Keysight X-Series Signal Analyzer

This documentation is for the following X-Series Instruments, with the N9061C or N9061EM0E applications installed:

- Multi-Touch Signal Analyzers (UXA, PXA, MXA, EXA)

Remote Language Compatibility Mode User's & Programmer's Reference

KEYSIGHT TECHNOLOGIES

Notices

Copyright Notice

Trademarks

WiMAX and Mobile WiMAX are US trademarks of the WiMAX Forum.

Manual Part Number

N9061-90001

Edition

Edition: 9, September 2021
Published in USA

Published by:

Keysight Technologies, Inc.
1400 Fountaingrove Parkway
Santa Rosa, CA 95403

Technology Licenses

The hardware and/or software described in this document are furnished under a license and may be used or copied only in accordance with the terms of such license.

U.S. Government Rights

The Software is "commercial computer software," as defined by Federal Acquisition Regulation ("FAR") 2.101. Pursuant to FAR 12.212 and 27.405-3 and Department of Defense FAR Supplement ("DFARS") 227.7202, the US government acquires commercial computer software under the same terms by which the software is customarily provided to the public. Accordingly, Keysight provides the Software to US government customers under its standard commercial license, which is embodied in its End User License Agreement (EULA), a copy of which can be found at http://www.keysight.com/find/sweula. The license set forth in the EULA represents the exclusive authority by which the US government may use, modify, distribute, or disclose the Software. The EULA and the license set forth therein, does not require or permit, among other things, that Keysight: (1) Furnish technical information related to commercial computer software or commercial computer software documentation that is not customarily provided to the public; or (2) Relinquish to, or otherwise provide, the government rights in excess of these rights customarily provided to the public to use, modify, reproduce, release, perform, display, or disclose commercial computer software or commercial computer software documentation. No additional government requirements beyond those set forth in the EULA shall apply, except to the extent that those terms, rights, or licenses are explicitly required from all providers of commercial computer software pursuant to the FAR and the DFARS and are set forth specifically in writing elsewhere in the EULA. Keysight shall be under no obligation to update, revise or otherwise modify the Software. With respect to any technical data as defined by FAR 2.101, pursuant to FAR 12.211 and 27.404.2 and DFARS 227.7102, the US government acquires no greater than Limited Rights as defined in FAR 27.401 or DFAR 227.7103-5 (c), as applicable in any technical data.

Warranty

THE MATERIAL CONTAINED IN THIS DOCUMENT IS PROVIDED "AS IS," AND IS SUBJECT TO BEING CHANGED, WITHOUT NOTICE, IN FUTURE EDITIONS. FURTHER, TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, KEYSIGHT DISCLAIMS ALL WARRANTIES, EITHER EXPRESS OR IMPLIED, WITH REGARD TO THIS MANUAL AND ANY INFORMATION CONTAINED HEREIN, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. KEYSIGHT SHALL NOT BE LIABLE FOR ERRORS OR FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES IN CONNECTION WITH THE FURNISHING, USE, OR PERFORMANCE OF THIS DOCUMENT OR OF ANY INFORMATION CONTAINED HEREIN. SHOULD KEYSIGHT AND THE USER HAVE A SEPARATE WRITTEN AGREEMENT WITH WARRANTY TERMS COVERING THE MATERIAL IN THIS DOCUMENT THAT CONFLICT WITH THESE TERMS, THE WARRANTY TERMS IN THE SEPARATE AGREEMENT SHALL CONTROL.

Safety Information

CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Table Of Contents

1 Documentation Roadmap

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

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	N9030B
	MXA Signal Analyzer	N9021B
		N9020B
	EXA Signal Analyzer	N9010B
	CXA Signal Analyzer	N9000B

1.2 Additional Documentation

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

This document is available in 2 formats:

- **Embedded Help**, in the instrument
- **Users & Programmers Reference**, in downloadable PDF format (this document)

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 Special Information for Remote Language Compatibility Mode

This chapter provides information that is specific to Remote Language Compatibility Mode, hereinafter referred to as "RLC Mode".

It includes the following topics:

2.1 RLC Mode Description

RLC Mode is a Remote Language Compatibility application for Keysight Technologies X-Series instruments. It allows X-Series instruments to be controlled using many non-SCPI remote programming commands originally intended for the following analyzers:

- 8560 E/EC Series Portable Spectrum Analyzers, comprising: 8560E, 8560EC, 8561E, 8561EC, 8562E, 8562EC, 8563E, 8563EC, 8564E, 8564EC, 8565E, 8565EC
- 8566A/B
- 8568A/B

(The 8566A/B and the 8568A/B are not considered part of the 8560 series of analyzers.)

An X-Series instrument with RLC Mode installed can replace these analyzers in many automated systems with minimal or no modification to the existing measurement software.

2.2 General Rules and Limitations

RLC Mode has been designed to emulate as closely as possible the operation of the specified spectrum analyzers. It is not, however, intended as a fully-compatible, direct replacement for these analyzers. This section highlights the following specific emulation differences and limitations:

– "AC/DC Coupling" on page 39
– "Couplings" on page 40
– "Markers" on page 40
– "Numeric Ranges" on page 40
– "Parsing" on page 40
– "Predefined Functions" on page 41
– "Remote Control" on page 41
– "Returning Data" on page 41
– "Units" on page 41
– "User-defined Functions" on page 42
– "Supported Commands" on page 42
– "EP Parameter" on page 42
– "OA Parameter" on page 42
– "Handling of Unsupported Commands and Queries" on page 42

2.2.1 AC/DC Coupling

The 44 GHz and 50 GHz X-Series instruments only have DC coupling. The X-Series instruments with a 26.5 GHz frequency range, and lower, default to AC coupling on preset. When the selected legacy instrument is HP8566A, HP8566B, HP8563, HP8564, or HP8565, RLC Mode defaults to DC coupling.

