved	Saved in instrument state
Min	100.000 ns
Max	559.0000 ms

8.1.9 Offset

Adjusts the accumulated offset between the periodic timer events and the trigger event. Adjusting the accumulated offset is different than setting an offset, and requires explanation.

The periodic timer is usually not synchronized with any external events, so the timing of its output events has no absolute meaning. Since the timing relative to external events (RF signals) is important, you need to be able to adjust (offset) it. However, you have no direct way to see when the periodic timer events occur. All that you can see is the trigger timing. When you want to adjust the trigger timing, you will be changing the internal offset between the periodic timer events and the trigger event. Because the absolute value of that internal offset is unknown, we will just call that the accumulated offset. Whenever the Offset parameter is changed, you are changing that accumulated offset. You can reset the displayed offset using Reset Offset Display. Changing the display does not change the value of the accumulated offset, and you can still make additional changes to accumulated offset.

To avoid ambiguity, we define that an increase in the "offset" parameter, either from the knob or the SCPI adjust command, serves to delay the timing of the trigger event.

Remote Command	`:TRIGger[:SEQuence]:FRAMe:OFFSet <time>`

	:TRIGger[:SEQuence]:FRAMe:OFFSet?
Example	:TRIG:FRAM:OFFS 1.2 ms
Notes	The front panel interface (for example, the knob), and this command, adjust the accumulated offset, which is shown on the control However, the actual amount sent to the hardware each time the offset is updated is the delta value, that is, the current accumulated offset value minus the previous accumulated offset value. Note that the accumulated offset value is essentially arbitrary; it represents the accumulated offset from the last time the offset was zeroed (with the Reset Offset Display key) Note that this command does not change the period of the trigger waveform. Note also that Offset is used only when the sync source is set to OFF, otherwise delay is used, see "Trigger Delay" on page 2485 An increase in the "offset" parameter, either from the knob or the SCPI adjust command, serves to delay the timing of the trigger event When the SCPI command is sent the value shown on the control is updated with the new value. However, the actual amount sent to the hardware is the delta value, that is, the current accumulated offset value minus the previous accumulated offset value The SCPI query simply returns the value currently showing on the key
Dependencies	The invalid data indicator turns on when the offset is changed, until the next sweep/measurement completes Only appears when Periodic Timer is selected as the Trigger or Gate Source
Couplings	The same offset is used in the Gate Source selection of the period timer
Preset	0 s
State Saved	Saved in instrument state
Min	-10.000 s
Max	10.000 s

8.1.10 Reset Offset Display

Resets the value of the periodic trigger offset display setting to 0.0 seconds. The current displayed trigger location may include an offset value defined with the **Offset** key. Pressing this control redefines the currently displayed trigger location as the new trigger point that is 0.0 s offset. The **Offset** control can then be used to add offset relative to this new timing.

Remote Command	:TRIGger[:SEQuence]:FRAMe:OFFSet:DISPlay:RESet
Example	:TRIG:FRAM:OFFS:DISP:RES
Dependencies	Only appears when Periodic Timer is selected as the Trigger or Gate Source

8.1.11 Offset Adjust (Remote Command Only)

Lets you advance the phase of the frame trigger by the amount you specify. It does *not* work in the same way as the related front panel keys.

The command does not change the period of the trigger waveform. If the command is sent multiple times, it advances the phase of the frame trigger an additional amount each time it is sent. Negative numbers are permitted.

Remote Command	`:TRIGger[:SEQuence]:FRAMe:ADJust <time>`
Example	`:TRIG:FRAM:ADJ 1.2 ms`
Notes	Note also that Offset is used only when the sync source is set to OFF, otherwise delay is used, see section "Trigger Delay" on page 2485 An increase in the "offset" parameter, either from the knob or the SCPI adjust command, serves to delay the timing of the trigger event The front panel interface (for example, the knob) and the `:TRIG:FRAM:OFFS` command adjust the accumulated offset, which is shown on the active function display. However, the actual amount sent to the hardware is the delta value, that is, the current offset value minus the previous offset value When the SCPI command is sent the value shown on the control (and the Active Function, if this happens to be the active function) is updated by increasing it (or decreasing it if the value sent is negative) by the amount specified in the SCPI command This is no query for this command
Dependencies	The invalid data indicator turns on when the offset is changed, until the next sweep/measurement completes
Couplings	The same offset is used in the Gate Source selection of the period timer
Preset	0 s
State Saved	Saved in instrument state
Min	-10.000 s
Max	10.000 s

8.1.12 Sync Source

For convenience, you can select the Periodic Timer Sync Source using this dropdown. You can also select it from the Periodic Sync Src tab, which also contains controls that let you configure the Sync Source.

Selects a signal source for you to synchronize your periodic timer trigger to, otherwise you might be triggering at some arbitrary location in the frame. Synchronization reduces the precision requirements on the setting of the period.

Example	`:TRIG:FRAM:SYNC EXT1`
	`:TRIG:FRAM:SYNC EXT2`
	`:TRIG:FRAM:SYNC RFB`
	`:TRIG:FRAM:SYNC OFF`

Dependencies	Only appears when Periodic Timer is selected as the Trigger or Gate Source
Preset	`OFF`
State Saved	Saved in instrument state

8.1.13 TV Line

Selects the **TV Line** number on which to trigger. Line number range is dependent on the settings of the **S**tandard and "Field" on page 2496menus within the TV trigger setup functions. When the line number is incremented beyond the upper limit, the value will change to the lower limit and continue incrementing from there. When the line number is decremented below the lower limit, the value will change to the upper limit and continue decrementing from there.

Remote Command	`:TRIGger[:SEQuence]:TV:LINE <integer>` `:TRIGger[:SEQuence]:TV:LINE?`
Example	`:TRIG:TV:LINE 20` `:TRIG:TV:LINE?`
Dependencies	Only available in the Swept SA measurement Only appears when TV is selected as the Trigger Source
Preset	17
State Saved	Saved in instrument state
Min	1 The minimum value is the minimum line, and rolls over to the maximum value. The minimum line number depends on which Field and standard are selected
Max	The maximum value is the maximum line, and rolls over to the minimum value. The maximum line number depends on which Field and standard are selected Field 1 (ODD): – Maximum line is 263 for formats NTSC-M, NTSC-Japan, NTSC-4.43, PAL-M and PAL-60 – Maximum line is 313 for formats PAL-B, D, G, H, I, PAL-N, PAL-N Combin, and SECAM-L Field 2 (EVEN): – The maximum line 262 for formats NTSC-M, NTSC-Japan, NTSC-4.43, PAL-M and PAL-60 – The maximum line is 312 for formats PAL-B, D, G, H, I, PAL-N, PAL-N Combin, and SECAM-L Field = Entire Frame: – 525, for formats NTSC-M, NTSC-Japan, NTSC-4.43, PAL-M and PAL-60 625, for formats PAL-B, D, G, H, I, PAL-N, PAL-N Combin, and SECAM-L

8.1.14 Field

Selects the **Field** on which to trigger:

Entire Frame	`ENTire`	Causes the selected line number to be viewed as an offset into the entire frame starting with line 1, the first line in Field One

Field One	ODD	Causes the selected line number to be viewed as an offset into the first field starting with Line 1, the first line in Field One
Field Two	EVEN	Causes the selected line number to be viewed as an offset into the second field. If Line 1 is selected, it is the 264th line of the frame (NTSC-M, NTSC-Japan, NTSC-4.43, PAL-M, PAL-60) or the 314th line of the frame (PAL-B,D,G,H,I, PAL-N, PAL-N-Combin, SECAM-L)

Remote Command	`:TRIGger[:SEQuence]:TV:FMODe ENTire | ODD | EVEN` `:TRIGger[:SEQuence]:TV:FMODe?`

Example	`:TRIG:TV:FMOD ENT`
	`:TRIG:TV:FMOD EVEN`
	`:TRIG:TV:FMOD ODD`

Dependencies	Only available in the Swept SA measurement Only appears when TV is selected as the Trigger Source This command is available only when Option B7B (TV trigger) is installed
Preset	`ENTire`
Range	`ENTire|ODD|EVEN`

8.1.15 Standard

Accesses the **Standard** menu keys, which select from the following TV standards:

NTSC-M	MNTSc
NTSC-Japan	JNTSc
NTSC-4.43	NTSC443
PAL-M	MPAL
PAL-B,D,G,H,I	BPAL
PAL-N	NPAL
PAL-N-Combin	CPAL
PAL-60	PAL60
SECAM-L	LSEC

As the TV standard is changed, the current line value is clipped as necessary to keep it valid for the chosen standard and field mode. For example, line 600 is selected in Entire Frame mode in PAL-N; if NTSC-M is selected, the line number is clipped to 525. Or, if line 313 is selected in Field 1 mode in PAL-N and NTSC-M is selected, the line number is clipped to 263. Changing back to the PAL-N standard will leave the line number at 263.

Remote Command	`:TRIGger[:SEQuence]:TV:STANdard MNTSc | JNTSc | NTSC443 | MPAL | BPAL | NPAL | CPAL | PAL60 | LSEC`

	`:TRIGger[:SEQuence]:TV:STANdard?`

Example	Sets NTSC-M
	`:TRIG:TV:STAN MNTS`
	Queries Standard
	`:TRIG:TV:STAN?`

Dependencies	Only available in the Swept SA measurement Only appears when TV is selected as the Trigger Source
Preset	`MNTS`
State Saved	Saved in instrument state
Range	`MNTSc|JNTSc|NTSC443|MPAL|BPAL|NPAL|CPAL|PAL60|LSEC`

8.1.16 Trigger Center Frequency

Sets the center frequency to be used by the auxiliary receiver for the Auxiliary Channel I/Q Magnitude trigger.

Remote Command	`:TRIGger[:SEQuence]:AIQMag:CENTer <freq>` `:TRIGger[:SEQuence]:AIQMag:CENTer?`
Example	`:TRIG:AIQM:CENT 10 MHz`
Notes	Trigger CF + 1/2 Trigger BW < Max Trigger CF - 1/2 Trigger BW > Min
Dependencies	Only appears when Aux Channel I/Q Mag is selected as the Trigger Source
Preset	0 Hz
State Saved	Saved in instrument state
Range	-40 MHz to 40 MHz
Min	-40 MHz
Max	40 MHz

8.1.17 Trigger BW

Sets the information bandwidth used by the auxiliary receiver for the Auxiliary Channel I/Q Magnitude trigger.

Remote Command	`:TRIGger[:SEQuence]:AIQMag:BANDwidth <freq>` `:TRIGger[:SEQuence]:AIQMag:BANDwidth?`
Example	`:TRIG:AIQM:BAND 8 MHz`
Notes	The combined sample rate for the main and auxiliary receivers cannot exceed 100 MSa/sec. The bandwidth available to the Trigger BW is limited to what is available after the main receiver's bandwidth (Info BW, sometimes pre-FFT BW) is set. Because of this limitation, the Max is not always

	achievable The combination of Trigger Center Freq and Trigger BW is also limited: – Trigger CF + 1/2 Trigger BW < Max – Trigger CF - 1/2 Trigger BW > Min
Dependencies	Only appears when Aux Channel I/Q Mag is selected as the Trigger Source
Preset	Bandwidth option dependent: – No Opt: 10 MHz – Opt B25: 25 MHz – Opt S40: 40 MHz
State Saved	Saved in instrument state
Range	10 Hz to Maximum
Min	10 Hz
Max	Bandwidth option & I/Q input path dependent: – No Opt, I or Q Only: 10 MHz, I+jQ: 20 MHz – Opt B25, I or Q Only: 25 MHz, I+jQ: 50 MHz – Opt S40, I or Q Only: 40 MHz, I+jQ: 80 MHz

8.1.18 Zero Span Delay Compensation On/Off

In zero span, there is a natural delay in the signal path, which comes from the RBW filter. This is usually desirable, as it allows you to trigger on events and also see those events, because the signal is delayed from the trigger event. However, in some cases it is desirable to eliminate this delay, so that trigger events line up exactly with the zero time point in zero span. You can use the **Zero Span Delay Comp On/Off** feature to enable or disable zero span delay compensation.

Remote Command	`:TRIGger[:SEQuence]:EXTernal1|EXTernal2|RFBurst:DELay:COMPensation OFF | ON | 0 | 1` `:TRIGger[:SEQuence]:EXTernal1|EXTernal2|RFBurst:DELay:COMPensation?`

Example	`:TRIG:EXT1:DEL:COMP ON`
	`:TRIG:EXT1:DEL:COMP?`
	`:TRIG:EXT2:DEL:COMP ON`
	`:TRIG:RFB:DEL:COMP ON`

Dependencies	No effect except in zero-span, but not locked out in nonzero spans Zero Span Delay Compensation only appears in the Swept SA and List Power Step measurements. Only External and RF Burst triggers support it This control does not appear in VXT

	If the SCPI command is sent when the control is not shown, an error is returned: -221, “Settings conflict; Feature not supported for this measurement” Only appears when External 1|2 or RF Burst is selected as the Trigger, Gate or Periodic Sync Source
Preset	`OFF`
State Saved	Saved in instrument state

8.1.19 Select PXI Line

Controls which PXI_TRIG[0..7] backplane line is used for the trigger source.

This control is only found in modular analyzer products.

Remote Command	`:TRIGger[:SEQuence]:PXI:LINE <line>` `:TRIGger[:SEQuence]:PXI:LINE?`
Example	`:TRIG:PXI:LIN 2`
Preset	0
State Saved	Saved in instrument state
Range	[0,7]

8.1.20 Reset Sync Monitor

Allows you to reset the status of Synchronization for Periodic trigger

Remote Command	`:TRIGger[:SEQuence]:FRAMe:SMONitor:RESet`
Example	`:TRIG:FRAM:SMON:RES`
Notes	This control works together with status bit 10 “Periodic Trigger Synchronized” in Condition Errors – Signal Integrity Message “Periodic Trigger, Waiting for Sync Source” will be generated show after pressing this control, and the status bit will be cleared Message “Periodic Trigger Synchronized” will be generated after successfully synchronizing to Sync Source, and the status bit will be set
Dependencies	Only appears when Periodic Timer is selected as the Trigger or Gate Source
Status Bits/OPC dependencies	Bit 10 of STATus:QUEStionable:INTegrity:SIGNal will be cleared after this control is pressed

8.1.21 Trigger Optimization

Sets the trigger behavior for various desired operation conditions.

Remote Command	`:TRIGger[:SEQuence]:OPTimize:MODe NORMal | MJITter` For option details, see More Information

	:TRIGger[:SEQuence]:OPTimize:MODe?
Example	:TRIG:OPT:MOD MJIT selects trigger optimization for minimum jitter :TRIG:OPT:MOD?
Dependencies	Only appears in VXT models M9410A/11A/15A Minimum jitter is functional only when digital IF BW is lower than 300 MHz
Preset	NORMal
State Saved	Yes
Range	NORMal|MJITter

More Information

Here is information about the various Trigger optimization type:

Trigger Optimization	Example	Notes
Normal	:TRIG:OPT:MOD NORM	No optimization
Minimum Jitter	:TRIG:OPT:MOD MJIT	Optimizes trigger for minimum jitter. A software resample method is provided to reduce jitter, at the expense of some measurement speed The acquisition jitter depends on the digital IF BW, the jitter will be smaller when digital IF BW gets larger. For example, when the digital IF BW is 98.3 MHz in 5GNR, the jitter varies under 15ns. When set MJITter as trigger optimization type, the jitter will be reduced to 1ns This setting apples to all the Trigger Sources

8.1.22 Trigger Settings Diagram

Lets you configure the Trigger system using a visual utility.

First, select what you want to configure (the Trigger, Gate or Periodic Sync Source) by tapping the box for **Trigger**, **Gate** or **Periodic Sync Source**.

Next, tap any box in the gray row to choose a Trigger Source to connect to. For **Periodic Sync Source**, you can also tap **Off**.

The **Trigger Settings Diagram** changes depending on context. The Trigger Sources that are available change depending on which input you have selected.

8.2 Gate Source

Contains controls that let you select and configure Gate control signals.

This tab appears in the **Trigger** menu panel for measurements that support gating. In measurements that do not support gating, this tab does not appear.

The menus under the **Gate Source** tab are the same as those under the **Trigger** tab, with these exceptions:

A smaller set of sources is available for gating.

The Free Run and Video selections are not provided for Gate

– The Trig Delay controls are not present

– Relative RF Burst Triggering is not available, just Absolute

– There is an additional control, Sync Holdoff, under Gate Source

Any changes to the settings in the setup menus under each Gate Source selection (for example: Trigger Level, Trigger Delay, etc.) also affect the corresponding settings under the Trigger menu keys. The gate system uses the Trigger SCPI commands for the setup functions, since each setting affects both Gate and Trigger.

Example: to set the Trigger Level for External 1 Trigger you use the command `:TRIG:EXT1:LEV`; to set the Trigger Level for External 1 Gate you use the same command, `:TRIG:EXT1:LEV`. By the same token, once you set the External 1 Trigger Level to 1v, it is 1v whether External 1 is being used as a Gate Source or a Trigger Source.

If a command is sent to the `TRIG` node to set the functions that are omitted from the **Gate Source** menus (Auto Trig, Holdoff, Trig Delay), it is accepted and the values stored, but the values are not visible from the **Gate Source** menus.

8.2.1 Select Gate Source

Selects the source of the Gate signal for doing Gated Trigger measurements.

This version of the **Select Gate Source** function is used in all measurements except the Pulse measurement application.

Selecting a Gate Source is similar to selecting a Trigger Source; you select from the same sources as for Trigger Source, but the choices are limited to:

– Line

– External 1|2

– Internal

– RF Burst

– Periodic

For the selection of the gate source the SCPI node, `:TRIGger[:SEQuence]:` is replaced by `[:SENSe]:SWEep:EGATe:` as shown in the remote command below. Because you can independently set the Gate Source and the Trigger Source, there is a separate SCPI command for the Gate Source.

Remote Command	`[:SENSe]:SWEep:EGATe:SOURce EXTernal1 | EXTernal2 | LINE | FRAMe | RFBurst | TV | VIDeo | PXI | INTernal` `[:SENSe]:SWEep:EGATe:SOURce?`
Example	`:SWE:EGAT:SOUR EXT1` `:SWE:EGAT:SOUR?`
Dependencies	The available choices for VXT are: Video, Internal, External 1, External 2, RF Burst, Periodic and PXI Internal and Periodic are not available in Spectrum Analyzer Mode In VXT, Internal is only in VXT models M9410A/11A, not in models M9420/21A `PXI` is only found in VXT The available choices for EXM are Video, Internal, External 1, External 2, RF Burst, and Periodic This control is not available in E7760 In some models, there is no second External input. In these models, the External 2 selection is not shown and the `EXTernal2` parameter will generate a “Hardware missing; Not available for this model number” error
Preset	GSM/EDGE: `FRAM` MSR: `EXT1` LTEATDD, 5G NR: – Direction is Downlink: `EXT1` – Direction is Uplink: `FRAM` All Others: `EXT1`

8.2.2 Sync Holdoff

Sync Holdoff, which only applies to the Periodic Timer, specifies the duration that the sync source signal for the Periodic Timer must be kept false before the transition to true to be recognized as the sync timing. The periodic timer phase is aligned when the sync source signal becomes true, after the Holdoff time is satisfied.

A holdoff of 2 ms will work with most WiMAX signals, but there may be cases where the burst off duration is less than 1 ms and this value will need to be changed.

Remote Command	`:TRIGger[:SEQuence]:FRAMe:SYNC:HOLDoff <time>`
	`:TRIGger[:SEQuence]:FRAMe:SYNC:HOLDoff?`
	`:TRIGger[:SEQuence]:FRAMe:SYNC:HOLDoff:STATe OFF | ON | 0 | 1`

	:TRIGger[:SEQuence]:FRAMe:SYNC:HOLDoff:STATe?
Example	:TRIG:FRAM:SYNC:HOLD 5 :TRIG:FRAM:SYNC:HOLD?
Dependencies	Only appears if Periodic is the selected Gate Source Does not appear in all Measurements. For example, does not appear in Swept SA
Preset	On, 1.000 ms 5G NR: On, 250.0 us Channel Quality: Off, 4 msec ON
State Saved	Saved in instrument state
Min	0 ms
Max	+500 ms

8.3 Gate Settings

Contains controls that let you control the gating function. The Gate functionality is used to view signals best viewed by qualifying them with other events.

This tab appears in the **Trigger** menu panel for measurements that support gating. In measurements that do not support gating, this tab does not appear.

In the Swept SA measurement, the Gate controls, and all SCPI under the `[:SENSe]:SWEep:EGATe` SCPI node are unavailable when Source Mode is set to Tracking. This is because the Gate circuitry is used to sync the external source. If the Tracking Source is turned on, the Gate is turned off.

Gate setup parameters are the same for all measurements – they do not change as you change measurements. Settings like these are called "Meas Global" and are unaffected by Meas Preset.

Note that Sweep Time auto coupling rules and annotation are changed when Gate is on.

8.3.1 Gate On/Off

Turns the gate function on and off.

When the Gate Function is `ON`, the selected Gate Method is used along with the gate settings and the signal at the gate source to control the sweep and video system with the gate signal. Not all measurements allow every type of Gate Methods.

If the Gate were to be turned `ON` without a gate signal present, Marker Count operation would be unreliable, so it is locked out whenever Gate is on for measurements that support Marker Count.

Remote Command	`[:SENSe]:SWEep:EGATe[:STATe] OFF | ON | 0 | 1` `[:SENSe]:SWEep:EGATe[:STATe]?`
Example	`:SWE:EGAT ON` `:SWE:EGAT?`
Dependencies	The function is unavailable (grayed-out) and `OFF` when: – Gate Method is LO or Video and FFT Sweep Type is manually selected – Gate Method is FFT, and Swept Sweep Type is manually selected – Marker Count is `ON` The following are unavailable whenever Gate is on: – **FFT** under **Sweep Type** when Method=`LO` or Video or **Swept** under **Sweep Type** when Method=`FFT` – **Marker Count**

	While Gate is on, the Auto Rules for Sweep Type are modified so that the choice agrees with the Gate Method: i.e., FFT for Method = FFT and Swept for Method = LO or Video When in the ACP measurement: – When Meas Method is RBW or FAST, this function is unavailable and the control is grayed-out – Whenever Gate is on, Meas Method, RBW, or FAST is unavailable and keys for those are grayed-out – When Gate is on, Offset Res BW and Offset Video BW are ignored (if you set these values) and the measurement works as if all Offset Res BW and all Offset Video BW are coupled with the Res BW and the Video BW under the BW menu. When Gate is on, the Offset BW control in the Offset/Limit menu is grayed-out
Preset	LTEATDD Mode: `ON` Other modes: `OFF`
State Saved	Saved in instrument state
Range	`OFF|ON`
Annunciation	Annunciated in the Meas Bar ; if Gate is on, the word "Gate:" followed by the gate type appears, where – LO = Gated LO – Vid = Gated Video – FFT = Gated FFT
Backwards Compatibility SCPI	`[:SENSe]:SWEep:TIME:GATE[:STATe]` ESA compatibility
Backwards Compatibility Notes	In ESA, Trig Delay (On) and Gate (On) could not be active at the same time. This dependency does not exist in PSA or in the X-Series

8.3.2 Gate View On/Off

Turning on Gate View puts the instrument into Gate View. When in Gate View, the regular view of the current measurement traces and results are reduced vertically to about 70% of the regular height. The Zero Span window, showing the positions of the Gate, is shown between the Measurement Bar and the reduced measurement window. By reducing the height of the measurement window, some of the annotation on the Data Display may not fit and is not shown.

Remote Command	`[:SENSe]:SWEep:EGATe:VIEW ON | OFF | 1 | 0` `[:SENSe]:SWEep:EGATe:VIEW?`
Example	`:SWE:EGAT:VIEW ON` turns on the gate view
Dependencies	In the Swept SA measurement: In Gate View, the regular Sweep Time (or Acquisition Time) control is grayed out, to avoid confusing the user who wants to set Gate View Sweep Time. When pressed, the grayed out control puts up the

	informational message "Use Gate View Sweep Time in the Gate menu" In the other measurements: When you turn Gate View on, the lower window takes on the current state of the instrument. Upon leaving Gate View, the instrument takes on the state of the lower window When you turn Gate View on, the upper window Sweep Time (or Acquisition Time) is set to Gate View Sweep Time (or Gate View Acquisition Time)
Couplings	These couplings apply to the Swept SA measurement: – When Gate View is turned on, the instrument is set to Zero Span – Gate View automatically turns off whenever a Span other than Zero is selected – Gate View automatically turns off if you press the Swept Span toggle under Freq while in Gate View, and the instrument returns to the Span it was in before entering Gate View (even if that is Zero Span) – When Gate View is turned on, the sweep time used is the Gate View Sweep Time. This is set according to the rules in section "Gate View Sweep Time" on page 2513 – When Gate View is turned off, Sweep Time is set to the normal Swept SA measurement sweep time – If Gate View is on and Gate is off, then turning on Gate turns off Gate View
Preset	OFF
State Saved	Saved in instrument state
Range	ON|OFF
Annunciation	For Gate View to work properly, a gate signal must be present at the selected Gate Source. Therefore, in Gate View, any time more than 2 seconds passes with no gate signal, a pop-up message "Waiting for gate input" appears. This message goes away when a gate signal appears

Turning Gate View off returns the instrument to the Normal measurement view.

In Swept SA, the normal measurement view is the single-window Swept SA view. When returning to this view, the Swept SA measurement returns to the Span it was in before entering **Gate View** (even if that is Zero Span).

The **Gate View** window is triggered from the Gate Source, with zero trigger delay. Also, when updating the **Gate View** window, the Gate itself must not operate. So it is internally shut off while the gate view window is being updated. For the Swept SA measurement, this means that the Gate is internally shut off whenever the gate view window is displayed. The measurement bar and controls continue to show the Trigger source for the main sweep window and give no indication that the Gate is shut off or that the Gate View window is triggered from the Gate Source.

When in **Gate View**, vertical lines are displayed in the Gate View window as follows:

Green lines labeled GATE START and GATE STOP are displayed at the gate edges as follows: in Edge Gate, a line is shown for Delay and one for the end of the Gate period, defined by Length. In Level Gate a line is shown only for Delay. You can adjust the position of the green lines by adjusting the gate length and the gate delay or by dragging them with your finger or the mouse.. These lines update in the Gate View window as the active function changes, even if the window is not being updated. In

Gated LO and Gated Video, these lines are positioned relative to the delay reference line (not relative to 0 time). In Gated FFT, their location is relative to the left edge of the screen.

A blue line is displayed showing the delay reference, that is, the reference point for the Gate Delay within the Zero Span window. The blue line represents where (in time) the effective location of the gate start would be if the gate were programmed to zero delay.

- A second blue line is displayed at the location that represents the boundary between "compensated IF" and "compensated LO" operating modes.
- The second blue line is labeled "MIN FAST" because it represents the minimum Gate Delay for fast Gated LO operation. This line is only displayed in Gated LO. You cannot scroll (knob) or decrement (down key) the Gate Delay to less than that represented by the position of this line, it can only be set below this position manually, although once there it can be moved freely with the knob while below the line.

A yellow line in the Gated Video case only, is displayed at B_{length}, where B_{length} is the display point (bucket) length for the swept trace, which is given by the Sweep Time (or Acquisition Time) for that trace divided by number of Points - 1. So it is referenced to 0 time, not to the delay reference. This line is labeled NEXT PT (it is not shown in the figure above because the figure above is for Gated LO).

The yellow line represents the edge of a display point (bucket). Normally in Gated Video, the bucket length must be selected so that it exceeds the off time of the burst. There is another way to use the instrument in Gated Video measurements, and that is to set the bucket width much shorter than the off time of the burst. Then use the Max Hold trace function to fill in "missing" buckets more slowly. This allows you to see some of the patterns of the Gated Video results earlier, though seeing a completely filled-in spectrum later.

8.3.3 Gate Delay

Controls the length of time from the time the gate condition goes True until the gate is turned on.

Remote Command	`[:SENSe]:SWEep:EGATe:DELay <time>` `[:SENSe]:SWEep:EGATe:DELay?`
Example	`:SWE:EGAT:DELay 500ms` `:SWE:EGAT:DELay?`
Notes	Units of time are required, or no units; otherwise an invalid suffix error message is generated
Preset	WiMAX OFDMA: 71 us GSM/EDGE: 600 us WLAN: 500 us 5G NR: 5 ms

	Others: 57.7 us
State Saved	Saved in instrument state
Min	0.0 us
Max	100 s
Backwards Compatibility SCPI	`[:SENSe]:SWEep:TIME:GATE:DELay` ESA compatibility

8.3.4 Gate Length

Controls the length of time that the gate is on after it opens.

Remote Command	`[:SENSe]:SWEep:EGATe:LENGth <time>` `[:SENSe]:SWEep:EGATe:LENGth?`
Example	`:SWE:EGAT:LENG 1` `:SWE:EGAT:LENG?`
Notes	Units of time are required, or no units; otherwise an invalid suffix error message is generated
Dependencies	Grayed-out when Gate Method is set to `FFT`, in which case the label changes to that shown below  The control is also grayed-out if Gate Control = `LEVel`
Preset	WiMAX OFDMA: 50 us GSM/EDGE: 200 us WLAN: 1.54 ms Others: 461.6 us
State Saved	Saved in instrument state
Min	100 ns
Max	5 s
Backwards Compatibility SCPI	`[:SENSe]:SWEep:TIME:GATE:LENGth` ESA compatibility

8.3.5 Gate Method

Lets you choose one of the three different types of gating. Not all types of gating are available for all measurements.

Remote Command	`[:SENSe]:SWEep:EGATe:METHod LO | VIDeo | FFT`

	For option details, see "LO" on page 2510, "Video" on page 2510 or "FFT" on page 2511 `[:SENSe]:SWEep:EGATe:METHod?`
Example	`:SWE:EGAT:METH FFT`
Dependencies	This function is only available in the Swept SA measurement in Spectrum Analyzer Mode This control is unavailable when Gate is On and FFT Sweep Type manually selected When selected, Sweep Type is forced to Swept, and the FFT selection in Sweep Type is grayed-out Only the `FFT` method is supported in non-SA products Only the `FFT` method is supported by VXT models M9410A/11A
Preset	`LO`
State Saved	Saved in instrument state
Range	`Video|LO|FFT`
Annunciation	In Meas Bar

LO

In `LO` gating, when Gate is `ON`, the LO sweeps whenever the gate conditions as specified in the Gate menu are satisfied by the signal at the Gate Source.

This form of gating is more sophisticated, and results in faster measurements. With Gated LO, the instrument only sweeps while the gate conditions are satisfied. This means that a sweep could take place over several gate events. It would start when the gate signal goes true and stop when it goes false, and then continue when it goes true again. But since the LO is sweeping as long as the gate conditions are satisfied, the sweep typically finishes much more quickly than with Gated Video.

When in zero span, there is no actual sweep performed. But data is only taken while the gate conditions are satisfied. So even though there is no sweep, the gate settings will impact when data is acquired.

Video

In `Video` gating, when Gate is `ON`, the video signal is allowed to pass through whenever the gate conditions as specified in the Gate menu are satisfied by the signal at the Gate Source.

This form of gating may be thought of as a simple switch, which connects the signal to the input of the spectrum analyzer. When the gate conditions are satisfied, the switch is closed, and when the gate conditions are not satisfied, the switch is open. So we only look at the signal while the gate conditions are satisfied.

With this type of gating, you usually set the instrument to sweep very slowly. In fact, a general rule is to sweep slowly enough that the gate is guaranteed to be closed at least once per data measurement interval (bucket). Then if the peak detector is used, each bucket will represent the peak signal as it looks with the gate closed.

FFT

In FFT gating, when Gate is ON, an FFT is performed whenever the gate conditions as specified in the Gate menu are satisfied by the signal at the Gate Source. This is an FFT measurement that begins when the gate conditions are satisfied. Since the time period of an FFT is approximately 1.83/RBW, you get a measurement that starts under predefined conditions and takes place over a predefined period. So, in essence, this is a gated measurement. You have limited control over the gate length but it works in FFT sweeps, which the other two methods do not.

Gated FFT is not possible in zero span since the instrument is not sweeping, so in zero span the Gated LO method is used. Data is still only taken while the gate conditions are satisfied, so the gate settings do impact when data is acquired.

The Gate Length will be 1.83/RBW.

This is a convenient way to make a triggered FFT measurement under control of an external gating signal.

8.3.6 Control Edge/Level

Sets the method of controlling the gating function from the gating signal.

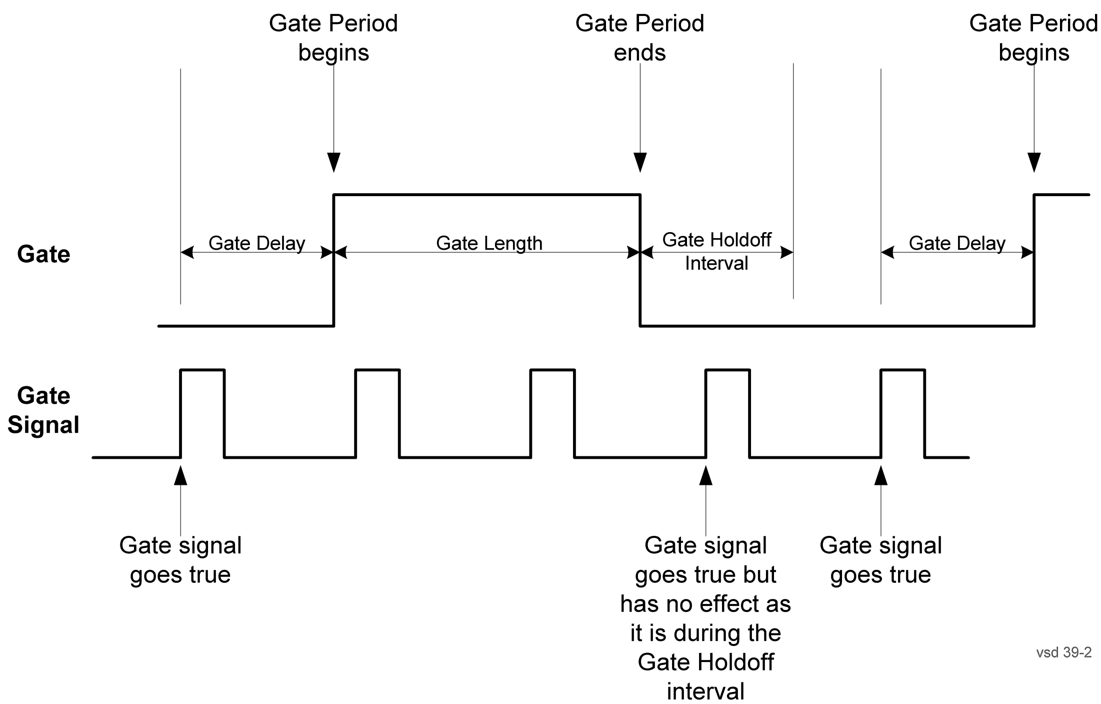
EDGE	The gate opens (after the Delay) on the selected edge (for example, positive) of the gate signal and closes on the alternate edge (for example, negative)
LEVel	The gate opens (after the Delay) when the gate signal has achieved a certain level and stays open as long as that level is maintained

Remote Command	[:SENSe]:SWEep:EGATe:CONTrol EDGE | LEVel [:SENSe]:SWEep:EGATe:CONTrol?
Example	:SWE:EGAT:CONT EDGE
Dependencies	If the Gate Method is FFT, this control is grayed-out and EDGE is selected If the Gate Source is TV, Frame, or Line, this control is grayed-out and EDGE is selected
Preset	EDGE
State Saved	Saved in instrument state
Backwards Compatibility SCPI	[:SENSe]:SWEep:TIME:GATE:TYPE ESA Compatibility

8.3.7 Gate Holdoff

Enables you to increase or decrease the wait time after a gate event ends before the instrument will respond to the next gate signal.

After any Gate event finishes, the instrument must wait for the sweep system to settle before it can respond to another Gate signal. The instrument calculates a "wait time," taking into account a number of factors, including RBW and Phase Noise Optimization settings. The goal is to achieve the same accuracy when gated as in ungated operation. The figure below illustrates this concept:



When **Gate Holdoff** is Auto, the wait time calculated by the instrument is used. When Gate Time is in Manual, the user may adjust the wait time, usually decreasing it in order to achieve greater speed, but at the risk of decreasing accuracy.

When the **Method** control is set to **Video** or **FFT**, the **Gate Holdoff** function has no effect.

In measurements that do not support Auto, the value shown when Auto is selected is "---" and the manually set holdoff is returned to a query.

Remote Command	`[:SENSe]:SWEep:EGATe:HOLDoff <time>`
	`[:SENSe]:SWEep:EGATe:HOLDoff?`
	`[:SENSe]:SWEep:EGATe:HOLDoff:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:SWEep:EGATe:HOLDoff:AUTO?`

Example	`:SWE:EGAT:HOLD 0.0002`
	`:SWE:EGAT:HOLD?`
	`:SWE:EGAT:HOLD:AUTO ON`
	`:SWE:EGAT:HOLD:AUTO?`

Couplings	When **Gate Holdoff** is **Auto**, the **Gate Holdoff** control shows the value calculated by the instrument for the

	wait time Pressing the **Gate Holdoff** control while it is in **Auto** and not selected, causes the control to become selected and allows the user to adjust the value. If the value is adjusted, the setting changes to **Man** Pressing the **Gate Holdoff** key, while it is in **Auto** and selected, does not change the value of **Gate Holdoff**, but causes the setting to change to **Man.** Now the user can adjust the value Pressing the control while it is in **Man** and selected, cause the value to change back to **Auto** Pressing the control while it is in **Man** and not selected, causes the control to become selected and allows the user to adjust the value When **Method** is set to **Video** or **FFT**, the **Gate Holdoff** function has no effect
Preset	Auto Auto/On
State Saved	Saved in instrument state
Range	Auto|Man
Min	1 µsec
Max	1 sec

8.3.8 Gate View Sweep Time

Controls the Sweep Time in the Gate View window. To provide an optimal view of the gate signal, the instrument initializes Gate View Sweep Time based on the current settings of Gate Delay and Gate Length.

NOTE Since Gate View Sweep Time is used to calculate Gate Delay and Gate Length increments, it is maintained even when not in Gate View.

NOTE In instruments without sweeping hardware such as some modular analyzers, this control may be labeled “Gate View Acquisition Time”

Remote Command	`[:SENSe]:SWEep:EGATe:TIME <time>` `[:SENSe]:SWEep:EGATe:TIME?`
Example	`:SWE:EGAT:TIME 500 ms`
Dependencies	Gate View Sweep Time is initialized: – On Preset (after initializing delay and length) – Every time the Gate Method is set/changed Additionally, in the Swept SA measurement, whenever you do a Preset, or leave Gate View, the instrument remembers the Gate Delay and Gate Length settings. Then, when returning to Gate View, if the current Gate Delay and/or Gate Length do not match the remembered values Gate View Sweep Time is re-initialized
Preset	WiMAX OFDMA: 5 ms GSM/EDGE: 1 ms

	5G NR: 10 ms Others: 800 µs
State Saved	Saved in instrument state
Min	1 µs
Max	6000 s
Annotation	The gate view Sweep Time is displayed in the lower-right corner of the gate view window

8.3.9 Gate View Start Time

Controls the time at the left edge of the Gate View.

Remote Command	`[:SENSe]:SWEep:EGATe:VIEW:STARt <time>` `[:SENSe]:SWEep:EGATe:VIEW:STARt?`
Example	`:SWE:EGAT:VIEW:STAR 10ms`
Notes	Units of time are required or no units; otherwise an invalid suffix error message is generated
Preset	0 ms
State Saved	Saved in instrument state
Min	0
Max	500 ms

8.3.10 Gate Delay Compensation

Allows you to select an RBW-dependent value by which to adjust the gate delay, to compensate for changes in the delay caused by RBW effects.

Youcan select between uncompensated operation and two types of compensation:

Uncompensated	`OFF`
Delay Until RBW Settled	`SETTled`
Compensate for RBW Group Delay	`GDELay`

For full details of these options, see "More Information" on page 2515

Remote Command	`[:SENSe]:SWEep:EGATe:DELay:COMPensation:TYPE OFF | SETTled | GDELay` `[:SENSe]:SWEep:EGATe:DELay:COMPensation:TYPE?`
Example	`:SWE:EGAT:DEL:COMP:TYPE SETT` `:SWE:EGAT:DEL:COMP:TYPE?`
Notes	Although this function is Meas Global, there are some measurements that do not support this function. In those measurements the control is not displayed, and the operation will be Uncompensated If some but not all measurements in a Mode support this function, then selecting a measurement that does not support it will not change the Meas Global selection; it will simply be “Uncompensated” while in

	that measurement. The SCPI command is still accepted while in that measurement If Gate Delay Compensation is not supported at all within a particular mode, the control is not displayed, and if the SCPI command is sent while in a measurement within that mode, an “Undefined Header” message is generated Note that, for modular products such as EXM and VXT, this function is not supported. In those products the control is not displayed and the SCPI is ignored, although it is accepted without error
Preset	TD-SCDMA, LTEA FDD/TDD, 5G NR modes: `GDELay` All other modes: `SETTled`
State Saved	Saved in instrument state
Range	`OFF|SETTled|GDELay`

More Information

Selecting **Uncompensated** means that the actual gate delay is as you set it.

Selecting **Delay Until RBW Settled** causes the gate delay to be increased above the user setting by an amount equal to 3.06/RBW. This compensated delay causes the GATE START and GATE STOP lines on the display to move by the compensation amount, and the actual hardware gate delay to be increased by the same amount. All the other gate lines (for example, MIN FAST) are unaffected. If the RBW subsequently changes, the compensation is readjusted for the new RBW. The value shown on the **Gate Delay** control does *not* change.

Delay Until RBW Settled allows excellent measurements of gated signals, by allowing the IF to settle following any transient that affects the burst. Excellent measurements also require that the analysis region not extend into the region affected by the falling edge of the burst. Thus, excellent measurements can only be made over a width that declines with narrowing RBWs, which is achieved by decreasing the gate length below the user setting by an amount equal to 2.53/RBW. Therefore, for general purpose compensation, you will still want to change the gate length with changes in RBW even if the gate delay is compensated. The compensated Gate Length is limited by the instrument so that it will never go below 10% of the value shown on the Gate Length key, as otherwise the sweep times could get very long. Anytime the **Gate Length** and **RBW** values combine in such a way that this limiting takes place, a warning is displayed . For measurements that contain multiple sweeps with different RBW like SEM and SPUR, the smallest RBW is used for this limiting.

Selecting **Compensate for RBW Group Delay** causes the gate delay to be increased above the user setting by an amount equal to 1.81/RBW. This compensated delay causes the GATE START, GATE STOP lines on the display to move by the compensation amount, and the actual hardware gate delay to be increased by the same amount. All the other gate lines (for example, MIN FAST) are unaffected. If the RBW subsequently changes, the compensation is readjusted for the new RBW. The value shown on the **Gate Delay** control does *not* change. **Compensate for RBW Group Delay** also includes gate length compensation; the gate length itself is adjusted as necessary to attempt to compensate for delay effects imposed by the RBW.