When AC coupled, the 8560E/61E/62E have a 100 kHz low frequency limit, whereas X-Series instruments have a 10 MHz limit.

For HP8568A/B compatibility and consistency, RLC Mode supports the `I1` and `I2` commands. These select AC or DC coupling at the RF input. Note that the HP8568A/B has two RF input ports, whereas X-Series instruments have only one.

2.2.2 Couplings

For optimal use of the X-Series instrument, RLC Mode uses the auto coupling features of the X-Series, and does not attempt to mimic the exact coupling behavior of the legacy analyzers. To eliminate the possibility of "Meas Uncal" errors between auto and manual values, values generally default to the X-Series auto settings where applicable (for example, Resolution Bandwidth). However, there are several exceptions, as follows:

To prevent timeout errors in the legacy code, the Resolution Bandwidth minimum matches the minimum in the legacy analyzer. Resolution Bandwidth steps and resolution, however, conform to X-Series values.

The Video Bandwidth couples to the Resolution Bandwidth according to the Video Bandwidth coupling offset value, specified by the `VBO` or `VBR` command. X-Series instruments set the Video Bandwidth according to the `VBO` or `VBR` setting, but use the X-Series instruments' available bandwidths, to prevent 'Meas Uncal' errors.

2.2.3 Markers

RLC Mode emulates the behavior of legacy products. If any program uses a marker state that is not available in the legacy instrument, further marker behavior is undefined, until a subsequent instrument preset occurs.

On systems that support `MKACT`, there are 4 completely different marker pairs, each with its own information. RLC Mode stores the currently active value of `MKACT`. For example, if `MKACT` is 2, then it uses Markers 3 and 4 instead of 1 and 2.

2.2.4 Numeric Ranges

Numeric ranges are limited to that of X-Series unless otherwise stated, although commands such as `FS` or `IP` that go to a default range use the range of the legacy instrument.

2.2.5 Parsing

For 8566B and 8568B emulation, RLC Mode remembers the active function and supports `UP`, `DN`, and `OA`, all of which change the active function. It also supports `?`, which does not change the active function.

Note that 8566/68 parses a command (for example `CF 10.3GZ`) immediately when it recognizes a complete command (in this example, following `GZ`), whereas RLC Mode parses at the end of a line, when it sees the line termination sequence.

2.2.6 Predefined Functions

In the 8566/8568/8560 Series analyzers, a “Predefined Function” is a command that returns a number that can be operated on by other commands. “Predefined Variables” follow the same concept, except that the value to be passed as a parameter to the next command is stored in a variable.

RLC Mode does not support this type of behavior, so any commands that originally acted as Predefined Functions or Variables, or that accepted Predefined Functions or Variables as arguments in the 8566/8568/8560 Series, no longer do so.

2.2.7 Remote Control

RLC Mode supports remote operation only via the GPIB interface. It does **not** support operation via LAN, USB or Telnet.

2.2.8 Returning Data

X-Series and legacy instruments adopt differing approaches when returning data to the controller.

X-Series and 8560-series analyzers operate a FIFO buffer for command return values. If a command returns a value that the controller does not read, the returned data is stored until such a time that the controller requires the value. In RLC Mode's 8560-series emulation mode, for example, if `CF?MA?FA?` is sent, the first query returns the result of `CF?`, the second query returns the result of `MA?` and the third query returns the result of `FA?`.

The 8566, 8568, and 8590-series legacy analyzers store only one value at a time. Any value stored is overwritten each time a command returns a value. RLC Mode handles this difference appropriately only within a single command string. In RLC Mode's 8566 and 8568 emulation mode, for example, if `CF?MA?FA?` is sent, only the result of `FA?` is returned.

2.2.9 Units

RLC Mode supports all units used in legacy products. The accepted units are HZ, KHZ, MHZ, GHZ, KZ, MZ, GZ, DBM, DBMV, DBUV, MV, UV, V, MW, UW, W, DB, DM, MS, US, SC, and S (case insensitive in 8566/68). A command terminator, such as ";", also acts as a unit terminator.

2.2.10 User-defined Functions

User-defined functions, traces, or variables (`FUNCDEF`, `TRDEF` or `VARDEF`) **cannot** be used as arguments or commands in programs for RLC Mode. In addition, the behavior of certain commands that rely on the “active functions” (`UP`, `DN`, etc.) may be slightly different.

2.2.11 Supported Commands

RLC Mode supports only a subset of 8566/8568/8560 Series commands. The list of supported commands was determined by feedback from customers, combined with technical considerations and constraints.

Device Clear is supported by RLC Mode, and causes a mode preset of the instrument.

2.2.12 EP Parameter

The `EP` (Enable Parameter) is supported by RLC Mode for the same active functions as the 8560 series. When used as a secondary keyword after a command, `EP` transfers control to the analyzer’s front-panel.

`EP` is not displayed in any of the format diagrams for individual commands listed in "Legacy Command Descriptions" on page 679.

2.2.13 OA Parameter

RLC Mode supports the `OA` parameter, which is used in conjunction with several legacy commands, such as `AT` and `CF`. `OA` is equivalent to a query; for example, `CF OA` is equivalent to `CF?`.

2.2.14 Handling of Unsupported Commands and Queries

If a command is valid for legacy products but not supported by RLC Mode, no error message is generated, although a "Command Not Supported" comment is appended to the Command Log file. Note that this logging behavior can be controlled via the Logging menu, as described in "Logging" on page 240.

If RLC Mode receives a query that is valid for legacy products, but is not supported by RLC Mode, it returns a "0", to avoid the situation where a program would otherwise halt indefinitely waiting for a return value.

2.3 Hardware and Firmware Requirements for RLC Mode

For maximum compatibility, you should select an X-Series instrument that equals or exceeds the frequency range of the legacy analyzer you are replacing. The frequency limits of the legacy analyzers are listed below.

Frequency Ranges of Legacy Analyzers

Remote Language	Start Frequency	Stop Frequency
8560E/EC	30 Hz	2.9 GHz
8561E/EC	30 Hz	6.5 GHz
8562E/EC	30 Hz	13.2 GHz
8563E/EC	9 kHz	26.5 GHz
8564E/EC	9 kHz	40.0 GHz
8565E/EC	9 kHz	50.0 GHz
HP8566A	2 GHz	22 GHz
HP8566B	2 GHz	22 GHz
HP8568A	0 Hz	1.5 GHz
HP8568B	0 Hz	1.5 GHz

2.4 Hints and Tips

This section provides hints and tips that will help you get the most from the X-Series RLC Mode.

2.4.1 Compatibility (Speed and Consistency)

To maximize compatibility with your legacy analyzer, the RLC Mode should be used on the instrument whose frequency range most closely matches the frequency range of your legacy analyzer. For example, the best match for the 8563E, which has a 26.5 GHz upper frequency limit, is an X-Series instrument that also has an upper frequency limit of 26.5 GHz.

2.4.2 Compatibility and Sweep Times

To maximize compatibility between X-Series instruments and legacy analyzers, use the Manual Swept mode for 8566A/B, 8568A/B analyzers. Manual Swept mode is the default setting on X-Series instruments with RLC Mode installed.

When analyzing stationary signals, you can change to the Best Speed setting, which is accessed from the "Sweep Type Rules" on page 242 menu. This results in faster sweep times on an X-Series instrument than on the legacy analyzers, due to the X-Series instrument's better performance. In the majority of applications, this faster speed would be desirable, but that is not always the case.

2.4.3 Timeout

Keysight recommends increasing the timeout on a serial poll (SPOLL) due to differences in Sweep Times on some settings. Note, however, that this may not be necessary when using the Best Speed setting on "Sweep Type Rules" on page 242 menu.

2.4.4 Synchronization (1)

To synchronize after an `IP` command, Keysight recommends that you use the `DONE` command. We also suggest that the `DONE` command be used in conjunction with a timeout of about 5 seconds, in case the instrument starts to Auto Align.

Alternatively, you can switch off auto alignment. To set auto alignment to Off, press "Auto Align" on page 401.

2.4.5 Synchronization (2)

Keysight recommends that synchronization (using the `DONE` command) be used with marker functions when signal tracking is turned on.

2.4.6 Changing Modes

After changing into or out of RLC Mode, allow at least a 1 second delay before sending subsequent commands.

2.4.7 AC and DC Coupling

The 8560 Series of legacy analyzers have one RF input port, and support AC and DC coupling through the command "COUPLE (Input Coupling)" on page 738.

The 8568A/B has two RF input ports:

- DC Coupled (with a BNC connector) to handle a frequency range of 100 Hz to 1.5 GHz
- AC Coupled (with an N Type connector) to handle a frequency range of 100 kHz to 1.5 GHz

If the input signal to the X-series instrument has a DC component, ensure that when you select legacy instrument emulation that involves a possible coupling change to DC, the input signal does not exceed the input specifications of the X-series instrument.

X-series instruments also have one RF input port. When using X-Series instruments, you must use DC coupling to see calibrated frequencies of less than 20 MHz. Signals of less than 20 MHz are not calibrated when using AC coupling on these instruments.

3 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 122

"Onscreen Keyboard key" on page 123

"Touch On/Off Key" on page 124

"Tab key" on page 125

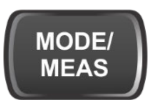
3.1 Screen Tabs

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 107 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 48. In addition, if you have a PC keyboard plugged in, the sequence CTL-SHIFT-M will open up this dialog.