Compensate for RBW Group Delay is similar to **Delay Until RBW Settled**, but compensates for the group delay of the RBW filter, rather than the filter settling time. As the RBW gets narrow, this can allow the settling tail of the RBW to affect the beginning part of the gated measurement, and allow the beginning of the RBW settling transient to affect the end of the gated measurement. These two effects are symmetric because the RBW response is symmetric. Because the gate length is not automatically compensated, some users might find this compensation to be more intuitive than compensation for RBW settling.

8.3.11 Min Fast Position Query (Remote Command Only)

Queries the position of the MIN FAST line, relative to the delay reference (REF) line. See "Gate View On/Off" on page 2506. If this query is sent while not in Gate view, the MinFast calculation is performed based on the current values of the appropriate parameters and the result is returned. Reading this value lets you set an optimal gate delay value for the current measurement setup.

Example	`:SWE:EGAT:MIN?`
Backwards Compatibility SCPI	`[:SENSe]:SWEep:EGATe:MINFast?`

8.3.12 Gate Preset (Remote Command Only)

Presets the time-gated spectrum analysis capability.

This command sets gate parameter values to the ESA preset values, as follows:

- Gate trigger type = edge
- Gate polarity = positive
- Gate delay = 1 us
- Gate length = 1 us

Backwards Compatibility SCPI	`[:SENSe]:SWEep:TIME:GATE:PRESet` ESA Compatibility

8.3.13 Gate Level (Remote Command Only)

Sets the gate input transition point level for the external TRIGGER inputs on the front and rear panel. This is a legacy command for PSA compatibility. It is simply an alias to the equivalent trigger level command.

Notes	This command is simply an alias to `:TRIGger[:SEQuence]:EXTernal[1]|2:LEVel`

Backwards Compatibility SCPI	[:SENSe]:SWEep:EGATe:EXTernal[1]|2:LEVel <voltage> [:SENSe]:SWEep:EGATe:EXTernal[1]|2:LEVel?

8.3.14 Gate Polarity (Remote Command Only)

Sets the polarity for the gate signal. This setup is now done using the gate trigger's slope setting.

When POSitive is selected, a positive-going edge (Edge) or a high voltage (Level) will satisfy the gate condition, after the delay set with the Gate Delay key. When NEGative is selected, a negative-going edge (Edge) or a low voltage (Level) will satisfy the gate condition after the delay.

Example	:SWE:EGAT:POL NEG :SWE:EGAT:POL?
Preset	POSitive
State Saved	Saved in instrument state
Backwards Compatibility SCPI	[:SENSe]:SWEep:TIME:GATE:POLarity ESA compatibility [:SENSe]:SWEep:EGATe:POLarity NEGative | POSitive [:SENSe]:SWEep:EGATe:POLarity?

Preset	HIGH
Backwards Compatibility SCPI	[:SENSe]:SWEep:TIME:GATE:LEVel HIGH | LOW [:SENSe]:SWEep:TIME:GATE:LEVel? ESA compatibility

8.4 Periodic Sync Src

Contains controls that let you select and configure the sync signal for the Periodic Timer Trigger.

For convenience controls for adjusting the level and slope of the selected sync source are provided here. Note that these settings match those in the **Trigger** and **Gate Source** menus; that is, each trigger source has only one value of level and slope, regardless of which menu it is accessed from.

8.4.1 Select Periodic Timer Sync Source

Selects a signal source for you to synchronize your periodic timer trigger to, otherwise you are triggering at some arbitrary location in the frame. Synchronization reduces the precision requirements on the setting of the period.

Note that, with Sync Source `OFF`, the timing will drift unless the signal source frequency is locked to the instrument frequency reference.

Remote Command	`:TRIGger[:SEQuence]:FRAMe:SYNC EXTernal1 | EXTernal2 | RFBurst | PXI | INTernal | OFF` `:TRIGger[:SEQuence]:FRAMe:SYNC?`

Example	`:TRIG:FRAM:SYNC EXT1`
	`:TRIG:FRAM:SYNC EXT2`
	`:TRIG:FRAM:SYNC RFB`
	`:TRIG:FRAM:SYNC OFF`

Dependencies	`PXI` and `INTernal` triggers are only found in modular analyzers such as VXT This control is not available in the E7760 or UXM In some models, there is no second External input. In these models, the External 2 selection is not shown, and the `EXTernal2` parameter generates a “Hardware missing; Not available for this model number” message
Preset	`OFF` GSM/EDGE, LTE, LTETDD, 5G NR: `RFBurst`
State Saved	Saved in instrument state
Backwards Compatibility SCPI	`:TRIGger[:SEQuence]:FRAMe:SYNC EXTernal` For backward compatibility, the parameter `EXTernal` is mapped to `EXTernal1`

8.5 Auto/Holdoff

Contains controls that let you adjust Auto Trigger and Trigger Holdoff parameters

This tab does not appear in Spectrum Analyzer Mode in VXT models M9420A/21A.

8.5.1 Trig Holdoff

Sets the holdoff time between triggers. When the trigger condition is satisfied, the trigger occurs, the delay begins, and the holdoff time begins. New trigger conditions will be ignored until the holdoff time expires. For a free-running trigger, the holdoff value is the minimum time between triggers.

Remote Command	`:TRIGger[:SEQuence]:HOLDoff <time>`
	`:TRIGger[:SEQuence]:HOLDoff?`
	`:TRIGger[:SEQuence]:HOLDoff:STATe OFF | ON | 0 | 1`
	`:TRIGger[:SEQuence]:HOLDoff:STATe?`

Example	`:TRIG:HOLD:STAT ON` `:TRIG:HOLD 100 ms`
Dependencies	Unavailable if the selected Input is `BBIQ`. If this is the case, the control is grayed-out if it is pressed the informational message “Feature not supported for this Input” is displayed. If the SCPI command is sent, the error “Settings conflict; Feature not supported for this Input” is generated
Preset	Off, 100 ms All modes but GSM/EDGE: `OFF` GSM/EDGE mode: `ON`
State Saved	Saved in instrument state
Min	0 s
Max	0.5 s VXT models M9410A/11A: 2.86 s

8.5.2 Auto Trig

Sets the time that the instrument will wait for the trigger conditions to be met. If they are not met after that much time, then the instrument is triggered anyway.

Remote Command	`:TRIGger[:SEQuence]:ATRigger <time>`
	`:TRIGger[:SEQuence]:ATRigger?`
	`:TRIGger[:SEQuence]:ATRigger:STATe OFF | ON | 0 | 1`
	`:TRIGger[:SEQuence]:ATRigger:STATe?`

Example	`:TRIG:ATR:STAT ON`

	:TRIG:ATR 100 ms
Notes	The "time that the instrument will wait" starts when the instrument is ready for a trigger, which may be hundreds of ms after the data acquisition for a sweep is done. The "time" ends when the trigger condition is satisfied, not when the delay ends
Dependencies	Not available in Real Time Spectrum Analyzer Mode
Preset	Off, 100 ms OFF
State Saved	Saved in instrument state
Min	1 ms
Max	100 s

8.5.3 Holdoff Type

Enables you to set the Trigger **Holdoff Type**.

NOTE **Holdoff Type is not supported by all measurements. If the current measurement does not support it, this control will not appear and the Holdoff Type will be Normal. If the Holdoff Type SCPI is sent while in such a measurement, the SCPI will be accepted and the setting remembered, but it will have no effect until a measurement is in force that supports Holdoff Type.**

Trigger Holdoff Type functionality

NORMal	This is the “oscilloscope” type of trigger holdoff, and is the setting when the Holdoff Type control does not appear. In this type of holdoff, no new trigger will be accepted until the holdoff interval has expired after the previous trigger
ABOVe	If the trigger slope is positive, a trigger event is generated only if the signal characteristic of interest crosses the trigger threshold (with positive slope) and then remains above the threshold for at least the holdoff time. For negative slope, the trigger event is generated if the signal characteristic crosses the threshold (with negative slope) after having been above the threshold for at least the holdoff time. In either case, the trigger event is associated with the time the level was crossed
BELow	If the trigger slope is positive, a trigger event is generated only if the signal characteristic of interest crosses the trigger threshold (with positive slope) after having been below the threshold for at least the holdoff time. For negative slope, the trigger event is generated if the signal characteristic crosses the threshold (with negative slope) and then remains below the threshold for at least the holdoff time. In either case, the trigger event is associated with the time the level was crossed

Remote Command	:TRIGger[:SEQuence]:HOLDoff:TYPE NORMal | ABOVe | BELow :TRIGger[:SEQuence]:HOLDoff:TYPE?
Example	:TRIG:HOLD:TYPE NORM

Preset	All modes but GSM/EDGE: `NORMal` GSM/EDGE, Bluetooth: `BELow`
State Saved	Saved in instrument state

9 Programming the Instrument

This section provides information about the instrument's SCPI programming interface.

You can also operate the instrument remotely using some legacy programming languages, by running either the N9061C Remote Language Compatibility measurement application, or the N9062C SCPI Language Compatibility measurement application.

9.1 List of Supported SCPI Commands

The SCPI commands available while using this application are listed below.

To find a command in the list, search according to its first alphanumeric character, ignoring any leading ":" or "[" characters. The sole exception to this is the asterisk [*] prefix, identifying IEEE 488.2 Common commands and queries; all these appear at the start of the list.

*

```
*CAL
*CAL?
*CLS
*ESE
*ESE?
*ESR?
*IDN?
*OPC
*OPC?
*OPT?
*RCL
*RST
*SAV
*SRE
*SRE?
*STB?
*TRG
*TST?
*WAI
```

A

```
ABORt
ABORt
ABORt
```

C

```
CALCulate:<meas>:MATH
CALCulate:<meas>:MATH?
CALCulate:ACPower:LIMit:STATe
CALCulate:ACPower:LIMit:STATe?
CALCulate:ACPower:MARKer[1]|2|...|12:MAXimum
CALCulate:ACPower:MARKer[1]|2|...|12:MAXimum:LEFT
CALCulate:ACPower:MARKer[1]|2|...|12:MAXimum:NEXT
CALCulate:ACPower:MARKer[1]|2|...|12:MAXimum:RIGHt
CALCulate:ACPower:MARKer[1]|2|...|12:MINimum
```

```
CALCulate:ACPower:MARKer[1]|2|...|12:MODE
CALCulate:ACPower:MARKer[1]|2|...|12:MODE?
CALCulate:ACPower:MARKer[1]|2|...|12:PTPeak
CALCulate:ACPower:MARKer[1]|2|...|12:REFerence
CALCulate:ACPower:MARKer[1]|2|...|12:REFerence?
CALCulate:ACPower:MARKer[1]|2|...|12:STATe
CALCulate:ACPower:MARKer[1]|2|...|12:STATe?
CALCulate:ACPower:MARKer[1]|2|...|12:TRACe
CALCulate:ACPower:MARKer[1]|2|...|12:TRACe?
CALCulate:ACPower:MARKer[1]|2|...|12:X
CALCulate:ACPower:MARKer[1]|2|...|12:X?
CALCulate:ACPower:MARKer[1]|2|...|12:X:POSition
CALCulate:ACPower:MARKer[1]|2|...|12:X:POSition?
CALCulate:ACPower:MARKer[1]|2|...|12:Y?
CALCulate:ACPower:MARKer:AOFF
CALCulate:ACPower:MARKer:COUPle[:STATe]
CALCulate:ACPower:MARKer:COUPle[:STATe]?
CALCulate:ACPower:MTRace
CALCulate:ACPower:MTRace?
CALCulate:ACPower:OFFSet[1]|2[:OUTer]:LIST:LIMit:NEGative
[:UPPer]:DATA
CALCulate:ACPower:OFFSet[1]|2[:OUTer]:LIST:LIMit:NEGative
[:UPPer]:DATA?
CALCulate:ACPower:OFFSet[1]|2[:OUTer]:LIST:LIMit:POSitive
[:UPPer]:DATA
CALCulate:ACPower:OFFSet[1]|2[:OUTer]:LIST:LIMit:POSitive
[:UPPer]:DATA?
CALCulate:CDPower:ASET:THReshold
CALCulate:CDPower:ASET:THReshold?
CALCulate:CDPower:ASET:THReshold:AUTO
CALCulate:CDPower:ASET:THReshold:AUTO?
CALCulate:CDPower:AXIS[:MS]
CALCulate:CDPower:AXIS[:MS]?
CALCulate:CDPower:DPCH:MS:CONFigure
CALCulate:CDPower:DPCH:MS:CONFigure?
CALCulate:CDPower:DTXBurst
CALCulate:CDPower:DTXBurst?
CALCulate:CDPower:IQPHase:ROTation
CALCulate:CDPower:IQPHase:ROTation?
CALCulate:CDPower:MARKer[1]|2|...|12:MAXimum
CALCulate:CDPower:MARKer[1]|2|...|12:MAXimum:LEFT
CALCulate:CDPower:MARKer[1]|2|...|12:MAXimum:NEXT
CALCulate:CDPower:MARKer[1]|2|...|12:MAXimum:RIGHt
CALCulate:CDPower:MARKer[1]|2|...|12:MINimum
CALCulate:CDPower:MARKer[1]|2|...|12:MODE
CALCulate:CDPower:MARKer[1]|2|...|12:MODE?
CALCulate:CDPower:MARKer[1]|2|...|12:PTPeak
CALCulate:CDPower:MARKer[1]|2|...|12:REFerence
CALCulate:CDPower:MARKer[1]|2|...|12:REFerence?
CALCulate:CDPower:MARKer[1]|2|...|12[:SET]:DESPread
CALCulate:CDPower:MARKer[1]|2|...|12:STATe
CALCulate:CDPower:MARKer[1]|2|...|12:STATe?
```

```
CALCulate:CDPower:MARKer[1]|2|...|12:SYMBol
CALCulate:CDPower:MARKer[1]|2|...|12:SYMBol?
CALCulate:CDPower:MARKer[1]|2|...|12:TRACe
CALCulate:CDPower:MARKer[1]|2|...|12:TRACe?
CALCulate:CDPower:MARKer[1]|2|...|12:X
CALCulate:CDPower:MARKer[1]|2|...|12:X?
CALCulate:CDPower:MARKer[1]|2|...|12:X:POSition
CALCulate:CDPower:MARKer[1]|2|...|12:X:POSition?
CALCulate:CDPower:MARKer[1]|2|...|12:Y?
CALCulate:CDPower:MARKer:AOFF
CALCulate:CDPower:MARKer:COUPle[:STATe]
CALCulate:CDPower:MARKer:COUPle[:STATe]?
CALCulate:CDPower:MTYPe
CALCulate:CDPower:MTYPe?
CALCulate:CDPower:PACKed
CALCulate:CDPower:PACKed?
CALCulate:CDPower:SBOundary:COMPosite
CALCulate:CDPower:SBOundary:COMPosite?
CALCulate:CDPower:SBOundary:SRATe
CALCulate:CDPower:SBOundary:SRATe?
CALCulate:CDPower:SEVM:FCOMpen
CALCulate:CDPower:SEVM:FCOMpen?
CALCulate:CDPower:SEVM:PCOMpen
CALCulate:CDPower:SEVM:PCOMpen?
CALCulate:CDPower:SPRead
CALCulate:CDPower:SPRead?
CALCulate:CDPower:SRATe
CALCulate:CDPower:SRATe?
CALCulate:CDPower:SSUPpress[:STATe]
CALCulate:CDPower:SSUPpress[:STATe]
CALCulate:CDPower:SWEep:OFFSet
CALCulate:CDPower:SWEep:OFFSet?
CALCulate:CDPower:SWEep:TIME
CALCulate:CDPower:SWEep:TIME?
CALCulate:CDPower:TDPCh
CALCulate:CDPower:TDPCh?
CALCulate:CDPower:TDPCh:AUTO
CALCulate:CDPower:TDPCh:AUTO?
CALCulate:CDPower:THSDpcch
CALCulate:CDPower:THSDpcch?
CALCulate:CDPower:TYPE
CALCulate:CDPower:TYPE?
CALCulate:CHPower:LIMit:POWer
CALCulate:CHPower:LIMit:POWer?
CALCulate:CHPower:LIMit:POWer:FAIL?
CALCulate:CHPower:LIMit:POWer:STATe
CALCulate:CHPower:LIMit:POWer:STATe?
CALCulate:CHPower:LIMit:PSDensity
CALCulate:CHPower:LIMit:PSDensity?
CALCulate:CHPower:LIMit:PSDensity:STATe
CALCulate:CHPower:LIMit:PSDensity:STATe?
CALCulate:CHPower:LIMit:PSD:FAIL?
CALCulate:CHPower:MARKer[1]|2|...|12:MAXimum
```

```
CALCulate:CHPower:MARKer[1]|2|...|12:MODE
CALCulate:CHPower:MARKer[1]|2|...|12:MODE?
CALCulate:CHPower:MARKer[1]|2|...|12:REFerence
CALCulate:CHPower:MARKer[1]|2|...|12:REFerence?
CALCulate:CHPower:MARKer[1]|2|...|12:STATe
CALCulate:CHPower:MARKer[1]|2|...|12:STATe?
CALCulate:CHPower:MARKer[1]|2|...|12:TRACe
CALCulate:CHPower:MARKer[1]|2|...|12:TRACe?
CALCulate:CHPower:MARKer[1]|2|...|12:X
CALCulate:CHPower:MARKer[1]|2|...|12:X?
CALCulate:CHPower:MARKer[1]|2|...|12:X:POSition
CALCulate:CHPower:MARKer[1]|2|...|12:X:POSition?
CALCulate:CHPower:MARKer[1]|2|...|12:Y?
CALCulate:CHPower:MARKer:AOFF
CALCulate:CHPower:MATH
CALCulate:CHPower:MATH?
CALCulate:CHPower:MTRace
CALCulate:CHPower:MTRace?
CALCulate:CLIMits:FAIL?
CALCulate:CWCDma:EVMQpsk:IQOFfset:INCLude
CALCulate:CWCDma:EVMQpsk:IQOFfset:INCLude?
CALCulate:CWCDma:RHO:ASET:THReshold
CALCulate:CWCDma:RHO:ASET:THReshold?
CALCulate:CWCDma:RHO:ASET:THReshold:AUTO
CALCulate:CWCDma:RHO:ASET:THReshold:AUTO?
CALCulate:CWCDma:RHO:DTXBurst
CALCulate:CWCDma:RHO:DTXBurst?
CALCulate:CWCDma:RHO:IQOFfset:INCLude
CALCulate:CWCDma:RHO:IQOFfset:INCLude?
CALCulate:DATA<n>:COMPress?
CALCulate:DATA[1]|2|...|6:PEAKs?
CALCulate:EVMQpsk:IQOFfset:INCLude
CALCulate:EVMQpsk:IQOFfset:INCLude?
CALCulate:EVMQpsk:LIMit:FERRor
CALCulate:EVMQpsk:LIMit:FERRor?
CALCulate:EVMQpsk:LIMit:RMS
CALCulate:EVMQpsk:LIMit:RMS?
CALCulate:EVMQpsk:MARKer[1]|2|...|12:CHIP
CALCulate:EVMQpsk:MARKer[1]|2|...|12:CHIP?
CALCulate:EVMQpsk:MARKer[1]|2|...|12:MAXimum
CALCulate:EVMQpsk:MARKer[1]|2|...|12:MAXimum:LEFT
CALCulate:EVMQpsk:MARKer[1]|2|...|12:MAXimum:NEXT
CALCulate:EVMQpsk:MARKer[1]|2|...|12:MAXimum:RIGHt
CALCulate:EVMQpsk:MARKer[1]|2|...|12:MINimum
CALCulate:EVMQpsk:MARKer[1]|2|...|12:MODE
CALCulate:EVMQpsk:MARKer[1]|2|...|12:MODE?
CALCulate:EVMQpsk:MARKer[1]|2|...|12:PTPeak
CALCulate:EVMQpsk:MARKer[1]|2|...|12:REFerence
CALCulate:EVMQpsk:MARKer[1]|2|...|12:REFerence?
CALCulate:EVMQpsk:MARKer[1]|2|...|12:STATe
CALCulate:EVMQpsk:MARKer[1]|2|...|12:STATe?
CALCulate:EVMQpsk:MARKer[1]|2|...|12:TRACe
CALCulate:EVMQpsk:MARKer[1]|2|...|12:TRACe?
```

```
CALCulate:EVMQpsk:MARKer[1]|2|...|12:X
CALCulate:EVMQpsk:MARKer[1]|2|...|12:X?
CALCulate:EVMQpsk:MARKer[1]|2|...|12:X:POSition
CALCulate:EVMQpsk:MARKer[1]|2|...|12:X:POSition?
CALCulate:EVMQpsk:MARKer[1]|2|...|12:Y?
CALCulate:EVMQpsk:MARKer:AOFF
CALCulate:EVMQpsk:MARKer:COUPle[:STATe]
CALCulate:EVMQpsk:MARKer:COUPle[:STATe]?
CALCulate:FPOWer:POWer[1,2,…,999]?
CALCulate:FPOWer:POWer[1,2,…,999]:CONFigure
CALCulate:FPOWer:POWer[1,2,…,999]:DEFine?
CALCulate:FPOWer:POWer[1,2,…,999]:FETCh?
CALCulate:FPOWer:POWer[1,2,…,999]:INITiate
CALCulate:FPOWer:POWer[1,2,…,999]:READ?
CALCulate:FPOWer:POWer[1,2,…,999]:READ1?
CALCulate:FPOWer:POWer[1,2,…,999]:READ2?
CALCulate:FPOWer:POWer[1,2,…,999]:RESet
CALCulate:LPSTep:LIST[1]|2|...|50?
CALCulate:MATH
CALCulate:MATH?
CALCulate:MONitor:MARKer[1]|2|...|12:FUNCtion
CALCulate:MONitor:MARKer[1]|2|...|12:FUNCtion?
CALCulate:MONitor:MARKer[1]|2|...|12:FUNCtion:BAND:LEFT
CALCulate:MONitor:MARKer[1]|2|...|12:FUNCtion:BAND:LEFT?
CALCulate:MONitor:MARKer[1]|2|...|12:FUNCtion:BAND:RIGHt
CALCulate:MONitor:MARKer[1]|2|...|12:FUNCtion:BAND:RIGHt?
CALCulate:MONitor:MARKer[1]|2|...|12:FUNCtion:BAND:SPAN
CALCulate:MONitor:MARKer[1]|2|...|12:FUNCtion:BAND:SPAN?
CALCulate:MONitor:MARKer[1]|2|...|12:MAXimum
CALCulate:MONitor:MARKer[1]|2|...|12:MAXimum:NEXT
CALCulate:MONitor:MARKer[1]|2|...|12:MODE
CALCulate:MONitor:MARKer[1]|2|...|12:MODE?
CALCulate:MONitor:MARKer[1]|2|...|12:REFerence
CALCulate:MONitor:MARKer[1]|2|...|12:REFerence?
CALCulate:MONitor:MARKer[1]|2|...|12:STATe
CALCulate:MONitor:MARKer[1]|2|...|12:STATe?
CALCulate:MONitor:MARKer[1]|2|...|12:TRACe
CALCulate:MONitor:MARKer[1]|2|...|12:TRACe?
CALCulate:MONitor:MARKer[1]|2|...|12:X
CALCulate:MONitor:MARKer[1]|2|...|12:X?
CALCulate:MONitor:MARKer[1]|2|...|12:X:POSition
CALCulate:MONitor:MARKer[1]|2|...|12:X:POSition?
CALCulate:MONitor:MARKer[1]|2|...|12:Y?
CALCulate:MONitor:MARKer:AOFF
CALCulate:MONitor:MARKer:COUPle[:STATe]
CALCulate:MONitor:MARKer:COUPle[:STATe]?
CALCulate:OBWidth:MARKer[1]|2|...|12:MAXimum
CALCulate:OBWidth:MARKer[1]|2|...|12:MODE
CALCulate:OBWidth:MARKer[1]|2|...|12:MODE?
CALCulate:OBWidth:MARKer[1]|2|...|12:REFerence
CALCulate:OBWidth:MARKer[1]|2|...|12:REFerence?
CALCulate:OBWidth:MARKer[1]|2|...|12:STATe
CALCulate:OBWidth:MARKer[1]|2|...|12:STATe?
```

```
CALCulate:OBWidth:MARKer[1]|2|...|12:TRACe
CALCulate:OBWidth:MARKer[1]|2|...|12:TRACe?
CALCulate:OBWidth:MARKer[1]|2|...|12:X
CALCulate:OBWidth:MARKer[1]|2|...|12:X?
CALCulate:OBWidth:MARKer[1]|2|...|12:X:POSition
CALCulate:OBWidth:MARKer[1]|2|...|12:X:POSition?
CALCulate:OBWidth:MARKer[1]|2|...|12:Y?
CALCulate:OBWidth:MARKer:AOFF
CALCulate:OBWidth:MATH
CALCulate:OBWidth:MATH?
CALCulate:OBWidth:MTRace
CALCulate:OBWidth:MTRace?
CALCulate:PCONtrol:MARKer[1]|2|...|12:MAXimum
CALCulate:PCONtrol:MARKer[1]|2|...|12:MODE
CALCulate:PCONtrol:MARKer[1]|2|...|12:MODE?
CALCulate:PCONtrol:MARKer[1]|2|...|12:REFerence
CALCulate:PCONtrol:MARKer[1]|2|...|12:REFerence?
CALCulate:PCONtrol:MARKer[1]|2|...|12:STATe
CALCulate:PCONtrol:MARKer[1]|2|...|12:STATe?
CALCulate:PCONtrol:MARKer[1]|2|...|12:TRACe
CALCulate:PCONtrol:MARKer[1]|2|...|12:TRACe?
CALCulate:PCONtrol:MARKer[1]|2|...|12:X
CALCulate:PCONtrol:MARKer[1]|2|...|12:X?
CALCulate:PCONtrol:MARKer[1]|2|...|12:X:POSition
CALCulate:PCONtrol:MARKer[1]|2|...|12:X:POSition?
CALCulate:PCONtrol:MARKer[1]|2|...|12:Y?
CALCulate:PCONtrol:MARKer:AOFF
CALCulate:PCONtrol:MARKer:COUPle[:STATe]
CALCulate:PCONtrol:MARKer:COUPle[:STATe]?
CALCulate:PCONtrol:PRACh:INTerval
CALCulate:PCONtrol:PRACh:INTerval?
CALCulate:PCONtrol:PRACh:MLENgth
CALCulate:PCONtrol:PRACh:MLENgth?
CALCulate:PCONtrol:PRACh:OFFSet
CALCulate:PCONtrol:PRACh:OFFSet?
CALCulate:PCONtrol:PRACh:PLENgth
CALCulate:PCONtrol:PRACh:PLENgth?
CALCulate:PCONtrol:SLOT:DELay
CALCulate:PCONtrol:SLOT:DELay?
CALCulate:PCONtrol:SLOT:INTerval
CALCulate:PCONtrol:SLOT:INTerval?
CALCulate:PCONtrol:SLOT:LENGth
CALCulate:PCONtrol:SLOT:LENGth?
CALCulate:PCONtrol:SLOT:OFFSet
CALCulate:PCONtrol:SLOT:OFFSet?
CALCulate:PSTatistic:MARKer[1]|2|...|12:MODE
CALCulate:PSTatistic:MARKer[1]|2|...|12:MODE?
CALCulate:PSTatistic:MARKer[1]|2|...|12:REFerence
CALCulate:PSTatistic:MARKer[1]|2|...|12:REFerence?
CALCulate:PSTatistic:MARKer[1]|2|...|12:TRACe
CALCulate:PSTatistic:MARKer[1]|2|...|12:TRACe?
CALCulate:PSTatistic:MARKer[1]|2|...|12:X
CALCulate:PSTatistic:MARKer[1]|2|...|12:X?
```

```
CALCulate:PSTatistic:MARKer[1]|2|...|12:Y?
CALCulate:PSTatistic:MARKer:AOFF
CALCulate:PSTatistic:MARKer:COUPle[:STATe]
CALCulate:PSTatistic:MARKer:COUPle[:STATe]?
CALCulate:PSTatistic:STORe:REFerence
CALCulate:RHO:ASET:THReshold
CALCulate:RHO:ASET:THReshold?
CALCulate:RHO:ASET:THReshold:AUTO
CALCulate:RHO:ASET:THReshold:AUTO?
CALCulate:RHO:DTXBurst
CALCulate:RHO:DTXBurst?
CALCulate:RHO:IQOFfset:INCLude
CALCulate:RHO:IQOFfset:INCLude?
CALCulate:RHO:LIMit:CDERror
CALCulate:RHO:LIMit:CDERror?
CALCulate:RHO:LIMit:CPICh[:BTS]
CALCulate:RHO:LIMit:CPICh[:BTS]?
CALCulate:RHO:LIMit:CPICh[:BTS]:POWer
CALCulate:RHO:LIMit:CPICh[:BTS]:POWer?
CALCulate:RHO:LIMit:FERRor
CALCulate:RHO:LIMit:FERRor?
CALCulate:RHO:LIMit:PEAK
CALCulate:RHO:LIMit:PEAK?
CALCulate:RHO:LIMit:RHO
CALCulate:RHO:LIMit:RHO?
CALCulate:RHO:LIMit:RMS
CALCulate:RHO:LIMit:RMS?
CALCulate:RHO:MARKer[1]|2|...|12:CHIP
CALCulate:RHO:MARKer[1]|2|...|12:CHIP?
CALCulate:RHO:MARKer[1]|2|...|12:MAXimum
CALCulate:RHO:MARKer[1]|2|...|12:MAXimum:LEFT
CALCulate:RHO:MARKer[1]|2|...|12:MAXimum:NEXT
CALCulate:RHO:MARKer[1]|2|...|12:MAXimum:RIGHt
CALCulate:RHO:MARKer[1]|2|...|12:MINimum
CALCulate:RHO:MARKer[1]|2|...|12:MODE
CALCulate:RHO:MARKer[1]|2|...|12:MODE?
CALCulate:RHO:MARKer[1]|2|...|12:PTPeak
CALCulate:RHO:MARKer[1]|2|...|12:REFerence
CALCulate:RHO:MARKer[1]|2|...|12:REFerence?
CALCulate:RHO:MARKer[1]|2|...|12:STATe
CALCulate:RHO:MARKer[1]|2|...|12:STATe?
CALCulate:RHO:MARKer[1]|2|...|12:TRACe
CALCulate:RHO:MARKer[1]|2|...|12:TRACe?
CALCulate:RHO:MARKer[1]|2|...|12:X
CALCulate:RHO:MARKer[1]|2|...|12:X?
CALCulate:RHO:MARKer[1]|2|...|12:X:POSition
CALCulate:RHO:MARKer[1]|2|...|12:X:POSition?
CALCulate:RHO:MARKer[1]|2|...|12:Y?
CALCulate:RHO:MARKer:AOFF
CALCulate:RHO:MARKer:COUPle[:STATe]
CALCulate:RHO:MARKer:COUPle[:STATe]?
CALCulate:RHO:SWEep:OFFSet
CALCulate:RHO:SWEep:OFFSet?
```

```
CALCulate:SEMask:LLINe:STATe
CALCulate:SEMask:LLINe:STATe?
CALCulate:SEMask:MARKer[1]|2|...|12:MODE
CALCulate:SEMask:MARKer[1]|2|...|12:MODE?
CALCulate:SEMask:MARKer[1]|2|...|12:TRACe
CALCulate:SEMask:MARKer[1]|2|...|12:TRACe?
CALCulate:SEMask:MARKer[1]|2|...|12:X
CALCulate:SEMask:MARKer[1]|2|...|12:X?
CALCulate:SEMask:MARKer[1]|2|...|12:X:POSition
CALCulate:SEMask:MARKer[1]|2|...|12:X:POSition?
CALCulate:SEMask:MARKer[1]|2|...|12:Y?
CALCulate:SEMask:MARKer:AOFF
CALCulate:SEMask:MARKer:COUPle[:STATe]
CALCulate:SEMask:MARKer:COUPle[:STATe]?
CALCulate:SEMask:MTRace
CALCulate:SEMask:MTRace?
CALCulate:SPURious:MARKer[1]|2|...|12:MAXimum
CALCulate:SPURious:MARKer[1]|2|...|12:MAXimum:LEFT
CALCulate:SPURious:MARKer[1]|2|...|12:MAXimum:NEXT
CALCulate:SPURious:MARKer[1]|2|...|12:MAXimum:RIGHt
CALCulate:SPURious:MARKer[1]|2|...|12:MINimum
CALCulate:SPURious:MARKer[1]|2|...|12:MODE
CALCulate:SPURious:MARKer[1]|2|...|12:MODE?
CALCulate:SPURious:MARKer[1]|2|...|12:PTPeak
CALCulate:SPURious:MARKer[1]|2|...|12:REFerence
CALCulate:SPURious:MARKer[1]|2|...|12:REFerence?
CALCulate:SPURious:MARKer[1]|2|...|12:STATe
CALCulate:SPURious:MARKer[1]|2|...|12:STATe?
CALCulate:SPURious:MARKer[1]|2|...|12:TRACe:ATTached
CALCulate:SPURious:MARKer[1]|2|...|12:TRACe:ATTached?
CALCulate:SPURious:MARKer[1]|2|...|12:X
CALCulate:SPURious:MARKer[1]|2|...|12:X?
CALCulate:SPURious:MARKer[1]|2|...|12:X:POSition
CALCulate:SPURious:MARKer[1]|2|...|12:X:POSition?
CALCulate:SPURious:MARKer[1]|2|...|12:Y?
CALCulate:SPURious:MARKer:AOFF
CALCulate:SPURious:MARKer:COUPle[:STATe]
CALCulate:SPURious:MARKer:COUPle[:STATe]?
CALCulate:SPURious:MATH
CALCulate:SPURious:MATH?
CALCulate:SPURious:MTRace
CALCulate:SPURious:MTRace?
CALCulate:SPURious[:RANGe][:LIST]:LIMit:ABSolute[:UPPer]:DATA
[:STARt]
CALCulate:SPURious[:RANGe][:LIST]:LIMit:ABSolute[:UPPer]:DATA
[:STARt]?
CALCulate:SPURious[:RANGe][:LIST]:LIMit:ABSolute
[:UPPer]:DATA:STOP:AUTO
CALCulate:SPURious[:RANGe][:LIST]:LIMit:ABSolute
[:UPPer]:DATA:STOP:AUTO?
CALCulate:WAVeform:MARKer[1]|2|...|12:FUNCtion
CALCulate:WAVeform:MARKer[1]|2|...|12:FUNCtion?
```

```
CALCulate:WAVeform:MARKer[1]|2|...|12:FUNCtion:BAND:LEFT
CALCulate:WAVeform:MARKer[1]|2|...|12:FUNCtion:BAND:LEFT?
CALCulate:WAVeform:MARKer[1]|2|...|12:FUNCtion:BAND:RIGHt
CALCulate:WAVeform:MARKer[1]|2|...|12:FUNCtion:BAND:RIGHt?
CALCulate:WAVeform:MARKer[1]|2|...|12:FUNCtion:BAND:SPAN
CALCulate:WAVeform:MARKer[1]|2|...|12:FUNCtion:BAND:SPAN?
CALCulate:WAVeform:MARKer[1]|2|...|12:MAXimum
CALCulate:WAVeform:MARKer[1]|2|...|12:MAXimum:NEXT
CALCulate:WAVeform:MARKer[1]|2|...|12:MINimum
CALCulate:WAVeform:MARKer[1]|2|...|12:MODE
CALCulate:WAVeform:MARKer[1]|2|...|12:MODE?
CALCulate:WAVeform:MARKer[1]|2|...|12:REFerence
CALCulate:WAVeform:MARKer[1]|2|...|12:REFerence?
CALCulate:WAVeform:MARKer[1]|2|...|12:TRACe
CALCulate:WAVeform:MARKer[1]|2|...|12:TRACe?
CALCulate:WAVeform:MARKer[1]|2|...|12:X
CALCulate:WAVeform:MARKer[1]|2|...|12:X?
CALCulate:WAVeform:MARKer[1]|2|...|12:X:POSition
CALCulate:WAVeform:MARKer[1]|2|...|12:X:POSition?
CALCulate:WAVeform:MARKer[1]|2|...|12:Y?
CALCulate:WAVeform:MARKer:AOFF
CALCulate:WAVeform:MARKer:COUPle[:STATe]
CALCulate:WAVeform:MARKer:COUPle[:STATe]?
CALibration[:ALL]
CALibration[:ALL]?
CALibration[:ALL]:NPENding
CALibration:AUTO
CALibration:AUTO?
CALibration:AUTO:ALERt
CALibration:AUTO:ALERt?
CALibration:AUTO:MODE
CALibration:AUTO:MODE?
CALibration:AUTO:TIME:OFF?
CALibration:DATA:BACKup
CALibration:DATA:DEFault
CALibration:DATA:INTernal:BACKup
CALibration:DATA:INTernal:RESTore
CALibration:EMIXer
CALibration:EMIXer?
CALibration:EXPired?
CALibration:FREQuency:REFerence:COARse
CALibration:FREQuency:REFerence:COARse?
CALibration:FREQuency:REFerence:FINE
CALibration:FREQuency:REFerence:FINE?
CALibration:FREQuency:REFerence:MODE
CALibration:FREQuency:REFerence:MODE?
CALibration:INTernal:ASFRanges?
CALibration:INTernal:ASFRanges:EXTend[:STATe]
CALibration:INTernal:ASFRanges:EXTend[:STATe]?
CALibration:INTernal:ASFRanges:FRANges
CALibration:INTernal:ASFRanges[:STATe]
CALibration:INTernal:EMPath
CALibration:INTernal:EMPath?
```

```
CALibration:INTernal:FAST[:ALL]
CALibration:INTernal:FAST[:ALL]?
CALibration:INTernal:HBANd[:ALL]
CALibration:INTernal:HBANd[:ALL]?
CALibration:INTernal:LBANd[:ALL]
CALibration:INTernal:LBANd[:ALL]?
CALibration:INTernal:LOLeakage
CALibration:INTernal:LOLeakage?
CALibration:INTernal:RECeiver[:ALL]
CALibration:INTernal:RECeiver[:ALL]?
CALibration:INTernal:RRHead:AMPLitude
CALibration:INTernal:RRHead:AMPLitude?
CALibration:INTernal:RRHead:IFCable
CALibration:INTernal:RRHead:IFCable?
CALibration:INTernal:RRHead:LOSync
CALibration:INTernal:RRHead:LOSync?
CALibration:INTernal:SOURce[:ALL]
CALibration:INTernal:SOURce[:ALL]?
CALibration:INTernal:SOURce[:ALL]:NPENding
CALibration:IQ:FLATness:I
CALibration:IQ:FLATness:I|IBAR|Q|QBAR:TIME?
CALibration:IQ:FLATness:IBAR
CALibration:IQ:FLATness:Q
CALibration:IQ:FLATness:QBAR
CALibration:IQ:ISOLation
CALibration:IQ:ISOLation:TIME?
CALibration:IQ:PROBe:I
CALibration:IQ:PROBe:I|:TIME?
CALibration:IQ:PROBe:IBar
CALibration:IQ:PROBe:IBAR:TIME?
CALibration:IQ:PROBe:I:CLEar
CALibration:IQ:PROBe:Q
CALibration:IQ:PROBe:QBar
CALibration:IQ:PROBe:QBAR:TIME?
CALibration:IQ:PROBe:Q:CLEar
CALibration:IQ:PROBe:Q:TIME?
CALibration:NFLoor
CALibration:NFLoor?
CALibration:NRF
CALibration:NRF?
CALibration:NRF:NPENding
CALibration:NRFPselector
CALibration:NRFPselector?
CALibration:REFerence:CLOCk?
CALibration:REFerence:CLOCk:END?
CALibration:REFerence:CLOCk:INITialize?
CALibration:RF
CALibration:RF?
CALibration:RF:NPENding
CALibration:RFPSelector:ONLY
CALibration:RFPSelector:ONLY?
CALibration:RFPSelector:SCHeduler:TIME:NEXT?
CALibration:TEMPerature:CURRent?
```

CALibration:TEMPerature:INTernal:EMPath?
CALibration:TEMPerature:INTernal:FAST?
CALibration:TEMPerature:INTernal:HBANd?
CALibration:TEMPerature:INTernal:LBANd?
CALibration:TEMPerature:INTernal:LOLeakage?
CALibration:TEMPerature:INTernal:RECeiver?
CALibration:TEMPerature:INTernal:RRHead:AMPLitude?
CALibration:TEMPerature:INTernal:RRHead:IFCable?
CALibration:TEMPerature:INTernal:RRHead:LOSync?
CALibration:TEMPerature:INTernal:SOURce?
CALibration:TEMPerature:LALL?
CALibration:TEMPerature:LIF?
CALibration:TEMPerature:LPReselector?
CALibration:TEMPerature:LRF?
CALibration:TEMPerature:NFLoor?
CALibration:TEMPerature:RFPSelector:LCONducted?
CALibration:TEMPerature:RFPSelector:LRADiated?
CALibration:TIME:ELAPsed:NFLoor?
CALibration:TIME:INTernal:EMPath?
CALibration:TIME:INTernal:FAST?
CALibration:TIME:INTernal:HBAN?
CALibration:TIME:INTernal:LBANd?
CALibration:TIME:INTernal:LOLeakage?
CALibration:TIME:INTernal:RECeiver?
CALibration:TIME:INTernal:RRHead:AMPLitude?
CALibration:TIME:INTernal:RRHead:IFCable?
CALibration:TIME:INTernal:RRHead:LOSync?
CALibration:TIME:INTernal:SOURce?
CALibration:TIME:LALL?
CALibration:TIME:LIF?
CALibration:TIME:LPReselector?
CALibration:TIME:LRF?
CALibration:TIME:NFLoor?
CALibration:TIME:REFerence:CLOCk?
CALibration:TIME:RFPSelector:LCONducted?
CALibration:TIME:RFPSelector:LRADiated?
CALibration:YTF
CALibration:YTF?
CALibration:YTF:NPENding
CONFigure?
CONFigure:<meas>[:NDEFault]
CONFigure:ACPower
CONFigure:ACPower
CONFigure:ACPower:NDEFault
CONFigure:CATalog?
CONFigure:CDPower
CONFigure:CDPower
CONFigure:CDPower:NDEFault
CONFigure:CHPower
CONFigure:CWCDma
CONFigure:CWCDma
CONFigure:CWCDma:NDEFault
CONFigure:EVMQpsk

```
CONFigure:EVMQpsk
CONFigure:EVMQpsk:NDEFault
CONFigure:LPSTep
CONFigure:LPSTep
CONFigure:LPSTep:NDEFault
CONFigure:MONitor
CONFigure:MONitor
CONFigure:MONitor:NDEFault
CONFigure:OBWidth
CONFigure:OBWidth
CONFigure:OBWidth:NDEFault
CONFigure:PCONtrol
CONFigure:PCONtrol
CONFigure:PCONtrol:NDEFault
CONFigure:PSTatistic
CONFigure:PSTatistic
CONFigure:PSTatistic:NDEFault
CONFigure:RHO
CONFigure:RHO
CONFigure:RHO:NDEFault
CONFigure:SEMask
CONFigure:SEMask
CONFigure:SEMask:NDEFault
CONFigure:SPURious
CONFigure:SPURious
CONFigure:SPURious:NDEFault
CONFigure:WAVeform
CONFigure:WAVeform
CONFigure:WAVeform:NDEFault
COUPle
```

D

```
DISPlay:ACPower:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:COUPle
DISPlay:ACPower:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:COUPle?
DISPlay:ACPower:VIEW:NSELect
DISPlay:ACPower:VIEW:NSELect?
DISPlay:ACPower:VIEW[:SELect]
DISPlay:ACPower:VIEW[:SELect]?
DISPlay:ACPower:WINDow[1]:BGRaph
DISPlay:ACPower:WINDow[1]:BGRaph?
DISPlay:ACPower:WINDow[1]:TRACe:Y[:SCALe]:COUPle
DISPlay:ACPower:WINDow[1]:TRACe:Y[:SCALe]:COUPle?
DISPlay:ACPower:WINDow[1]:TRACe:Y[:SCALe]:PDIVision
DISPlay:ACPower:WINDow[1]:TRACe:Y[:SCALe]:PDIVision?
DISPlay:ACPower:WINDow[1]:TRACe:Y[:SCALe]:RLEVel
DISPlay:ACPower:WINDow[1]:TRACe:Y[:SCALe]:RLEVel?
DISPlay:ACPower:WINDow[1]:TRACe:Y[:SCALe]:RPOSition
DISPlay:ACPower:WINDow[1]:TRACe:Y[:SCALe]:RPOSition?
DISPlay:ACTivefunc[:STATe]
DISPlay:ACTivefunc[:STATe]?
DISPlay:ANNotation:MBAR[:STATe]
```

```
DISPlay:ANNotation:MBAR[:STATe]?
DISPlay:ANNotation:SCReen[:STATe]
DISPlay:ANNotation:SCReen[:STATe]?
DISPlay:ANNotation:TRACe[:STATe]
DISPlay:ANNotation:TRACe[:STATe]?
DISPlay:BACKlight
DISPlay:BACKlight?
DISPlay:CDPower:CDOMain:SPAN:STARt
DISPlay:CDPower:CDOMain:SPAN:STARt?
DISPlay:CDPower:CDOMain:SPAN:STOP
DISPlay:CDPower:CDOMain:SPAN:STOP?
DISPlay:CDPower:CPOWer[:STATe]
DISPlay:CDPower:CPOWer[:STATe]?
DISPlay:CDPower:TEXT:BFORmat
DISPlay:CDPower:TEXT:BFORmat?
DISPlay:CDPower:VIEW:NSELect
DISPlay:CDPower:VIEW:NSELect?
DISPlay:CDPower:VIEW[:SELect]
DISPlay:CDPower:VIEW[:SELect]?
DISPlay:CDPower:WINDow[1]
DISPlay:CDPower:WINDow[1]
DISPlay:CDPower:WINDow[1]|3|4|5|6|8:TRACe:Y[:SCALe]:RLEVel
DISPlay:CDPower:WINDow[1]|3|4|5|6|8:TRACe:Y[:SCALe]:RLEVel?
DISPlay:CDPower:WINDow4|5|6|8:TRACe:X[:SCALe]:COUPle
DISPlay:CDPower:WINDow4|5|6|8:TRACe:X[:SCALe]:COUPle?
DISPlay:CDPower:WINDow4|5|6|8:TRACe:X[:SCALe]:PDIVision
DISPlay:CDPower:WINDow4|5|6|8:TRACe:X[:SCALe]:PDIVision?
DISPlay:CDPower:WINDow4|5|6|8:TRACe:X[:SCALe]:RLEVel
DISPlay:CDPower:WINDow4|5|6|8:TRACe:X[:SCALe]:RLEVel?
DISPlay:CDPower:WINDow4|5|6|8:TRACe:Y[:SCALe]:COUPle
DISPlay:CDPower:WINDow4|5|6|8:TRACe:Y[:SCALe]:COUPle?
DISPlay:CDPower:WINDow4|5|6|8:TRACe:Y[:SCALe]:RPOSition
DISPlay:CDPower:WINDow4|5|6|8:TRACe:Y[:SCALe]:RPOSition?
DISPlay:CHPower:VIEW:NSELect
DISPlay:CHPower:VIEW:NSELect?
DISPlay:CHPower:VIEW[:SELect]
DISPlay:CHPower:VIEW[:SELect]?
DISPlay:CHPower:WINDow[1]:BGRaph
DISPlay:CHPower:WINDow[1]:BGRaph?
DISPlay:CHPower:WINDow[1]:TRACe:Y[:SCALe]:COUPle
DISPlay:CHPower:WINDow[1]:TRACe:Y[:SCALe]:COUPle?
DISPlay:CHPower:WINDow[1]:TRACe:Y[:SCALe]:PDIVision
DISPlay:CHPower:WINDow[1]:TRACe:Y[:SCALe]:PDIVision?
DISPlay:CHPower:WINDow[1]:TRACe:Y[:SCALe]:RLEVel
DISPlay:CHPower:WINDow[1]:TRACe:Y[:SCALe]:RLEVel?
DISPlay:CHPower:WINDow[1]:TRACe:Y[:SCALe]:RPOSition
DISPlay:CHPower:WINDow[1]:TRACe:Y[:SCALe]:RPOSition?
DISPlay:CWCDma:VIEW[:SELect]
DISPlay:CWCDma:VIEW[:SELect]?
DISPlay:ENABle
DISPlay:ENABle?
DISPlay:EVMQpsk:VIEW:NSELect
DISPlay:EVMQpsk:VIEW:NSELect?
```

```
DISPlay:EVMQpsk:VIEW[:SELect]
DISPlay:EVMQpsk:VIEW[:SELect]?
DISPlay:EVMQpsk:WINDow2:TRACe:COFFset
DISPlay:EVMQpsk:WINDow2:TRACe:COFFset?
DISPlay:EVMQpsk:WINDow2:TRACe:FVECtor[:STATe]
DISPlay:EVMQpsk:WINDow2:TRACe:FVECtor[:STATe]?
DISPlay:EVMQpsk:WINDow2:TRACe:INTPolation[:STATe]
DISPlay:EVMQpsk:WINDow2:TRACe:INTPolation[:STATe]?
DISPlay:EVMQpsk:WINDow2:TRACe:IQCHips
DISPlay:EVMQpsk:WINDow2:TRACe:IQCHips?
DISPlay:EVMQpsk:WINDow2:TRACe:POLar
DISPlay:EVMQpsk:WINDow2:TRACe:POLar?
DISPlay:EVMQpsk:WINDow2:TRACe:ROTQpi[:STATe]
DISPlay:EVMQpsk:WINDow2:TRACe:ROTQpi[:STATe]?
DISPlay:EVMQpsk:WINDow3|4|5:TRACe:X[:SCALe]:COUPle
DISPlay:EVMQpsk:WINDow3|4|5:TRACe:X[:SCALe]:COUPle?
DISPlay:EVMQpsk:WINDow3|4|5:TRACe:X[:SCALe]:PDIVision
DISPlay:EVMQpsk:WINDow3|4|5:TRACe:X[:SCALe]:PDIVision?
DISPlay:EVMQpsk:WINDow3|4|5:TRACe:X[:SCALe]:RLEVel
DISPlay:EVMQpsk:WINDow3|4|5:TRACe:X[:SCALe]:RLEVel?
DISPlay:EVMQpsk:WINDow3|4|5:TRACe:X[:SCALe]:RPOSition
DISPlay:EVMQpsk:WINDow3|4|5:TRACe:X[:SCALe]:RPOSition?
DISPlay:EVMQpsk:WINDow3|4|5:TRACe:Y[:SCALe]:COUPle
DISPlay:EVMQpsk:WINDow3|4|5:TRACe:Y[:SCALe]:COUPle?
DISPlay:EVMQpsk:WINDow3|4|5:TRACe:Y[:SCALe]:PDIVision
DISPlay:EVMQpsk:WINDow3|4|5:TRACe:Y[:SCALe]:PDIVision?
DISPlay:EVMQpsk:WINDow3|4|5:TRACe:Y[:SCALe]:RLEVel
DISPlay:EVMQpsk:WINDow3|4|5:TRACe:Y[:SCALe]:RLEVel?
DISPlay:EVMQpsk:WINDow3|4|5:TRACe:Y[:SCALe]:RPOSition
DISPlay:EVMQpsk:WINDow3|4|5:TRACe:Y[:SCALe]:RPOSition?
DISPlay:FSCReen[:STATe]
DISPlay:FSCReen[:STATe]?
DISPlay:GRATicule[:STATe]
DISPlay:GRATicule[:STATe]?
DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:COUPle
DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:COUPle?
DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:PDIVision
DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:PDIVision?
DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:RLEVel
DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:RLEVel?
DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:RPOSition
DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:RPOSition?
DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:COUPle
DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:COUPle?
DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:PDIVision
DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:PDIVision?
DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:RLEVel
DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:RLEVel?
DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:RPOSition
DISPlay:LPSTep:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:RPOSition?
DISPlay:LPSTep:VIEW:RESType
DISPlay:LPSTep:VIEW:RESType?
DISPlay:LPSTep:VIEW[:SELect]
```

```
DISPlay:LPSTep:VIEW[:SELect]?
DISPlay:MONitor:VIEW:NSELect
DISPlay:MONitor:VIEW:NSELect?
DISPlay:MONitor:VIEW[:SELect]
DISPlay:MONitor:VIEW[:SELect]?
DISPlay:MONitor:WINDow[1]:TRACe:Y[:SCALe]:COUPle
DISPlay:MONitor:WINDow[1]:TRACe:Y[:SCALe]:COUPle?
DISPlay:MONitor:WINDow[1]:TRACe:Y[:SCALe]:PDIVision
DISPlay:MONitor:WINDow[1]:TRACe:Y[:SCALe]:PDIVision?
DISPlay:MONitor:WINDow[1]:TRACe:Y[:SCALe]:RLEVel
DISPlay:MONitor:WINDow[1]:TRACe:Y[:SCALe]:RLEVel?
DISPlay:MONitor:WINDow[1]:TRACe:Y[:SCALe]:RPOSition
DISPlay:MONitor:WINDow[1]:TRACe:Y[:SCALe]:RPOSition?
DISPlay:OBWidth:VIEW:NSELect
DISPlay:OBWidth:VIEW:NSELect?
DISPlay:OBWidth:VIEW[:SELect]
DISPlay:OBWidth:VIEW[:SELect]?
DISPlay:OBWidth:WINDow[1]:TRACe:Y[:SCALe]:COUPle
DISPlay:OBWidth:WINDow[1]:TRACe:Y[:SCALe]:COUPle?
DISPlay:OBWidth:WINDow[1]:TRACe:Y[:SCALe]:PDIVision
DISPlay:OBWidth:WINDow[1]:TRACe:Y[:SCALe]:PDIVision?
DISPlay:OBWidth:WINDow[1]:TRACe:Y[:SCALe]:RLEVel
DISPlay:OBWidth:WINDow[1]:TRACe:Y[:SCALe]:RLEVel?
DISPlay:OBWidth:WINDow[1]:TRACe:Y[:SCALe]:RPOSition
DISPlay:OBWidth:WINDow[1]:TRACe:Y[:SCALe]:RPOSition?
DISPlay:OBWidth:WINDow[1]:XDB
DISPlay:OBWidth:WINDow[1]:XDB?
DISPlay:OBWidth:WINDow2:BOUNdaries:FREQuency
DISPlay:OBWidth:WINDow2:BOUNdaries:FREQuency?
DISPlay:PCONtrol:VIEW:NSELect
DISPlay:PCONtrol:VIEW:NSELect?
DISPlay:PCONtrol:VIEW[:SELect]
DISPlay:PCONtrol:VIEW[:SELect]?
DISPlay:PCONtrol:WINDow[1]|4:TRACe:X[:SCALe]:COUPle
DISPlay:PCONtrol:WINDow[1]|4:TRACe:X[:SCALe]:COUPle?
DISPlay:PCONtrol:WINDow[1]|4:TRACe:X[:SCALe]:PDIVision
DISPlay:PCONtrol:WINDow[1]|4:TRACe:X[:SCALe]:PDIVision?
DISPlay:PCONtrol:WINDow[1]|4:TRACe:X[:SCALe]:RLEVel
DISPlay:PCONtrol:WINDow[1]|4:TRACe:X[:SCALe]:RLEVel?
DISPlay:PCONtrol:WINDow[1]|4:TRACe:X[:SCALe]:RPOSition
DISPlay:PCONtrol:WINDow[1]|4:TRACe:X[:SCALe]:RPOSition?
DISPlay:PCONtrol:WINDow[1]|4:TRACe:Y[:SCALe]:COUPle
DISPlay:PCONtrol:WINDow[1]|4:TRACe:Y[:SCALe]:COUPle?
DISPlay:PCONtrol:WINDow[1]|4:TRACe:Y[:SCALe]:PDIVision
DISPlay:PCONtrol:WINDow[1]|4:TRACe:Y[:SCALe]:PDIVision?
DISPlay:PCONtrol:WINDow[1]|4:TRACe:Y[:SCALe]:RLEVel
DISPlay:PCONtrol:WINDow[1]|4:TRACe:Y[:SCALe]:RLEVel?
DISPlay:PCONtrol:WINDow[1]|4:TRACe:Y[:SCALe]:RPOSition
DISPlay:PCONtrol:WINDow[1]|4:TRACe:Y[:SCALe]:RPOSition?
DISPlay:PCONtrol:WINDow4:TRACe:CPHase[:STATe]
DISPlay:PCONtrol:WINDow4:TRACe:CPHase[:STATe]?
DISPlay:PCONtrol:WINDow:TEXT:SNUMber
DISPlay:PCONtrol:WINDow:TEXT:SNUMber?
```

```
DISPlay:PSTatistic:GAUSsian[:STATe]
DISPlay:PSTatistic:GAUSsian[:STATe]?
DISPlay:PSTatistic:RTRace[:STATe]
DISPlay:PSTatistic:RTRace[:STATe]?
DISPlay:PSTatistic:VIEW[1]:WINDow2:TRACe:X[:SCALe]:PDIVision
DISPlay:PSTatistic:VIEW[1]:WINDow2:TRACe:X[:SCALe]:PDIVision?
DISPlay:RHO:CDOMain:SPAN:STARt
DISPlay:RHO:CDOMain:SPAN:STARt?
DISPlay:RHO:CDOMain:SPAN:STOP
DISPlay:RHO:CDOMain:SPAN:STOP?
DISPlay:RHO:TEXT:TFUNit
DISPlay:RHO:TEXT:TFUNit?
DISPlay:RHO:VIEW:NSELect
DISPlay:RHO:VIEW:NSELect?
DISPlay:RHO:VIEW[:SELect]
DISPlay:RHO:VIEW[:SELect]?
DISPlay:RHO:WINDow2:TRACe:COFFset
DISPlay:RHO:WINDow2:TRACe:COFFset?
DISPlay:RHO:WINDow2:TRACe:FVECtor[:STATe]
DISPlay:RHO:WINDow2:TRACe:FVECtor[:STATe]?
DISPlay:RHO:WINDow2:TRACe:IQCHips
DISPlay:RHO:WINDow2:TRACe:IQCHips?
DISPlay:RHO:WINDow2:TRACe:POLar
DISPlay:RHO:WINDow2:TRACe:POLar?
DISPlay:RHO:WINDow2:TRACe:ROTQpi[:STATe]
DISPlay:RHO:WINDow2:TRACe:ROTQpi[:STATe]?
DISPlay:RHO:WINDow3
DISPlay:RHO:WINDow3
DISPlay:RHO:WINDow3|4|5|10|11|12:TRACe:Y[:SCALe]:COUPle
DISPlay:RHO:WINDow3|4|5|10|11|12:TRACe:Y[:SCALe]:COUPle?
DISPlay:RHO:WINDow3|4|5|10|11|12:TRACe:Y[:SCALe]:RPOSition
DISPlay:RHO:WINDow3|4|5|10|11|12:TRACe:Y[:SCALe]:RPOSition?
DISPlay:RHO:WINDow3|4|5|6|10|11|12:TRACe:Y[:SCALe]:RLEVel
DISPlay:RHO:WINDow3|4|5|6|10|11|12:TRACe:Y[:SCALe]:RLEVel?
DISPlay:RHO:WINDow3|4|5:TRACe:X[:SCALe]:COUPle
DISPlay:RHO:WINDow3|4|5:TRACe:X[:SCALe]:COUPle?
DISPlay:RHO:WINDow3|4|5:TRACe:X[:SCALe]:PDIVision
DISPlay:RHO:WINDow3|4|5:TRACe:X[:SCALe]:PDIVision?
DISPlay:RHO:WINDow3|4|5:TRACe:X[:SCALe]:RLEVel
DISPlay:RHO:WINDow3|4|5:TRACe:X[:SCALe]:RLEVel?
DISPlay:RHO:WINDow3|4|5:TRACe:X[:SCALe]:RPOSition
DISPlay:RHO:WINDow3|4|5:TRACe:X[:SCALe]:RPOSition?
DISPlay:SEMask:VIEW:NSELect
DISPlay:SEMask:VIEW:NSELect?
DISPlay:SEMask:VIEW[:SELect]
DISPlay:SEMask:VIEW[:SELect]?
DISPlay:SEMask:WINDow[1]:TRACe:X[:SCALe]:COUPle
DISPlay:SEMask:WINDow[1]:TRACe:X[:SCALe]:COUPle?
DISPlay:SEMask:WINDow[1]:TRACe:X[:SCALe]:PDIVision
DISPlay:SEMask:WINDow[1]:TRACe:X[:SCALe]:PDIVision?
DISPlay:SEMask:WINDow[1]:TRACe:X[:SCALe]:RLEVel
DISPlay:SEMask:WINDow[1]:TRACe:X[:SCALe]:RLEVel?
DISPlay:SEMask:WINDow[1]:TRACe:X[:SCALe]:RPOSition
```

```
DISPlay:SEMask:WINDow[1]:TRACe:X[:SCALe]:RPOSition?
DISPlay:SEMask:WINDow[1]:TRACe:Y[:SCALe]:COUPle
DISPlay:SEMask:WINDow[1]:TRACe:Y[:SCALe]:COUPle?
DISPlay:SEMask:WINDow[1]:TRACe:Y[:SCALe]:PDIVision
DISPlay:SEMask:WINDow[1]:TRACe:Y[:SCALe]:PDIVision?
DISPlay:SEMask:WINDow[1]:TRACe:Y[:SCALe]:RLEVel
DISPlay:SEMask:WINDow[1]:TRACe:Y[:SCALe]:RLEVel?
DISPlay:SEMask:WINDow[1]:TRACe:Y[:SCALe]:RPOSition
DISPlay:SEMask:WINDow[1]:TRACe:Y[:SCALe]:RPOSition?
DISPlay:SPURious:VIEW:RANGe:TABLe:FMODe
DISPlay:SPURious:VIEW:RANGe:TABLe:FMODe?
DISPlay:SPURious:VIEW[:SELect]
DISPlay:SPURious:VIEW[:SELect]?
DISPlay:SPURious:WINDow[1]:TRACe:Y[:SCALe]:COUPle
DISPlay:SPURious:WINDow[1]:TRACe:Y[:SCALe]:COUPle?
DISPlay:SPURious:WINDow[1]:TRACe:Y[:SCALe]:PDIVision
DISPlay:SPURious:WINDow[1]:TRACe:Y[:SCALe]:PDIVision?
DISPlay:SPURious:WINDow[1]:TRACe:Y[:SCALe]:RLEVel
DISPlay:SPURious:WINDow[1]:TRACe:Y[:SCALe]:RLEVel?
DISPlay:THEMe
DISPlay:THEMe?
DISPlay:UINTerface:CSIZe
DISPlay:UINTerface:CSIZe?
DISPlay:UINTerface:HTABs
DISPlay:UINTerface:HTABs?
DISPlay:UINTerface:STAB
DISPlay:UINTerface:TYPE?
DISPlay:VIEW:ADVanced:CATalog?
DISPlay:VIEW:ADVanced:DELete
DISPlay:VIEW:ADVanced:DELete:ALL
DISPlay:VIEW:ADVanced:NAME
DISPlay:VIEW:ADVanced:REName
DISPlay:VIEW:ADVanced:SELect
DISPlay:VIEW:ADVanced:SELect?
DISPlay:VIEW:ADVanced:USER:CATalog?
DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:X[:SCALe]:COUPle
DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:X[:SCALe]:COUPle?
DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:X[:SCALe]:PDIVision
DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:X[:SCALe]:PDIVision?
DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:X[:SCALe]:RLEVel
DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:X[:SCALe]:RLEVel?
DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:X[:SCALe]:RPOSition
DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:X[:SCALe]:RPOSition?
DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:Y[:SCALe]:COUPle
DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:Y[:SCALe]:COUPle?
DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:Y[:SCALe]:PDIVision
DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:Y[:SCALe]:PDIVision?
DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:Y[:SCALe]:RLEVel
DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:Y[:SCALe]:RLEVel?
DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:Y[:SCALe]:RPOSition
DISPlay:WAVeform:VIEW[1]|2:WINDow[1]:TRACe:Y[:SCALe]:RPOSition?
DISPlay:WAVeform:VIEW:NSELect
DISPlay:WAVeform:VIEW:NSELect?
```

```
DISPlay:WAVeform:VIEW[:SELect]
DISPlay:WAVeform:VIEW[:SELect]?
DISPlay:WINDow[1]:ANNotation[:ALL]
DISPlay:WINDow[1]:ANNotation[:ALL]?
```

F

```
FETCh:<meas>[n]?
FETCh:ACPower[n]?
FETCh:CDPower[n]?
FETCh:CHPower:CHPower?
FETCh:CHPower:DENSity?
FETCh:CHPower:DENSity[n]?
FETCh:CHPower[n]?
FETCh:CWCDma[n]?
FETCh:EVMQpsk[n]?
FETCh:LPSTep[n]?
FETCh:MONitor[n]?
FETCh:OBWidth:FERRor?
FETCh:OBWidth[n]?
FETCh:OBWidth:OBWidth?
FETCh:OBWidth:XDB?
FETCh:PCONtrol[n]?
FETCh:PSTatistic[n]?
FETCh:RHO[n]?
FETCh:SEMask[n]?
FETCh:SPURious[n]?
FETCh:WAVeform[n]?
FORMat:BORDer
FORMat:BORDer?
FORMat[:TRACe][:DATA]
FORMat[:TRACe][:DATA]?
```

G

```
GLOBal:FREQuency:CENTer[:STATe]
GLOBal:FREQuency:CENTer[:STATe]?
```

H

```
HCOPy:ABORt
HCOPy[:IMMediate]
```

I

```
ID?
INITiate:<meas>
INITiate:ACPower
```

```
INITiate:CDPower
INITiate:CONTinuous
INITiate:CONTinuous
INITiate:CONTinuous
INITiate:CONTinuous?
INITiate:CONTinuous?
INITiate:CONTinuous?
INITiate:CWCDma
INITiate[:IMMediate]
INITiate[:IMMediate]
INITiate[:IMMediate]
INITiate:LPSTep
INITiate:MONitor
INITiate:OBWidth
INITiate:PAUSe
INITiate:PAUSe
INITiate:PAUSe
INITiate:PCONtrol
INITiate:PSTatistic
INITiate:RESTart
INITiate:RESTart
INITiate:RESTart
INITiate:RESume
INITiate:RESume
INITiate:RESume
INITiate:RHO
INITiate:SEMask
INITiate:SPURious
INITiate:WAVeform
INPut[1]:IQ[:I]:IMPedance
INPut[1]:IQ[:I]:IMPedance?
INPut[1]:IQ:Q:IMPedance
INPut[1]:IQ:Q:IMPedance?
INPut:COUPling
INPut:COUPling?
INPut:COUPling:I
INPut:COUPling:I?
INPut:COUPling:Q
INPut:COUPling:Q?
INPut:FEXTender:CABLe:CORRection
INPut:IMPedance:REFerence
INPut:IMPedance:REFerence?
INPut:IQ[:I]:DIFFerential
INPut:IQ[:I]:DIFFerential?
INPut:IQ:MIRRored
INPut:IQ:MIRRored?
INPut:IQ:Q:DIFFerential
INPut:IQ:Q:DIFFerential?
INPut:OFFSet:I
INPut:OFFSet:I?
INPut:OFFSet:Q
INPut:OFFSet:Q?
INSTrument:CATalog?
```

```
INSTrument:CONFigure:<mode>:<meas>
INSTrument:COUPle:DEFault
INSTrument:COUPle:DEFault
INSTrument:COUPle:EMC:STANdard
INSTrument:COUPle:EMC:STANdard?
INSTrument:COUPle:FREQuency:BAND:EXTend
INSTrument:COUPle:FREQuency:BAND:EXTend
INSTrument:COUPle:FREQuency:BAND:EXTend?
INSTrument:COUPle:FREQuency:BAND:EXTend?
INSTrument:COUPle:FREQuency:CENTer
INSTrument:COUPle:FREQuency:CENTer
INSTrument:COUPle:FREQuency:CENTer?
INSTrument:COUPle:FREQuency:CENTer?
INSTrument:COUPle:SCReen:INPut
INSTrument:COUPle:SCReen:INPut?
INSTrument:DEFault
INSTrument:NSELect
INSTrument:NSELect?
INSTrument:SCReen:CATalog?
INSTrument:SCReen:CREate
INSTrument:SCReen:DELete
INSTrument:SCReen:DELete:ALL
INSTrument:SCReen:MULTiple?
INSTrument:SCReen:MULTiple[:STATe]
INSTrument:SCReen:ORIentation
INSTrument:SCReen:REName
INSTrument:SCReen:SELect
INSTrument:SCReen:SELect?
INSTrument:SCReen:STAB?
INSTrument[:SELect]
INSTrument[:SELect]
INSTrument[:SELect]
INSTrument[:SELect]
INSTrument[:SELect]
INSTrument[:SELect]
INSTrument[:SELect]
INSTrument[:SELect]?
```

L

```
LXI:IDENtify[:STATe]
LXI:IDENtify[:STATe]?
```

M

```
MEASure:<meas>[n]?
MEASure:ACPower[n]?
MEASure:CDPower[n]?
MEASure:CHPower:CHPower?
MEASure:CHPower:DENSity?
MEASure:CHPower:DENSity[n]?
```

```
MEASure:CHPower[n]?
MEASure:CWCDma[n]?
MEASure:EVMQpsk[n]?
MEASure:LPSTep[n]?
MEASure:MONitor[n]?
MEASure:OBWidth:FERRor?
MEASure:OBWidth[n]?
MEASure:OBWidth:OBWidth?
MEASure:OBWidth:XDB?
MEASure:PCONtrol[n]?
MEASure:PSTatistic[n]?
MEASure:RHO[n]?
MEASure:SEMask[n]?
MEASure:SPURious[n]?
MEASure:WAVeform[n]?
MMEMory:CATalog?
MMEMory:CDIRectory
MMEMory:CDIRectory?
MMEMory:COPY
MMEMory:COPY:DEVice
MMEMory:DATA
MMEMory:DATA?
MMEMory:DELete
MMEMory:HEADer:ID?
MMEMory:LOAD:CCORrection
MMEMory:LOAD:CORRection
MMEMory:LOAD:CORRection:GROup
MMEMory:LOAD:LIMit
MMEMory:LOAD:RTYPe
MMEMory:LOAD:SCONfig
MMEMory:LOAD:STATe
MMEMory:LOAD:TRACe
MMEMory:LOAD:TRACe:DATA
MMEMory:LOAD:TRACe:REGister
MMEMory:MDIRectory
MMEMory:MOVE
MMEMory:RDIRectory
MMEMory:REGister:STATe:LABel
MMEMory:REGister:STATe:LABel?
MMEMory:REGister:TRACe:LABel
MMEMory:REGister:TRACe:LABel?
MMEMory:RMEDia:LABel
MMEMory:RMEDia:LABel?
MMEMory:RMEDia:LIST?
MMEMory:RMEDia:SIZE?
MMEMory:RMEDia:WPRotect?
MMEMory:STORe:CORRection
MMEMory:STORe:CORRection:GROup
MMEMory:STORe:LIMit
MMEMory:STORe:QSAVe
MMEMory:STORe:QSAVe?
MMEMory:STORe:RESults
MMEMory:STORe:SCONfig
```

MMEMory:STORe:SCReen
MMEMory:STORe:SCReen:THEMe
MMEMory:STORe:SCReen:THEMe?
MMEMory:STORe:STATe
MMEMory:STORe:TRACe
MMEMory:STORe:TRACe:REGister

O

OUTPut:ANALog
OUTPut:ANALog?
OUTPut:ANALog:AUTO
OUTPut:ANALog:AUTO?
OUTPut:ANALog:SVIDeo
OUTPut:ANALog:SVIDeo?
OUTPut:AUX
OUTPut:AUX?
OUTPut:AUX:AIF
OUTPut:AUX:AIF?
OUTPut:AUX:IO
OUTPut:AUX:IO?
OUTPut:AUX:IO:DATA<n>
OUTPut:DBUS[1][:STATe]
OUTPut:DBUS[1][:STATe]?
OUTPut:DBUS2:DATA
OUTPut:DBUS2:DATA?
OUTPut:DBUS2[:STATe]
OUTPut:DBUS2[:STATe]?
OUTPut:EIF
OUTPut:EIF?
OUTPut[:EXTernal][:STATe]
OUTPut[:EXTernal][:STATe]?
OUTPut:IF2
OUTPut:IF2?
OUTPut:IQ:OUTPut
OUTPut:IQ:OUTPut?
OUTPut:MODulation[:STATe]
OUTPut:MODulation[:STATe]?

R

READ:<meas>[n]?
READ:ACPower[n]?
READ:CDPower[n]?
READ:CHPower:CHPower?
READ:CHPower:DENSity?
READ:CHPower:DENSity[n]?
READ:CHPower[n]?
READ:CWCDma[n]?
READ:EVMQpsk[n]?
READ:LPSTep[n]?

```
READ:MONitor[n]?
READ:OBWidth:FERRor?
READ:OBWidth[n]?
READ:OBWidth:OBWidth?
READ:OBWidth:XDB?
READ:PCONtrol[n]?
READ:PSTatistic[n]?
READ:RHO[n]?
READ:SEMask[n]?
READ:SPURious[n]?
READ:WAVeform[n]?
```

S

```
[:SENSe]:<measurement>:PFILter[:STATe]
[:SENSe]:<measurement>:PFILter[:STATe]?
[:SENSe]:ACPower:AVERage:COUNt
[:SENSe]:ACPower:AVERage:COUNt?
[:SENSe]:ACPower:AVERage[:STATe]
[:SENSe]:ACPower:AVERage[:STATe]?
[:SENSe]:ACPower:AVERage:TCONtrol
[:SENSe]:ACPower:AVERage:TCONtrol?
[:SENSe]:ACPower:BANDwidth[:RESolution]
[:SENSe]:ACPower:BANDwidth[:RESolution]?
[:SENSe]:ACPower:BANDwidth[:RESolution]:AUTO
[:SENSe]:ACPower:BANDwidth[:RESolution]:AUTO?
[:SENSe]:ACPower:BANDwidth[:RESolution]:FPOWer:MODE
[:SENSe]:ACPower:BANDwidth[:RESolution]:FPOWer:MODE?
[:SENSe]:ACPower:BANDwidth:SHAPe
[:SENSe]:ACPower:BANDwidth:SHAPe?
[:SENSe]:ACPower:BANDwidth:TYPE
[:SENSe]:ACPower:BANDwidth:TYPE?
[:SENSe]:ACPower:BANDwidth:VIDeo
[:SENSe]:ACPower:BANDwidth:VIDeo?
[:SENSe]:ACPower:BANDwidth:VIDeo:AUTO
[:SENSe]:ACPower:BANDwidth:VIDeo:AUTO?
[:SENSe]:ACPower:CARRier[1]|2:AUTO[:STATe]
[:SENSe]:ACPower:CARRier[1]|2:AUTO[:STATe]?
[:SENSe]:ACPower:CARRier[1]|2:COUNt
[:SENSe]:ACPower:CARRier[1]|2:COUNt?
[:SENSe]:ACPower:CARRier[1]|2:CPSD
[:SENSe]:ACPower:CARRier[1]|2:CPSD
[:SENSe]:ACPower:CARRier[1]|2:CPSD?
[:SENSe]:ACPower:CARRier[1]|2:CPSD?
[:SENSe]:ACPower:CARRier[1]|2:INDex
[:SENSe]:ACPower:CARRier[1]|2:INDex?
[:SENSe]:ACPower:CARRier[1]|2:LIST:BANDwidth[:INTegration]
[:SENSe]:ACPower:CARRier[1]|2:LIST:BANDwidth[:INTegration]?
[:SENSe]:ACPower:CARRier[1]|2:LIST:COUPle
[:SENSe]:ACPower:CARRier[1]|2:LIST:COUPle?
[:SENSe]:ACPower:CARRier[1]|2:LIST:FILTer:ALPHa
[:SENSe]:ACPower:CARRier[1]|2:LIST:FILTer:ALPHa?
```

[:SENSe]:ACPower:CARRier[1]|2:LIST:FILTer[:RRC][:STATe]
[:SENSe]:ACPower:CARRier[1]|2:LIST:FILTer[:RRC][:STATe]?
[:SENSe]:ACPower:CARRier[1]|2:LIST:PPResent
[:SENSe]:ACPower:CARRier[1]|2:LIST:PPResent?
[:SENSe]:ACPower:CARRier[1]|2:LIST:WIDTh
[:SENSe]:ACPower:CARRier[1]|2:LIST:WIDTh?
[:SENSe]:ACPower:CARRier[1]|2[:POWer]
[:SENSe]:ACPower:CARRier[1]|2[:POWer]
[:SENSe]:ACPower:CARRier[1]|2[:POWer]?
[:SENSe]:ACPower:CARRier[1]|2[:POWer]?
[:SENSe]:ACPower:CARRier[1]|2:PREFerence:TYPE
[:SENSe]:ACPower:CARRier[1]|2:PREFerence:TYPE
[:SENSe]:ACPower:CARRier[1]|2:PREFerence:TYPE?
[:SENSe]:ACPower:CARRier[1]|2:PREFerence:TYPE?
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[:SENSe]:ACPower:CARRier[1]|2:RCARrier?
[:SENSe]:ACPower:CARRier[1]|2:RCARrier:AUTO
[:SENSe]:ACPower:CARRier[1]|2:RCARrier:AUTO?
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[:SENSe]:ACPower:CARRier[1]|2:RCFRequency:AUTO
[:SENSe]:ACPower:CARRier[1]|2:RCFRequency:AUTO?
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[:SENSe]:ACPower:DETector:AUTO?
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[:SENSe]:ACPower:DETector[:FUNCtion]?
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[:SENSe]:ACPower:FILTer:BANDwidth[:INTegration]?
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[:SENSe]:ACPower:FREQuency:SPAN?
[:SENSe]:ACPower:FREQuency:SYNThesis:AUTO[:STATe]
[:SENSe]:ACPower:FREQuency:SYNThesis:AUTO[:STATe]?
[:SENSe]:ACPower:FREQuency:SYNThesis[:STATe]
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[:SENSe]:ACPower:IF:GAIN:FPOWer
[:SENSe]:ACPower:IF:GAIN:FPOWer?
[:SENSe]:ACPower:METHod
[:SENSe]:ACPower:METHod?
[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:RCARrier
[:SENSe]:ACPower:OFFSet[1]|2:INNer:LIST:RCARrier?
[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:ABSolute
[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:ABSolute?
[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth[:INTegration]
[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth[:INTegration]?
[:SENSe]:ACPower:OFFSet[1]|2
[:OUTer]:LIST:BANDwidth:RESolution:AUTO
[:SENSe]:ACPower:OFFSet[1]|2
[:OUTer]:LIST:BANDwidth:RESolution:AUTO?
[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:SHAPe
[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:SHAPe?
[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:TYPE

```
[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:TYPE?
[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:VIDeo:AUTO
[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:BANDwidth:VIDeo:AUTO?
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[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:FILTer:ALPHa?
[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:FILTer[:RRC][:STATe]
[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:FILTer[:RRC][:STATe]?
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[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:RCARrier?
[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:RPSDensity
[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:RPSDensity?
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[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:SIDE?
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[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:STATe?
[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:TEST
[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:LIST:TEST?
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[:SENSe]:ACPower:OFFSet[1]|2[:OUTer]:TYPE
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[:SENSe]:ACPower:SAVoid[:STATe]?
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[:SENSe]:ACPower:SWEep:POINts?
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[:SENSe]:ACPower:SWEep:TIME?
[:SENSe]:ACPower:SWEep:TIME:AUTO
[:SENSe]:ACPower:SWEep:TIME:AUTO?
[:SENSe]:ACPower:SWEep:TIME:AUTO:RULes
[:SENSe]:ACPower:SWEep:TIME:AUTO:RULes?
[:SENSe]:ACPower:TYPE
[:SENSe]:ACPower:TYPE?
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[:SENSe]:AFINput[1]|2:COUPling?
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[:SENSe]:AFINput[1]|2:IMPedance?
[:SENSe]:AFINput[1]|2:LOW
[:SENSe]:AFINput[1]|2:LOW?
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[:SENSe]:CCORection:CSET:COMMent?
[:SENSe]:CCORrection:CSET:ALL:DELete
[:SENSe]:CCORrection:CSET:DATA
[:SENSe]:CCORrection:CSET:DELete
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[:SENSe]:CCORrection:CSET:DESCription?
[:SENSe]:CCORrection:CSET:DIRection
[:SENSe]:CCORrection:CSET:DIRection?
[:SENSe]:CCORrection:CSET:PORT
[:SENSe]:CCORrection:CSET:PORT?
[:SENSe]:CCORrection:CSET:SELect
```

```
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[:SENSe]:CCORrection:CSET[:STATe]?
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[:SENSe]:CCORrection:CSET:X:SPACing?
[:SENSe]:CCORrection:DATA?
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[:SENSe]:CDPower:CAPTure:TIME[:FRAMe]?
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[:SENSe]:CDPower:CRATe?
[:SENSe]:CDPower:FERRor:TRANge
[:SENSe]:CDPower:FERRor:TRANge?
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[:SENSe]:CDPower:FILTer:ALPHa?
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[:SENSe]:CDPower:FILTer[:RRC][:STATe]?
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[:SENSe]:CDPower:PRACh:SIGNature:AUTO?
[:SENSe]:CDPower:SBOundary[:BTS]
[:SENSe]:CDPower:SBOundary[:BTS]?
[:SENSe]:CDPower:SBOundary:LIST[:BTS]:APPend
[:SENSe]:CDPower:SBOundary:LIST[:BTS]:CHANnel?
[:SENSe]:CDPower:SBOundary:LIST[:BTS]:INIT
[:SENSe]:CDPower:SBOundary:LIST[:BTS]:NCHannels?
[:SENSe]:CDPower:SBOundary:LIST[:BTS]:PRESet
[:SENSe]:CDPower:SBOundary:LIST[:BTS]:REPLace
[:SENSe]:CDPower:SBOundary:LIST:MS:APPend
[:SENSe]:CDPower:SBOundary:LIST:MS:CHANnel?
[:SENSe]:CDPower:SBOundary:LIST:MS:INIT
[:SENSe]:CDPower:SBOundary:LIST:MS:NCHannels?
[:SENSe]:CDPower:SBOundary:LIST:MS:REPLace
[:SENSe]:CDPower:SBOundary:MS
[:SENSe]:CDPower:SBOundary:MS?
[:SENSe]:CDPower:SCCPch:SPRead
[:SENSe]:CDPower:SCCPch:SPRead?
```

```
[:SENSe]:CDPower:SCCPch:SRATe
[:SENSe]:CDPower:SCCPch:SRATe?
[:SENSe]:CDPower:SFORmat:MS
[:SENSe]:CDPower:SFORmat:MS?
[:SENSe]:CDPower:SPECtrum
[:SENSe]:CDPower:SPECtrum?
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[:SENSe]:CDPower:SSLot:NUMBer?
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[:SENSe]:CDPower:SSLot[:STATe]?
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[:SENSe]:CDPower:SYNC:CPICh:ESTimator?
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[:SENSe]:CDPower:SYNC:MS?
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[:SENSe]:CDPower:SYNC:SCRamble[:BTS]?
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[:SENSe]:CDPower:SYNC:SCRamble[:BTS]:AUTO?
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[:SENSe]:CDPower:SYNC:SCRamble[:BTS]:OFFSet?
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[:SENSe]:CDPower:SYNC:SYMBol:SPRead?
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[:SENSe]:CDPower:SYNC:SYMBol:SRATe?
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[:SENSe]:CHPower:BANDwidth[:RESolution]
[:SENSe]:CHPower:BANDwidth[:RESolution]?
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[:SENSe]:CHPower:BANDwidth[:RESolution]:AUTO?
[:SENSe]:CHPower:BANDwidth:SHAPe
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[:SENSe]:CHPower:BANDwidth:VIDeo?
[:SENSe]:CHPower:BANDwidth:VIDeo:AUTO
[:SENSe]:CHPower:BANDwidth:VIDeo:AUTO?
[:SENSe]:CHPower:DETector:AUTO
[:SENSe]:CHPower:DETector:AUTO?
[:SENSe]:CHPower:DETector[:FUNCtion]
[:SENSe]:CHPower:DETector[:FUNCtion]?
[:SENSe]:CHPower:FILTer[:RRC]:ALPHa
```

```
[:SENSe]:CHPower:FILTer[:RRC]:ALPHa?
[:SENSe]:CHPower:FILTer[:RRC]:BANDwidth
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[:SENSe]:CHPower:FILTer[:RRC][:STATe]?
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[:SENSe]:CHPower:FREQuency:SPAN?
[:SENSe]:CHPower:FREQuency:SPAN:AUTO
[:SENSe]:CHPower:FREQuency:SPAN:AUTO?
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[:SENSe]:CHPower:FREQuency:SYNThesis:AUTO[:STATe]
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[:SENSe]:CHPower:IF:GAIN:AUTO[:STATe]?
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[:SENSe]:CHPower:IF:GAIN[:STATe]?
[:SENSe]:CHPower:SAVoid[:STATe]
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[:SENSe]:CHPower:SWEep:POINts
[:SENSe]:CHPower:SWEep:POINts?
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[:SENSe]:CHPower:SWEep:TIME?
[:SENSe]:CHPower:SWEep:TIME:AUTO
[:SENSe]:CHPower:SWEep:TIME:AUTO?
[:SENSe]:CHPower:SWEep:TIME:AUTO:RULes
[:SENSe]:CHPower:SWEep:TIME:AUTO:RULes?
[:SENSe]:CORRection:BTS[:RF]:GAIN
[:SENSe]:CORRection:BTS[:RF]:GAIN?
[:SENSe]:CORRection:CSET[1]|2|...|16:ANTenna[:UNIT]
[:SENSe]:CORRection:CSET[1]|2|...|16:ANTenna[:UNIT]?
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[:SENSe]:CORRection:CSET:ALL[:STATe]
[:SENSe]:CORRection:CSET:ALL[:STATe]?
[:SENSe]:CORRection:CSET:GROup[1]|2|...|10:DATA
[:SENSe]:CORRection:CSET:GROup[1]|2|...|10:DATA?
```