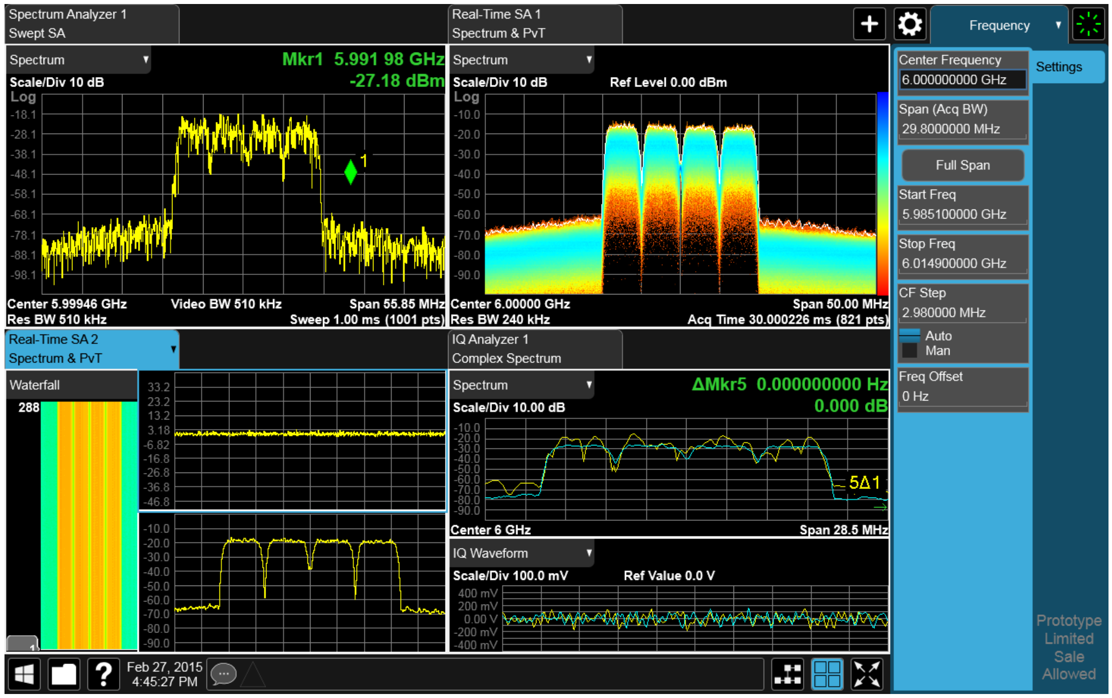
The + tab at the right of the Screen Tabs bar adds a new Screen by cloning the current screen. The new Screen has the identical setup and settings as the current Screen. You can then change the Mode, Measurement and/or settings of the new Screen.

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 48

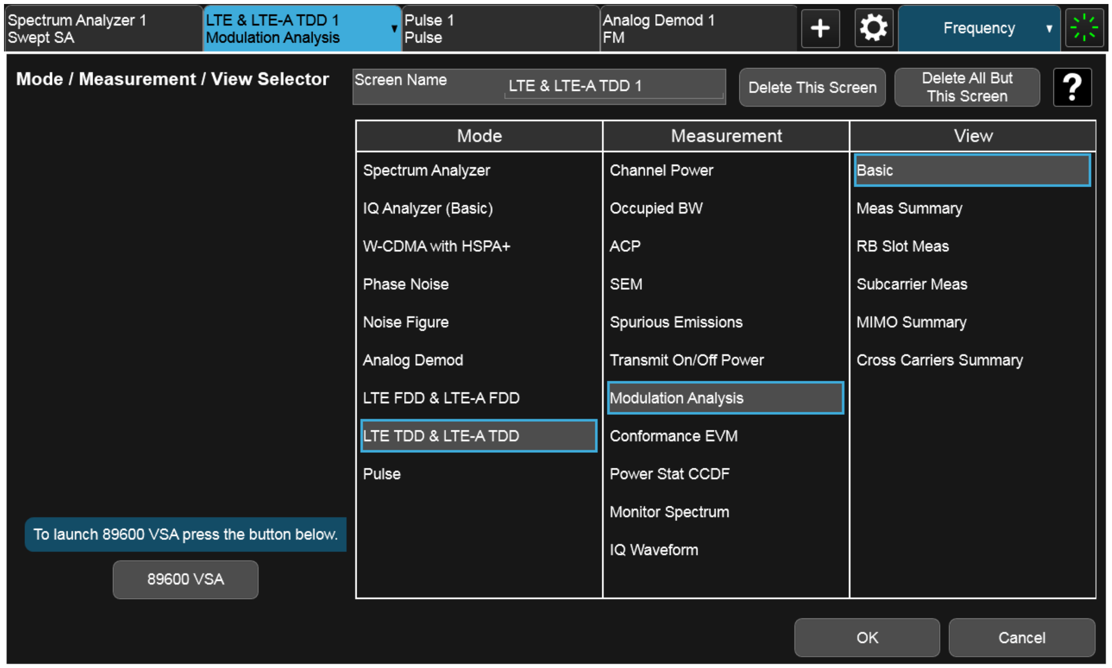
– "Add Screen" on page 64

– "Multiscreen" on page 107

3.1.1 Mode/Meas/View Dialog

The Mode/Meas/View dialog opens when you press the selected (blue) Screen tab (see "Screen Tabs" on page 47) or the **Mode/Meas** front panel key.

This dialog displays lists of available Modes, Measurements and Views, as well as the "Sequencer" on page 58 control for configuring Screens.



3.1.1.1 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 51

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 51.

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 50. The Mode Numbers may be found in the table under "Index to Modes" on page 51.

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 50.

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 51 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.