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[:SENSe]:CORRection:CSET:GROup:COMMent?
[:SENSe]:CORRection:CSET:GROup:DELete
[:SENSe]:CORRection:CSET:GROup:DESCription
[:SENSe]:CORRection:CSET:GROup:DESCription?
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[:SENSe]:CORRection:CSET:GROup[:STATe]?
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[:SENSe]:CORRection:IMPedance[:INPut][:MAGNitude]?
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[:SENSe]:CORRection:IQ:I|Q:ATTenuation
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[:SENSe]:CORRection:NOISe:FLOor:ADAptive?
[:SENSe]:CORRection:NOISe:FLOor:ADAptive?
[:SENSe]:CORRection:SA[:RF]:GAIN
[:SENSe]:CORRection:SA[:RF]:GAIN?
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[:SENSe]:MONitor:SWEep:TIME:AUTO
[:SENSe]:MONitor:SWEep:TIME:AUTO?
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[:SENSe]:OBWidth:AVERage:COUNt?
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[:SENSe]:OBWidth:AVERage[:STATe]?
[:SENSe]:OBWidth:AVERage:TCONtrol
[:SENSe]:OBWidth:AVERage:TCONtrol?
[:SENSe]:OBWidth:BANDwidth[:RESolution]
[:SENSe]:OBWidth:BANDwidth[:RESolution]?
[:SENSe]:OBWidth:BANDwidth[:RESolution]:AUTO
[:SENSe]:OBWidth:BANDwidth[:RESolution]:AUTO?
[:SENSe]:OBWidth:BANDwidth:SHAPe
[:SENSe]:OBWidth:BANDwidth:SHAPe?
[:SENSe]:OBWidth:BANDwidth:VIDeo
[:SENSe]:OBWidth:BANDwidth:VIDeo?
[:SENSe]:OBWidth:BANDwidth:VIDeo:AUTO
[:SENSe]:OBWidth:BANDwidth:VIDeo:AUTO?
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[:SENSe]:OBWidth:DETector:AUTO?
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[:SENSe]:OBWidth:DETector[:FUNCtion]?
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[:SENSe]:OBWidth:FREQuency:SPAN?
[:SENSe]:OBWidth:FREQuency:SPAN:AUTO
[:SENSe]:OBWidth:FREQuency:SPAN:AUTO?
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[:SENSe]:OBWidth:PREFerence
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[:SENSe]:OBWidth:SAVoid[:STATe]?
[:SENSe]:OBWidth:SWEep:POINts
[:SENSe]:OBWidth:SWEep:POINts?
[:SENSe]:OBWidth:SWEep:TIME
[:SENSe]:OBWidth:SWEep:TIME?
[:SENSe]:OBWidth:SWEep:TIME:AUTO
[:SENSe]:OBWidth:SWEep:TIME:AUTO?
[:SENSe]:OBWidth:SWEep:TIME:AUTO:RULes
```

```
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[:SENSe]:PCONtrol:BANDwidth[:RESolution]:TYPE?
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[:SENSe]:PCONtrol:CAPTure:TIME?
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[:SENSe]:PCONtrol:CRATe?
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[:SENSe]:PCONtrol:FILTer[:RRC]:ALPHa?
[:SENSe]:PCONtrol:FILTer[:RRC]:AUTO
[:SENSe]:PCONtrol:FILTer[:RRC]:AUTO?
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[:SENSe]:PCONtrol:FILTer[:RRC][:STATe]?
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[:SENSe]:PCONtrol:MINTerval?
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[:SENSe]:PCONtrol:PRACh:NFLoor?
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[:SENSe]:PCONtrol:PRACh:SIGNature?
[:SENSe]:PCONtrol:PRACh:SIGNature:AUTO
[:SENSe]:PCONtrol:PRACh:SIGNature:AUTO?
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[:SENSe]:PCONtrol:SBOundary:LIST:MS:INIT
[:SENSe]:PCONtrol:SBOundary:LIST:MS:NCHannels?
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[:SENSe]:PCONtrol:SSLot:NUMBer?
[:SENSe]:PCONtrol:SSLot[:STATe]
[:SENSe]:PCONtrol:SSLot[:STATe]?
[:SENSe]:PCONtrol:SWEep:TIME:TRANsient
[:SENSe]:PCONtrol:SWEep:TIME:TRANsient?
[:SENSe]:PCONtrol:SYNC:SCRamble
[:SENSe]:PCONtrol:SYNC:SCRamble?
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[:SENSe]:POWer:IQ[:I]:RANGe[:UPPer]?
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```

```
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[:SENSe]:POWer[:RF]:ATTenuation:AUTO?
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[:SENSe]:POWer[:RF]:MW:PATH:AUTO?
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[:SENSe]:POWer[:RF]:RANGe
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[:SENSe]:POWer[:RF]:RANGe:PARatio?
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[:SENSe]:POWer[:RF]:SWPResel:BW
[:SENSe]:POWer[:RF]:SWPResel:BW?
```

```
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[:SENSe]:PSTatistic:BANDwidth:AUTO
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[:SENSe]:RHO:FILTer[:RRC]:ALPHa?
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```

```
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[:SENSe]:RHO:PRACh:SIGNature:AUTO?
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[:SENSe]:RHO:SAVoid[:STATe]?
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[:SENSe]:RHO:SBOundary:LIST[:BTS]:APPend
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[:SENSe]:RHO:SBOundary:LIST[:BTS]:REPLace
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[:SENSe]:RHO:SYNC:SCRamble[:BTS]?
[:SENSe]:RHO:SYNC:SCRamble[:BTS]:AUTO
```

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[:SENSe]:ROSCillator:SOURce:TYPE
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[:SENSe]:SPURious[:RANGe]:ALL:SWEep:TYPE:AUTO
[:SENSe]:SPURious[:RANGe]:ALL:SWEep:TYPE:AUTO?
[:SENSe]:SPURious[:RANGe][:LIST]:ATTenuation:AUTO
[:SENSe]:SPURious[:RANGe][:LIST]:ATTenuation:AUTO?
[:SENSe]:SPURious[:RANGe][:LIST]:BANDwidth:IMULti
[:SENSe]:SPURious[:RANGe][:LIST]:BANDwidth:IMULti?
[:SENSe]:SPURious[:RANGe][:LIST]:BANDwidth[:RESolution]:AUTO
[:SENSe]:SPURious[:RANGe][:LIST]:BANDwidth[:RESolution]:AUTO?
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[:SENSe]:SPURious[:RANGe][:LIST]:BANDwidth:SHAPe?
[:SENSe]:SPURious[:RANGe][:LIST]:BANDwidth:VIDeo:AUTO
[:SENSe]:SPURious[:RANGe][:LIST]:BANDwidth:VIDeo:AUTO?
```

```
[:SENSe]:SPURious[:RANGe][:LIST]:DETector[1][:FUNCtion]
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[:SENSe]:SPURious[:RANGe][:LIST]:DETector2[:FUNCtion]
[:SENSe]:SPURious[:RANGe][:LIST]:DETector2[:FUNCtion]?
[:SENSe]:SPURious[:RANGe][:LIST]:FREQuency:CENTer
[:SENSe]:SPURious[:RANGe][:LIST]:FREQuency:CENTer?
[:SENSe]:SPURious[:RANGe][:LIST]:FREQuency:SPAN
[:SENSe]:SPURious[:RANGe][:LIST]:FREQuency:SPAN?
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[:SENSe]:SPURious[:RANGe][:LIST]:FREQuency:STARt?
[:SENSe]:SPURious[:RANGe][:LIST]:FREQuency:STOP
[:SENSe]:SPURious[:RANGe][:LIST]:FREQuency:STOP?
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[:SENSe]:SPURious[:RANGe][:LIST]:PEAK:EXCursion?
[:SENSe]:SPURious[:RANGe][:LIST]:PEAK:THReshold
[:SENSe]:SPURious[:RANGe][:LIST]:PEAK:THReshold?
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[:SENSe]:SPURious[:RANGe][:LIST]:STATe?
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[:SENSe]:SPURious[:RANGe][:LIST]:SWEep:POINts:AUTO?
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[:SENSe]:SPURious[:RANGe][:LIST]:SWEep:TIME:AUTO?
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[:SENSe]:SPURious:REPT:MODE?
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[:SENSe]:SPURious:SPUR?
[:SENSe]:SPURious:SWEep:TIME:AUTO:RULes
[:SENSe]:SPURious:SWEep:TIME:AUTO:RULes?
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[:SENSe]:SPURious:TYPE?
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[:SENSe]:SWEep:EGATe:CONTrol?
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[:SENSe]:SWEep:EGATe:HOLDoff?
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[:SENSe]:SWEep:EGATe:HOLDoff:AUTO?
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[:SENSe]:SWEep:EGATe:SOURce?
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[:SENSe]:SWEep:EGATe:TIME?
[:SENSe]:SWEep:EGATe:VIEW
[:SENSe]:SWEep:EGATe:VIEW?
[:SENSe]:SWEep:EGATe:VIEW:STARt
```

[:SENSe]:SWEep:EGATe:VIEW:STARt?
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[:SENSe]:SWEep:IF:DITHer?
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[:SENSe]:SWEep:IMAGeprot
[:SENSe]:SWEep:IMAGeprot
[:SENSe]:SWEep:IMAGeprot?
[:SENSe]:SWEep:IMAGeprot?
[:SENSe]:SWEep:IMAGeprot?
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[:SENSe]:VOLTage|POWer:IQ:MIRRored?
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[:SENSe]:VOLTage:IQ[:I]:RANGe[:UPPer]?
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[:SENSe]:VOLTage:IQ:RANGe:AUTO?
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[:SENSe]:WAVeform:DIF:FILTer:TYPE

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[:SENSe]:WAVeform:DIF:FILTer:TYPE?
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[:SENSe]:WAVeform:FREQuency:SYNThesis:AUTO[:STATe]?
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[:SENSe]:WAVeform:FREQuency:SYNThesis[:STATe]?
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[:SENSe]:WAVeform:IF:GAIN:LEVel?
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[:SENSe]:WAVeform:IF:GAIN:OFFSet?
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[:SENSe]:WAVeform:LO:MIXMode?
[:SENSe]:WAVeform:LO:MIXMode:SIDE?
[:SENSe]:WAVeform:SAVoid[:STATe]
[:SENSe]:WAVeform:SAVoid[:STATe]?
[:SENSe]:WAVeform:SRATe
[:SENSe]:WAVeform:SRATe?
[:SENSe]:WAVeform:SWEep:TIME
[:SENSe]:WAVeform:SWEep:TIME?
SERVice[:PRODuction]:SOURce:MCONtrol:MPLicense[:STATe]
SERVice[:PRODuction]:SOURce:MCONtrol:MPLicense[:STATe]?
SOURce:AM[:DEPTh][:LINear]
SOURce:AM[:DEPTh][:LINear]?
SOURce:AM:INTernal:FREQuency
SOURce:AM:INTernal:FREQuency?
SOURce:AM:INTernal:FREQuency:STEP[:INCRement]
SOURce:AM:INTernal:FREQuency:STEP[:INCRement]?
SOURce:AM:STATe
SOURce:AM:STATe?
SOURce:FM[:DEViation]
SOURce:FM[:DEViation]?
SOURce:FM:INTernal:FREQuency
SOURce:FM:INTernal:FREQuency?
SOURce:FM:INTernal:FREQuency:STEP[:INCRement]
SOURce:FM:INTernal:FREQuency:STEP[:INCRement]?
SOURce:FM:STATe
SOURce:FM:STATe?
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SOURce:FREQuency:CHANnels:BAND?
SOURce:FREQuency:CHANnels:NUMBer
SOURce:FREQuency:CHANnels:NUMBer?
SOURce:FREQuency:COUPling
SOURce:FREQuency:COUPling?
SOURce:FREQuency:COUPling:OFFSet
SOURce:FREQuency:COUPling:OFFSet?
SOURce:FREQuency[:CW]

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SOURce:FREQuency[:CW]?
SOURce:FREQuency:OFFSet
SOURce:FREQuency:OFFSet?
SOURce:FREQuency:REFerence
SOURce:FREQuency:REFerence?
SOURce:FREQuency:REFerence:SET
SOURce:FREQuency:REFerence:STATe
SOURce:FREQuency:REFerence:STATe?
SOURce:FREQuency:STEP[:INCRement]
SOURce:FREQuency:STEP[:INCRement]?
SOURce:LIST:INITiation:ARMed?
SOURce:LIST:NUMBer:STEPs
SOURce:LIST:NUMBer:STEPs?
SOURce:LIST:REPetition:TYPE
SOURce:LIST:SETup:AMPLitude
SOURce:LIST:SETup:AMPLitude?
SOURce:LIST:SETup:CLEar
SOURce:LIST:SETup:CNFRequency
SOURce:LIST:SETup:CNFRequency?
SOURce:LIST:SETup:DURation:TYPE
SOURce:LIST:SETup:DURation:TYPE?
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SOURce:LIST:SETup:INPut:TRIGger?
SOURce:LIST:SETup:OUTPut:TRIGger
SOURce:LIST:SETup:OUTPut:TRIGger?
SOURce:LIST:SETup:RADio:BAND
SOURce:LIST:SETup:RADio:BAND?
SOURce:LIST:SETup:RADio:BAND:LINK
SOURce:LIST:SETup:RADio:BAND:LINK?
SOURce:LIST:SETup:TOCount
SOURce:LIST:SETup:TOCount?
SOURce:LIST:SETup:TRANsition:TIME
SOURce:LIST:SETup:TRANsition:TIME?
SOURce:LIST:SETup:WAVeform
SOURce:LIST:SETup:WAVeform?
SOURce:LIST[:STATe]
SOURce:LIST[:STATe]?
SOURce:LIST:STEP[1]|2|...|…|1000:SETup
SOURce:LIST:STEP[1]|2|...|…|1000:SETup?
SOURce:LIST:STEP[1]|2|...|…|1000:SETup:AMPLitude
SOURce:LIST:STEP[1]|2|...|…|1000:SETup:AMPLitude?
SOURce:LIST:STEP[1]|2|...|…|1000:SETup:CNFRequency
SOURce:LIST:STEP[1]|2|...|…|1000:SETup:CNFRequency
SOURce:LIST:STEP[1]|2|...|…|1000:SETup:CNFRequency?
SOURce:LIST:STEP[1]|2|...|…|1000:SETup:CNFRequency?
SOURce:LIST:STEP[1]|2|...|…|1000:SETup:DURation:TCOunt
SOURce:LIST:STEP[1]|2|...|…|1000:SETup:DURation:TCOunt
SOURce:LIST:STEP[1]|2|...|…|1000:SETup:DURation:TCOunt?
SOURce:LIST:STEP[1]|2|...|…|1000:SETup:DURation:TCOunt?
SOURce:LIST:STEP[1]|2|...|…|1000:SETup:DURation:TYPE
SOURce:LIST:STEP[1]|2|...|…|1000:SETup:DURation:TYPE?
SOURce:LIST:STEP[1]|2|...|…|1000:SETup:INPut:TRIGger
SOURce:LIST:STEP[1]|2|...|…|1000:SETup:INPut:TRIGger?
```

SOURce:LIST:STEP[1]|2|...|…|1000:SETup:OUTPut:TRIGger
SOURce:LIST:STEP[1]|2|...|…|1000:SETup:OUTPut:TRIGger
SOURce:LIST:STEP[1]|2|...|…|1000:SETup:RADio:BAND
SOURce:LIST:STEP[1]|2|...|…|1000:SETup:RADio:BAND?
SOURce:LIST:STEP[1]|2|...|…|1000:SETup:RADio:BAND:LINK
SOURce:LIST:STEP[1]|2|...|…|1000:SETup:RADio:BAND:LINK?
SOURce:LIST:STEP[1]|2|...|…|1000:SETup:TRANsition:TIME
SOURce:LIST:STEP[1]|2|...|…|1000:SETup:TRANsition:TIME?
SOURce:LIST:STEP[1]|2|...|…|1000:SETup:WAVeform
SOURce:LIST:STEP[1]|2|...|…|1000:SETup:WAVeform?
SOURce:LIST:TRIGger[:IMMediate]
SOURce:LIST:TRIGger:INITiate[:IMMediate]
SOURce:LIST:TRIGger:OUTPut:TYPE
SOURce:LIST:TRIGger:OUTPut:TYPE?
SOURce:LIST:TRIGger:OUTPut:TYPE:MARKer
SOURce:LIST:TRIGger:OUTPut:TYPE:MARKer?
SOURce:PM[:DEViation]
SOURce:PM[:DEViation]?
SOURce:PM:INTernal:FREQuency
SOURce:PM:INTernal:FREQuency?
SOURce:PM:INTernal:FREQuency:STEP[:INCRement]
SOURce:PM:INTernal:FREQuency:STEP[:INCRement]?
SOURce:PM:STATe
SOURce:PM:STATe?
SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]
SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]?
SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]:UNIT
SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]:UNIT?
SOURce:POWer[:LEVel][:IMMediate]:OFFSet
SOURce:POWer[:LEVel][:IMMediate]:OFFSet?
SOURce:POWer:REFerence
SOURce:POWer:REFerence?
SOURce:POWer:REFerence:STATe
SOURce:POWer:REFerence:STATe?
SOURce:POWer:STEP[:INCRement]
SOURce:POWer:STEP[:INCRement]?
SOURce:PRESet
SOURce:RADio:ARB:DEFault:DIRectory?
SOURce:RADio:ARB:BASeband:FREQuency:OFFSet
SOURce:RADio:ARB:BASeband:FREQuency:OFFSet?
SOURce:RADio:ARB:BASeband:POWer
SOURce:RADio:ARB:BASeband:POWer?
SOURce:RADio:ARB:CATalog?
SOURce:RADio:ARB:CATalog?
SOURce:RADio:ARB:DEFault:DIRectory
SOURce:RADio:ARB:DELete
SOURce:RADio:ARB:DELete:ALL
SOURce:RADio:ARB:FCATalog?
SOURce:RADio:ARB:FCATalog?
SOURce:RADio:ARB:HEADer:CLEar
SOURce:RADio:ARB:HEADer:INFormation?
SOURce:RADio:ARB:HEADer:SAVE
SOURce:RADio:ARB:IQADjustment:DELay

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SOURce:RADio:ARB:IQADjustment:DELay?
SOURce:RADio:ARB:IQADjustment:GAIN
SOURce:RADio:ARB:IQADjustment:GAIN?
SOURce:RADio:ARB:IQADjustment:[STATe]
SOURce:RADio:ARB:IQADjustment:[STATe]?
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SOURce:RADio:ARB:LOAD:ALL
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SOURce:RADio:ARB:MDEStination:ALCHold?
SOURce:RADio:ARB:MDEStination:PULSe
SOURce:RADio:ARB:MDEStination:PULSe?
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SOURce:RADio:ARB:MPLicensed:UID:LOCKed?
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SOURce:RADio:ARB:MPOLarity:MARKer1?
SOURce:RADio:ARB:MPOLarity:MARKer2
SOURce:RADio:ARB:MPOLarity:MARKer2?
SOURce:RADio:ARB:MPOLarity:MARKer3
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SOURce:RADio:ARB:MPOLarity:MARKer4
SOURce:RADio:ARB:MPOLarity:MARKer4?
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SOURce:RADio:ARB:RETRigger?
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SOURce:RADio:ARB:RMS:CALCulation:MODE
SOURce:RADio:ARB:RMS:CALCulation:MODE?
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SOURce:RADio:ARB:RSCaling?
SOURce:RADio:ARB:SCLock:RATE
SOURce:RADio:ARB:SCLock:RATE?
SOURce:RADio:ARB:SEQuence[:MWAVeform]
SOURce:RADio:ARB:SEQuence[:MWAVeform]?
SOURce:RADio:ARB:SEQuence:SYNC
SOURce:RADio:ARB:SEQuence:SYNC
SOURce:RADio:ARB:SEQuence:SYNC?
SOURce:RADio:ARB:SEQuence:SYNC?
SOURce:RADio:ARB[:STATe]
SOURce:RADio:ARB[:STATe]?
SOURce:RADio:ARB:TRIGger:INITiate
SOURce:RADio:ARB:TRIGger[:SOURce]
SOURce:RADio:ARB:TRIGger[:SOURce]?
SOURce:RADio:ARB:TRIGger[:SOURce]:EXTernal:DELay
SOURce:RADio:ARB:TRIGger[:SOURce]:EXTernal:DELay?
SOURce:RADio:ARB:TRIGger[:SOURce]:EXTernal:DELay:STATe
SOURce:RADio:ARB:TRIGger[:SOURce]:EXTernal:DELay:STATe?
SOURce:RADio:ARB:TRIGger[:SOURce]:EXTernal:SLOPe
SOURce:RADio:ARB:TRIGger[:SOURce]:EXTernal:SLOPe?
SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:DELay
SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:DELay?
SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:DELay:STATe
SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:DELay:STATe?
```

```
SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:LINE
SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:LINE?
SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:SLOPe
SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:SLOPe?
SOURce:RADio:ARB:TRIGger:SYNC[:STATe]
SOURce:RADio:ARB:TRIGger:SYNC[:STATe]?
SOURce:RADio:ARB:TRIGger:TYPE
SOURce:RADio:ARB:TRIGger:TYPE?
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SOURce:RADio:ARB:TRIGger:TYPE:CONTinuous[:TYPE]?
SOURce:RADio:ARB:TRIGger:TYPE:SADVance[:TYPE]
SOURce:RADio:ARB:TRIGger:TYPE:SADVance[:TYPE]?
SOURce:RADio:ARB:WAVeform
SOURce:RADio:ARB:WAVeform?
SOURce:RADio:BAND:LINK
SOURce:RADio:BAND:LINK?
SOURce:SYNC:CONFig
SOURce:SYNC:CONFig?
SOURce:SYNC:REMote:ADDRess
SOURce:SYNC:REMote:ADDRess:ADD
SOURce:SYNC:REMote:ADDRess:DELete
SOURce:SYNC:REMote:IPPort
SOURce:SYNC:REMote:SEC1?
SOURce:SYNC:REMote:SECondary
SOURce:SYNC:RTSetting:STATe
SOURce:SYNC:RTSetting:STATe?
SOURce:SYNC:SETTings:ENABle
SOURce:SYNC:SETTings:ENABle?
SOURce:SYNC:SETTings:SEGMent2:ENABle
SOURce:SYNC:SETTings:SEGMent2:ENABle?
SOURce:SYNC:SETTings:SEGMent2:FREQuency
SOURce:SYNC:SETTings:SEGMent2:FREQuency?
SOURce:SYNC:STARt
SOURce:SYNC:STOP
SOURce:SYNC:TYPE
SOURce:SYNC:TYPE?
STATus:OPERation:CONDition?
STATus:OPERation:ENABle
STATus:OPERation:ENABle?
STATus:OPERation[:EVENt]?
STATus:OPERation:NTRansition
STATus:OPERation:NTRansition?
STATus:OPERation:PTRansition
STATus:OPERation:PTRansition?
STATus:PRESet
STATus:QUEStionable:CALibration:CONDition?
STATus:QUEStionable:CALibration:ENABle
STATus:QUEStionable:CALibration:ENABle?
STATus:QUEStionable:CALibration[:EVENt]?
STATus:QUEStionable:CALibration:EXTended:FAILure:CONDition?
STATus:QUEStionable:CALibration:EXTended:FAILure:ENABle
STATus:QUEStionable:CALibration:EXTended:FAILure:ENABle?
STATus:QUEStionable:CALibration:EXTended:FAILure[:EVENt]?
```

```
STATus:QUEStionable:CALibration:EXTended:FAILure:NTRansition
STATus:QUEStionable:CALibration:EXTended:FAILure:NTRansition?
STATus:QUEStionable:CALibration:EXTended:FAILure:PTRansition
STATus:QUEStionable:CALibration:EXTended:FAILure:PTRansition?
STATus:QUEStionable:CALibration:EXTended:NEEDed:CONDition?
STATus:QUEStionable:CALibration:EXTended:NEEDed:ENABle
STATus:QUEStionable:CALibration:EXTended:NEEDed:ENABle?
STATus:QUEStionable:CALibration:EXTended:NEEDed[:EVENt]?
STATus:QUEStionable:CALibration:EXTended:NEEDed:NTRansition
STATus:QUEStionable:CALibration:EXTended:NEEDed:NTRansition?
STATus:QUEStionable:CALibration:EXTended:NEEDed:PTRansition
STATus:QUEStionable:CALibration:EXTended:NEEDed:PTRansition?
STATus:QUEStionable:CALibration:NTRansition
STATus:QUEStionable:CALibration:NTRansition?
STATus:QUEStionable:CALibration:PTRansition
STATus:QUEStionable:CALibration:PTRansition?
STATus:QUEStionable:CALibration:SKIPped:CONDition?
STATus:QUEStionable:CALibration:SKIPped:ENABle
STATus:QUEStionable:CALibration:SKIPped:ENABle?
STATus:QUEStionable:CALibration:SKIPped[:EVENt]?
STATus:QUEStionable:CALibration:SKIPped:NTRansition
STATus:QUEStionable:CALibration:SKIPped:NTRansition?
STATus:QUEStionable:CALibration:SKIPped:PTRansition
STATus:QUEStionable:CALibration:SKIPped:PTRansition?
STATus:QUEStionable:CONDition?
STATus:QUEStionable:ENABle
STATus:QUEStionable:ENABle?
STATus:QUEStionable[:EVENt]?
STATus:QUEStionable:FREQuency:CONDition?
STATus:QUEStionable:FREQuency:ENABle
STATus:QUEStionable:FREQuency:ENABle?
STATus:QUEStionable:FREQuency[:EVENt]?
STATus:QUEStionable:FREQuency:NTRansition
STATus:QUEStionable:FREQuency:NTRansition?
STATus:QUEStionable:FREQuency:PTRansition
STATus:QUEStionable:FREQuency:PTRansition?
STATus:QUEStionable:INTegrity:CONDition?
STATus:QUEStionable:INTegrity:ENABle
STATus:QUEStionable:INTegrity:ENABle?
STATus:QUEStionable:INTegrity[:EVENt]?
STATus:QUEStionable:INTegrity:NTRansition
STATus:QUEStionable:INTegrity:NTRansition?
STATus:QUEStionable:INTegrity:PTRansition
STATus:QUEStionable:INTegrity:PTRansition?
STATus:QUEStionable:INTegrity:SIGNal:CONDition?
STATus:QUEStionable:INTegrity:SIGNal:ENABle
STATus:QUEStionable:INTegrity:SIGNal:ENABle?
STATus:QUEStionable:INTegrity:SIGNal[:EVENt]?
STATus:QUEStionable:INTegrity:SIGNal:NTRansition
STATus:QUEStionable:INTegrity:SIGNal:NTRansition?
STATus:QUEStionable:INTegrity:SIGNal:PTRansition
STATus:QUEStionable:INTegrity:SIGNal:PTRansition?
STATus:QUEStionable:INTegrity:UNCalibrated:CONDition?
```

STATus:QUEStionable:INTegrity:UNCalibrated:ENABle
STATus:QUEStionable:INTegrity:UNCalibrated:ENABle?
STATus:QUEStionable:INTegrity:UNCalibrated[:EVENt]?
STATus:QUEStionable:INTegrity:UNCalibrated:NTRansition
STATus:QUEStionable:INTegrity:UNCalibrated:NTRansition?
STATus:QUEStionable:INTegrity:UNCalibrated:PTRansition
STATus:QUEStionable:INTegrity:UNCalibrated:PTRansition?
STATus:QUEStionable:NTRansition
STATus:QUEStionable:NTRansition?
STATus:QUEStionable:POWer:CONDition?
STATus:QUEStionable:POWer:ENABle
STATus:QUEStionable:POWer:ENABle?
STATus:QUEStionable:POWer[:EVENt]?
STATus:QUEStionable:POWer:NTRansition
STATus:QUEStionable:POWer:NTRansition?
STATus:QUEStionable:POWer:PTRansition
STATus:QUEStionable:POWer:PTRansition?>
STATus:QUEStionable:PTRansition
STATus:QUEStionable:PTRansition?
STATus:QUEStionable:TEMPerature:CONDition?
STATus:QUEStionable:TEMPerature:ENABle
STATus:QUEStionable:TEMPerature:ENABle?
STATus:QUEStionable:TEMPerature[:EVENt]?
STATus:QUEStionable:TEMPerature:NTRansition
STATus:QUEStionable:TEMPerature:NTRansition?
STATus:QUEStionable:TEMPerature:PTRansition
STATus:QUEStionable:TEMPerature:PTRansition?
SYSTem:APPLication:CATalog[:NAME]?
SYSTem:APPLication:CATalog[:NAME]:COUNt?
SYSTem:APPLication:CATalog:OPTion?
SYSTem:APPLication:CATalog:REVision?
SYSTem:APPLication[:CURRent][:NAME]?
SYSTem:APPLication[:CURRent]:OPTion?
SYSTem:APPLication[:CURRent]:REVision?
SYSTem:CALibration:ABORt
SYSTem:CALibration:CGRoup
SYSTem:CALibration:CGRoup?
SYSTem:CALibration:CGRoup:APPLy
SYSTem:CALibration:CGRoup:APPLy?
SYSTem:CALibration:CGRoup:APPLy:AOFF
SYSTem:CALibration:CGRoup:COPY
SYSTem:CALibration:CGRoup:COPY:FROM
SYSTem:CALibration:CGRoup:COPY:FROM?
SYSTem:CALibration:DELete:ALL
SYSTem:CALibration:DESCription
SYSTem:CALibration:DESCription?
SYSTem:CALibration:FREQuency:OFFSet
SYSTem:CALibration:FREQuency:OFFSet?
SYSTem:CALibration:IDENtify
SYSTem:CALibration:INITiate:SELected
SYSTem:CALibration:INPut
SYSTem:CALibration:INPut?
SYSTem:CALibration:MODule[1]|2|...|10:SNUMber?

```
SYSTem:CALibration:MODule:SELect
SYSTem:CALibration:MODule:SELect?
SYSTem:CALibration:REFerence
SYSTem:CALibration:REFerence?
SYSTem:CALibration:ROW[1]|2|…|100:FEATtenuation:TYPE?
SYSTem:CALibration:ROW[1]|2|…|100:APPLy:STATe
SYSTem:CALibration:ROW[1]|2|…|100:APPLy:STATe?
SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:STARt
SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:STARt?
SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:STEP
SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:STEP?
SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:STOP
SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:STOP?
SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:TYPE
SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:TYPE?
SYSTem:CALibration:ROW[1]|2|…|100:CALibrate:STATe
SYSTem:CALibration:ROW[1]|2|…|100:CALibrate:STATe?
SYSTem:CALibration:ROW[1]|2|…|100:CAPPlied?
SYSTem:CALibration:ROW[1]|2|…|100:COUPling
SYSTem:CALibration:ROW[1]|2|…|100:COUPling?
SYSTem:CALibration:ROW[1]|2|…|100:DELete
SYSTem:CALibration:ROW[1]|2|…|100:DUPLicate
SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:STARt
SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:STARt?
SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:STEP
SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:STEP?
SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:STOP
SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:STOP?
SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:TYPE
SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:TYPE?
SYSTem:CALibration:ROW[1]|2|…|100:FATTenuation:STARt
SYSTem:CALibration:ROW[1]|2|…|100:FATTenuation:STARt?
SYSTem:CALibration:ROW[1]|2|…|100:FATTenuation:STOP
SYSTem:CALibration:ROW[1]|2|…|100:FATTenuation:STOP?
SYSTem:CALibration:ROW[1]|2|…|100:FATTenuation:TYPE
SYSTem:CALibration:ROW[1]|2|…|100:FATTenuation:TYPE?
SYSTem:CALibration:ROW[1]|2|…|100:FEATtenuation:STARt
SYSTem:CALibration:ROW[1]|2|…|100:FEATtenuation:STARt?
SYSTem:CALibration:ROW[1]|2|…|100:FEATtenuation:STEP
SYSTem:CALibration:ROW[1]|2|…|100:FEATtenuation:STEP?
SYSTem:CALibration:ROW[1]|2|…|100:FEATtenuation:STOP
SYSTem:CALibration:ROW[1]|2|…|100:FEATtenuation:STOP?
SYSTem:CALibration:ROW[1]|2|…|100:FEATtenuation:TYPE
SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:POINts
SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:POINts?
SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:STARt
SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:STARt?
SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:STEP
SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:STEP?
SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:STOP
SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:STOP?
SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:SYNThesis:ALL[:STATe]
SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:SYNThesis[:STATe]
```

SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:SYNThesis[:STATe]?
SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:SYNThesis[:STATe]?
SYSTem:CALibration:ROW[1]|2|…|100:IF:GAIN[:STATe]?
SYSTem:CALibration:ROW[1]|2|…|100:IF:GAIN[:STATe]HIGH|LOW|ALL
SYSTem:CALibration:ROW[1]|2|…|100:IF:PATH
SYSTem:CALibration:ROW[1]|2|…|100:IF:PATH?
SYSTem:CALibration:ROW[1]|2|…|100:INSert
SYSTem:CALibration:ROW[1]|2|…|100:LAST?
SYSTem:CALibration:ROW[1]|2|…|100:LO:MMODe
SYSTem:CALibration:ROW[1]|2|…|100:LO:MMODe?
SYSTem:CALibration:ROW[1]|2|…|100:MATCh[:STATe]
SYSTem:CALibration:ROW[1]|2|…|100:MATCh[:STATe]?
SYSTem:CALibration:ROW[1]|2|…|100:NAME
SYSTem:CALibration:ROW[1]|2|…|100:NAME?
SYSTem:CALibration:ROW[1]|2|…|100:POWer:GAIN:BAND
SYSTem:CALibration:ROW[1]|2|…|100:POWer:GAIN:BAND?
SYSTem:CALibration:ROW[1]|2|…|100:POWer[:RF]:GAIN:LNA[:STATe]
SYSTem:CALibration:ROW[1]|2|…|100:POWer[:RF]:GAIN:LNA[:STATe]?
SYSTem:CALibration:ROW[1]|2|…|100:STATus?
SYSTem:CALibration:ROW[1]|2|…|100:TYPE
SYSTem:CALibration:ROW[1]|2|…|100:TYPE?
SYSTem:CALibration:ROW[1]|2|…|100:UCMeas
SYSTem:CALibration:ROW[1]|2|…100POWer[:RF]:MW:PATH
SYSTem:CALibration:ROW[1]|2|…100:POWer[:RF]:MW:PATH?
SYSTem:CALibration:STATus:ALL?
SYSTem:CALibration:TUNE:FREQuency
SYSTem:CALibration:TUNE:FREQuency?
SYSTem:CALibration:TUNE:OUTput[:STATe]
SYSTem:CALibration:TUNE:OUTput[:STATe]?
SYSTem:CALibration:TUNE:REFerence
SYSTem:CALibration:TUNE:REFerence?
SYSTem:CALibration:TUNE[:SELected]
SYSTem:CALibration:TUNE[:SELected]?
SYSTem:CALibration:TUNE:SPACing
SYSTem:CALibration:TUNE:SPACing?
SYSTem:CALibration:TUNE:TYPE
SYSTem:CALibration:TUNE:TYPE?
SYSTem:COMMunicate:GPIB[1][:SELF]:ADDRess
SYSTem:COMMunicate:GPIB[1][:SELF]:ADDRess?
SYSTem:COMMunicate:GPIB[1][:SELF]:CONTroller[:ENABle]
SYSTem:COMMunicate:GPIB[1][:SELF]:CONTroller[:ENABle]?
SYSTem:COMMunicate:LAN:INSTrument:PORT?
SYSTem:COMMunicate:LAN:IPV4:CONFig
SYSTem:COMMunicate:LAN:IPV4:CONFig?
SYSTem:COMMunicate:LAN:IPV6:CONFig
SYSTem:COMMunicate:LAN:IPV6:CONFig?
SYSTem:COMMunicate:LAN:MULTiple:NIC:ENABled?
SYSTem:COMMunicate:LAN:PHYSical:IPADdress:LIST?
SYSTem:COMMunicate:LAN:SCPI:EOSession:DCLEar:ENABle
SYSTem:COMMunicate:LAN:SCPI:EOSession:DCLEar:ENABle?
SYSTem:COMMunicate:LAN:SCPI:HISLip:ENABle
SYSTem:COMMunicate:LAN:SCPI:HISLip:ENABle?
SYSTem:COMMunicate:LAN:SCPI:SICL:ENABle

```
SYSTem:COMMunicate:LAN:SCPI:SICL:ENABle?
SYSTem:COMMunicate:LAN:SCPI:SOCKet:CONTrol?
SYSTem:COMMunicate:LAN:SCPI:SOCKet:ENABle
SYSTem:COMMunicate:LAN:SCPI:SOCKet:ENABle?
SYSTem:COMMunicate:LAN:SCPI:TELNet:ENABle
SYSTem:COMMunicate:LAN:SCPI:TELNet:ENABle?
SYSTem:COMMunicate:USB:CONNection?
SYSTem:COMMunicate:USB:PACKets?
SYSTem:COMMunicate:USB:STATus?
SYSTem:CONFigure[:SYSTem]?
SYSTem:CSYStem?
SYSTem:DATE
SYSTem:DATE?
SYSTem:DEFault
SYSTem:DISPlay:BACKlight:INTensity
SYSTem:DISPlay:BACKlight:INTensity?
SYSTem:DISPlay:CFORmat
SYSTem:DISPlay:CFORmat?
SYSTem:DISPlay:HINTs?
SYSTem:DISPlay:HINTs[:STATe]
SYSTem:DISPlay:LANGuage
SYSTem:DISPlay:LANGuage?
SYSTem:DISPlay:MPPosition
SYSTem:DISPlay:MPPosition?
SYSTem:DISPlay:MPTab
SYSTem:DISPlay:MPTab?
SYSTem:DISPlay:NEPimmediate
SYSTem:DISPlay:NEPimmediate?
SYSTem:ERRor[:NEXT]?
SYSTem:ERRor:VERBose
SYSTem:ERRor:VERBose?
SYSTem:HELP:HEADers?
SYSTem:HID?
SYSTem:IDN
SYSTem:IDN?
SYSTem:IDN:CONFigure
SYSTem:IDN:CONFigure?
SYSTem:KLOCk
SYSTem:KLOCk?
SYSTem:LICense[:FPACk]:WAVeform:ADD
SYSTem:LICense[:FPACk]:WAVeform:CLEar
SYSTem:LICense[:FPACk]:WAVeform:FREE?
SYSTem:LICense[:FPACk]:WAVeform:LOCK
SYSTem:LICense[:FPACk]:WAVeform:NAME?
SYSTem:LICense[:FPACk]:WAVeform:REPLace
SYSTem:LICense[:FPACk]:WAVeform:STATus?
SYSTem:LICense[:FPACk]:WAVeform:UID?
SYSTem:LICense[:FPACk]:WAVeform:USED?
SYSTem:LKEY
SYSTem:LKEY?
SYSTem:LKEY:BORRow
SYSTem:LKEY:BORRow?
SYSTem:LKEY:BORRow:LIST?
```

```
SYSTem:LKEY:BORRow:NETWork:COUT:ENABle
SYSTem:LKEY:BORRow:RETurn
SYSTem:LKEY:COUT?
SYSTem:LKEY:COUT:LIST?
SYSTem:LKEY:DELete
SYSTem:LKEY:LIST?
SYSTem:LKEY:SOFTware:SUPPort:EXPiration:DATE?
SYSTem:LKEY:WAVeform:ADD
SYSTem:LKEY:WAVeform:CLEar
SYSTem:LKEY:WAVeform:FREE?
SYSTem:LKEY:WAVeform:LOCK
SYSTem:LKEY:WAVeform:NAME?
SYSTem:LKEY:WAVeform:REPLace
SYSTem:LKEY:WAVeform:STATus?
SYSTem:LKEY:WAVeform:UID?
SYSTem:LKEY:WAVeform:USED?
SYSTem:LOCK:NAME?
SYSTem:LOCK:OWNer?
SYSTem:LOCK:RELease
SYSTem:LOCK:REQuest?
SYSTem:LOFF
SYSTem:LWSTation
SYSTem:METRics:FPANel?
SYSTem:METRics:SCPI?
SYSTem:METRics:STIMe?
SYSTem:MRELay:COUNt?
SYSTem:OPTions?
SYSTem:PDOWn
SYSTem:PERSona:DEFault
SYSTem:PERSona:DEFault?
SYSTem:PERSona:MANufacturer
SYSTem:PERSona:MANufacturer?
SYSTem:PERSona:MANufacturer:DEFault
SYSTem:PERSona:MANufacturer:DEFault?
SYSTem:PERSona:MODel
SYSTem:PERSona:MODel?
SYSTem:PERSona:MODel:DEFault
SYSTem:PERSona:MODel:DEFault?
SYSTem:PON:APPLication:LLISt
SYSTem:PON:APPLication:LLISt?
SYSTem:PON:APPLication:VMEMory[:AVAilable]?
SYSTem:PON:APPLication:VMEMory:TOTal?
SYSTem:PON:APPLication:VMEMory:USED?
SYSTem:PON:APPLication:VMEMory:USED:NAME?
SYSTem:PON:ETIMe?
SYSTem:PON:FPGA:LOAD
SYSTem:PON:FPGA:PREFerence
SYSTem:PON:MODE
SYSTem:PON:MODE?
SYSTem:PON:TIME?
SYSTem:PON:TYPE
SYSTem:PON:TYPE?
SYSTem:PRESet
```

```
SYSTem:PRESet:FULL
SYSTem:PRESet:TYPE
SYSTem:PRESet:TYPE?
SYSTem:PRESet:USER
SYSTem:PRESet:USER:ALL
SYSTem:PRESet:USER:SAVE
SYSTem:PRINt:THEMe
SYSTem:PRINt:THEMe?
SYSTem:PUP
SYSTem:PUP:PROCess
SYSTem:SECurity:USB:WPRotect[:ENABle]
SYSTem:SECurity:USB:WPRotect[:ENABle]?
SYSTem:SEQuencer
SYSTem:SEQuencer?
SYSTem:SET
SYSTem:SET?
SYSTem:SHOW
SYSTem:SHOW?
SYSTem:SOFTware:VERSion:DATE?
SYSTem:TEMPerature:HEXTreme?
SYSTem:TEMPerature:LEXTreme?
SYSTem:TIME
SYSTem:TIME?
SYSTem:VERSion?
```