3.1.1.2 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`

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`

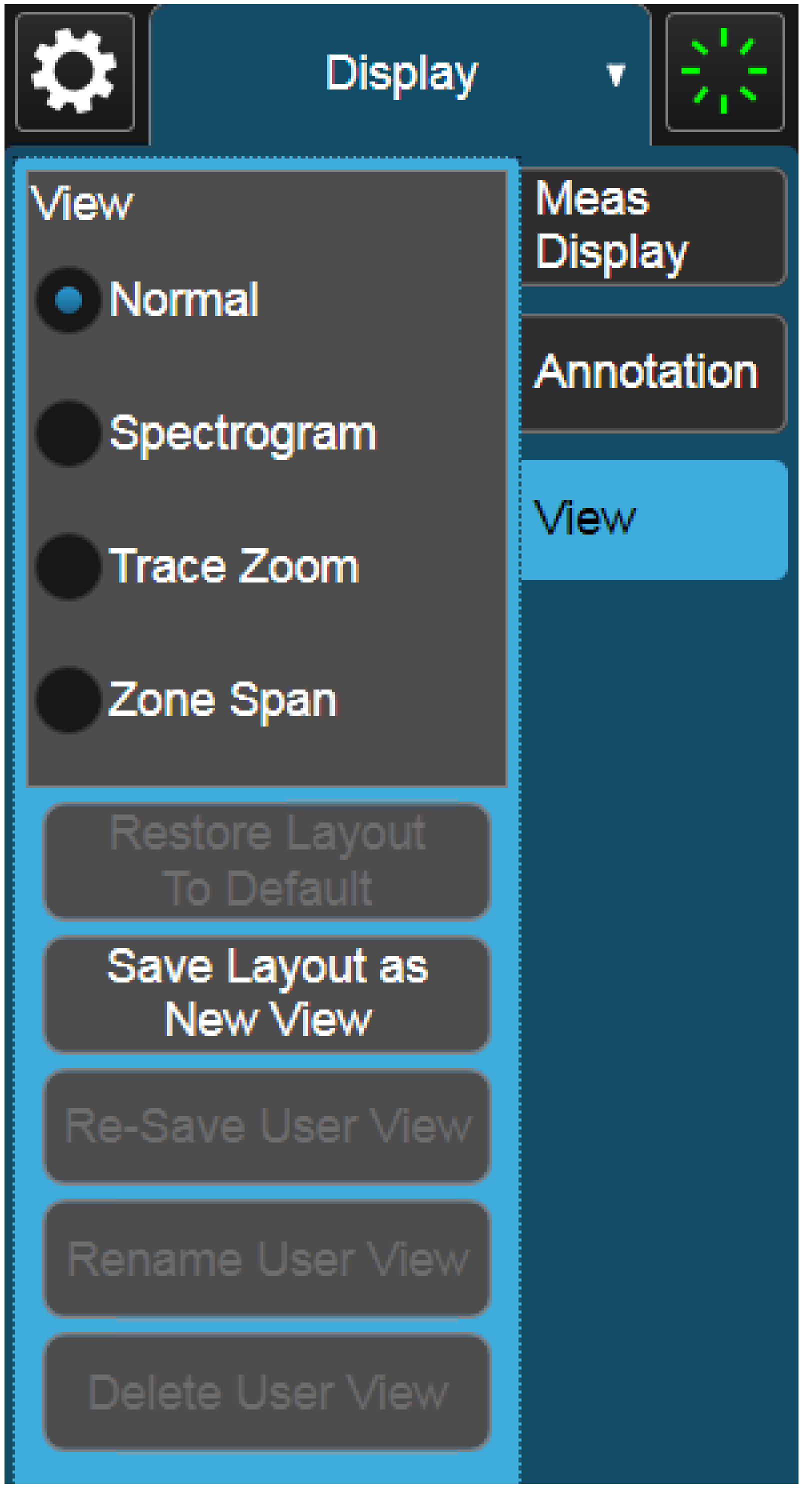
3.1.1.3 Measurement

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.

3.1.1.4 View

A View is a collection of Result Windows. The View column of the "Mode/Meas/View Dialog" on page 48 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 48.



3.1.1.5 Sequencer

Allows multiple Screens to update sequentially while in "Multiscreen" on page 107 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 47).

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 109

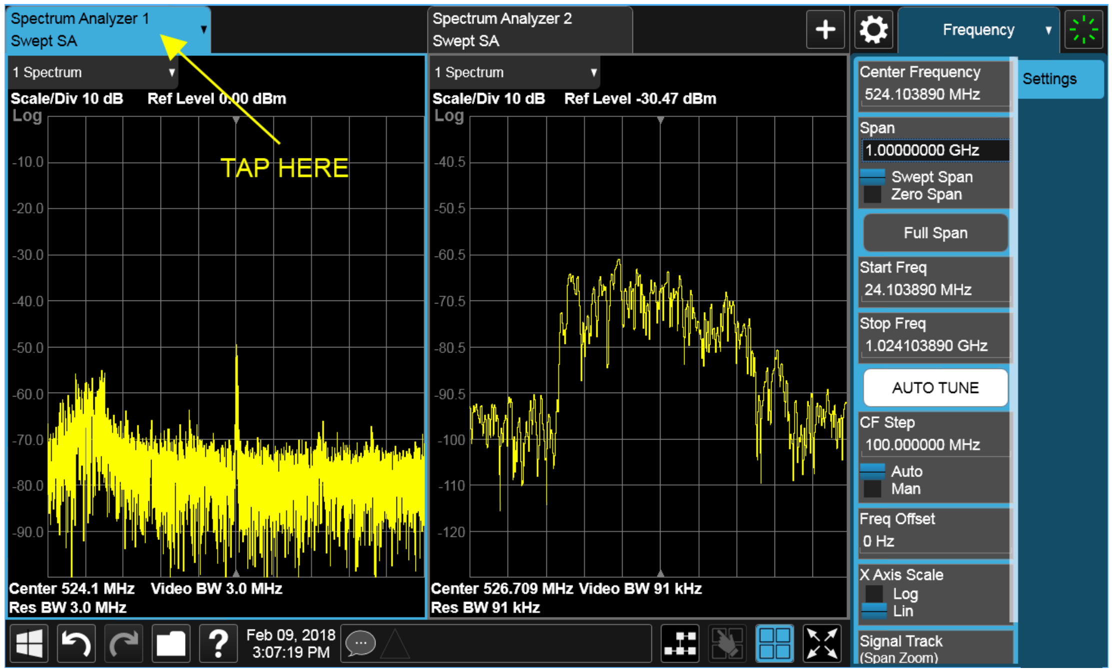
NOTE — When the Sequencer is running, Auto alignment is temporarily disabled. A pending auto alignment might be executed when the sequencer is stopped.