T

```
TRACe[:<meas>]:CLEar:ALL
TRACe:<meas>:COPY
TRACe:<meas>:EXCHange
TRACe[:<meas>]:PRESet:ALL
TRACe[1]|2|...|6[:<meas>]:DISPlay[:STATe]
TRACe[1]|2|...|6[:<meas>]:DISPlay[:STATe]?
TRACe[1]|2|...|6[:<meas>]:UPDate[:STATe]
TRACe[1]|2|...|6[:<meas>]:UPDate[:STATe]?
TRACe[1]|2|3:ACPower:DISPlay[:STATe]
TRACe[1]|2|3:ACPower:DISPlay[:STATe]?
TRACe[1]|2|3:ACPower:TYPE
TRACe[1]|2|3:ACPower:TYPE?
TRACe[1]|2|3:ACPower:UPDate[:STATe]
TRACe[1]|2|3:ACPower:UPDate[:STATe]?
TRACe[1]|2|3:CHPower:DISPlay[:STATe]
TRACe[1]|2|3:CHPower:DISPlay[:STATe]?
TRACe[1]|2|3:CHPower:TYPE
TRACe[1]|2|3:CHPower:TYPE?
TRACe[1]|2|3:CHPower:UPDate[:STATe]
TRACe[1]|2|3:CHPower:UPDate[:STATe]?
TRACe[1]|2|3:MONitor:DISPlay[:STATe]
TRACe[1]|2|3:MONitor:DISPlay[:STATe]?
TRACe[1]|2|3:MONitor:TYPE
TRACe[1]|2|3:MONitor:TYPE?
TRACe[1]|2|3:MONitor:UPDate[:STATe]
```

```
TRACe[1]|2|3:MONitor:UPDate[:STATe]?
TRACe[1]|2|3:OBWidth:TYPE
TRACe[1]|2|3:SEMask:TYPE
TRACe[1]|2|3:SEMask:TYPE?
TRACe[1]|2|3:SPURious:DISPlay[:STATe]
TRACe[1]|2|3:SPURious:DISPlay[:STATe]?
TRACe[1]|2|3:SPURious:TYPE
TRACe[1]|2|3:SPURious:TYPE?
TRACe[1]|2|3:SPURious:UPDate[:STATe]
TRACe[1]|2|3:SPURious:UPDate[:STATe]?
TRACe:CLEar
TRACe:COPY
TRACe[:DATA]
TRACe[:DATA]?
TRACe:EXCHange
TRACe:MATH:MEAN?
TRACe:MATH:SMOoth
TRACe:MATH:SMOoth:POINts
TRACe:MATH:SMOoth:POINts?
TRACe:MONitor:CLEar:ALL
TRACe:OBWidth:TYPE?
TRIGger:<measurement>[:SEQuence]:IQ:SOURce
TRIGger:<measurement>[:SEQuence]:IQ:SOURce?
TRIGger:<measurement>[:SEQuence]:RF:SOURce
TRIGger:<measurement>[:SEQuence]:RF:SOURce?
TRIGger:<measurement>[:SEQuence]:SOURce
TRIGger:<measurement>[:SEQuence]:SOURce?
TRIGger[1]|2|...|4[:SEQuence]:OUTPut
TRIGger[1]|2|...|4[:SEQuence]:OUTPut?
TRIGger[1]|2|...|4[:SEQuence]:OUTPut:DIRection
TRIGger[1]|2|...|4[:SEQuence]:OUTPut:DIRection?
TRIGger[1]|2|...|4[:SEQuence]:OUTPut:POLarity
TRIGger[1]|2|...|4[:SEQuence]:OUTPut:POLarity?
TRIGger:PXIE:ANALyzer[:SEQuence]:OUTPut
TRIGger:PXIE:ANALyzer[:SEQuence]:OUTPut?
TRIGger:PXIE:ANALyzer[:SEQuence]:OUTPut:LINE
TRIGger:PXIE:ANALyzer[:SEQuence]:OUTPut:LINE?
TRIGger:PXIE:ANALyzer[:SEQuence]:OUTPut:POLarity
TRIGger:PXIE:ANALyzer[:SEQuence]:OUTPut:POLarity?
TRIGger:PXIE:SOURce[:SEQuence]:OUTPut
TRIGger:PXIE:SOURce[:SEQuence]:OUTPut?
TRIGger:PXIE:SOURce[:SEQuence]:OUTPut:LINE
TRIGger:PXIE:SOURce[:SEQuence]:OUTPut:LINE?
TRIGger:PXIE:SOURce[:SEQuence]:OUTPut:POLarity
TRIGger:PXIE:SOURce[:SEQuence]:OUTPut:POLarity?
TRIGger[:SEQuence]:<trig_source>:DELay
TRIGger[:SEQuence]:<trig_source>:DELay?
TRIGger[:SEQuence]:<trig_source>:DELay:STATe
TRIGger[:SEQuence]:<trig_source>:DELay:STATe?
TRIGger[:SEQuence]:<trig_source>:LEVel
TRIGger[:SEQuence]:<trig_source>:LEVel?
TRIGger[:SEQuence]:<trig_source>:SLOPe
TRIGger[:SEQuence]:<trig_source>:SLOPe?
```

```
TRIGger[:SEQuence]:AIQMag:BANDwidth
TRIGger[:SEQuence]:AIQMag:BANDwidth?
TRIGger[:SEQuence]:AIQMag:CENTer
TRIGger[:SEQuence]:AIQMag:CENTer?
TRIGger[:SEQuence]:ATRigger
TRIGger[:SEQuence]:ATRigger?
TRIGger[:SEQuence]:ATRigger:STATe
TRIGger[:SEQuence]:ATRigger:STATe?
TRIGger[:SEQuence]:EXTernal1|EXTernal2|RFBurst:DELay:COMPensation
TRIGger[:SEQuence]:EXTernal1|EXTernal2|RFBurst:DELay:COMPensation?
TRIGger[:SEQuence]:FRAMe:ADJust
TRIGger[:SEQuence]:FRAMe:OFFSet
TRIGger[:SEQuence]:FRAMe:OFFSet?
TRIGger[:SEQuence]:FRAMe:OFFSet:DISPlay:RESet
TRIGger[:SEQuence]:FRAMe:PERiod
TRIGger[:SEQuence]:FRAMe:PERiod?
TRIGger[:SEQuence]:FRAMe:SMONitor:RESet
TRIGger[:SEQuence]:FRAMe:SYNC
TRIGger[:SEQuence]:FRAMe:SYNC?
TRIGger[:SEQuence]:FRAMe:SYNC:HOLDoff
TRIGger[:SEQuence]:FRAMe:SYNC:HOLDoff?
TRIGger[:SEQuence]:FRAMe:SYNC:HOLDoff:STATe
TRIGger[:SEQuence]:FRAMe:SYNC:HOLDoff:STATe?
TRIGger[:SEQuence]:HOLDoff
TRIGger[:SEQuence]:HOLDoff?
TRIGger[:SEQuence]:HOLDoff:STATe
TRIGger[:SEQuence]:HOLDoff:STATe?
TRIGger[:SEQuence]:HOLDoff:TYPE
TRIGger[:SEQuence]:HOLDoff:TYPE?
TRIGger[:SEQuence]:INTernal:SOURce:OUTPut
TRIGger[:SEQuence]:INTernal:SOURce:OUTPut?
TRIGger[:SEQuence]:INTernal:SOURce:OUTPut:POLarity
TRIGger[:SEQuence]:INTernal:SOURce:OUTPut:POLarity?
TRIGger[:SEQuence]:OFFSet:STATe
TRIGger[:SEQuence]:OFFSet:STATe?
TRIGger[:SEQuence]:OPTimize:MODe
TRIGger[:SEQuence]:OPTimize:MODe?
TRIGger[:SEQuence]:PXI:LINE
TRIGger[:SEQuence]:PXI:LINE?
TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute
TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute?
TRIGger[:SEQuence]:RFBurst:LEVel:RELative
TRIGger[:SEQuence]:RFBurst:LEVel:RELative?
TRIGger[:SEQuence]:RFBurst:LEVel:TYPE
TRIGger[:SEQuence]:RFBurst:LEVel:TYPE?
TRIGger[:SEQuence]:SOURce
TRIGger[:SEQuence]:SOURce?
TRIGger[:SEQuence]:TV:FMODe
TRIGger[:SEQuence]:TV:FMODe?
TRIGger[:SEQuence]:TV:LINE
TRIGger[:SEQuence]:TV:LINE?
TRIGger[:SEQuence]:TV:STANdard
TRIGger[:SEQuence]:TV:STANdard?
```

U

```
UNIT:ACPower:POWer:PSD
UNIT:ACPower:POWer:PSD?
UNIT:CHPower:POWer:PSD
UNIT:CHPower:POWer:PSD?
```

9.2 IEEE 488.2 Common Commands

The instrument supports the following subset of IEEE 488.2 Common Commands, as defined in Chapter 10 of IEEE Standard 488.2–1992. As indicated below, some of these commands correspond directly to instrument front-panel functionality, while others are available only as remote commands.

9.2.1 *CAL? - Calibration Query

`*CAL?` Performs a full alignment and returns a number indicating the success of the alignment. A zero is returned if the alignment is successful. A one is returned if any part of the alignment fails. The equivalent SCPI command is `:CALibrate[:ALL]?`

See "Align Now All" on page 1978.

Remote Command	`*CAL`
Example	`*CAL?` Runs a full alignment and returns 0 if no problems encountered

Status Bits/OPC dependencies	See "Align Now All" on page 1978

9.2.2 *CLS - Clear Status

Clears the status byte register. It does this by emptying the error queue and clearing all bits in all of the event registers, and consequently all bits in the Status Byte register.

The Status Byte register summarizes the states of the other registers. It is also responsible for generating service requests.

Remote Command	`*CLS`
Example	`*CLS` Clears the error queue and the Status Byte Register
Notes	For related commands, see the `:SYSTem:ERRor[:NEXT]?` command. See also the `:STATus:PRESet` command and all commands in the STATus subsystem
Status Bits/OPC dependencies	Resets all bits in all event registers to 0, which resets all the status byte register bits to 0 also
Backwards Compatibility Notes	In general the status bits used in the X-Series status system are backwards compatible with ESA and PSA. However, unlike ESA and PSA, all conditions generate events that go into the event log, and some will also generate status bits

9.2.3 *ESE - Standard Event Status Enable

Sets the desired bits in the Event Enable Register of the "Standard Event Status Register" on page 2625, which enables the corresponding bits in the Standard Event Status register. This register monitors I/O errors and synchronization conditions such as operation complete, request control, query error, device dependent error, status execution error, command error, and power on. The selected bits are OR’d to become a summary bit (bit 5) in the byte register, which can be queried.

The query returns the state of the standard event status enable register.

Numeric values for bit patterns can be entered using decimal or hexadecimal representations (that is, 0 to 32767 is equivalent to #H0 to #H7FFF).

Remote Command	`*ESE <integer>`
	
	`*ESE?`

Example	`*ESE 36`
	
	Enables the Standard Event Status Register to monitor query and command errors (bits 2 and 5)
	
	`*ESE?`
	
	Returns a 36 indicating that the query and command status bits are enabled

Notes	For related commands, see the STATus subsystem and :SYSTem:ERRor[:NEXT]? commands
Preset	255
State Saved	Not saved in state
Min	0
Max	255

9.2.4 *ESR? - Standard Event Status Register Query

Queries and clears the "Standard Event Status Register" on page 2625. (This is a destructive read.) The value returned is a hexadecimal number that reflects the current state (0/1) of all the bits in the register.

Remote Command	*ESR?
Example	*ESR? Returns a 1 if there is either a query or command error, otherwise it returns a zero
Notes	For related commands, see the STATus subsystem commands
Preset	0
Min	0
Max	255
Status Bits/OPC dependencies	Standard Event Status Register (bits 0 – 7)

9.2.5 *IDN? - Identification Query

Returns a string of instrument identification information. The string will contain the model number, serial number, and firmware revision.

The response is organized into four fields separated by commas. The field definitions are as follows:

– Manufacturer

– Model

– Serial number

– Firmware version

Remote Command	*IDN?
Example	*IDN? Returns instrument identification information, such as: Keysight Technologies,N9040B,US01020004,A.15.02

Remote Command	`:ID?`

Example	`:ID?`
	Returns model number, such as:
	`N9040B`

Notes	ID? Is provided for backwards compatibility When in Remote Language Compatibility mode, the `ID?` query returns the model number of the emulated instrument When in any other mode, the returned model number is that of the actual instrument

9.2.6 *OPC? - Operation Complete

The `*OPC` command sets bit 0 in the standard event status register (SER) to "1" when pending operations have finished, that is when all overlapped commands are complete. It does not hold off subsequent operations. You can determine when the overlapped commands have completed either by polling the OPC bit in SER, or by setting up the status system such that a service request (SRQ) is asserted when the OPC bit is set.

The `*OPC?` query returns a "1" after all the current overlapped commands are complete. So it holds off subsequent commands until the "1" is returned, then the program continues. This query can be used to synchronize events of other instruments on the external bus.

Remote Command	`*OPC` `*OPC?`

Example	Select single sweeping:
	`:INIT:CONT 0`
	Initiate a sweep:
	`:INIT:IMM`
	Hold off any further commands until the sweep is complete:
	`*OPC?`

Notes	Not global to all remote ports or front panel. `*OPC` only considers operation that was initiated on the same port that the `*OPC` command was issued from `*OPC` is an overlapped command, but `*OPC?` is sequential
Backwards Compatibility Notes	1. Commands such as, *`OPC/*OPC?/*WAI/*RST` used to be global. They considered front panel operation in conjunction with the GPIB functionality. Now they are evaluated on a per channel basis. That is, the various rear panel remote ports and the front panel i/o are all considered separately. Only the functionality initiated on the port where the `*OPC` was sent, is considered for its operation 2. `*OPC` used to hold off until the operation bits were cleared. Now it holds off until all overlapping commands are completed. Also, earlier instruments did not wait for completion of all processes, only the ones identified here (in the STATus:OPERation register):

- Calibrating: monitored by PSA, ESA, VSA (E4406A)
- Sweeping: monitored by PSA, ESA, VSA (E4406A)
- Waiting for Trigger: monitored by PSA, ESA, VSA (E4406A)
- Measuring: monitored by PSA and ESA (but not in all Modes)
- Paused: monitored by VSA (E4406A)
- Printing: monitored by VSA (E4406A)
- Mass memory busy: monitored by VSA (E4406A)

9.2.7 *OPT? - Query Instrument Options

Returns a string of all the installed instrument options. It is a comma separated list with quotes, such as:

`“550,B25,B40,BBA,CRP,CRW,EA3,EDP,ESC,EXM,FBP,LNP,MPB,NF2,RTS,EMC,FP2"`

Remote Command	`*OPT?`

9.2.8 *RCL - Recall Instrument State

This command recalls the instrument state from the specified instrument memory register.

- If the state being loaded has a newer firmware revision than the revision of the instrument, no state is recalled and an error is reported
- If the state being loaded has an equal firmware revision than the revision of the instrument, the state will be loaded.
- If the state being loaded has an older firmware revision than the revision of the instrument, the instrument will only load the parts of the state that apply to the older revision.

Remote Command	`*RCL <register #>`
Example	`*RCL 7` Recalls the instrument state that is currently stored in register 7 (register 8 in the UI)
Notes	Registers 0 through 15 are accessible from the front panel in menu keys for Recall Registers. Register 0 is the front panel Register 1
Min	0
Max	127
Status Bits/OPC dependencies	The command is sequential

9.2.9 *RST - Reset

*RST is equivalent to :SYST:PRES;:INIT:CONT OFF, which is a Mode Preset in the Single measurement state. This remote command is preferred over the Mode Preset remote command :SYST:PRES, because optimal remote programming occurs with the instrument in the single measurement state.

*RST clears all pending OPC bits and sets the Status Byte to 0.

Remote Command	*RST
Example	*RST
Notes	Sequential
Couplings	*RST causes the currently running measurement to be aborted and causes the default measurement to be active. *RST gets the mode to a consistent state, with all of the default couplings set
Status Bits/OPC dependencies	Clears all pending OPC bits. The Status Byte is set to 0
Backwards Compatibility Notes	In legacy analyzers, *RST did not set the analyzer to **Single**, but in the X-Series it does, for compliance with the IEEE 488.2 specification. In the Swept SA measurement, you can configure the instrument to be compatible with legacy analyzers in this regard, using the Meas Setup, Legacy Compat, *RST function In the X-Series, *RST does not do a *CLS (clear the status bits and the error queue). In legacy analyzers, *RST used to do the equivalent of :SYSTem:PRESet, *CLS and :INITiate:CONTinuous OFF. But to be 488.2 compliant, *RST in the X-Series does not do a *CLS

9.2.10 *SAV - Save Instrument State

This command saves the current instrument state and mode to the specified instrument memory register.

Remote Command	*SAV <register #>
Example	*SAV 9 Saves the instrument state in register 9 (register 10 in the UI)
Notes	Registers 0 through 15 are accessible from the front panel in menu keys for Save Registers. Register 0 is the front panel Register 1
Min	0
Max	127
Status Bits/OPC dependencies	The command is sequential

9.2.11 *SRE - Service Request Enable

This command enables the desired bits of the "Service Request Enable Register" on page 2624.

The query returns the value of the register, indicating which bits are currently enabled.

Numeric values for bit patterns can be entered using decimal or hexadecimal representations (that is, 0 to 32767 is equivalent to #H0 to #H7FFF).

Remote Command	`*SRE <integer>` `*SRE?`
Example	`*SRE 22` Enables bits 1, 2, and 4 in the service request enable register
Notes	For related commands, see the `STATus` subsystem and `:SYSTem:ERRor[:NEXT]?` commands
Preset	0
Min	0
Max	255
Status Bits/OPC dependencies	Service Request Enable Register (all bits, 0 – 7)

9.2.12 *STB? - Status Byte Query

Returns the value of the "Status Byte Register" on page 2621 without erasing its contents.

Remote Command	`*STB?`
Example	`*STB?` Returns a decimal value for the bits in the status byte register For example, if a 16 is returned, it indicates that bit 5 is set and one of the conditions monitored in the standard event status register is set
Notes	See related command `*CLS`
Status Bits/OPC dependencies	Status Byte Register (all bits, 0 – 7)

9.2.13 *TRG - Trigger

This command triggers the instrument. Use the `:TRIGger[:SEQuence]:SOURce` command to select the trigger source.

Remote Command	`*TRG`
Example	`*TRG` Triggers the instrument to take a sweep or start a measurement, depending on the current instrument settings
Notes	See related command `:INITiate:IMMediate`

9.2.14 *TST? - Self Test Query

This query performs the internal self-test routines, and returns a number indicating the success of the testing.

A zero is returned if the test is successful, 1 if it fails.

Remote Command	`*TST?`
Example	`*TST?` Runs the self-test routines and returns: 0=passed, 1=some part failed

9.2.15 *WAI - Wait-to-Continue

This command causes the instrument to wait until all overlapped commands are completed before executing any additional commands. There is no query form for the command.

Remote Command	`*WAI`
Example	`:INIT:CONT OFF; INIT;*WAI` Sets the instrument to single sweep. Starts a sweep and waits for its completion.
Status Bits/OPC dependencies	Not global to all remote ports or front panel. *OPC only considers operation that was initiated on the same port as the *OPC command was issued from.

9.3 SCPI Operation and Results Query

Remote control of measurements and query of measurement result data is performed using SCPI commands. There are a number of different commands you can use to control the measurement, depending on how you wish to operate the instrument. There are also a number of queries that you can use to extract the measurement data.

In this section “Mode” refers to the Measurement Application, for example, Spectrum Analyzer or 5G NR.

9.3.1 Mode Control

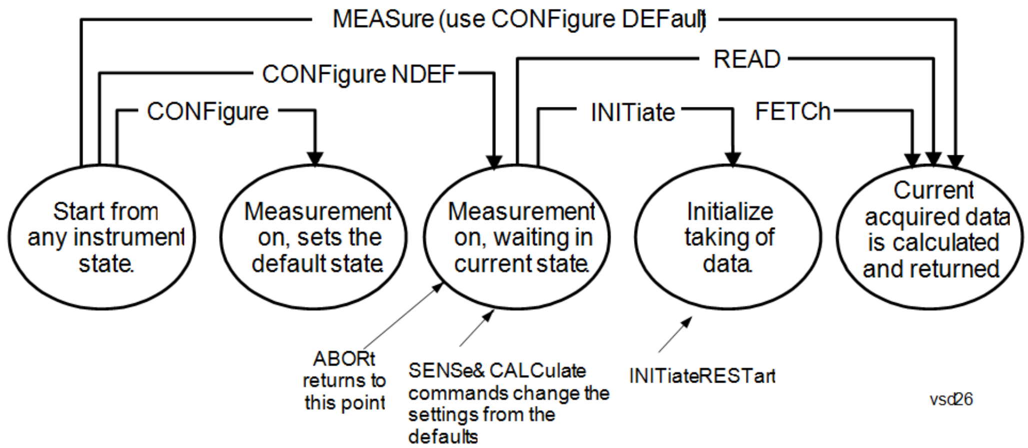
You can use either `INSTrument:SELect` (:INST:SEL) or `INSTrument:NSELect` (:INST:NSEL) to select the instrument's "Mode" on page 86.

The `:INSTrument:CONFigure` command causes a Mode *and* Measurement switch at the same time. This results in faster overall switching than sending the `:INSTrument:SELect` and `CONFigure` commands separately. See "Mode and Measurement Select" on page 87.

9.3.2 Measurement Control

Here are the measurement control commands and their functions, also illustrated in the diagram below. Note that some of these commands also result in data being returned.

"CONFigure" on page 2594	Switches to the desired measurement
"INITiate" on page 2595	Starts the measurement
"FETCh" on page 2595	Queries the data
"READ" on page 2596	Starts the measurement and queries the data
"MEASure" on page 2597	Switches to the desired measurement, starts the measurement and queries the data



9.3.2.1 CONFigure

This command stops the current measurement (if any) and sets up the instrument for the measurement specified by the `<meas>` keyword, using the factory default instrument settings. It does not initiate the taking of measurement data unless `:INIT:CONTinuous` is `ON`. If you change any measurement settings after using the `:CONFigure` command, the `:READ` command can be used to initiate a measurement without changing the settings back to their defaults.

Normally the `:CONFigure` command presets the measurement after selecting it; however, if sent with the `NDEFault` parameter, it selects it without performing a Preset.

Remote Command	`:CONFigure:<meas>[:NDEFault]` `:CONFigure?`

Example	Select and preset the Swept SA measurement:
	`:CONF:SAN`
	Select the Swept SA measurement *without* presetting:
	`:CONF:SAN:NDEF`
	Query the current measurement:
	`:CONF?`

Remote Command	`:CONFigure:CATalog?`
Example	`:CONF:CATalog?` Returns a quoted string of all licensed measurement names in the current mode. For example, `"SAN, CHP, OBW, ACP, PST, TXP, SPUR, SEM, LIST"` for the Spectrum Analyzer mode

9.3.2.2 INITiate

Initiates a trigger cycle for the specified measurement, but does not output any data. You must then use the `:FETCh:<meas>` command to return data. If a measurement other than the current one is specified (via the `<meas>` keyword), the instrument will switch to that measurement and then initiate it.

Remote Command	`:INITiate:<meas>`
Example	`:INIT:SAN` Switches to the SANalyzer (Swept SA) measurement if not already there, and starts the measurement

`:INITiate` does not change any of the measurement settings. For example, if you have already run the ACP measurement and you send `:INIT:ACP?`, it will initiate a new ACP measurement using the same instrument settings as the last time ACP was run.

If another measurement is running, `:INIT` will switch to the specified measurement. For example, suppose you are running the Channel Power measurement. If you send `:INIT:ACP?`, it will change from channel power to ACP and will initiate an ACP measurement.

If your selected measurement is currently in the idle state, it triggers the measurement, assuming the trigger conditions are met. Then it completes one trigger cycle. Depending upon the measurement and the number of averages, there may be multiple data acquisitions, with multiple trigger events, for one full trigger cycle.

`:INIT` also holds off additional commands until the acquisition is complete.

9.3.2.3 FETCh

The `:FETCh` command puts selected data from the most recent measurement into the output buffer. Use `:FETCh` if you have already made a good measurement and you want to return data. You can issue `:FETCh` multiple times to get data for different `n` values, for example, both scalars and trace data from a single measurement, without restarting or re-making the measurement.

Remote Command	`:FETCh:<meas>[n]?`
Example	`:FETCh:SAN2?` Fetches item 2 (Trace 2) from the SAN (Swept SA) measurement when the measurement completes If not in the Swept SA measurement, returns an error

`:FETCh` does not change any of the measurement settings, it simply reads the results of the current measurement. `:FETCh` may be used to return results other than those specified with the original `:READ` or `:MEASure` command that you sent.

You can only `:FETCh` results from the measurement that is currently active, it will not change to a different measurement. An error message is reported if a measurement other than the current one is specified.

If you need to get new measurement data, use the `:READ` command, which is equivalent to `:INITiate` followed by `:FETCh`.

The measurement results for n=1 (usually the scalar result) will be returned if the optional `n` value is not included, or is set to 1. If the `n` value is set to a value other than 1, the selected data results will be returned. See each measurement for details of what types of scalar results or trace data results are available. The binary data formats should be used for handling large blocks of data since they are smaller and transfer faster than the ASCII format. (`:FORMat:DATA`)

Note that the data returned in response to a `:FETCh?` uses the data setting specified by the `:FORMat:BORDer` and `:FORMat:DATA` commands, and can return real or ASCII data. If the format is set to `INT,32`, it returns REAL,32 data.

9.3.2.4 READ

Initiates a trigger cycle for the specified measurement and outputs the requested data. If a measurement other than the current one is specified (via the appropriate `<meas>` keyword), the instrument will switch to that measurement before it initiates the measurement and returns results.

Remote Command	`:READ:<meas>[n]?`
Example	`:READ:SAN2?` Switches to the `SANalyzer` (Swept SA) measurement if not already there, starts the measurement, and returns item 2 (Trace 2) from the measurement when the measurement completes

`:READ` does not change any of the measurement settings. For example, if have already run the ACP measurement and you send `:READ:ACP?`, it will initiate a new ACP measurement using the same instrument settings as the last time ACP was run.

`:READ` will switch to the specified measurement if the instrument is not already in that measurement. For example, suppose you have already run the ACP measurement, but now you are running the Channel Power measurement. When you send `:READ:ACP?`, it will change from channel power back to ACP and, using the previous ACP settings, will initiate the measurement and return results.

The measurement results for n=1 (usually the scalar result) will be returned if the optional `n` value is not included, or is set to 1. If the `n` value is set to a value other than 1, the selected data results will be returned. See each measurement for details of what types of scalar results or trace data results are available. The binary data formats should be used for handling large blocks of data, since they are smaller and transfer faster than the ASCII format. (`:FORMat:DATA`)

Note that the data returned in response to a `:READ?` query uses the data setting specified by the `:FORMat:BORDer` and `:FORMat:DATA` commands, and can return real or ASCII data. If the format is set to `INT,32`, it returns REAL,32 data

`:READ` holds off additional commands until the acquisition is complete.

9.3.2.5 MEASure

`:MEASure` stops the current measurement (if any) and sets up the instrument for the specified measurement using the factory default instrument settings, initiates a trigger cycle for the specified measurement and outputs the requested data.

Remote Command	`:MEASure:<meas>[n]?`
Example	`:MEAS:SAN2?` Switches to the `SANalyzer` (Swept SA) measurement, starts the measurement, and reads back item 2 (Trace 2) when the measurement completes

This is a fast single-command way to make a measurement using the factory default instrument settings. These are the settings and units that conform to the Mode Setup settings (e.g., Radio Standard) that you have currently selected.

- Stops the current measurement (if any) and sets up the instrument for the specified measurement using the factory defaults
- Initiates the data acquisition for the measurement
- Blocks other SCPI communication, waiting until the measurement is complete before returning results
- If the function does averaging, it is turned on and the number of averages is set to 10
- After the data is valid it returns the scalar results, or the trace data, for the specified measurement. The type of data returned may be defined by an [n] value that is sent with the command
- The scalar measurement results will be returned if the optional [n] value is not included, or is set to 1. If the `n` value is set to a value other than 1, the selected trace data results will be returned. See each command for details of what types of scalar results or trace data results are available
- ASCII is the default format for the data output. (Older versions of Spectrum Analysis and Phase Noise mode measurements only supported ASCII.) The binary data formats should be used for handling large blocks of data, since they are smaller and faster than the ASCII format. Refer to the `:FORMat:DATA` command for more information

If you need to change some of the measurement parameters from the factory default settings, you can set up the measurement using the `:CONFigure` command. Use the commands in the `:SENSe:<meas>` and `:CALCulate:<meas>` subsystems to change the settings. Then you can use the `:READ?` command to initiate the measurement and query the results.

If you need to make a given measurement repeatedly, with settings other than the factory defaults, you can use the commands in the `:SENSe:<meas>` and `:CALCulate:<meas>` subsystems to set up the measurement. Then use the `:READ?` command to initiate the measurement and query the results.

Measurement settings persist if you initiate a different measurement and then return to a previous one. Use `:READ:<meas>?` if you want to use those persistent settings. If you want to go back to the default settings, use `:MEASure:<meas>?`

Note that the data returned in response to a `:MEASure?` query uses the data setting specified by the `:FORMat:BORDer` and `:FORMat:DATA` commands and can return real or ASCII data. If the format is set to `INT,32`, it returns `REAL,32` data.

9.3.3 Trace Control Commands

The following commands and queries are available to format and manipulate trace data.

9.3.3.1 Clear Trace (Remote Command Only)

Clears the selected trace (from the front panel) or the specified trace (from SCPI). Does not affect the state of any function or variable in the instrument. Loads `mintracevalue` into all of the points in the selected trace, unless the trace is in Min Hold, in which case it loads `maxtracevalue`. It does this even if Update = Off.

Remote Command	`:TRACe:CLEar TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6`
Example	`:TRAC:CLE TRACE1` Clears trace 1

9.3.3.2 Send/Query Trace Data (Remote Command Only)

This command allows trace data to be sent to the instrument or queried from the instrument.

The response to the query is a list of the amplitude points that comprise the requested trace in the current Y Axis Unit of the instrument. The X Axis Unit is that of the destination trace (for send) or the source trace (for query).

See also:

– "Query Trace Data" on page 2599

– "More Information" on page 2599

Remote Command	:TRACe[:DATA] TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6, <data>
Notes	The TRACe[:DATA] command is of the form: :TRACe:DATA <trace>,<data> where <trace> can be one of the following parameters: TRACE1, TRACE2, TRACE3, TRACE4, TRACE5, TRACE6 and where <data> can be: - ASCII data, which consists of a string of values separated by comma *or* - REAL or INTeger sent as a definite length block, with a header describing the data to follow
Couplings	Sweep points will affect the amount of data The :FORMat:DATA command ("Format Data: Numeric Data (Remote Command Only)" on page 2600) describes the different types of data formats that can be used with trace data Use the :FORMat:BORDer command to set the byte order ("Format Data: Byte Order (Remote Command Only)" on page 2601)

Query Trace Data

Remote Command	:TRACe[:DATA]? TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6
Example	Send five points to Trace 1. Assuming that :FORMat:DATA is set to ASCII, Y Axis Unit is set to dBm, and sweep points is set to 5, this will result in Trace 1 consisting of the five points: -1 dBm, -2 dBm, -3 dBm, -4 dBm, and -5 dBm: :TRAC TRACE1,-1,-2,-3,-4,-5 Query the instrument for the contents of trace 2: :TRAC? TRACE2
Backwards Compatibility Notes	In the X-Series, the legacy RAWTRACE, LLINE1, LLINE2 parameters for trace data query are no longer available

More Information

The format and byte-ordering of the sent or received data will be dependent on the :FORMat:DATA and :FORMat:BORDer commands. ASCII data consists of a string of comma separated values. REAL or INTeger data is sent as a definite length block, with a header describing the data to follow.

For example, a four point trace might look like this if in ASCII (:FORMat:DATA ASCIi):

```
-5.87350E+01, -5.89110E+01, -5.87205E+01, -5.12345E+01<NL><END>
```

and like this if in INTeger with 4 bytes per point (:FORMat:DATA INT,32):

```
#216<16 bytes of data><NL><END>
```

where the 2 in the #216 means “2 digits of numeric data to follow”, and the 16 is the 2 digits and means “16 binary bytes to follow” (this is the definite length block format).

Note that the data is terminated with `<NL><END>`. (For GPIB, this is newline, or linefeed, followed by EOI set true. For LAN, this is newline only.)

The data format set by `:FORMat:DATA` and `:FORMat:BORDer` is used both for sending data to the instrument and receiving data from the instrument.

When sending data to the instrument, the data block must contain exactly the number of points currently specified in Sweep, Points or an error message will be generated and there will be no change to the target trace.

No units terminator (for example, dB or V) is used when sending data; the data is taken as being in the current Y Axis Unit of the instrument.

When a trace is sent to the instrument, it immediately overwrites all of the data in the target trace. Consequently the trace should be inactive in order to achieve predictable results. If you send trace data while a trace is active, and particularly if a sweep or an Average or Max/Min Hold sequence is already in progress, you may end up with a trace that combines the data you sent with measurement data. Similarly, when querying trace data, it is best if the instrument is *not* sweeping during the query.

Therefore, it is generally advisable to be in Single Sweep, or have the trace in View, when sending trace data to the instrument, or querying trace data from the instrument.

9.3.3.3 Format Data: Numeric Data (Remote Command Only)

This command specifies the format of the trace data input and output. It specifies the formats used for trace data during data transfer across any remote port. It affects only the data format for setting and querying trace data for the `:TRACe[:DATA]`, `:TRACe[:DATA]?`, `:CALCulate:DATA[n]?` and `:FETCh:SANalyzer[n]?` commands and queries.

Remote Command	`:FORMat[:TRACe][:DATA] ASCii | INTeger,32 | REAL,32 | REAL,64` `:FORMat[:TRACe][:DATA]?`
Notes	The query response is: – `ASCii`: ASC,8 – `REAL,32`: REAL,32 – `REAL,64`: REAL,64 – `INTeger,32`: INT,32 When the numeric data format is `REAL` or `ASCii`, data is output in the current Y Axis unit. When the data format is `INTeger`, data is output in units of m dBm (.001 dBm) The `INT,32` format returns binary 32-bit integer values in internal units (m dBm), in a definite length

	block
Dependencies	Sending a data format spec with an invalid number (for example `INT,48`) generates no error. The instrument simply uses the default (8 for `ASCii`, 32 for `INTeger`, 32 for `REAL`) Sending data to the analyzer that does not conform to the current `FORMat` specified results in an error Sending ASCII data when a definite block is expected generates message -161 "Invalid Block Data" Sending a definite block when ASCII data is expected generates message -121 "Invalid Character in Number"
Preset	`ASCii`
Backwards Compatibility Notes	Note that the `INT,32` format applied only to the command, `:TRACe:DATA`, to preserve backwards compatibility for the Swept SA measurement. For all other commands/queries that honor `:FORMat:DATA`, if `INT,32` is sent, the instrument behaves as though it were set to `REAL,32`

The specs for each output type are:

- `ASCii` - Amplitude values are in ASCII, in the current Y Axis Unit, one ASCII character per digit, values separated by commas. Each value is in the form: `SX.YYYYYEsZZ`, where:
  - S = sign (+ or -)
  - X = one digit to left of decimal point
  - Y = 5 digits to right of decimal point
  - E = E, exponent header
  - s = sign of exponent (+ or -)
  - ZZ = two digit exponent
- `REAL,32` - Binary 32-bit real values in the current Y Axis Unit, in a definite length block
- `REAL,64` - Binary 64-bit real values in the current Y Axis Unit, in a definite length block

9.3.3.4 Format Data: Byte Order (Remote Command Only)

Selects the binary data byte order for data transfer and other queries. It controls whether binary data is transferred in `NORMal` or `SWAPped` mode.

Affects only the byte order for setting and querying trace data for the `:TRACe[:DATA]`, `:TRACe[:DATA]?`, `:CALCulate:DATA[n]?` and `:FETCh:SANalyzer[n]?` commands and queries.

By definition any command that specifies that it uses `:FORMat:DATA` uses any format supported by `:FORMat:DATA`.

- NORMal order. The byte sequence begins with the most significant byte (MSB) first, and ends with the least significant byte (LSB) last, in the sequence: 1|2|3|4
- SWAPped order. The byte sequence begins with the LSB first, and ends with the MSB last, in the sequence: 4|3|2|1

Remote Command	:FORMat:BORDer NORMal | SWAPped :FORMat:BORDer?
Preset	NORMal

9.3.3.5 Calculate/Compress Trace Data Query (Remote Command Only)

Returns compressed data for the currently selected measurement and sub-opcode n where:

n = any valid sub-opcode for that measurement. See the :MEASure:<measurement>? query description of your specific measurement for information on the data that can be returned.

The data is returned in the current Y Axis Unit of the instrument. The command is used with a sub-opcode <n> (default = 1) to specify the trace. With trace queries, it is best if the instrument is *not* sweeping during the query. Therefore, it is generally advisable to be in **Single** Sweep, or set Update = Off.

This query is used to compress or decimate a long trace, to extract and return only the desired data. A typical example would be to acquire N frames of GSM data and return the mean power of the first burst in each frame. The query can also be used to identify the best curve fit for the data.

Remote Command	:CALCulate:DATA<n>:COMPress? BLOCk | CFIT | MAXimum | MINimum | MEAN | DMEan | RMS | SAMPle | SDEViation | PPHase [,<soffset>[,<length>[,<roffset>[,<rlimit>]]]]
Notes	The command supports 5 parameters. Note that the last 4 (<soffset>,<length>,<roffset>,<rlimit>) are optional, but these optional parameters must be entered in the specified order. For example, if you want to specify <length>, then you must also specify <soffset>. See details below for a definition of each of these parameters This command uses the data in the format specified by :FORMat:DATA, returning either binary or ASCII data As an example, to query the mean power of a set of GSM bursts: – Supply a signal that is a set of GSM bursts – Select the IQ Waveform measurement (in IQ Analyzer Mode) – Set the sweep time to acquire at least one burst – Set the triggers such that acquisition happens at a known position relative to a burst – Then query the mean burst levels using: :CALC:DATA2:COMP? MEAN,24e-6,526e-6

These parameter values correspond to GSM signals, where `526e-6` is the length of the burst in the slot and you just want 1 burst

BLOCk or block data

Returns all the data points from the region of the trace data that you specify. For example, it could be used to return the data points of an input signal over several timeslots, excluding the portions of the trace data that you do not want. (This is x,y pairs for trace data, and I,Q pairs for complex data.)

CFIT or curve fit

Applies curve fitting routines to the data.

`<soffset>` and `<length>` are required to define the data that you want.

`<roffset>` is an optional parameter for the desired order of the curve equation.

The query returns the following values: the x-offset (in seconds) and the curve coefficients ((order + 1) values).

`MIN`, `MAX`, `MEAN`, `DME`, `RMS`, `SAMP`, `SDEV` and `PPH` return one data value for each specified region (or `<length>`) of trace data, for as many regions as possible until you run out of trace data (using `<roffset>` to specify regions), or they return the number of regions you specify (using `<rlimit>`), ignoring any data beyond that.

MINimum

Returns the minimum data point (y value) for the specified region(s) of trace data. For I/Q trace data, the minimum magnitude of the I/Q pairs is returned.

MAXimum

Returns the maximum data point (y value) for the specified region(s) of trace data. For I/Q trace data, the maximum magnitude of the I/Q pairs is returned.

MEAN

Returns a single value that is the arithmetic mean of the data point values (in dB/ dBm) for the specified region(s) of trace data. For I/Q trace data, the mean of the magnitudes of the I/Q pairs is returned. See the following equations.

NOTE

If the original trace data is in dB, this function returns the arithmetic mean of those log values, not log of the mean power which is a more useful value. The mean of the log is the better measurement technique when measuring CW signals in the presence of noise. The mean of the power, expressed in dB, is useful in power measurements such as Channel Power. To achieve the mean of the power, use the RMS option.

Equation 1: Mean Value of Data Points for Specified Region(s)

$$\text{MEAN} = \frac{1}{n} \sum_{Xi \in \text{region(s)}} Xi$$

where Xi is a data point value, and n is the number of data points in the specified region(s).

Equation 2: Mean Value of I/Q Data Pairs for Specified Region(s)

$$\text{MEAN} = \frac{1}{n} \sum_{Xi \in \text{region(s)}} |Xi|$$

where |Xi| is the magnitude of an I/Q pair, and n is the number of I/Q pairs in the specified region(s).

DMEan

Returns a single value that is the mean power (in dB/ dBm) of the data point values for the specified region(s) of trace data. See the following equation:

Equation 3: DMEan Value of Data Points for Specified Region(s)

$$\text{DME} = 10 \times \log_{10}\left(\frac{1}{n} \sum_{Xi \in \text{region(s)}} 10^{\frac{Xi}{10}}\right)$$

RMS

Returns a single value that is the average power on a root-mean-squared voltage scale (arithmetic rms) of the data point values for the specified region(s) of trace data. See the following equation.

Equation 4: RMS Value of Data Points for Specified Region(s)

$$\text{RMS} = \sqrt{\frac{1}{n} \sum_{Xi \in \text{region(s)}} Xi^2}$$

where Xi is a data point value, and n is the number of data points in the specified region(s).

For I/Q trace data, the rms of the magnitudes of the I/Q pairs is returned. See the following equation.

NOTE This function is very useful for I/Q trace data. However, if the original trace data is in dB, this function returns the rms of the log values which is not usually needed.

Equation 5: RMS Value of I/Q Data Pairs for Specified Region(s)

$$RMS = \sqrt{\frac{1}{n} \sum_{Xi \in region(s)} Xi\, Xi^*}$$

where Xi is the complex value representation of an I/Q pair, Xi* its conjugate complex number, and n is the number of I/Q pairs in the specified region(s).

Once you have the rms value for a region of trace data (linear or I/Q), you may want to calculate the mean power. You must convert this rms value (peak volts) to power in dBm:

*10 x log[10 * (rms value)2]*

SAMPle

Returns the first data value (x,y pair) for the specified region(s) of trace data. For I/Q trace data, the first I/Q pair is returned.

SDEViation

Returns a single value that is the arithmetic standard deviation for the data point values for the specified region(s) of trace data. See the following equation.

Equation 6: Standard Deviation of Data Point Values for Specified Region(s)

$$SDEV = \sqrt{\frac{1}{n} \sum_{Xi \in region(s)} (Xi - \overline{X})^2}$$

where Xi is a data point value, X is the arithmetic mean of the data point values for the specified region(s), and n is the number of data points in the specified region(s).

For I/Q trace data, the standard deviation of the magnitudes of the I/Q pairs is returned. See the following equation.

Equation 7: Standard Deviation of I/Q Data Pair Values for Specified Region(s)

$$SDEV = \sqrt{\frac{1}{n} \sum_{Xi \in region(s)} (|Xi| - \overline{X})^2}$$

where |Xi| is the magnitude of an I/Q pair, X is the mean of the magnitudes for the specified region(s), and n is the number of data points in the specified region(s).

PPHase

Returns the x,y pairs of both rms power (dBm) and arithmetic mean phase (radian) for every specified region and frequency offset (Hz). The number of pairs is defined by the specified number of regions. This parameter can be used for I/Q vector (n=0) in Waveform (time domain) measurement and all parameters are specified by data point in `PPHase`.

The rms power of the specified region may be expressed as:

Power = 10 x log [10 x (RMS I/Q value)] + 10

The RMS I/Q value (peak volts) is:

$$\sqrt{\frac{1}{n}\sum_{Xi \in \text{region}} Xi\, Xi^*}$$

where Xi is the complex value representation of an I/Q pair, Xi* its conjugate complex number, and n is the number of I/Q pairs in the specified region.

The arithmetic mean phase of the specified region may be expressed as:

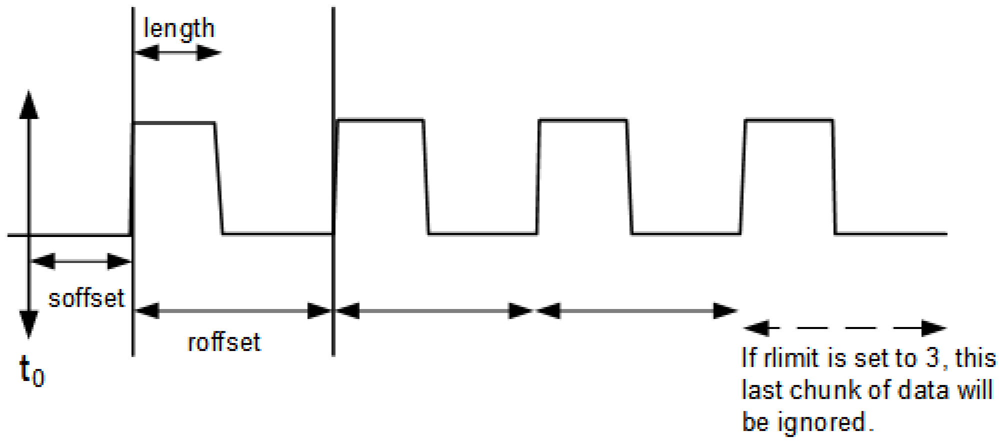
$$\frac{1}{n}\sum_{Yi \in \text{region}} Yi$$

where Yi is the unwrapped phase of I/Q pair with applying frequency correction and n is the number of I/Q pairs in the specified region.

The frequency correction is made by the frequency offset calculated by the arithmetic mean of every specified region's frequency offset. Each frequency offset is calculated by the least square method against the unwrapped phase of I/Q pair.

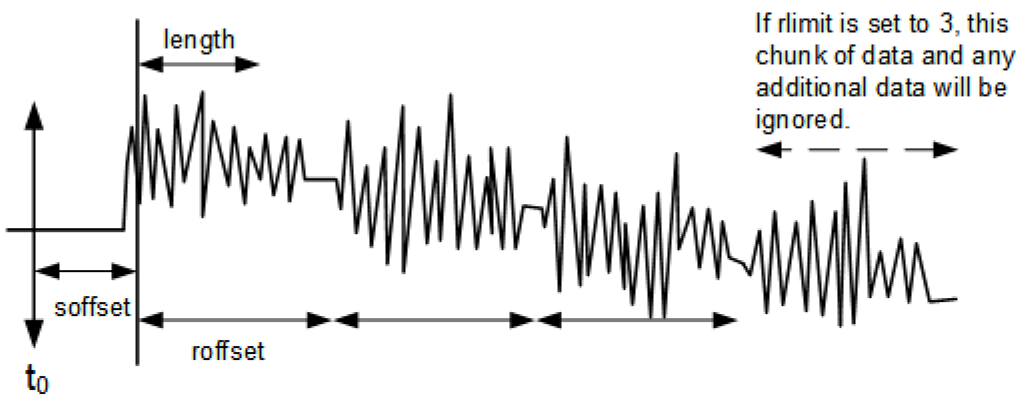
Sample Trace Data - Constant Envelope

(See below for explanation of variables.)



Sample Trace Data - Not Constant Envelope

(See below for explanation of variables.)



`<soffset>`	*Start Offset* is an optional real number. (It is in seconds for time-domain traces, and is a dimensionless index 0 to Npoints – 1, for frequency-domain traces)\ It specifies the amount of data at the beginning of the trace that will be ignored before the decimation process starts. It is the time or frequency change from the start of the trace to the point where you want to start using the data The default value is zero
`<length>`	*Length* is an optional real number. (It is in seconds for time-domain traces, and is a dimensionless index 0 to Npoints – 1, for frequency-domain traces) It defines how much data will be compressed into one value This parameter has a default value equal to the current trace length
`<roffset>`	*Repeat Offset* is an optional real number. (It is in seconds for time-domain traces, and is a dimensionless index 0 to Npoints – 1, for frequency-domain traces) It defines the beginning of the next field of trace elements to be compressed. This is relative to the beginning of the previous field This parameter has a default value equal to the `<length>` variable Note that this parameter is used for a completely different purpose when curve

	fitting (see `CFIT` above)
`<rlimit>`	*Repeat Limit* is an optional integer. It specifies the number of data items that you want returned. It will ignore any additional items beyond that number. You can use the Start offset and the Repeat limit to pick out exactly what part of the data you want to use The default value is all the data

9.3.3.6 Calculate Peaks of Trace Data (Remote Command Only)

Returns a list of all the peaks for the currently selected measurement and sub-opcode `n`. The peaks must meet the requirements of the peak threshold and excursion values.

`n` = any valid sub-opcode for the current measurement. See the `:MEASure:<measurement>?` query description for your specific measurement, for information on the data that can be returned.

The command can only be used with specific sub-opcodes with measurement results that are trace data. Both real and complex traces can be searched, but complex traces are converted to magnitude in dBm. In many measurements, the sub-opcode n = 0 is the raw trace data, which cannot be searched for peaks. Sub-opcode n = 1 is often calculated results values, which also cannot be searched for peaks.

This command uses the data setting specified by the `:FORMat:BORDer` and `:FORMat:DATA` commands, and can return real or ASCII data. If the format is set to `INT,32`, it returns `REAL,32` data.

The command has four types of parameters:

- Threshold (in dBm)
- Excursion (in dB)
- Sorting order (amplitude, frequency, time)
- Optional in some measurements: Display line use (all, > display line, < display line)

Remote Command	For Swept SA measurement:
	`:CALCulate:DATA[1]|2|...|6:PEAKs? <threshold>,<excursion>[,AMPLitude | FREQuency | TIME[,ALL | GTDLine | LTDLine]]`
	For most other measurements:
	`:CALCulate:DATA[1]|2|...|6:PEAKs? <threshold>,<excursion>[,AMPLitude | FREQuency | TIME]`

Notes	`<n>` - The trace that will be used `<threshold>` - The level below which trace data peaks are ignored. Note that the threshold value is required and is always used as a peak criterion. To effectively disable the threshold criterion for this command, provide a substantially low threshold value, such as –200 dBm. Note also that the threshold

value used in this command is independent of and has no effect on the threshold value stored under the Peak Criteria menu

`<excursion>` - The minimum amplitude variation (rise and fall) required for a signal to be identified as peak. Note that the excursion value is required and is always used as a peak criterion. To effectively disable the excursion criterion for this command, provide the minimum value of 0.0 dB. Note also that the excursion value used in this command is independent of and has no effect on the excursion value stored under the Peak Criteria menu

Values must be provided for threshold and excursion. The sorting and display line parameters are optional (defaults are `AMPLitude` and `ALL`)

Note that there is always a Y-axis value for the display line, regardless of whether the display line state is on or off. It is the current Y-axis value of the display line which is used by this command to determine whether a peak should be reported

Sorting order:

- `AMPLitude` - lists the peaks in order of descending amplitude, with the highest peak first (default if optional parameter not sent)
- `FREQuency` - lists the peaks in order of occurrence, left to right across the x-axis
- `TIME` - lists the peaks in order of occurrence, left to right across the x-axis

Peaks vs. Display Line:

- `ALL` - lists all of the peaks found (default if optional parameter not sent)
- `GTDLine` (greater than display line) - lists all of the peaks found above the display line
- `LTDLine` (less than display line) - lists all of the peaks found below the display line

As an example, for Swept SA measurement in Spectrum Analyzer Mode:

`:CALC:DATA4:PEAK? –40,10,FREQ,GTDL`

This identifies the peaks of trace 4 that are above –40 dBm, with excursions of at least 10 dB. The peaks are returned in order of increasing frequency, starting with the lowest frequency. Only the peaks that are above the display line are returned

Query Results 1:

With `:FORMat:DATA REAL,32` selected, returns a list of floating-point numbers. The first value in the list is the number of peak points that are in the following list. A peak point consists of two values: a peak amplitude followed by its corresponding frequency (or time)

If no peaks are found, the peak list consists of only the number of peaks (0)

9.3.3.7 Smooth Trace Data (Remote Command Only)

Included for ESA compatibility. Not recommended for new designs. Use the `:CALCulate:DATA:COMPress` command instead.

Smoothes the trace according to the number of points specified in `:TRACe:MATH:SMOoth:POINts`. There is no equivalent front panel function.

The purpose of this function is to perform a spatial video averaging, as compared to the temporal version supplied by the video-average command

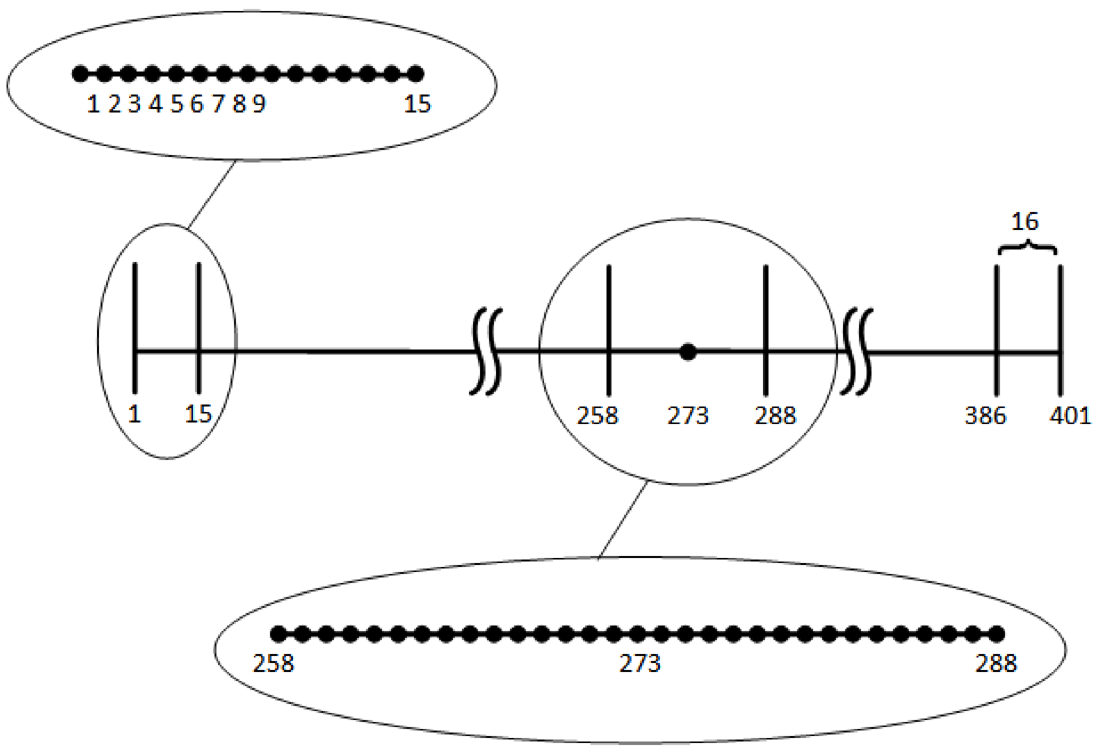
[:SENSe]:AVERage:TYPE VIDeo. The functions of :TRACe:MATH:SMOoth <trace> and [:SENSe]:AVERage:TYPE VIDeo|POWer are not interchangeable.

Remote Command	:TRACe:MATH:SMOoth TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6

Each point value is replaced with the average of the values of the selected number of points, with half of those points located on each side of any particular point (when possible). Refer to the illustration below. This shows a 401 point trace with a smoothing number of 31. Think of the trace points as “buckets” of data. To smooth (arbitrary) point 273, the instrument averages buckets 258 through 288, and applies that value to point 273.

Increasing the number of points increases smoothing, at the cost of decreasing resolution.

The amount of smoothing decreases at the end points. Because :TRACe:MATH:SMOoth <trace> averages values that occur before and after the data point in time, display irregularities can be caused at the start and stop frequencies. To avoid possible irregularities (signal distortion) at the ends of the trace, use small values for the smooth parameter.



The following discussion of the end-point smoothing phenomenon refers to the illustration above.

With 31 smoothing points and a 401 point trace, point 16 will be the first point to have full 31-bucket smoothing. Likewise, point 386 will be the last point with full 31-bucket smoothing. Under the conditions stated, points 2 through 15 will be smoothed as follows: Point 2 is derived from averaging buckets 1 through 3. Point 3 is derived from averaging buckets 1 through 5, Point 4 is derived from averaging buckets 1 through 7, and so forth until point 16 is reached. The quantity of buckets used for the smoothing running average increases at the rate of 2 buckets per point, from point 1 to point ([smoothing number+1]/2), at which time the full number of smoothing points is utilized. The same characteristic occurs at the completion of the trace, beginning at point 386, beyond which the number of averaging buckets begins to decrease until point 401 is reached.

By replacing the value of each point in a trace with the average of the values of a number of points centered about that point, any rapid variations in noise or signals are smoothed into more gradual variations. It thereby performs a function similar to reducing the video bandwidth without the corresponding changes in sweep time; as such, frequency resolution is decreased. Also, signal peaks are reduced with large smoothing values. This can cause the amplitude to appear to be less than its actual value.

9.3.3.8 Number of Points for Smoothing (Remote Command Only)

Included for ESA compatibility. Not recommended for new designs. Use the `:CALCulate:DATA:COMPress` command instead: "Calculate/Compress Trace Data Query (Remote Command Only)" on page 2602.

Specifies the number of points that will be smoothed. Increasing the number of points increases smoothing, at the cost of decreasing resolution. If the number of points is an even number, then the number of points is increased by one. If the number of points is larger than the number of sweep points, then the number of sweep points is used, unless the number of sweep points is even, in which case the number of points will be the sweep points minus one. The number of points smoothed is always an odd number.

Remote Command	`:TRACe:MATH:SMOoth:POINts <integer>` `:TRACe:MATH:SMOoth:POINts?`
Example	`:TRAC:MATH:SMO:POIN 501`
Notes	Only odd values are allowed; if an even `<integer>` value is specified, add 1 unless `<integer>` = number of sweep points, in which case subtract 1 Used with the `:TRACe:MATH:SMOoth` command: "Smooth Trace Data (Remote Command Only) " on page 2609
Preset	11
Min	3
Max	Number of sweep points

9.3.3.9 Mean Trace Data (Remote Command Only)

Included for ESA compatibility. Not recommended for new designs. Use the `:CALCulate:DATA:COMPress` command instead: "Calculate/Compress Trace Data Query (Remote Command Only)" on page 2602.

Returns the mean of the amplitudes of the trace amplitude elements, in measurement units.

Remote Command	`:TRACe:MATH:MEAN? TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6`
Example	`:TRAC:MATH:MEAN? TRACE2`

9.4 STATus Subsystem

The SCPI STATus Subsystem allows you to monitor a number of status conditions within the instrument through the use of a hierarchy of status registers containing bits which go true or false depending on various conditions.

9.4.1 Status Registers

This section provides an overview of SCPI status registers and how to manage them. The section "STATus Subsystem Registers and Commands" on page 2618 gives detailed programming information for each of the X-Series status registers.

9.4.1.1 What Are Status Registers

The status system contains multiple registers that are arranged in a hierarchical order. The lower-level status registers propagate their data to the higher-level registers in the data structures by means of summary bits. The status byte register is at the top of the hierarchy and contains general status information for the instrument's events and conditions. All other individual registers are used to determine the specific events or conditions. For a diagram of the registers and their interconnections, see above.

The operation and questionable status registers are sets of registers that monitor the overall instrument condition. They are accessed with the STATus:OPERation and STATus:QUEStionable commands in the STATus command subsystem. Each register set is made up of five registers:

- Condition Register—Reports the real-time state of the signals monitored by this register set. There is no latching or buffering for a condition register
- Positive Transition Register—This filter register controls which signals will set a bit in the event register when the signal makes a low to high transition (when the condition bit changes from 0 to 1)
- Negative Transition Register—This filter register controls which signals will set a bit in the event register when the signal makes a high to low transition (when the condition bit changes from 1 to 0)
- Event Register—Latches any signal state changes, in the way specified by the filter registers. Bits in the event register are never cleared by signal state changes. Event registers are cleared when read. They are also cleared by `*CLS` and by presetting the instrument
- Event Enable Register—Controls which of the bits, being set in the event register, will be summarized as a single output for the register set. Summary bits are then used by the next higher register

The STATus:QUEStionable registers report abnormal operating conditions. The status register hierarchy is:

1. The summary outputs from the six STATus:QUEStionable:<keyword> detail registers are inputs to the STATus:QUEStionable register
2. The summary output from the STATus:QUEStionable register is an input to the Status Byte Register. See the overall system in Figure at the beginning of this section

The STATus:OPERation register set has no summarized inputs. The inputs to the STATus:OPERation:CONDition register indicate the real time state of the instrument. The STATus:OPERation:EVENt register summary output is an input to the Status Byte Register.

9.4.1.2 What Are Status Register SCPI Commands

Monitoring of the instrument conditions is done at the highest level using the following IEEE 488.2 common commands. Complete command descriptions are available in the section "IEEE 488.2 Common Commands" on page 2585. Individual status registers can be set and queried using the commands in the "STATus Subsystem Registers and Commands" on page 2618 section.

- *CLS (clear status) clears the status byte by emptying the error queue and clearing all the event registers.
- *ESE, *ESE? (event status enable) sets and queries the bits in the enable register part of the standard event status register.
- *ESR? (event status register) queries and clears the event register part of the standard event status register.
- *OPC, *OPC? (operation complete) sets the standard event status register to monitor the completion of all commands. The query stops any new commands from being processed until the current processing is complete, then returns a ‘1’.
- *PSC, *PSC? (power-on state clear) sets the power-on state so that it clears the service request enable register and the event status enable register at power on.
- *SRE, *SRE? (service request enable) sets and queries the value of the service request enable register.
- *STB? (status byte) queries the value of the status byte register without erasing its contents.

9.4.1.3 How to Use the Status Registers

A program often needs to be able to detect and manage error conditions or changes in instrument status. There are two methods you can use to programmatically access the information in status registers:

- The polling method
- The service request (SRQ) method

In the polling method, the instrument has a passive role. It only tells the controller that conditions have changed when the controller asks the right question. In the SRQ method, the instrument takes a more active role. It tells the controller when there has been a condition change without the controller asking. Either method allows you to monitor one or more conditions.

The polling method works well if you do not need to know about changes the moment they occur. The SRQ method should be used if you must know immediately when a condition changes. To detect a change using the polling method, the program must repeatedly read the registers.

Use the SRQ method when:

- you need time-critical notification of changes
- you are monitoring more than one device which supports SRQs
- you need to have the controller do something else while waiting
- you can’t afford the performance penalty inherent to polling

Use polling when:

- your programming language/development environment does not support SRQ interrupts
- you want to write a simple, single-purpose program and don’t want the added complexity of setting up an SRQ handler
- To monitor a condition:
- Determine which register contains the bit that reports the condition.
- Send the unique SCPI query that reads that register.
- Examine the bit to see if the condition has changed.

You can monitor conditions in different ways.

- **Check the current instrument hardware and firmware status.** Do this by querying the condition registers which continuously monitor status. These registers represent the current state of the instrument. Bits in a condition register are updated in real time. When the condition monitored by a particular bit becomes true, the bit is set to 1. When the condition becomes false, the bit is reset to 0.
- **Monitor a particular condition (bit).** You can enable a particular bit(s), using the event enable register. The instrument will then monitor that particular condition (s). If the bit becomes true (0 to 1 transition) in the event register, it will stay set until the event register is cleared. Querying the event register allows you to detect

that this condition occurred even if the condition no longer exists. The event register can only be cleared by querying it or sending the *CLS command.

- Monitor a particular type of change in a condition (bit).
- The transition registers are preset to register if the condition goes from 0 to 1 (false to true, or a positive transition).
- This can be changed so the selected condition is detected if the bit goes from 1 to 0 (true to false, or a negative transition).
- It can also be set for both types of transitions occurring.
- Or it can be set for neither transition. If both transition registers are set to 0 for a particular bit position, that bit will not be set in the event register for either type of change.

Using the Service Request (SRQ) Method

Your language, bus, and programming environment must be able to support SRQ interrupts. (For example, BASIC used with VXI-11.3 (GPIB over LAN). When you monitor a condition with the SRQ method, you must:

1. Determine which bit monitors the condition
2. Determine how that bit reports to the request service (RQS) bit of the status byte
3. Send SCPI commands to enable the bit that monitors the condition and to enable the summary bits that report the condition to the RQS bit
4. Enable the controller to respond to service requests

When the condition changes, the instrument sets its RQS bit. The controller is informed of the change as soon as it occurs. As a result, the time the controller would otherwise have used to monitor the condition can be used to perform other tasks. Your program determines how the controller responds to the SRQ.

Bit 6 of the status byte register is the request service (RQS) bit. The *SRE command is used to configure the RQS bit to report changes in instrument status. When such a change occurs, the RQS bit is set. It is cleared when the status byte register is queried using *SRE? (with a serial poll.) It can be queried without erasing the contents with *STB?.

When a register being set causes a summary bit in the status byte to change from 0 to 1, the instrument can initiate the service request (SRQ) process. However, the process is only initiated if both of the following conditions are true:

- The corresponding bit of the service request enable register is also set to 1.
- The instrument does not have a service request pending. (A service request is

considered to be pending between the time the instrument's SRQ process is initiated and the time the controller reads the status byte register.)

The SRQ process sets the SRQ true. It also sets the status byte's request service (RQS) bit to 1. Both actions are necessary to inform the controller that the instrument requires service. Setting the SRQ line only informs the controller that some device on the bus requires service. Setting the RQS bit allows the controller to determine which instrument requires service.

If your program enables the controller to detect and respond to service requests, it should instruct the controller to perform a serial poll when the SRQ is set true. Each device on the bus returns the contents of its status byte register in response to this poll. The device who's RQS bit is set to 1 is the device that requested service.

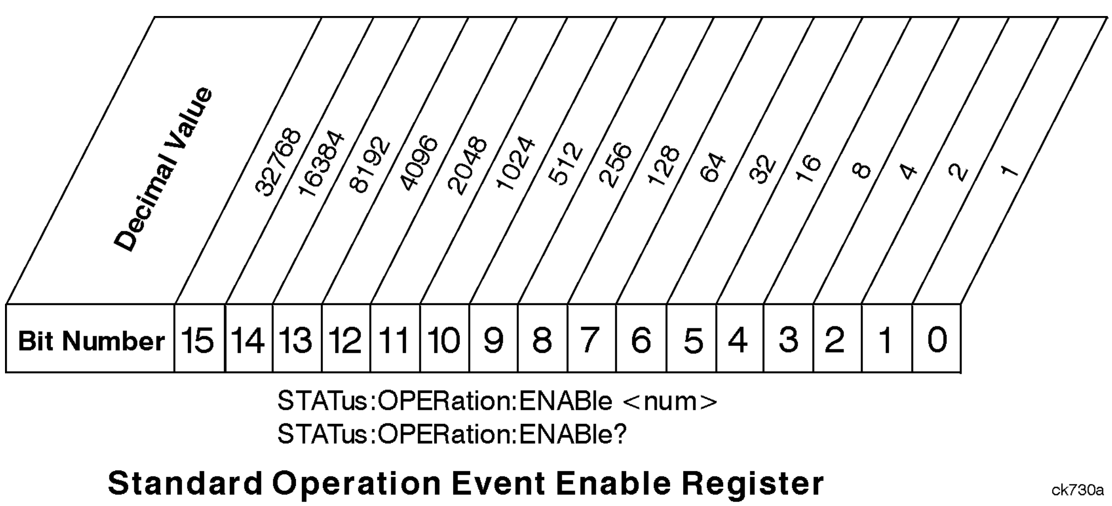
NOTE **When you read the instrument's status byte register with a serial poll, the RQS bit is reset to 0. Other bits in the register are not affected.**

If the status register is configured to SRQ on end-of-measurement and the measurement is in continuous mode, then restarting a measurement (INIT command) can cause the measuring bit to pulse low. This causes an SRQ when you have not actually reached the "end-of-measurement" condition. To avoid this:

1. Set `:INITiate:CONTinuous` off
2. Set/enable the status registers
3. Restart the measurement (send INIT)

9.4.1.4 Status Register Bit Parameters

The diagram below shows a typical status register, the Standard Operation Event Enable register. Each bit in a register is represented by a numerical value based on its location. This number is sent with the command to enable a particular bit. If you want to enable more than one bit, you would send the sum of all the bits that you want to monitor.



Standard Operation Event Enable Register

NOTE Bit 15 is not used to report status.

Example 1:

1. To enable bit 0 and bit 6 of standard event status register, you would send `*ESE 65` because 1 + 64 = 65
2. The results of a query are evaluated in a similar way. If `*STB?` returns a decimal value of 140, (140 = 128 + 8 + 4) then bit 7 is true, bit 3 is true and bit 2 is true

Example 2:

1. Suppose you want to know if an Auto-trigger Timeout occurs, but you only cared about that specific condition. So you would want to know what was happening with bit 10 in the Status Questionable Integrity register, and not about any other bits
2. It's usually a good idea to start by clearing all the status registers with `*CLS`
3. Sending `STAT:QUES:INT:ENAB 1024` lets you monitor only bit 10 events, instead of the default monitoring all the bits in the register. The register default is for positive transition events (0 to 1 transition). That is, when an auto-trigger timeout occurs. If instead, you wanted to know when the Auto-trigger timeout condition is cleared, then you would set `STAT:QUES:INT:PTR 0` and `STAT:QUES:INT:NTR 32767`
4. Now, the only output from the Status Questionable Integrity register will come from a bit 10 positive transition. That output goes to the Integrity Sum bit 9 of the Status Questionable register
5. You can do a similar thing with this register to only look at bit 9 using `STAT:QUES:ENAB 512`
6. The Status Questionable register output goes to the "Status Questionable Summary" bit 3 of the Status Byte Register. The output from this register can be enabled using `*SRE 8`
7. Finally, you would use the serial polling functionality available for the particular bus/software that you are using to monitor the Status Byte Register. (You could also use `*STB?` to poll the Status Byte Register)

9.4.2 STATus Subsystem Registers and Commands

The STATus subsystem remote commands set and query the status registers. This system of registers monitors various events and conditions in the instrument. Software written to control the instrument may need to monitor some of these events and conditions.

NOTE

All status register commands are sequential. You can send them in the middle of an ongoing overlapped command to get the current status. You can also send them following a sequential command. In this case, the status register command waits for the completion of the previously-sent sequential command before performing the action.

Most commands are sequential commands; only a few are overlapped.

If a command *is* overlapped, then that is explicitly stated in the command description.

Specific status bits are assigned to monitor various aspects of the instrument operation and status. See the "Status Register Diagram" on page 2619 for information about the bit assignments and status register interconnections. See also the Keysight X-Series Signal Analyzers Instrument Messages manual for more detail on the instrument conditions that can cause these bits to be set.

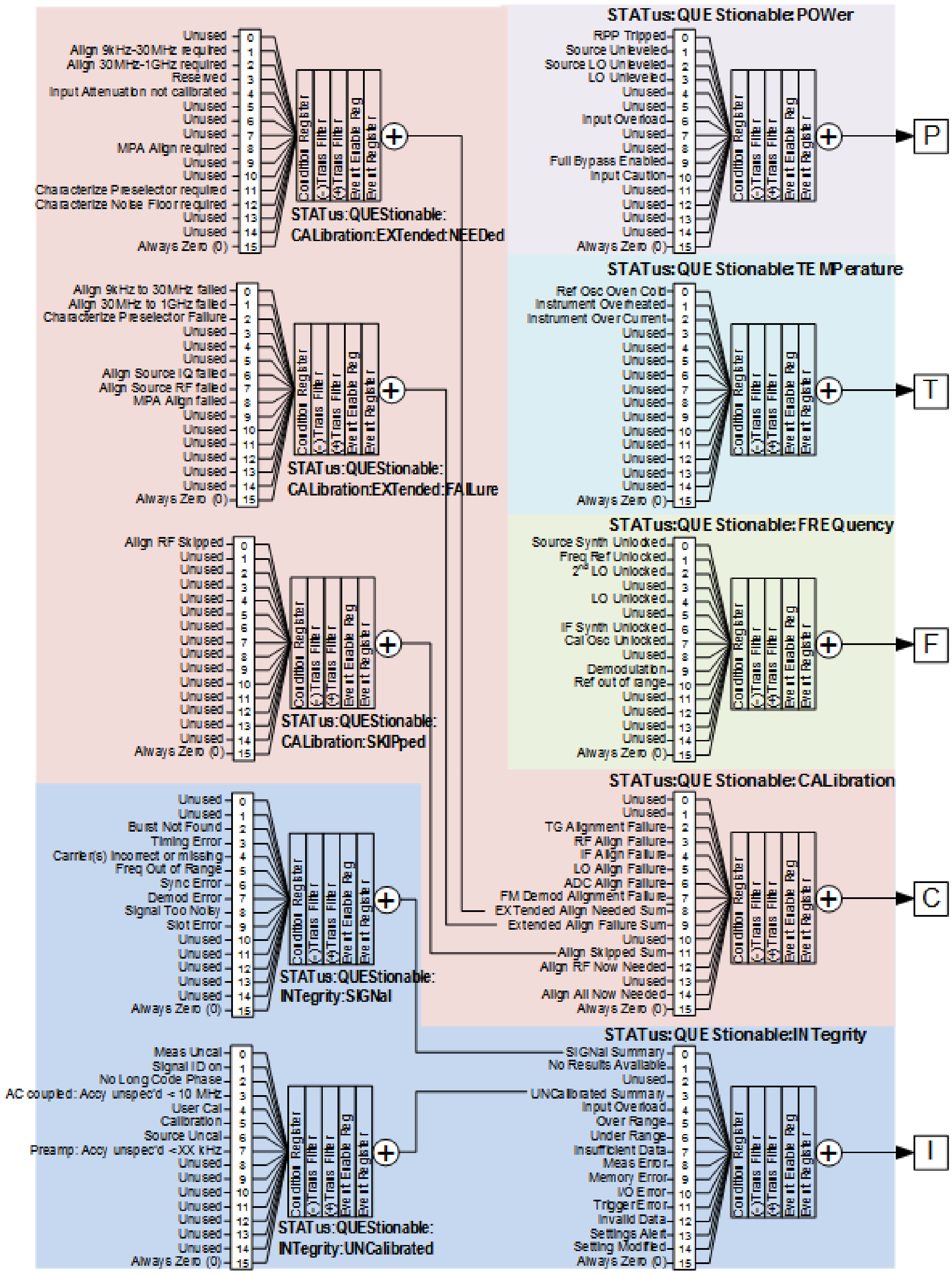
The STATus subsystem controls and queries the SCPI-defined instrument status reporting structures. Each status register has a set of five commands used for querying or masking that particular register.

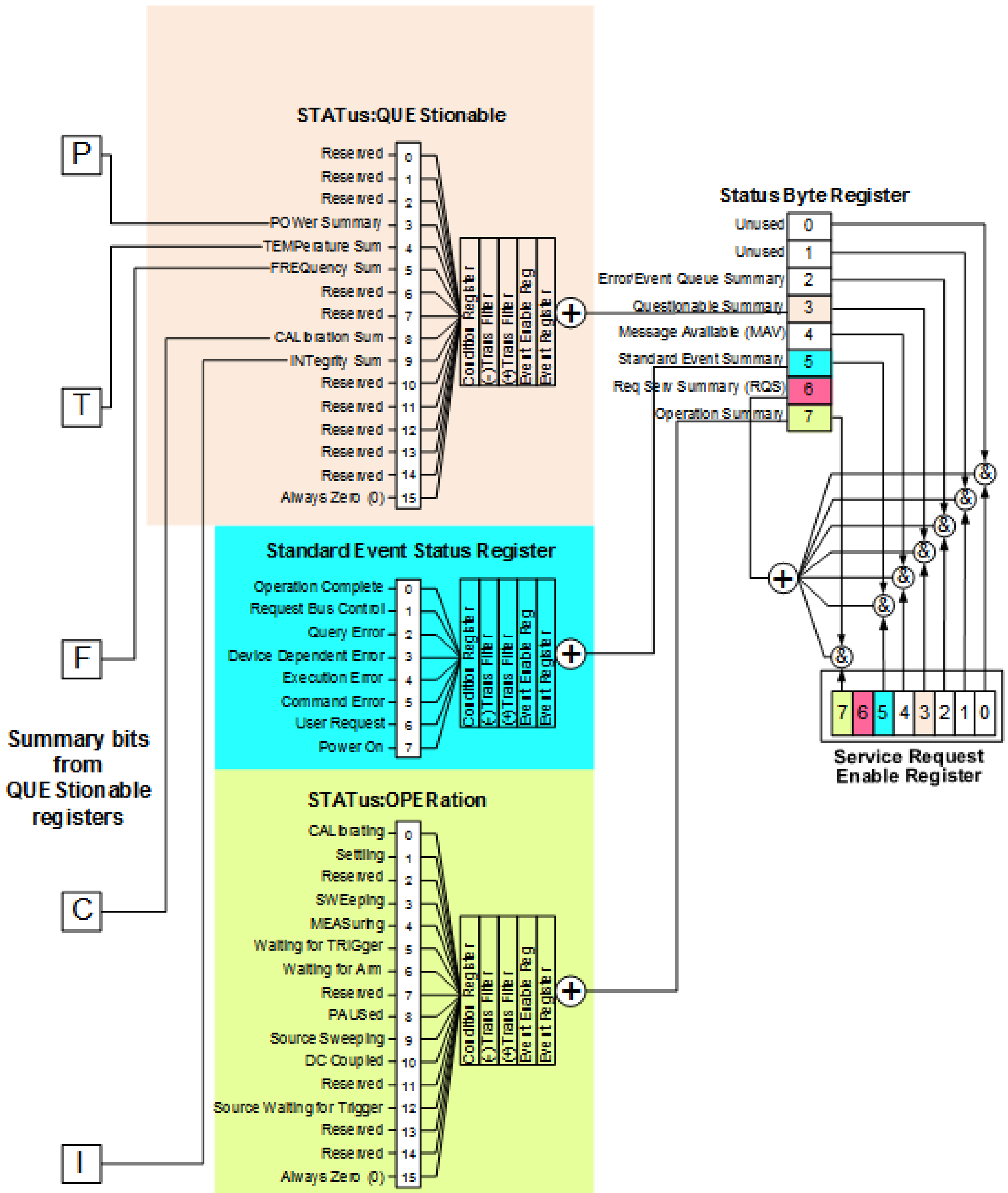
Numeric values for bit patterns can be entered using decimal or hexadecimal representations. (i.e. 0 to 32767 is equivalent to #H0 to #H7FFF. It is also equal to all ones, 111111111111111). See "Status Register Bit Parameters" on page 2617 for information about using bit patterns for variable parameters.

9.4.2.1 Status Register Diagram

The following diagram provides a graphical overview of the entire X-Series Status Register Subsystem.

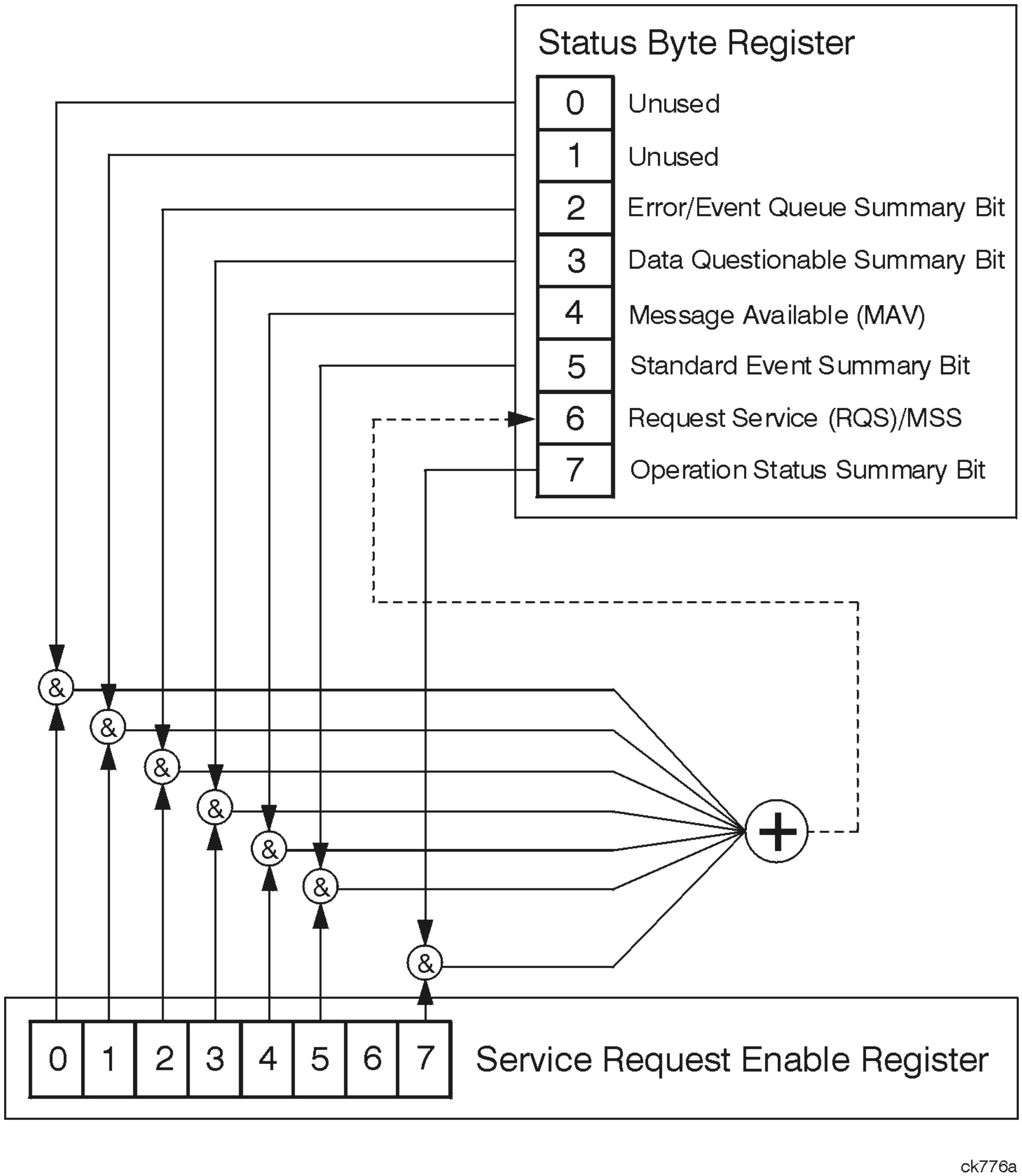
For readability, the diagram is split into two sections.

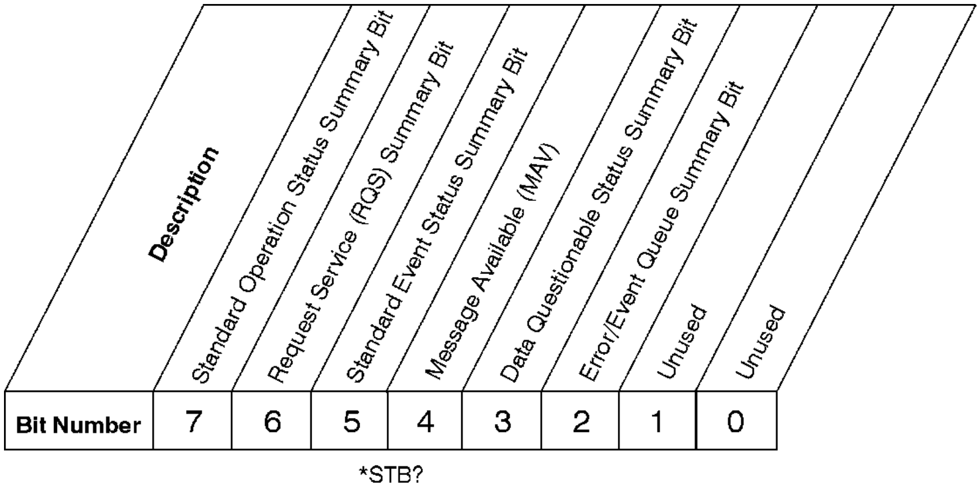

STATus:QUEStionable:CALibration:EXTended:NEEDed
Unused
Align 9kHz-30MHz required
Align 30MHz-1GHz required
Reserved
Input Attenuation not calibrated
MPA Align required
Characterize Preselector required
Characterize Noise Floor required
Always Zero (0)
STATus:QUEStionable:CALibration:EXTended:FAILure
Align 9kHz to 30MHz failed
Align 30MHz to 1GHz failed
Characterize Preselector Failure
Align Source IQ failed
Align Source RF failed
MPA Align failed
STATus:QUEStionable:CALibration:SKIPped
Align RF Skipped
STATus:QUEStionable:INTegrity:SIGNal
Burst Not Found
Timing Error
Carrier(s) incorrect or missing
Freq Out of Range
Sync Error
Demod Error
Signal Too Noisy
Slot Error
STATus:QUEStionable:INTegrity:UNCalibrated
Meas Uncal
Signal ID on
No Long Code Phase
AC coupled: Accy unspec'd < 10 MHz
User Cal
Calibration
Source Uncal
Preamp: Accy unspec'd <XX kHz
STATus:QUEStionable:POWer
RPP Tripped
Source Unleveled
Source LO Unleveled
LO Unleveled
Input Overload
Full Bypass Enabled
Input Caution
STATus:QUEStionable:TEMPerature
Ref Osc Oven Cold
Instrument Overheated
Instrument Over Current
STATus:QUEStionable:FREQuency
Source Synth Unlocked
Freq Ref Unlocked
2nd LO Unlocked
LO Unlocked
IF Synth Unlocked
Cal Osc Unlocked
Demodulation
Ref out of range
STATus:QUEStionable:CALibration
TG Alignment Failure
RF Align Failure
IF Align Failure
LO Align Failure
ADC Align Failure
FM Demod Alignment Failure
EXTended Align Needed Sum
Extended Align Failure Sum
Align Skipped Sum
Align RF Now Needed
Align All Now Needed
STATus:QUEStionable:INTegrity
SIGNal Summary
No Results Available
UNCalibrated Summary
Over Range
Under Range
Insufficient Data
Meas Error
Memory Error
I/O Error
Trigger Error
Invalid Data
Settings Alert
Setting Modified
Condition Register
(-)Trans Filter
(+)Trans Filter
Event Enable Reg
Event Register
P
T
F
C
I



9.4.2.2 Status Byte Register

The Status Byte register provides a one-byte overview of the entire STATus subsystem. All the other registers funnel into this register with summary bits, as shown in the "Status Register Diagram" on page 2619.


Status Byte Register
0 Unused
1 Unused
2 Error/Event Queue Summary Bit
3 Data Questionable Summary Bit
4 Message Available (MAV)
5 Standard Event Summary Bit
6 Request Service (RQS)/MSS
7 Operation Status Summary Bit
&
+
0 1 2 3 4 5 6 7
Service Request Enable Register
ck776a



Status Byte Register

ck725a

Bit	Description
0, 1	These bits are always set to 0
2	A 1 in this bit position indicates that the SCPI error queue is not empty which means that it contains at least one error message
3	A 1 in this bit position indicates that the data questionable summary bit has been set. The data questionable event register can then be read to determine the specific condition that caused this bit to be set
4	A 1 in this bit position indicates that the instrument has data ready in the output queue. There are no lower status groups that provide input to this bit
5	A 1 in this bit position indicates that the standard event summary bit has been set. The standard event status register can then be read to determine the specific event that caused this bit to be set
6	A 1 in this bit position indicates that the instrument has at least one reason to report a status change. This bit is also called the master summary status bit (MSS)
7	A 1 in this bit position indicates that the standard operation summary bit has been set. The standard operation event register can then be read to determine the specific condition that caused this bit to be set

To query the status byte register, send the query `*STB?` The response will be the decimal sum of the bits which are set to 1. For example, if bit number 7 and bit number 3 are set to 1, the decimal sum of the 2 bits is 128 plus 8. So the decimal value 136 is returned. The `*STB` command does not clear the status register.

The RQS bit is read and reset by a serial poll. The same bit position (MSS) is read, non-destructively by the *STB? query. If you serial poll bit 6 it is read as RQS, but if you send `*STB` it reads bit 6 as MSS. For more information refer to the IEEE 488.2 standard, section 11. In addition to the status byte register, the status byte group also contains the service request enable register. This register lets you choose which bits in the status byte register will trigger a service request.

See also "*STB? - Status Byte Query" on page 2591

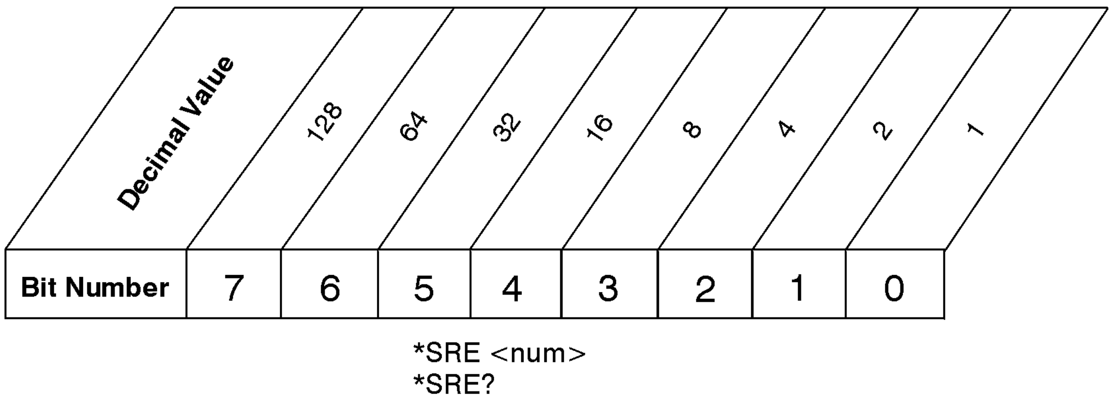
Service Request Enable Register

This register enables the desired bits of the Service Request (SRQ) subsystem.

Send `*SRE <integer>`, where `<integer>` is the sum of the decimal values of the bits you want to enable plus the decimal value of bit 6. For example, assume that you want to enable bit 7 so that whenever the standard operation status register summary bit is set to 1 it will trigger a service request. Send `*SRE 192` (because 192 = 128 + 64). You must always add 64 (the numeric value of RQS bit 6) to your numeric sum when you enable any bits for a service request.

`*SRE?` returns the decimal value of the sum of the bits previously enabled with `*SRE <integer>`.

The service request enable register presets to zeros (0).



Service Request Enable Register ck726a

See also "*SRE - Service Request Enable" on page 2591

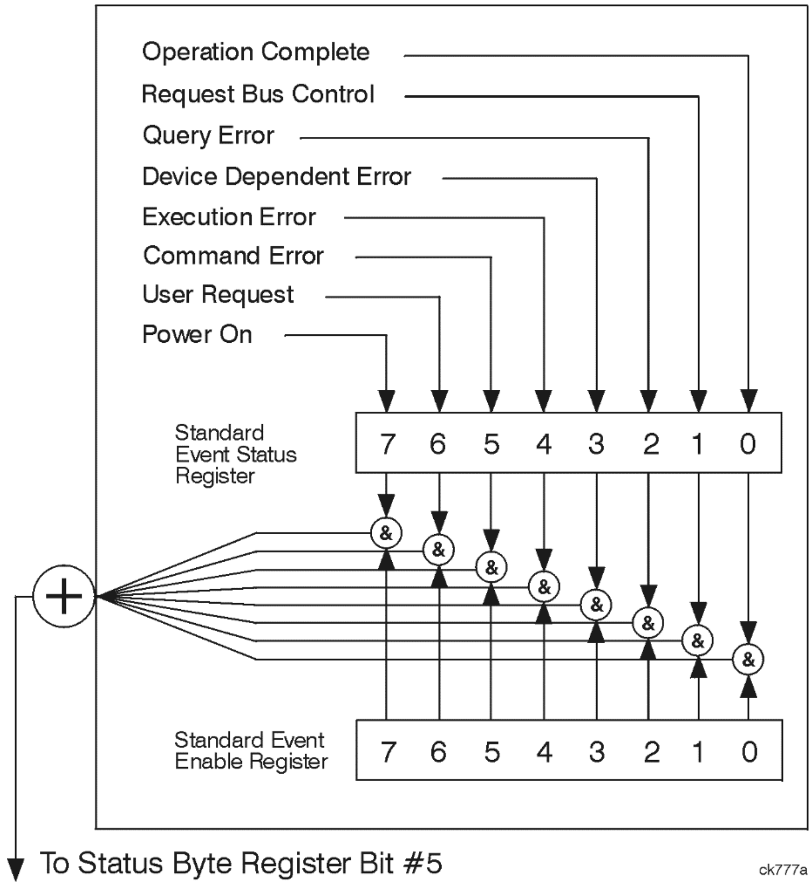
Preset the Status Byte

Sets bits in most of the enable and transition registers to their default state. It presets all the Transition Filters, Enable Registers, and the Error/Event Queue Enable. It has no effect on Event Registers, Error/Event QUEue, IEEE 488.2 ESE, and SRE Registers as described in:

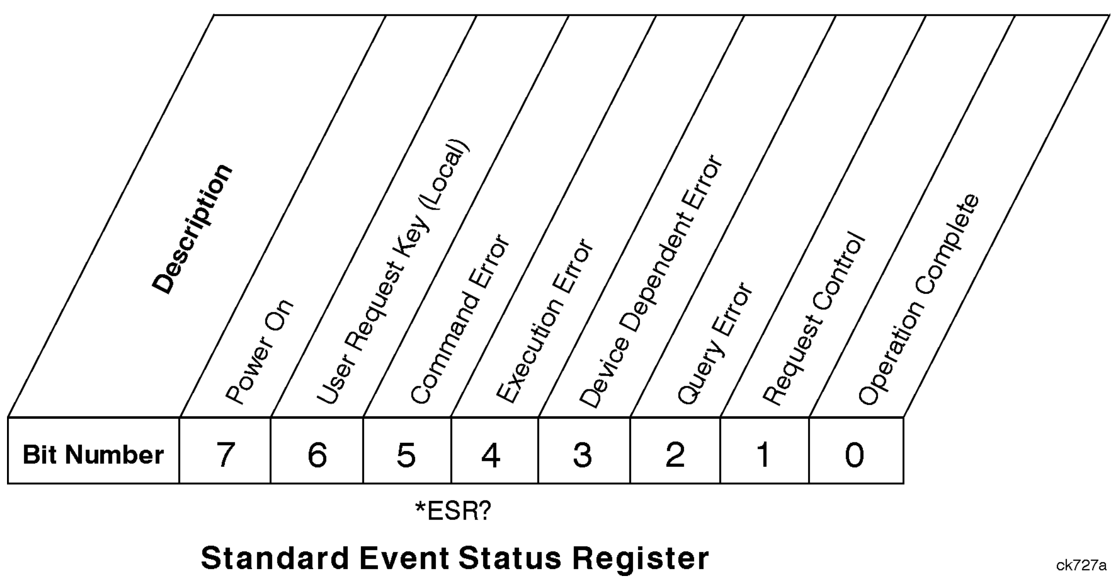
IEEE Standard 488.2–1992

Remote Command	`:STATus:PRESet`
Example	`:STAT:PRES`

9.4.2.3 Standard Event Status Register



The standard event status register contains the following bits:



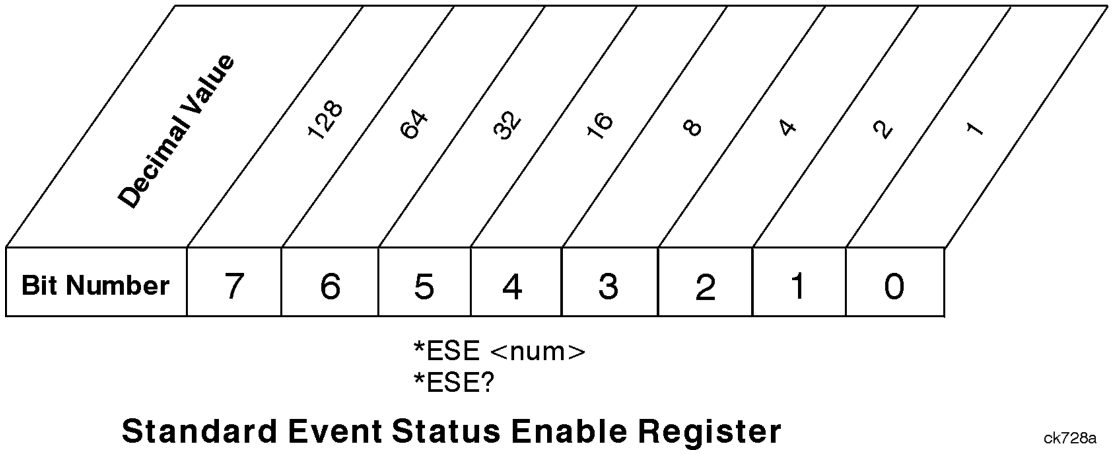
Bit	Description
0	A 1 in this bit position indicates that all pending operations were completed following execution of the *OPC command
1	This bit is for GPIB handshaking to request control. Currently it is set to 0 because there are no implementations where the spectrum analyzer controls another instrument
2	A 1 in this bit position indicates that a query error has occurred. Query errors have SCPI error numbers from -499 to -400
3	A 1 in this bit position indicates that a device dependent error has occurred. Device dependent errors have SCPI error numbers from -399 to -300 and 1 to 32767
4	A 1 in this bit position indicates that an execution error has occurred. Execution errors have SCPI error numbers from -299 to -200
5	A 1 in this bit position indicates that a command error has occurred. Command errors have SCPI error numbers from -199 to -100
6	A 1 in this bit position indicates that the LOCAL key has been pressed. This is true even if the instrument is in local lockout mode
7	A 1 in this bit position indicates that the instrument has been turned off and then on

The standard event status register is used to determine the specific event that set bit 5 in the status byte register. To query the standard event status register, send the query `*ESR?`. The response will be the decimal sum of the bits that are enabled (set to 1). For example, if bit number 7 and bit number 3 are enabled, the decimal sum of the 2 bits is 128 plus 8. So the decimal value 136 is returned. See also "*ESR? - Standard Event Status Register Query" on page 2587

The Standard Event Status Enable Register

In addition to the standard event status register, the standard event status group also contains a standard event status enable register. This register lets you choose which bits in the standard event status register will set the summary bit (bit 5 of the status byte register) to 1. Send the `*ESE <integer>` command where <integer> is the sum of the decimal values of the bits you want to enable. For example, to enable bit 7 and bit 6 so that whenever either of those bits is set to 1, the standard event status summary bit of the status byte register will be set to 1, send the command `*ESE 192` (128 + 64). The command `*ESE?` returns the decimal value of the sum of the bits previously enabled with the `*ESE <integer>` command.

The standard event status enable register presets to zeros (0).



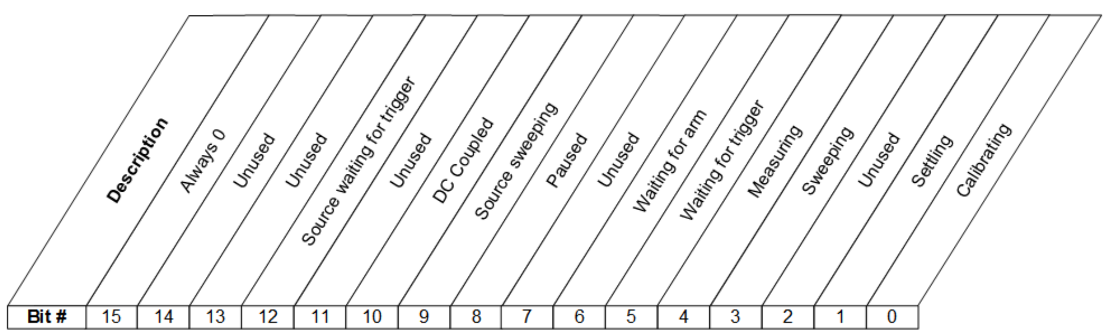
Standard Event Status Enable Register

See also "*ESE - Standard Event Status Enable" on page 2586

9.4.2.4 STATus:OPERation Register

The operation and questionable status registers are registers that monitor the overall instrument condition. They are accessed with the STATus:OPERation and STATus:QUEStionable commands.

The operation status register monitors the current instrument measurement state and various instrument operations for a quick summary of what is happening within the instrument. It checks to see if the instrument is calibrating, sweeping, or waiting for a trigger. Also see "*OPC? - Operation Complete" on page 2588.



STATus:OPERation Register

Bit	Condition	Operation
0	Calibrating	The instrument is busy executing its Align Now process
1	Settling	The instrument circuitry is settling
3	Sweeping	The instrument is busy taking a sweep.
4	Measuring	The instrument is busy making a measurement. Measurements often require multiple sweeps. They are initiated by keys under the **MEASURE** key or with the MEASure group of commands. The bit is valid for most X-Series Modes.
5	Waiting for trigger	The instrument is waiting for the trigger conditions to be met, then it will trigger a sweep or measurement.

Bit	Condition	Operation
6	Waiting for arm	The instrument is waiting for the trigger to be armed
8	Paused	The measurement is paused
9	Source Sweeping	The List Sequencer is running or Freq Scan results are available
10	DC Coupled	The instrument is DC coupled
12	Source Waiting for Trigger	The built in source is waiting for a trigger

Operation Condition Query

This query returns the decimal value of the sum of the bits in the Status Operation Condition register.

NOTE The data in this register is continuously updated and reflects the current conditions.

Remote Command	`:STATus:OPERation:CONDition?`
Example	`:STAT:OPER:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Operation Enable

This command determines which bits in the Operation Event register, will set the Operation Status Summary bit (bit 7) in the Status Byte Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

NOTE The preset condition is to have all bits in this enable register set to 0. To have any Operation Events reported to the Status Byte Register, one or more bits need to be set to 1.

Remote Command	`:STATus:OPERation:ENABle <integer>` `:STATus:OPERation:ENABle?`
Example	`:STAT:OPER:ENAB 1` Sets the register so that Align Now events will be reported to the Status Byte Register.
Preset	0
Min	0
Max	32767

Status Bits/OPC dependencies	Sequential command

Operation Event Query

This query returns the decimal value of the sum of the bits in the Operation Event register.

NOTE The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

Remote Command	`:STATus:OPERation[:EVENt]?`
Example	`:STAT:OPER?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Operation Negative Transition

This command determines which bits in the Operation Condition register will set the corresponding bit in the Operation Event register when the condition register bit has a negative transition (1 to 0). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:OPERation:NTRansition <integer>` `:STATus:OPERation:NTRansition?`
Example	`:STAT:OPER:NTR 1` Align Now operation complete will be reported to the Status Byte Register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Operation Positive Transition

This command determines which bits in the Operation Condition register will set the corresponding bit in the Operation Event register when the condition register bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Remote Command	:STATus:OPERation:PTRansition <integer> :STATus:OPERation:PTRansition?
Example	:STAT:OPER:PTR 1 Align Now operation beginning will be reported to the Status Byte Register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

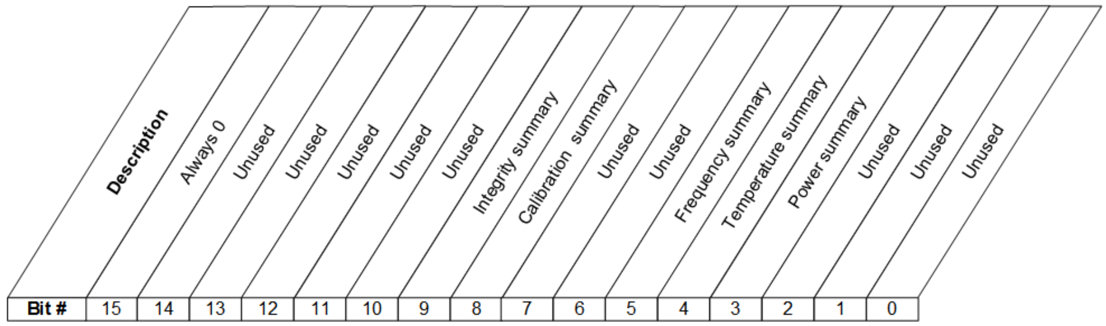
Backwards Compatibility

1. The STATus:OPERation register bit 4 is a “Measuring” bit. The bit is valid for SA mode and all the application modes. In older products the bit was only valid for ESA/PSA Spectrum Analysis, Phase Noise, and Noise Figure modes. It was also in ESA’s Bluetooth, cdmaOne, and GSM modes.
2. The STATus:OPERation register bit 8 is a “Paused” bit. The bit is valid for SA mode and all the application modes. In older products the bit was only valid for ESA/PSA Spectrum Analysis, Phase Noise, and Noise Figure modes. It was also in ESA’s Bluetooth, cdmaOne, and GSM modes.
3. The STATus:OPERation register bit 11 was a “Printing” bit in VSA and in the VSA/PSA applications. Bit 11 is not used in Next Generation because it is not needed in a Windows operation system.
4. The STATus:OPERation register bit 12 was a “Mass memory busy” bit in VSA and in the VSA/PSA applications. Bit 12 is not used in Next Generation because it is not needed in a Windows operation system.

9.4.2.5 STATus:QUEStionable Register

The operation and questionable status registers are registers that monitor the overall instrument condition. They are accessed with the STATus:OPERation and STATus:QUEStionable commands.

The questionable status register monitors the instrument’s condition to see if anything questionable has happened to it. It is looking for anything that might cause an error or a bad measurement like a hardware problem, an out of calibration situation, or a unusual signal. All the bits are summary bits from lower-level event registers.



STATus:QUEStionable Register

Bit	Condition	Operation
3	Power summary	This bit is the summary bit for the STATus:QUEStionable:POWer register
4	Temperature summary	This bit is the summary bit for the STATus:QUEStionable:TEMPerature register
5	Frequency summary	This bit is the summary bit for the STATus:QUEStionable:FREQuency register
8	Calibration summary	This bit is the summary bit for the STATus:QUEStionable:CALibration register
9	Integrity summary	This bit is the summary bit for the STATus:QUEStionable:INTegrity register

See:

– "Questionable Condition" on page 2631
– "Questionable Enable" on page 2632
– "Questionable Event Query" on page 2632
– "Questionable Negative Transition" on page 2633
– "Questionable Positive Transition" on page 2633

Questionable Condition

This query returns the decimal value of the sum of the bits in the Questionable Condition register.

NOTE **The data in this register is continuously updated and reflects the current conditions.**

Remote Command	`:STATus:QUEStionable:CONDition?`
Example	`:STAT:QUES:COND?`
Preset	0

Status Bits/OPC dependencies	Sequential command

Questionable Enable

This command determines which bits in the Questionable Event register will set the Questionable Status Summary bit (bit3) in the Status Byte Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

NOTE **The preset condition is all bits in this enable register set to 0. To have any Questionable Events reported to the Status Byte Register, one or more bits need to be set to 1. The Status Byte Event Register should be queried after each measurement to check the Questionable Status Summary (bit 3). If it is equal to 1, a condition during the test may have made the test results invalid. If it is equal to 0, this indicates that no hardware problem or measurement problem was detected by the analyzer.**

Remote Command	`:STATus:QUEStionable:ENABle <integer>` `:STATus:QUEStionable:ENABle?`
Example	`:STAT:QUES:ENAB 16` Sets the register so that questionable temperature events will be reported to the Status Byte Register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Event Query

This query returns the decimal value of the sum of the bits in the Questionable Event register.

NOTE **The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.**

Remote Command	`:STATus:QUEStionable[:EVENt]?`
Example	`:STAT:QUES?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Negative Transition

This command determines which bits in the Questionable Condition register will set the corresponding bit in the Questionable Event register when the condition register bit has a negative transition (1 to 0). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:NTRansition <integer>` `:STATus:QUEStionable:NTRansition?`
Example	`:STAT:QUES:NTR 16` Temperature summary 'questionable cleared' will be reported to the Status Byte Register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

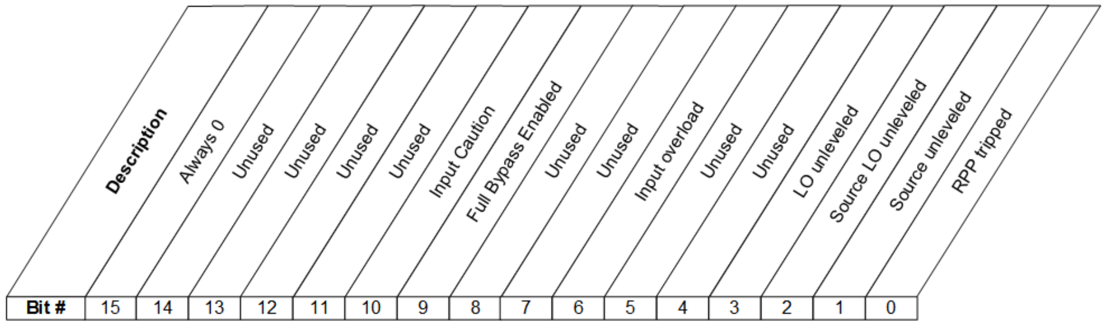
Questionable Positive Transition

This command determines which bits in the Questionable Condition register will set the corresponding bit in the Questionable Event register when the condition register bit has a positive transition (0 to 1). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:PTRansition <integer>` `:STATus:QUEStionable:PTRansition?`
Example	`:STAT:QUES:PTR 16` Temperature summary 'questionable asserted' will be reported to the Status Byte Register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

9.4.2.6 Questionable Power Register

The STATus:QUEStionable:POWer register monitors power-related conditions within the instrument and summarizes them in bit 3 of the STATus:QUEStionable register.



STATus:QUEStionable:POWer Register

Bit	Condition	Operation
0	RPP tripped	(not currently in use)
1	Source Unleveled	The built-in source is not properly leveled
2	Source LO Unleveled	(not currently in use)
3	LO Unleveled	(not currently in use)
6	Input Overload	A power overload condition exists at an input
9	Full Bypass Enabled	Frontend circuitry is bypassed, use caution to protect the mixer
10	Input Caution	Input circuitry is configured such that care is required to prevent damage

See:

– "Questionable Power Condition" on page 2634

– "Questionable Power Enable" on page 2635

– "Questionable Power Event Query" on page 2635

– "Questionable Power Negative Transition" on page 2635

– "Questionable Power Positive Transition" on page 2636

Questionable Power Condition

This query returns the decimal value of the sum of the bits in the Questionable Power Condition register.

NOTE: The data in this register is continuously updated and reflects the current conditions.

Remote Command	`:STATus:QUEStionable:POWer:CONDition?`
Example	`:STAT:QUES:POW:COND?`

Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Power Enable

This command determines which bits in the Questionable Power Condition Register will set bits in the Questionable Power Event register, which also sets the Power Summary bit (bit 3) in the Questionable Register. The variable `<integer>` is the sum of the decimal values of the bits you want to enable.

Remote Command	`:STATus:QUEStionable:POWer:ENABle <integer>` `:STATus:QUEStionable:POWer:ENABle?`
Example	`:STAT:QUES:POW:ENAB 2` Source Unleveled will be reported to the Power Summary of the Status Questionable register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Power Event Query

This query returns the decimal value of the sum of the bits in the Questionable Power Event register.

NOTE **The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.**

Remote Command	`:STATus:QUEStionable:POWer[:EVENt]?`
Example	`:STAT:QUES:POW?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Power Negative Transition

This command determines which bits in the Questionable Power Condition register will set the corresponding bit in the Questionable Power Event register when the condition register bit has a negative transition (1 to 0). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:POWer:NTRansition <integer>` `:STATus:QUEStionable:POWer:NTRansition?`
Example	`:STAT:QUES:POW:NTR 2` Source Unlevelled being cleared will be reported to the Power Summary of the Status Questionable register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

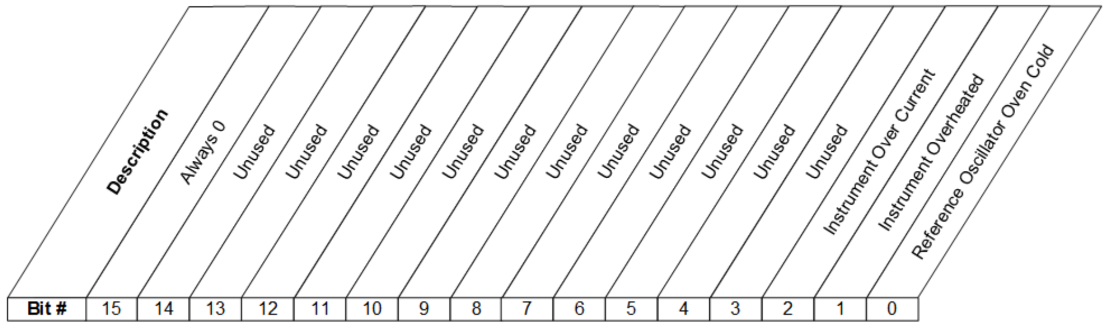
Questionable Power Positive Transition

This command determines which bits in the Questionable Power Condition register will set the corresponding bit in the Questionable Power Event register when the condition register bit has a positive transition (0 to 1). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:POWer:PTRansition <integer>` `:STATus:QUEStionable:POWer:PTRansition?>`
Example	`:STAT:QUES:POW:PTR 32` Source Unleveled being set will be reported to the Power Summary of the Status Questionable register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

9.4.2.7 Questionable Temperature Register

The STATus:QUEStionable:TEMPerature register monitors temperature-related conditions within the instrument and summarizes them in bit 4 of the STATus:QUEStionable register.



STATus:QUEStionable:TEMPerature Register

Bit	Condition	Operation
0	Reference Oscillator Oven Cold	(not currently in use)
1	Instrument overheated (over temperature)	Excessive heat has been detected in some part of the instrument
2	Instrument over current	Excessive heat has been detected in some part of the instrument, the instrument should be restarted

See:

– "Questionable Temperature Condition" on page 2637

– "Questionable Temperature Enable" on page 2638

– "Questionable Temperature Event Query" on page 2638

– "Questionable Temperature Negative Transition" on page 2638

– "Questionable Temperature Positive Transition" on page 2639

Questionable Temperature Condition

This query returns the decimal value of the sum of the bits in the Questionable Temperature Condition register.

NOTE **The data in this register is continuously updated and reflects the current conditions.**

Remote Command	`:STATus:QUEStionable:TEMPerature:CONDition?`
Example	`:STAT:QUES:TEMP:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Temperature Enable

This command determines which bits in the Questionable Temperature Condition Register will set bits in the Questionable Temperature Event register, which also sets the Temperature Summary bit (bit 4) in the Questionable Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

Remote Command	`:STATus:QUEStionable:TEMPerature:ENABle <integer>` `:STATus:QUEStionable:TEMPerature:ENABle?`
Example	`:STAT:QUES:TEMP:ENAB 2` Instrument Overheated will be reported to the Temperature Summary of the Status Questionable register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Temperature Event Query

This query returns the decimal value of the sum of the bits in the Questionable Temperature Event register.

NOTE **The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.**

Remote Command	`:STATus:QUEStionable:TEMPerature[:EVENt]?`
Example	`:STAT:QUES:TEMP?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Temperature Negative Transition

This command determines which bits in the Questionable Temperature Condition register will set the corresponding bit in the Questionable Temperature Event register when the condition register bit has a negative transition (1 to 0). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:TEMPerature:NTRansition <integer>`

	:STATus:QUEStionable:TEMPerature:NTRansition?
Example	:STAT:QUES:TEMP:NTR 2 Instrument Overheated being cleared will be reported to the Temperature Summary of the Status Questionable register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

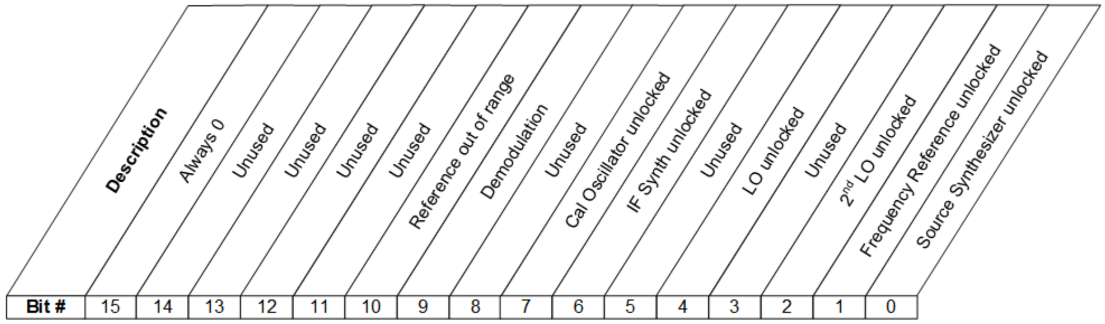
Questionable Temperature Positive Transition

This command determines which bits in the Questionable Temperature Condition register will set the corresponding bit in the Questionable Temperature Event register when the condition register bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Remote Command	:STATus:QUEStionable:TEMPerature:PTRansition <integer> :STATus:QUEStionable:TEMPerature:PTRansition?
Example	:STAT:QUES:TEMP:PTR 2 Instrument Overheated being set will be reported to the Temperature Summary of the Status Questionable register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

9.4.2.8 Questionable Frequency Register

The STATus:QUEStionable:FREQuency register monitors frequency-related conditions within the instrument and summarizes them in bit 5 of the STATus:QUEStionable register.



STATus:QUEStionable:FREQuency Register

Bit	Condition	Operation
0	Source Synth Unlocked	The synthesizer in the built-in source is not locked
1	Frequency Reference Unlocked	The instrument’s frequency reference is unlocked
2	2nd LO Unlocked	The instrument’s second LO (local oscillator) is unlocked
4	LO Unlocked	The instrument’s main LO (local oscillator) is unlocked
6	IF Synth Unlocked	The synthesizer in the IF is not locked
7	Cal Osc Unlocked	The oscillator used for internal calibrations is not locked
9	Demodulation	Demodulation cannot be performed due to an out of range frequency
10	Reference missing or out of range	The signal being fed to a reference input is missing or too high or low in frequency for the reference to lock

See:

– "Questionable Frequency Condition" on page 2640

– "Questionable Frequency Enable" on page 2641

– "Questionable Frequency Event Query" on page 2641

– "Questionable Frequency Negative Transition" on page 2642

– "Questionable Frequency Positive Transition" on page 2642

Questionable Frequency Condition

This query returns the decimal value of the sum of the bits in the Questionable Frequency Condition register.

NOTE

The data in this register is continuously updated and reflects the current conditions.

Remote Command	:STATus:QUEStionable:FREQuency:CONDition?
Example	:STAT:QUES:FREQ:COND?
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Frequency Enable

This command determines which bits in the Questionable Frequency Condition Register will set bits in the Questionable Frequency Event register, which also sets the Frequency Summary bit (bit 5) in the Questionable Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

Remote Command	:STATus:QUEStionable:FREQuency:ENABle <integer> :STATus:QUEStionable:FREQuency:ENABle?
Example	:STAT:QUES:FREQ:ENAB 2 Frequency Reference Unlocked will be reported to the Frequency Summary of the Status Questionable register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Frequency Event Query

This query returns the decimal value of the sum of the bits in the Questionable Frequency Event register.

NOTE: The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

Remote Command	:STATus:QUEStionable:FREQuency[:EVENt]?
Example	:STAT:QUES:FREQ?
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Frequency Negative Transition

This command determines which bits in the Questionable Frequency Condition register will set the corresponding bit in the Questionable Frequency Event register when the condition register bit has a negative transition (1 to 0). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:FREQuency:NTRansition <integer>` `:STATus:QUEStionable:FREQuency:NTRansition?`
Example	`:STAT:QUES:FREQ:NTR 2` Frequency Reference ‘regained lock’ will be reported to the Frequency Summary of the Status Questionable register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Frequency Positive Transition

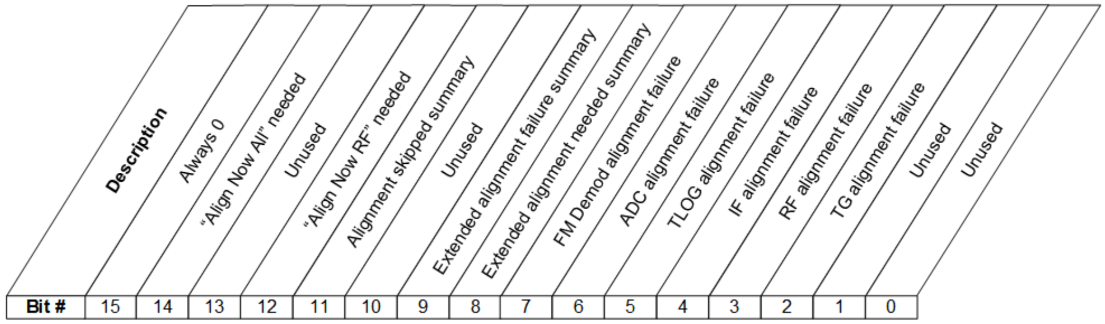
This command determines which bits in the Questionable Frequency Condition register will set the corresponding bit in the Questionable Frequency Event register when the condition register bit has a positive transition (0 to 1). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:FREQuency:PTRansition <integer>` `:STATus:QUEStionable:FREQuency:PTRansition?`
Example	`:STAT:QUES:FREQ:PTR 2` Frequency Reference ‘became unlocked’ will be reported to the Frequency Summary of the Status Questionable register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

9.4.2.9 Questionable Calibration Register

The STATus:QUEStionable:CALibration register monitors calibration-related conditions within the instrument and summarizes them in bit 8 of the

STATus:QUEStionable register. Three of the bits are summary bits from lower-level event registers.



STATus:QUEStionable:CALibration Register

Bit	Condition	Operation
2	TG Alignment Failure	The Tracking Generator failed to align properly
3	RF Alignment Failure	The RF section (frontend) failed to align properly
4	IF Alignment Failure	The IF section failed to align properly
5	LO Alignment Failure	The LO (local oscillator) failed to align properly
6	ADC Alignment Failure	The ADC section failed to align properly
7	FM Demod Alignment Failure	The FM Demod section failed to align properly
8	Extended Align Needed Summary	Summary bit for the STATus:QUEStionable:CALibration:EXTended:NEEDed sub-register
9	Extended Align Failure Summary	Summary bit for the STATus:QUEStionable:CALibration:EXTended:FAILure sub-register
11	Align Skipped Sum Summary	Summary bit for the STATus:QUEStionable:CALibration:SKIPped sub-register
12	"Align Now RF" required	Go to the System, Alignments, Align Now menu and perform an "Align Now RF"
14	"Align Now All" required	Go to the System, Alignments, Align Now menu and perform an "Align Now All"

See:

– "Questionable Calibration Condition" on page 2644
– "Questionable Calibration Enable" on page 2644
– "Questionable Calibration Event Query" on page 2644
– "Questionable Calibration Negative Transition" on page 2645
– "Questionable Calibration Positive Transition" on page 2645

Questionable Calibration Condition

This query returns the decimal value of the sum of the bits in the Questionable Calibration Condition register.

NOTE **The data in this register is continuously updated and reflects the current conditions.**

Remote Command	`:STATus:QUEStionable:CALibration:CONDition?`
Example	`:STAT:QUES:CAL:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Enable

This command determines which bits in the Questionable Calibration Condition Register will set bits in the Questionable Calibration Event register, which also sets the Calibration Summary bit (bit 8) in the Questionable Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:ENABle <integer>` `:STATus:QUEStionable:CALibration:ENABle?`
Example	`:STAT:QUES:CAL:ENAB 16384` Can be used to query if an alignment is needed, if you have turned off the automatic alignment process
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Event Query

This query returns the decimal value of the sum of the bits in the Questionable Calibration Event register.

NOTE **The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.**

Remote Command	`:STATus:QUEStionable:CALibration[:EVENt]?`

Example	:STAT:QUES:CAL?
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Negative Transition

This command determines which bits in the Questionable Calibration Condition register will set the corresponding bit in the Questionable Calibration Event register when the condition register bit has a negative transition (1 to 0). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Remote Command	:STATus:QUEStionable:CALibration:NTRansition <integer> :STATus:QUEStionable:CALibration:NTRansition?
Example	:STAT:QUES:CAL:NTR 16384 "Align All Now Needed" being cleared will be reported to the Calibration Summary of the Status Questionable register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

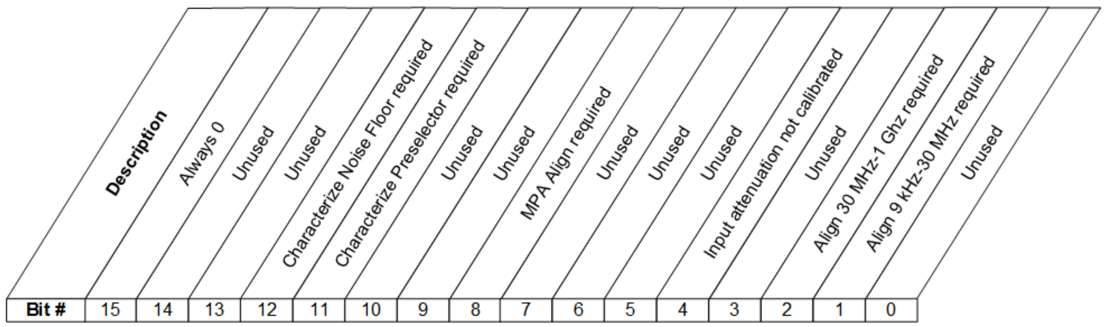
Questionable Calibration Positive Transition

This command determines which bits in the Questionable Calibration Condition register will set the corresponding bit in the Questionable Calibration Event register when the condition register bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Remote Command	:STATus:QUEStionable:CALibration:PTRansition <integer> :STATus:QUEStionable:CALibration:PTRansition?
Example	:STAT:QUES:CAL:PTR 16384 "Align All Now Needed" being set will be reported to the Calibration Summary of the Status Questionable register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

9.4.2.10 Questionable Calibration Extended Needed Register

The STATus:QUEStionable:CALibration:EXTended:NEEDed register monitors conditions which occur because a calibration or alignment is required to guarantee accurate measurements. It summarizes them in bit 8 of the STATus:QUEStionable:CALibration register.



STATus:QUEStionable:CALibration:EXTended:NEEDed Register

Bit	Condition	Operation
1	Align 9kHz-30MHz required	EMI receiver alignment required, 9kHz-30 MHz (conducted band)
2	Align 30MHz-1GHz required	EMI receiver alignment required, 30 MHz-1 GHz (radiated band)
4	Input Attenuation not calibrated	The input attenuator is uncalibrated
8	MPA Align required	The Multiport Adaptor must be calibrated (EXT only)
11	Characterize Preselector required	Go to the System, Alignments, Advanced menu and perform a “Characterize Preselector”
12	Characterize Noise Floor required	Go to the System, Alignments, Advanced menu and perform a “Characterize Noise Floor”

See:

– "Questionable Calibration Extended Needed Condition " on page 2647
– "Questionable Calibration Extended Needed Enable" on page 2647
– "Questionable Calibration Extended Needed Event Query" on page 2647
– "Questionable Calibration Extended Needed Negative Transition" on page 2648
– "Questionable Calibration Extended Needed Positive Transition" on page 2648

Questionable Calibration Extended Needed Condition

This query returns the decimal value of the sum of the bits in the Questionable Calibration Extended Needed Condition register.

NOTE: The data in this register is continuously updated and reflects the current conditions.

Remote Command	`:STATus:QUEStionable:CALibration:EXTended:NEEDed:CONDition?`
Example	`:STAT:QUES:CAL:EXT:NEED:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Extended Needed Enable

This command determines which bits in the Questionable Calibration Extended Needed Condition Register will set bits in the Questionable Calibration Extended Needed Event register, which also sets bit 14 of the Questionable Calibration Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:EXTended:NEEDed:ENABle <integer>` `:STATus:QUEStionable:CALibration:EXTended:NEEDed:ENABle?`
Example	`:STAT:QUES:CAL:EXT:NEED:ENAB 2` Can be used to query if an EMI conducted alignment is needed
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Extended Needed Event Query

This query returns the decimal value of the sum of the bits in the Questionable Calibration Extended Needed Event register.

NOTE: The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

Remote Command	`:STATus:QUEStionable:CALibration:EXTended:NEEDed[:EVENt]?`
Example	`:STAT:QUES:CAL:EXT:NEED?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Extended Needed Negative Transition

This command determines which bits in the Questionable Calibration Extended Needed Condition register will set the corresponding bit in the Questionable Calibration Extended Needed Event register when the condition register bit has a negative transition (1 to 0). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:EXTended:NEEDed:NTRansition <integer>` `:STATus:QUEStionable:CALibration:EXTended:NEEDed:NTRansition?`
Example	`:STAT:QUES:CAL:EXT:NEED:NTR 2` Conducted alignment required bit being cleared will be reported
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Extended Needed Positive Transition

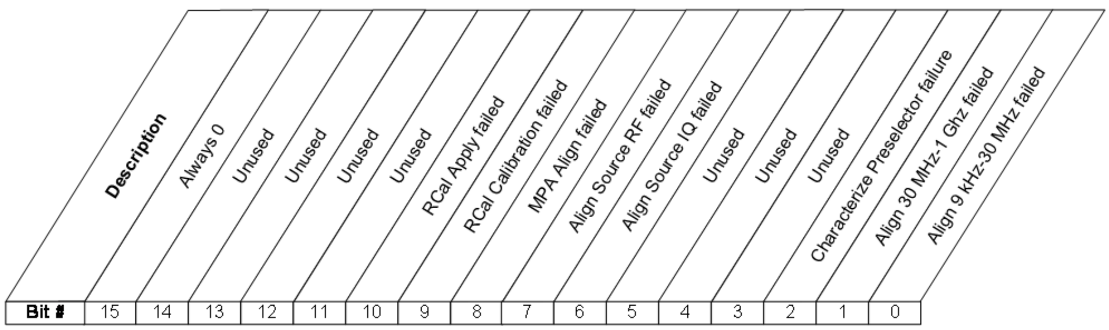
This command determines which bits in the Questionable Calibration Extended Needed Condition register will set the corresponding bit in the Questionable Calibration Extended Needed Event register when the condition register bit has a positive transition (0 to 1). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:EXTended:NEEDed:PTRansition <integer>` `:STATus:QUEStionable:CALibration:EXTended:NEEDed:PTRansition?`
Example	`:STAT:QUES:CAL:EXT:NEED:PTR 2` Conducted alignment required bit being set will be reported
Preset	32767
Min	0

Max	32767
Status Bits/OPC dependencies	Sequential command

9.4.2.11 Questionable Calibration Extended Failure Register

The STATus:QUEStionable:CALibration:EXTended:FAILure register monitors conditions which occur because a calibration or alignment has failed to complete properly. It summarizes them in bit 9 of the STATus:QUEStionable:CALibration register.



STATus:QUEStionable:CALibration:EXTended:FAILure Register

Bit	Condition	Operation
0	Align 9kHz-30MHz failed	EMI receiver alignment failed, 9kHz-30 MHz (conducted band)
1	Align 30MHz-1GHz failed	EMI receiver alignment failed, 30 MHz-1 GHz (radiated band)
2	Characterize Preselector required	The preselector characterization failed
6	Align Source IQ failed	The alignment of the built-in source IQ section failed
7	Align Source RF failed	The alignment of the built-in source RF section failed
8	MPA Align failed	The Multiport Adaptor must be calibrated (EXT only)
9	RCal Calibration failed	The calibration request sent to the RCal module failed
10	RCal Apply failed	The applying of the calibration data failed

See:

– "Questionable Calibration Extended Failure Condition" on page 2650

– "Questionable Calibration Extended Failure Enable" on page 2650

– "Questionable Calibration Extended Failure Event Query" on page 2650

– "Questionable Calibration Extended Failure Negative Transition" on page 2651

– "Questionable Calibration Extended Failure Positive Transition" on page 2651

Questionable Calibration Extended Failure Condition

This query returns the decimal value of the sum of the bits in the Questionable Calibration Extended Failure Condition register.

NOTE The data in this register is continuously updated and reflects the current conditions.

Remote Command	`:STATus:QUEStionable:CALibration:EXTended:FAILure:CONDition?`
Example	`:STAT:QUES:CAL:EXT:FAIL:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Extended Failure Enable

This command determines which bits in the Questionable Calibration Extended Failure Condition Register will set bits in the Questionable Calibration Extended Failure Event register, which also sets bit 9 of the Questionable Calibration Register. The variable `<integer>` is the sum of the decimal values of the bits you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:EXTended:FAILure:ENABle <integer>` `:STATus:QUEStionable:CALibration:EXTended:FAILure:ENABle?`
Example	`:STAT:QUES:CAL:EXT:FAIL:ENAB 1` Can be used to query if an EMI conducted alignment failed
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Extended Failure Event Query

This query returns the decimal value of the sum of the bits in the Questionable Calibration Extended Failure Event register.

NOTE The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

Remote Command	:STATus:QUEStionable:CALibration:EXTended:FAILure[:EVENt]?
Example	:STAT:QUES:CAL:EXT:FAIL?
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Extended Failure Negative Transition

This command determines which bits in the Questionable Calibration Extended Failure Condition register will set the corresponding bit in the Questionable Calibration Extended Failure Event register when the condition register bit has a negative transition (1 to 0). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Remote Command	:STATus:QUEStionable:CALibration:EXTended:FAILure:NTRansition <integer> :STATus:QUEStionable:CALibration:EXTended:FAILure:NTRansition?
Example	:STAT:QUES:CAL:EXT:FAIL:NTR 1 Conducted alignment failed bit being cleared will be reported
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Extended Failure Positive Transition

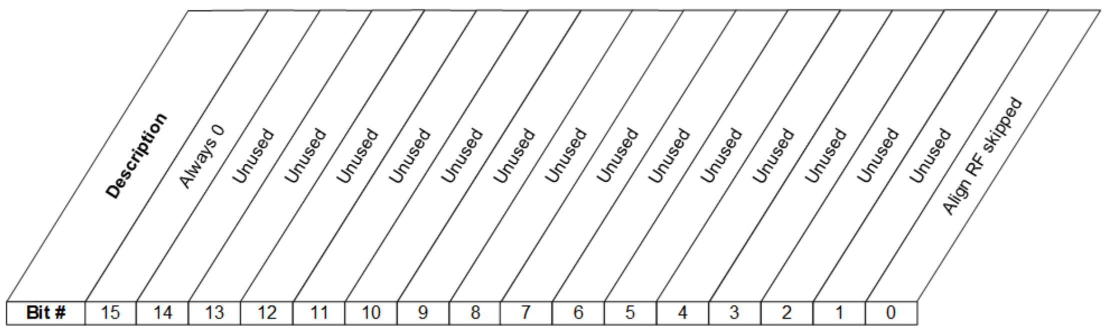
This command determines which bits in the Questionable Calibration Extended Failure Condition register will set the corresponding bit in the Questionable Calibration Extended Failure Event register when the condition register bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Remote Command	:STATus:QUEStionable:CALibration:EXTended:FAILure:PTRansition <integer> :STATus:QUEStionable:CALibration:EXTended:FAILure:PTRansition?
Example	:STAT:QUES:CAL:EXT:FAIL:PTR 1 Conducted alignment failed bit being set will be reported
Preset	32767
Min	0

Max	32767
Status Bits/OPC dependencies	Sequential command

9.4.2.12 Questionable Calibration Skipped Register

The STATus:QUEStionable:CALibration:EXTended:NEEDed register monitors conditions which occur because a calibration or alignment has been skipped due to various settings or conditions. It summarizes them in bit 11 of the STATus:QUEStionable:CALibration register.



STATus:QUEStionable:CALibration:SKIPped Register

Bit	Condition	Operation
0	Align RF skipped	During an alignment, the calibration of the RF section (frontend) of the instrument was not performed. This can be caused by an interfering user signal present at the RF Input See "Auto Align" on page 1972, "Align Now All" on page 1978 and "Align Now RF" on page 1981

See:

- "Questionable Calibration Skipped Condition" on page 2652
- "Questionable Calibration Skipped Enable" on page 2653
- "Questionable Calibration Skipped Event Query" on page 2653
- "Questionable Calibration Skipped Negative Transition" on page 2654
- "Questionable Calibration Skipped Positive Transition" on page 2654

Questionable Calibration Skipped Condition

This query returns the decimal value of the sum of the bits in the Questionable Calibration Skipped Condition register.

NOTE The data in this register is continuously updated and reflects the current conditions.

Remote Command	:STATus:QUEStionable:CALibration:SKIPped:CONDition?
Example	:STAT:QUES:CAL:SKIP:COND?
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Skipped Enable

This command determines which bits in the Questionable Calibration Skipped Condition Register will set bits in the Questionable Calibration Skipped Event register, which also sets bit 11 of the Questionable Calibration Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

Remote Command	:STATus:QUEStionable:CALibration:SKIPped:ENABle <integer> :STATus:QUEStionable:CALibration:SKIPped:ENABle?
Example	:STAT:QUES:CAL:SKIP:ENAB 1 Can be used to query if an RF alignment skipped condition is detected
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Skipped Event Query

This query returns the decimal value of the sum of the bits in the Questionable Calibration Event register.

NOTE The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

Remote Command	:STATus:QUEStionable:CALibration:SKIPped[:EVENt]?
Example	:STAT:QUES:CAL:SKIP?
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Skipped Negative Transition

This command determines which bits in the Questionable Calibration Skipped Condition register will set the corresponding bit in the Questionable Calibration Skipped Event register when the condition register bit has a negative transition (1 to 0). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:SKIPped:NTRansition <integer>` `:STATus:QUEStionable:CALibration:SKIPped:NTRansition?`
Example	`:STAT:QUES:CAL:SKIP:NTR 1` RF Align Skipped bit being cleared will be reported
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Skipped Positive Transition

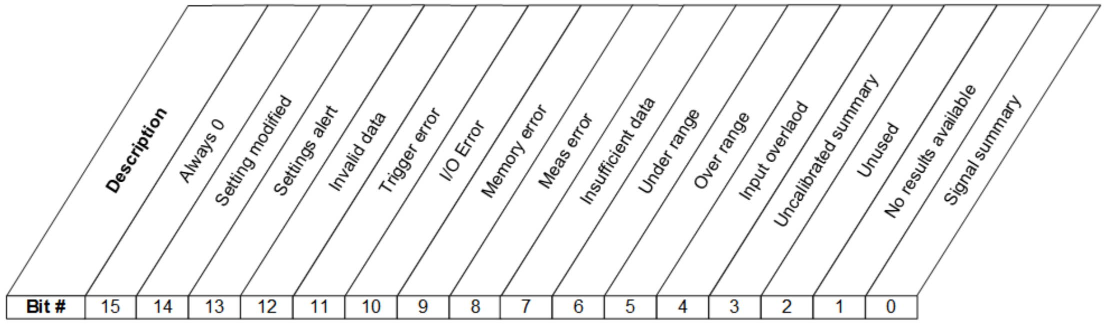
This command determines which bits in the Questionable Calibration Skipped Condition register will set the corresponding bit in the Questionable Calibration Skipped Event register when the condition register bit has a positive transition (0 to 1). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:SKIPped:PTRansition <integer>` `:STATus:QUEStionable:CALibration:SKIPped:PTRansition?`
Example	`:STAT:QUES:CAL:SKIP:PTR 1` RF Align Skipped bit being set will be reported
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

9.4.2.13 Questionable Integrity Register

The STATus:QUEStionable:INTegrity register monitors measurement integrity-related conditions within the instrument and summarizes them in bit 9 of the

STATus:QUEStionable register. Two of the bits are summary bits from lower-level event registers.



STATus:QUEStionable:INTegrity Register

Bit	Condition	Operation
0	Signal Summary	This bit is the summary bit for the STATus:QUEStionable:INTegrity:SIGNal sub-register
1	No Result	The current measurement is incompatible with a setting or combination of settings, such as the selected Input, Radio Standard, etc.
3	Uncalibrated Summary	This bit is the summary bit for the STATus:QUEStionable:INTegrity:UNCalibrated sub-register
4	Input Overload	A signal overload condition exists
5	Over Range	The signal at the input for this measurement is too high. You should increase the attenuation or decrease the signal level
6	Under Range	The signal at the input for this measurement is too low. You should decrease the attenuation or increase the signal level
7	Insufficient Data	Signal or settings conditions did not allow enough data to be taken during an acquisition for a valid measurement
8	Meas Error	(not currently in use)
9	Memory Error	There is not enough memory to perform the desired operation
10	I/O Error	I/O settings are preventing communication with an instrument or peripheral
11	Trigger Error	Signal or settings conditions did not allow enough data to be taken during an acquisition for a valid measurement
12	Invalid data	The Invalid Data indicator (* in upper right of display) is on, indicating that onscreen data may be stale and not match the current settings
13	Settings Alert	Settings are not right for a valid measurement, but the instrument is nonetheless allowing a measurement to be taken
14	Setting Modified	Settings are not right for a valid measurement, and the instrument is using different settings than the ones you entered in order to take a measurement

See:

– "Questionable Integrity Condition" on page 2656

– "Questionable Integrity Enable" on page 2656

– "Questionable Integrity Event Query" on page 2657

– "Questionable Integrity Negative Transition" on page 2657

– "Questionable Integrity Positive Transition" on page 2657

Questionable Integrity Condition

This query returns the decimal value of the sum of the bits in the Questionable Integrity Condition register.

NOTE

The data in this register is continuously updated and reflects the current conditions.

Remote Command	`:STATus:QUEStionable:INTegrity:CONDition?`
Example	`:STAT:QUES:INT:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Enable

This command determines which bits in the Questionable Integrity Condition Register will set bits in the Questionable Integrity Event register, which also sets the Integrity Summary bit (bit 9) in the Questionable Register. The variable `<integer>` is the sum of the decimal values of the bits you want to enable.

Remote Command	`:STATus:QUEStionable:INTegrity:ENABle <integer>` `:STATus:QUEStionable:INTegrity:ENABle?`
Example	`:STAT:QUES:INT:ENAB 8` Uncalibrated Summary will be reported to the Integrity Summary of the Status Questionable register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Event Query

This query returns the decimal value of the sum of the bits in the Questionable Integrity Event register.

NOTE The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

Remote Command	`:STATus:QUEStionable:INTegrity[:EVENt]?`
Example	`:STAT:QUES:INT?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Negative Transition

This command determines which bits in the Questionable Integrity Condition register will set the corresponding bit in the Questionable Integrity Event register when the condition register bit has a negative transition (1 to 0).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:INTegrity:NTRansition <integer>` `:STATus:QUEStionable:INTegrity:NTRansition?`
Example	`:STAT:QUES:INT:NTR 8` Uncalibrated Summary being cleared will be reported to the Integrity Summary of the Status Questionable register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Positive Transition

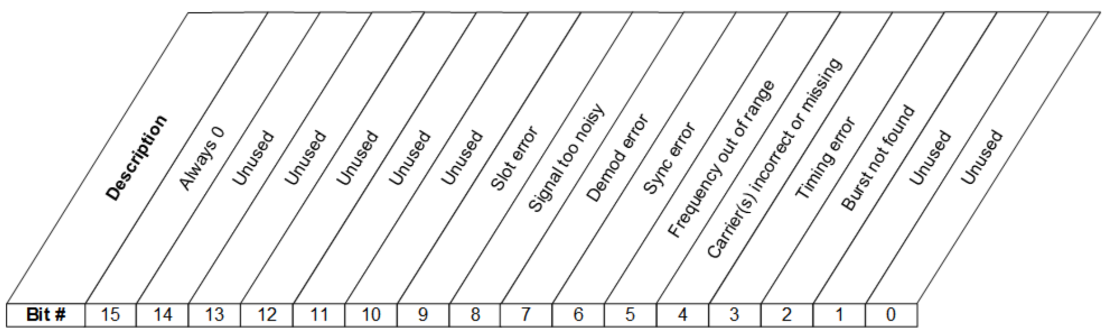
This command determines which bits in the Questionable Integrity Condition register will set the corresponding bit in the Questionable Integrity Event register when the condition register bit has a positive transition (0 to 1). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote	`:STATus:QUEStionable:INTegrity:PTRansition <integer>`

Command	`:STATus:QUEStionable:INTegrity:PTRansition?`
Example	`:STAT:QUES:INT:PTR 8` Uncalibrated Summary being set will be reported to the Integrity Summary of the Status Questionable register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

9.4.2.14 Questionable Integrity Signal Register

The STATus:QUEStionable:INTegrity:SIGNal register monitors conditions which occur because a measurement may not be able to return an accurate or valid result due to signal conditions. It summarizes them in bit 0 of the STATus:QUEStionable:INTegrity register.



STATus:QUEStionable:INTegrity:SIGNal Register

Bit	Condition	Operation
2	Burst not found	The instrument is expecting a bursted signal but such a signal cannot be detected because of inappropriate parameter settings or incorrect signal content
3	Timing Error	The instrument can't establish appropriate timing from the signal
4	Carrier(s) incorrect or missing	The instrument can't find the expected carrier(s) within the frequency ranges in which it is looking
5	Frequency out of range	One or more system or signal input frequencies are out of range
6	Sync error	The instrument can't establish sync with the measured signal
7	Demod error	The instrument cannot demodulate the signal due to inappropriate signal or settings conditions
8	Signal Too Noisy	The instrument cannot measure the desired signal because it is too noisy
9	Slot Error	No valid signal slot found in captured data

See:

- "Questionable Integrity Signal Condition" on page 2659
- "Questionable Integrity Signal Enable" on page 2659
- "Questionable Integrity Signal Event Query" on page 2660
- "Questionable Integrity Signal Negative Transition" on page 2660
- "Questionable Integrity Signal Positive Transition" on page 2660

Questionable Integrity Signal Condition

This query returns the decimal value of the sum of the bits in the Questionable Integrity Signal Condition register.

NOTE The data in this register is continuously updated and reflects the current conditions.

Remote Command	`:STATus:QUEStionable:INTegrity:SIGNal:CONDition?`
Example	`:STAT:QUES:INT:SIGN:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Signal Enable

This command determines which bits in the Questionable Integrity Signal Condition Register will set bits in the Questionable Integrity Signal Event register, which also sets the Integrity Summary bit (bit 9) in the Questionable Register. The variable `<integer>` is the sum of the decimal values of the bits you want to enable.

Remote Command	`:STATus:QUEStionable:INTegrity:SIGNal:ENABle <integer>` `:STATus:QUEStionable:INTegrity:SIGNal:ENABle?`
Example	`:STAT:QUES:INT:SIGN:ENAB 4` Burst Not Found will be reported to the Integrity Summary of the Status Questionable register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Signal Event Query

This query returns the decimal value of the sum of the bits in the Questionable Integrity Signal Event register.

NOTE **The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.**

Remote Command	`:STATus:QUEStionable:INTegrity:SIGNal[:EVENt]?`
Example	`:STAT:QUES:INT:SIGN?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Signal Negative Transition

This command determines which bits in the Questionable Integrity Signal Condition register will set the corresponding bit in the Questionable Integrity Signal Event register when the condition register bit has a negative transition (1 to 0). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:INTegrity:SIGNal:NTRansition <integer>` `:STATus:QUEStionable:INTegrity:SIGNal:NTRansition?`
Example	`:STAT:QUES:INT:SIGN:NTR 4` Burst not found being cleared will be reported to the Integrity Summary of the Status Questionable register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Signal Positive Transition

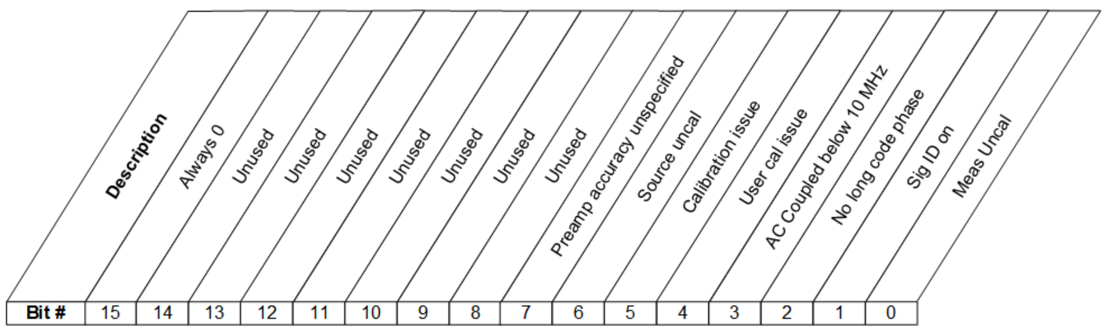
This command determines which bits in the Questionable Integrity Signal Condition register will set the corresponding bit in the Questionable Integrity Signal Event register when the condition register bit has a positive transition (0 to 1). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:INTegrity:SIGNal:PTRansition <integer>`

	`:STATus:QUEStionable:INTegrity:SIGNal:PTRansition?`
Example	`:STAT:QUES:INT:SIGN:PTR 4`
	Burst not found being set will be reported to the Integrity Summary of the Status Questionable register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

9.4.2.15 Questionable Integrity Uncalibrated Register

The STATus:QUEStionable:INTegrity:UNCalibrated register monitors conditions which occur because a measurement may not be able to return an accurate or valid result due to a mismatch between instrument settings and the signal, placing the instrument in an uncalibrated state for that signal. It summarizes them in bit 3 of the STATus:QUEStionable:INTegrity register.



STATus:QUEStionable:INTegrity:UNCalibrated Register

Bit	Condition	Operation
0	Meas Uncal	A Meas Uncal warning is being displayed; generally this means the sweep time must be reduced or the RBW increased
1	Signal ID on	In external mixing, the Sig ID function is on, which will impact the trace results
2	No Long Code Phase	The long code phase that identifies an access channel cannot be found (WCDMA)
3	AC coupled: Accy unspec'd <10 MHz	The instrument is AC coupled but is operating below 10 MHz, where the blocking capacitor will impact measurement accuracy
4	User cal issue	In noise figure measurements, the User Cal has not been performed or has been invalidated
5	Calibration issue	In noise figure measurements, one or more calibration or measurement frequency point exceeds the currently loaded Cal or Meas ENR Table frequency ranges.
6	Source uncal	While using a Tracking Source, settings are putting it into an

Bit	Condition	Operation
		uncalibrated operational state
7	Preamp accuracy unspecified below XX MHz	The preamp is being used but is operating below frequencies for which its accuracy is specified

See:

- "Questionable Integrity Uncalibrated Condition" on page 2662
- "Questionable Integrity Uncalibrated Enable" on page 2662
- "Questionable Integrity Uncalibrated Event Query" on page 2663
- "Questionable Integrity Uncalibrated Negative Transition" on page 2663
- "Questionable Integrity Uncalibrated Positive Transition" on page 2664

Questionable Integrity Uncalibrated Condition

This query returns the decimal value of the sum of the bits in the Questionable Integrity Uncalibrated Condition register.

NOTE The data in this register is continuously updated and reflects the current conditions.

Remote Command	`:STATus:QUEStionable:INTegrity:UNCalibrated:CONDition?`
Example	`:STAT:QUES:INT:UNC:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Uncalibrated Enable

This command determines which bits in the Questionable Integrity Uncalibrated Condition Register will set bits in the Questionable Integrity Uncalibrated Event register, which also sets the Data Uncalibrated Summary bit (bit 3) in the Questionable Integrity Register. The variable `<integer>` is the sum of the decimal values of the bits you want to enable.

Remote Command	`:STATus:QUEStionable:INTegrity:UNCalibrated:ENABle` `:STATus:QUEStionable:INTegrity:UNCalibrated:ENABle?`
Example	`:STAT:QUES:INT:UNC:ENAB 1`

	Oversweep (Meas Uncal) will be reported to the Integrity Summary of the Status Questionable register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Uncalibrated Event Query

This query returns the decimal value of the sum of the bits in the Questionable Integrity Uncalibrated Event register.

NOTE **The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.**

Remote Command	`:STATus:QUEStionable:INTegrity:UNCalibrated[:EVENt]?`
Example	`:STAT:QUES:INT:UNC?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Uncalibrated Negative Transition

This command determines which bits in the Questionable Integrity Uncalibrated Condition register will set the corresponding bit in the Questionable Integrity Uncalibrated Event register when the condition register bit has a negative transition (1 to 0). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:INTegrity:UNCalibrated:NTRansition <integer>` `:STATus:QUEStionable:INTegrity:UNCalibrated:NTRansition?`
Example	`:STAT:QUES:INT:UNC:NTR 1` Oversweep cleared will be reported to the Integrity Summary of the Status Questionable register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Uncalibrated Positive Transition

This command determines which bits in the Questionable Integrity Uncalibrated Condition register will set the corresponding bit in the Questionable Integrity Uncalibrated Event register when the condition register bit has a positive transition (0 to 1). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:INTegrity:UNCalibrated:PTRansition <integer>` `:STATus:QUEStionable:INTegrity:UNCalibrated:PTRansition?`
Example	`:STAT:QUES:INT:UNC:PTR 1` Oversweep set will be reported to the Integrity Summary of the Status Questionable register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

10 Hardware-Accelerated Fast Power Measurement (Remote Command Only)

The **Fast Power** option (FP2) enables very fast channel power measurements for instruments with the prerequisite hardware (DP2 and/or B40). It accomplishes this by performing real-time overlapped FFTs at the hardware layer, using software for basic post-processing before returning the result to the user. The upshot of this approach is improved throughput for user applications that require many sequential power measurements.

The analysis bandwidth of FP2 may be limited by the licenses in the instrument.

NOTE **FP2 is remote-only, which means the instrument does not switch to any particular mode or measurement. FP2 commands can be sent while another application is in use on the front panel.**

Each Fast Power measurement can be predefined using an array index, and up to 1,000 measurements can be stored. In the following documentation, instances of [1,2,...,999] can be substituted with a particular measurement index, for example, `:CALC:FPOW:POW1?`, `:CALC:FPOW:POW2?`, `:CALC:FPOW:POW134?`. In this way, power measurements can be defined one time in a batch, and then executed multiple times without having to redefine them, similar to "list mode" on other measurements.

In addition to basic channel power measurements, there are a number of other measurement "functions" for each channel, including peak power, peak frequency, and power spectral density.

10.1 Reset Fast Power Measurement (Remote Command Only)

Resets the measurement configuration to the defaults.

Remote Command	`:CALCulate:FPOWer:POWer[1,2,…,999]:RESet`
Example	`:CALC:FPOW:POW1:RES`
Notes	Option FP2 is required

10.2 Reset Fast Power Measurement (Remote Command Only)

Resets the measurement configuration to the defaults.

Remote Command	`:CALCulate:FPOWer:POWer[1,2,…,999]:RESet`
Example	`:CALC:FPOW:POW1:RES`
Notes	Option FP2 is required

10.2.1 Acquisition Time

Example	`:CALC:FPOW:POW1:DEF "AcquisitionTime=0.002"`
Notes	Sets the time in which the entire spectrum is measured. An increase in the acquisition time yields an improvement in measurement repeatability
Preset	0.001 s
Range	0 s to 1 s

10.2.2 Center Frequency

Example	`:CALC:FPOW:POW1:DEF "CenterFrequency=2e9"`
Notes	Sets the frequency in which the measurement is centered around. "Channel Offset Frequency Array" on page 2674 is calculated relative to the center frequency
Preset	1 GHz
Range	0 Hz to maximum instrument frequency

10.2.3 DC Coupled

Example	`:CALC:FPOW:POW1:DEF "DCCoupled=True"`
Notes	Allows you to specify whether the DC blocking capacitor is utilized. Set to `True` when measuring frequencies below 10 MHz
Preset	False
Range	True (DC Coupled) or False (AC Coupled)

10.2.4 Detector Type

Example	`:CALC:FPOW:POW1:DEF "DetectorType=Peak"`
Notes	Option FP2 is required Allows you to choose whether a RMS average or peak value is used during the measurement

Preset	RmsAverage
Range	RmsAverage, Peak

10.2.5 Do Noise Correction

Example	`:CALC:FPOW:POW1:DEF "DoNoiseCorrection=True"`
Notes	When noise correction is enabled, the linear noise power contributed by the instrument is subtracted from all measurements. This effectively lowers the noise floor of the instrument When noise correction is enabled, the first measurement for a given set of input parameters will take extra time. This is because the instrument takes an extra acquisition with the RF input disconnected from the instrument's front end to measure the noise of just the instrument. The measured noise floor is stored in a cache so the noise acquisition will occur only once for the same state settings. In other words, if noise correction was turned on and the instrument made an acquisition at frequency A, then frequency B, and back again to frequency A, the hidden initial noise floor acquisition would only occur for the first acquisition at frequency A and the cached noise floor would be used the second time frequency A was measured
Preset	False
Range	True (enable noise correction) or False (disable noise correction)

10.2.6 Do Spur Suppression

Example	`:CALC:FPOW:POW1:DEF "DoSpurSuppression=True"`
Notes	When measuring very low level signals, or when large out-of-band inputs are input into the instrument, sometimes unwanted spurs and residuals can appear in the measured spectrum. Spur suppression is a method to help minimize the levels of these internally generated spurs and residuals When spur suppression is enabled, the instrument will automatically take two acquisitions using two different internal analog LO frequencies. The FFT spectrums from both acquisitions are combined by taking the minimum power between both traces on a per FFT bin basis. External signals will have the same amplitude for both traces and therefore will return the expected amplitudes. However, low level spurs and residuals generated internally to the instrument tend to move to different FFT bins depending on the internal analog LO frequency used, and therefore tend to be suppressed using this spur suppression method Because two acquisitions, rather than a single acquisition, are made when spur suppression is enabled, the measurement time will always be slower when spur suppression is enabled
Preset	False
Range	True (enable spur suppression) or False (disable spur suppression)

10.2.7 Electronic Attenuator Bypass

Example	`:CALC:FPOW:POW1:DEF "ElecAttBypass =False"`
Notes	Allows you to either utilize or bypass the electronic attenuator. The electronic attenuator is only available for frequencies up to 3.6 GHz. Set parameter to true when using frequencies above 3.6 GHz and set the

	parameter to false when using the preamp
Preset	True
Range	True (bypass electronic attenuator) or False (use electronic attenuator)

10.2.8 Electronic Attenuation

Example	`:CALC:FPOW:POW1:DEF "ElecAttenuation=10"`
Notes	Option EA3 is required The electronic attenuation value parameter sets the amount of electrical attenuation from 0 to 24 dB (1 dB steps) Set "ElecAttBypass=False" to make sure the electronic attenuator path is enabled
Preset	0 dB
Range	0 – 24 dB (1 dB steps)

10.2.9 External Reference Frequency

Example	`:CALC:FPOW:POW1:DEF "ExternalReferenceFrequency=10"`
Notes	This is the user-specified frequency of the external reference: – Used when "Frequency Reference Source" on page 2669 is set to external or auto when the external source is present – Unused if `FrequencyReferenceSource` is set to internal
Preset	10 MHz

10.2.10 Frequency Reference Source

Example	`:CALC:FPOW:POW1:DEF "FrequencyReferenceSource= InternalFrequencyReference"`
Notes	Specifies which frequency reference source should be used for this request: – If `ExternalFrequencyReference` is selected and no external reference is present, the frequency reference unlocks but the data acquisition will continue – If `AutoExternalFrequencyReference` is selected, the hardware senses whether an external source is present before starting the data acquisition. If no external source is present then the internal source is selected and the data acquisition will continue
Preset	`InternalFrequencyReference`
Range	`InternalFrequencyReference, ExternalFrequencyReference, AutoExternalFrequencyReference`

10.2.11 IF Gain

Example	`:CALC:FPOW:POW1:DEF "IFGain=10"`
Notes	Allows you to specify the gain at the IF stage anywhere from -6 to 16 dB (1 dB steps). This is an advanced feature; for most cases this should remain at its default value of 0 dB
Preset	0 dB
Range	-6 – 16 dB (1 dB steps)

10.2.12 IF Type

Example	`:CALC:FPOW:POW1:DEF "IFType=B25M"`
Notes	Allows you to select between different IF paths. For example, if the signal is less than 25 MHz wide, then you can select the B25M path to take advantage of additional filtering on this analog IF path
Preset	B40M
Range	B10M, B25M, B40M

10.2.13 Include Power Spectrum

Example	`:CALC:FPOW:POW1:DEF "IncludePowerSpectrum=True"`
Notes	Allows you to read data on the entire spectrum for diagnostic purposes. It is not recommended for production use. See `:CALC:FPOW:POW[n]:READ2?` for details on the binary format of the response
Preset	False
Range	True (return both channel power and full power spectrum) False (returns only channel power)

10.2.14 Mechanical Attenuation

Example	`:CALC:FPOW:POW1:DEF "MechAttenuation=10"`
Notes	Sets the amount of mechanical attenuation anywhere from 0 to 70 dB (2 dB steps)
Preset	0 dB
Range	0 – 70 dB (2 dB steps)

10.2.15 Preamp Mode

Example	`:CALC:FPOW:POW1:DEF "PreAmpMode=Low"`
Notes	The license for the appropriate preamp is required Specifies whether the preamps are being utilized. Low allows any preamps up to 3.6 GHz, and Full allows

	all licensed preamps. Set "ElecAttBypass=True" in order to utilize any preamps
Preset	Off
Range	Off, Low, Full

10.2.16 Resolution Bandwidth Mode

Example	`:CALC:FPOW:POW1:DEF "PreAmpMode=Low"`
Notes	Allows you to choose whether the RBW filter is automatically or manually set. The BestSpeed value minimizes measurement time, while the Narrowest value minimizes RBW size (minimum of two FFT bins per RBW) To manually specify an RBW, set this parameter to Explicit, and set the ResolutionBW parameter to the desired value
Preset	BestSpeed
Range	BestSpeed, Narrowest, Explicit

10.2.17 Resolution Bandwidth

Example	`:CALC:FPOW:POW1:DEF "ResolutionBW=25e3"`
Notes	Sets the 3-dB bandwidth of the RBW filter. The ResolutionBWMode parameter must be set to Explicit in order to manually set the RBW
Preset	0 Hz

10.2.18 Trigger Delay

Example	`:CALC:FPOW:POW1:DEF "TriggerDelay=0.025"`
Notes	Sets the time after an external trigger is detected until the measurement is performed
Preset	0 s
Range	0 – 1 s

10.2.19 Trigger Level

Example	`:CALC:FPOW:POW1:DEF "TriggerLevel=2"`
Notes	Sets the voltage value at which an external trigger is detected
Preset	1.2 V
Range	-5 to 5 V

10.2.20 Trigger Slope

Example	`:CALC:FPOW:POW1:DEF "TriggerSlope=Negative"`
Notes	Specifies the direction of the edge trigger voltage for detection
Preset	Positive
Range	Positive, Negative

10.2.21 Trigger Source

Example	`:CALC:FPOW:POW1:DEF "TriggerSource=Ext1"`
Notes	Allows you to choose between measurement’s triggering freely or controlled by an external input. Ext1 and Ext2 correspond to Trigger 1 In and Trigger 2 In, respectively
Preset	Free
Range	Free, Ext1, Ext2

10.2.22 Trigger Timeout

Example	`:CALC:FPOW:POW1:DEF "TriggerTimeout=0.1"`
Notes	Sets the time in which the instrument will wait for a trigger before automatically performing the measurement
Preset	1 s
Range	0 – 1 s

10.2.23 Signal Input

Example	`:CALC:FPOW:POW1:DEF "SignalInput=Fp50MHzCW"`
Notes	Allows you to select between using the main RF input or the internal instrument reference CW signal of 50 MHz
Preset	FpMainRf
Range	FpMainRf, Fp50MHzCW

10.2.24 Use Preselector

Example	`:CALC:FPOW:POW1:DEF "UsePreSelector=True"`
Notes	Allows you to either utilize or bypass the front end tunable filter at frequencies above 3.6 GHz. For frequencies below 3.6 GHz, the preselector is automatically bypassed, so you do not need to set this parameter to False in those cases

Preset	False
Range	True (use preselector above 3.6 GHz) False (preselector bypassed)

10.2.25 Channel Bandwidth Array

Example	`:CALC:FPOW:POW1:DEF "Bandwidth=[3.84e6, 5e6, 3.84e6]"`
Notes	Defines the bandwidth of each channel that will be measured All array parameters should have the same number of elements. Alternatively, if all the elements are the same value, a single number with no square brackets can be used to define the parameter
Preset	[1e6]
Range	0 to 40 MHz

10.2.26 Channel Filter Type Array

Example	`:CALC:FPOW:POW1:DEF "FilterType=[RRC, IBW, RRC]"`
Notes	The filter type parameter allows you to choose between an integration bandwidth (IBW) filter or a root-raised-cosine (RRC) filter. The integration bandwidth filter weighs all frequencies within the bandwidth equally. The root-raised-cosine filter has an associated shape parameter, defined by the FilterAlpha parameter All array parameters should have the same number of elements. Alternatively, if all the elements are the same value, a single value with no square brackets can be used to define the parameter
Preset	[IBW]
Range	IBW, RRC

10.2.27 Channel Filter Alpha Array

Example	`:CALC:FPOW:POW1:DEF "FilterAlpha=[0.5, 0.0, 0.5]"`
Notes	The filter alpha parameter allows you to adjust the alpha value associated with the root-raised-cosine (RRC) filter type. Set FilterType to RRC in order to utilize this parameter All array parameters should have the same number of elements. Alternatively, if all the elements are the same value, a single number with no square brackets can be used to define the parameter
Preset	[0.22]
Range	0.0 – 1.0

10.2.28 Channel Measurement Function Array

Example	`:CALC:FPOW:POW1:DEF "Function=[BandPower, PeakPower, BandPower]"`
Notes	This parameter array defines what measurement is being made for each individually-specified channel:

	BandPower	Total power within the specified bandwidth of the channel (dBm)
	BandDensity	Total power density within the specified bandwidth of the channel (dBm/Hz)
	PeakPower	The peak power value within the specified bandwidth of the channel (dBm)
	PeakFrequency	The frequency which corresponds to the peak power value within the specified bandwidth of the channel. This frequency is relative to the center frequency (Hz)
	XdBBandwidth	The half power (-3.01 dB) bandwidth of the highest amplitude signal that resides within the channel (Hz), dB is configurable using XdBBandwidth parameter
	OccupiedBandwidth	The bandwidth at which 99% of the total power resides within the channel (Hz), percentage configurable using OccupiedBand-widthPercent parameter
	All array parameters should have the same number of elements Alternatively, if all the elements are the same value, a single value with no square brackets can be used to define the parameter	
Preset	BandPower	
Range	BandPower, BandDensity, PeakPower, PeakFrequency, XdBBandwidth, OccupiedBandwidth	

10.2.29 Channel Offset Frequency Array

Example	`:CALC:FPOW:POW1:DEF "OffsetFrequency=[-5e6, 0, 5e6]"`
Notes	The offset frequency parameter array defines the difference between the center frequency to the center frequency of each channel All array parameters should have the same number of elements
Preset	[0]
Range	0 to 20 MHz

10.2.30 Channel Occupied Bandwidth Percent Array

Example	`:CALC:FPOW:POW1:DEF "OccupiedBandwidthPercent =[0.95, 0.95, 0.95]"`
Notes	This parameter only applies for channels whose Function is set to OccupiedBandwidth. The occupied bandwidth percent parameter specifies the percent of total power in these channels. The valid range for this parameter is 0.0 to 1.0, where 1.0 represents 100%. The default for this parameter is 0.99, which will return the bandwidth that contains 99% of the total channel power
Preset	[0.99]
Range	0 – 1.0

10.2.31 Channel x-dB Bandwidth Array

Example	`:CALC:FPOW:POW1:DEF " XdBBandwidth =[-6.02, -3.01, -1.0]"`
Notes	This parameter only applies for channels whose Function is set to `XdBBandwidth`. The X dB bandwidth parameter is used to specify the power relative to the peak channel power over which the bandwidth is calculated. The parameter value must be a negative number
Preset	[-3.01]
Range	-200 to 0 dB

10.3 Define Fast Power Measurement Query (Remote Command Only)

Retrieves a list of all defined parameters in an ASCII string format

The following is an example of returned results:

```
"DCCoupled=False,ElecAttBypass=True,ElecAttenuation=0,IFGain=0,MechAttenuation=0
,PreAmpMode=Off,PreSelectorOffset=0,UsePreSelector=False,ExternalReferenceFreque
ncy=10000000,FrequencyReferenceSource=AutoExternalFrequencyReference,IFType=B40M
,LOMode=SLW,SignalInput=FpMainRf,AcquisitionTime=0.001,CenterFrequency=100000000
0,ResolutionBW=0,ResolutionBWMode=BestSpeed,DetectorType=RmsAverage,Bandwidth=
[1000000],OffsetFrequency=[0],Function=[BandPower],FilterType=[IBW],FilterAlpha=
[0.22],OccupiedBandwidthPercent=[0.99],XdBBandwidth=
[3.01],DoNoiseCorrection=False,DoSpurSuppression=False,MeasurementMethod=Hardwar
eFFT,IncludePowerSpectrum=False,TriggerDelay=0,TriggerLevel=1.2,TriggerSlope=Pos
itive,TriggerSource=Free,TriggerTimeout=1"
```

Remote Command	`:CALCulate:FPOWer:POWer[1,2,…,999]:DEFine?`
Example	`:CALC:FPOW:POW1:DEF?`
Notes	Retrieves a list of all defined parameters in an ASCII format

10.4 Configure Fast Power Measurement (Remote Command Only)

Begins hardware setup and returns immediately, with no acquisition made. This can be used in parallel with other hardware operations to effectively hide the hardware setup time.

Remote Command	`:CALCulate:FPOWer:POWer[1,2,…,999]:CONFigure`
Example	`:CALC:FPOW:POW1:CONF`
Notes	Option FP2 is required

10.5 Initiate Fast Power Measurement (Remote Command Only)

Begins an acquisition and returns immediately. The results of the measurement can be retrieved using `:FETCh`.

Remote Command	`:CALCulate:FPOWer:POWer[1,2,…,999]:INITiate`
Example	`:CALC:FPOW:POW1:INIT`
Notes	Option FP2 is required

10.6 Fetch Fast Power Measurement (Remote Command Only)

Used to retrieve the results of an acquisition initiated by `:INIT`. The returned results are in *ASCII string* format. The string begins and ends with quotation marks.

Remote Command	`:CALCulate:FPOWer:POWer[1,2,…,999]:FETCh?`
Example	`:CALC:FPOW:POW1:FETC?`
Notes	Option FP2 is required Returns m comma-separated ASCII values, where m corresponds to the number of bandwidths defined 1. Declared function return in the 1st specified channel 2. Declared function return in the 2nd specified channel … m. Declared function return in the last specified channel The INIT and FETC? command sequence performs the same functionality of a single CALC:FPOW:POW[n]? query. Units of the returned values are dependent on the Function parameter for each channel

10.7 Execute Fast Power Measurement (Remote Command Only)

This query is shorthand for `:INIT` immediately followed by `:FETC?`. The returned results are in *ASCII string* format. The string begins and ends with quotation marks.

Remote Command	`:CALCulate:FPOWer:POWer[1,2,…,999]?`
Example	`:CALC:FPOW:POW1?`
Notes	Option FP2 is required See notes for Fast Power Fetch for return format

10.8 Binary Read Fast Power Measurement (Remote Command Only)

This query is shorthand for `:INIT` immediately followed by `:FETC?`. The returned results are in *binary format*.

Remote Command	`:CALCulate:FPOWer:POWer[1,2,…,999]:READ?` `:CALCulate:FPOWer:POWer[1,2,…,999]:READ1?`
Example	`:CALC:FPOW:POW1:READ?` `:CALC:FPOW:POW1:READ1?`
Notes	Option FP2 is required Returns m 4 byte floating point binary values (Little-Endian), where m corresponds to the number of bandwidths defined

10.9 Diagnostic Binary Read Fast Power Measurement (Remote Command Only)

This query is shorthand for `:INIT` immediately followed by `:FETC?`. The returned results are in *binary format*. This command is used primarily for diagnostic purposes, to test for ADC overloads and to visibly inspect the spectrum.

Remote Command	`:CALCulate:FPOWer:POWer[1,2,…,999]:READ2?`
Example	`:CALC:FPOW:POW1:READ2?`
Notes	Option FP2 is required Note: Spectrum data is only returned if the IncludePowerSpectrum parameter is set to True. If IncludePowerSpectrum is False, the number of spectrum points will be zero (0) Units of the returned values are dependent on the Function parameter per channel (e.g. dBm for BandPower, Hz for PeakFrequency) Returns binary data (Little-Endian) that contains information on m amount of channels, along with ADC over range and full spectrum data The following is the binary format of the response Bandwidth Return Value 1. Number of channels specified, m [4 byte int] 2. Declared function result for the 1st specified channel [4 byte float] 3. Declared function result for the 2nd specified channel [4 byte float] … (m + 1). Declared function result for the last (mth) specified channel [4 byte float] ADC Over Range 1. ADC over-range occurred (1: true, 0: false) [2 byte short] Spectrum Data 1. Number of points in the spectrum data, k [4 byte int] 2. Start frequency of spectrum data (Hz) [8 byte double] 3. Step frequency of spectrum data (Hz) [8 byte double] 4. FFT bin at 1st point (dBm) [4 byte float] 5. FFT bin at 2nd point (dBm) [4 byte float] … (k + 3). FFT bin at last (kth) point (dBm) [4 byte float]

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