See "More Information" on page 59

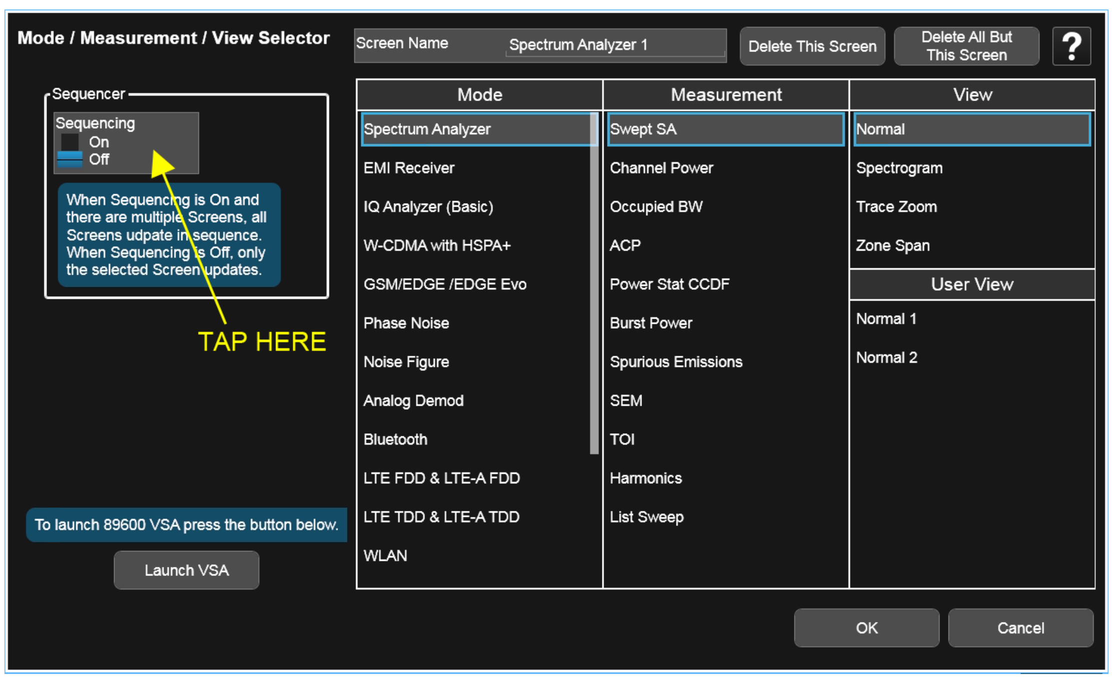
Remote Command	`:SYSTem:SEQuencer ON | OFF | 1 | 0` `:SYSTem:SEQuencer?`
Example	`:SYST:SEQ ON`
Notes	If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; Screen SCPI cannot be used when Display is disabled" is generated
Dependencies	To start the Sequencer,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

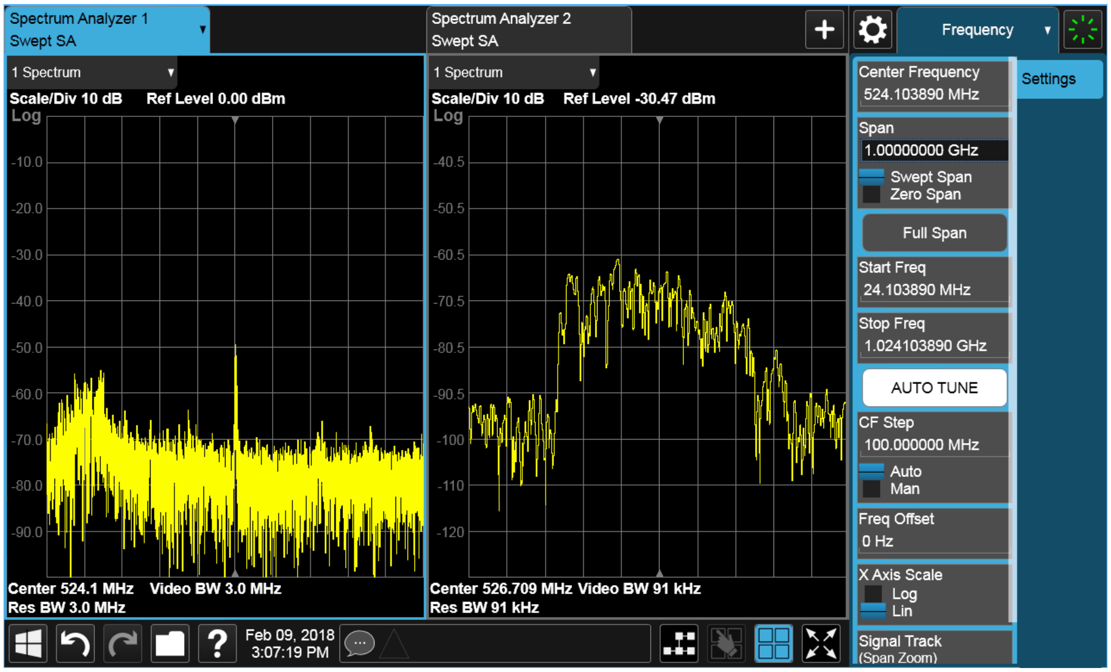


In the Sequencer block in the upper left hand corner, tap the Sequencing switch to turn it On:

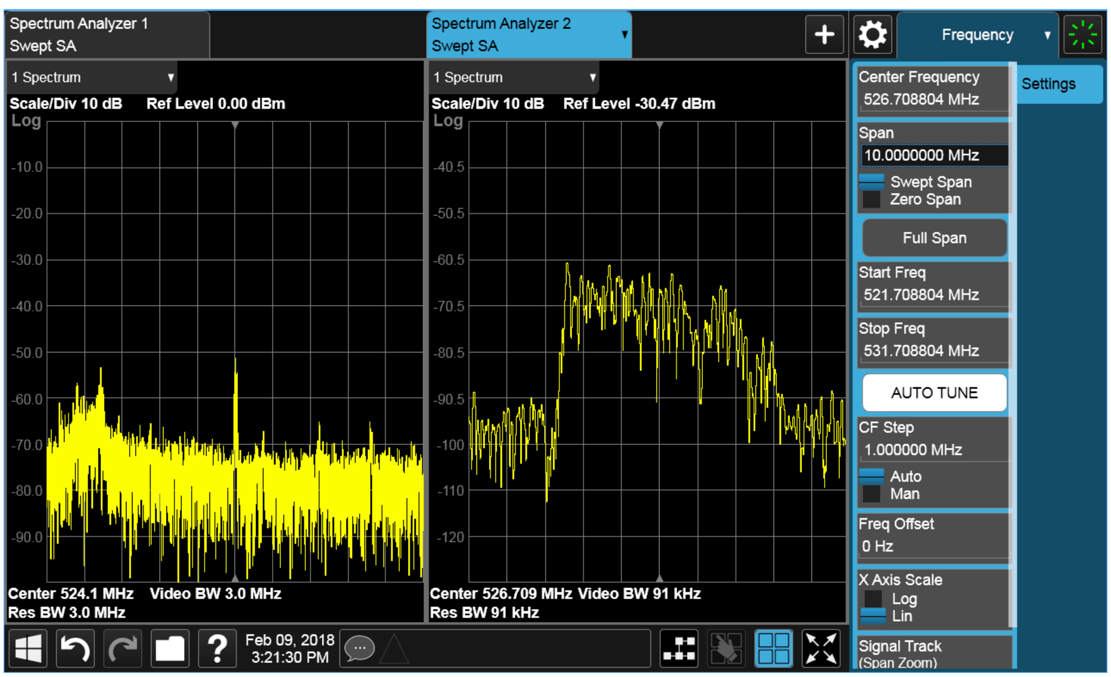


The instrument will immediately exit the Mode/Meas/View Dialog and begin making measurements in each of the screens, one after the other. When a measurement is being made in a particular Screen, that Screen's tab will be blue.

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.

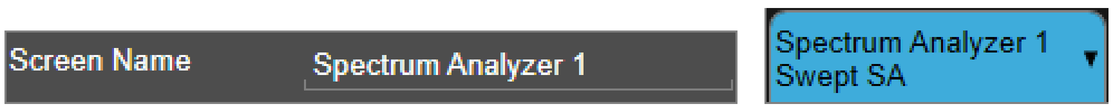
When the Sequencer is running, the screens update in the order in which they were created.

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.

3.1.1.6 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 48:



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

3.1.1.7 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

3.1.1.8 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

3.1.1.9 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".

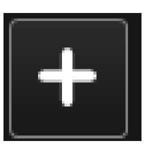
Example

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

3.1.2 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 47 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 48 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 107.

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

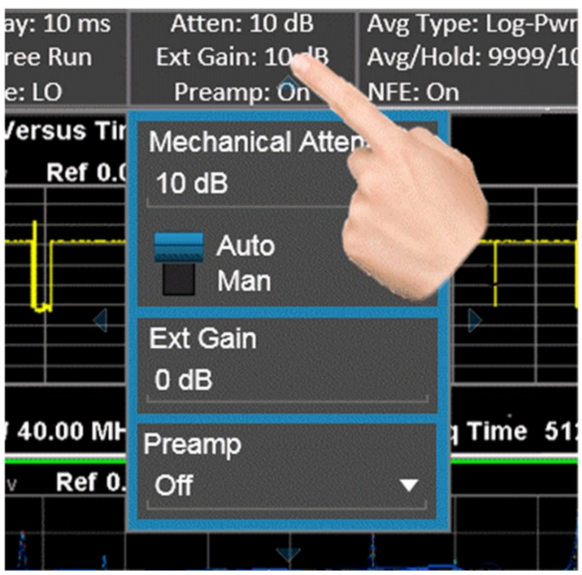
3.2 Meas Bar

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:

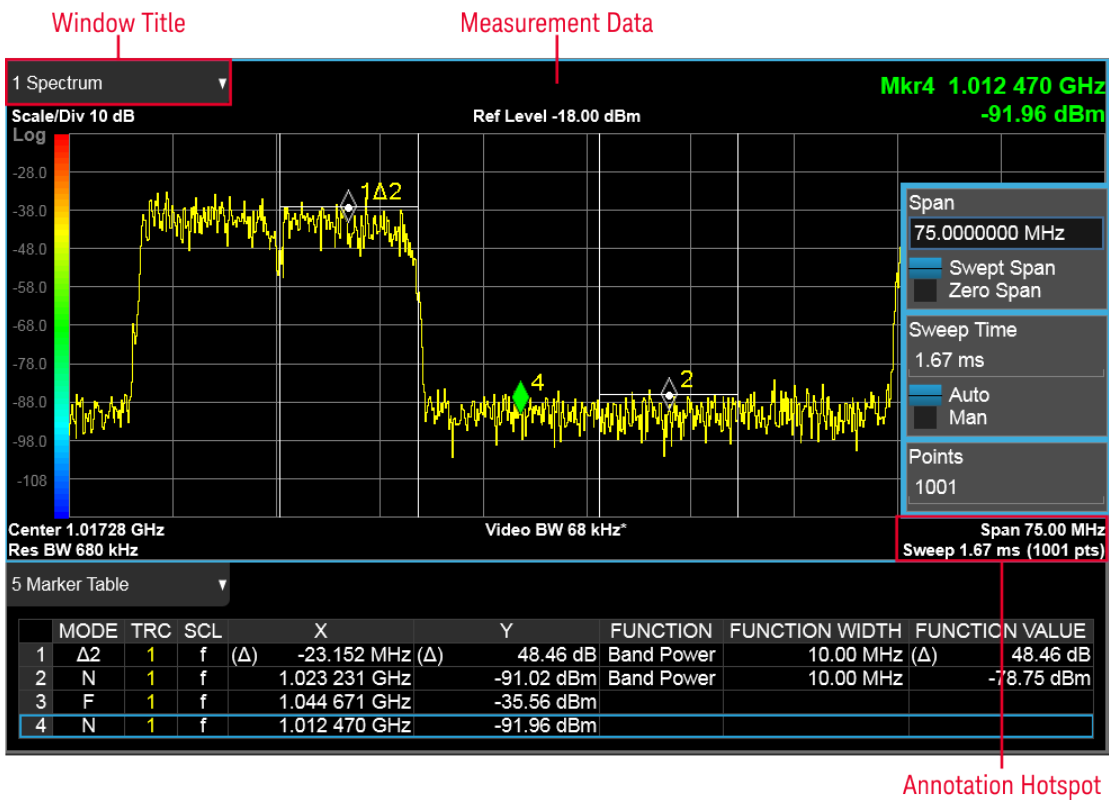
- The top row shows the Trace Number, in the trace color.
- The second row shows the Trace Type for each trace (W=Clear/Write, A=Trace Average, M=Max Hold, m=Min Hold); this letter is in white if the trace is Active, in gray if the trace is inactive; there is a bar through the letter if the trace is 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.

3.3 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.



Each window in the Measurement display contains a "Window Title" on page 69, "Measurement Data" on page 73, and graphical windows also may contain "Annotation Hotspot" on page 76s.

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.

3.3.1 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”).

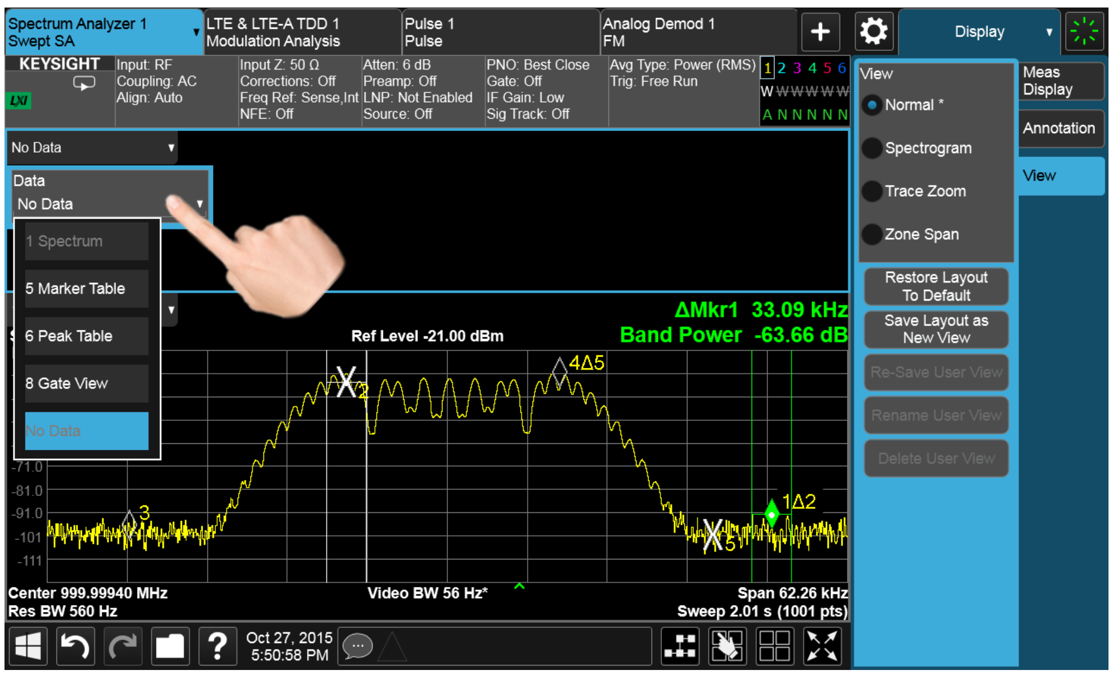
Measurements that support User Views (see "View Editor" on page 85) also display the Window Number in the Window Title, to enable window addressing from SCPI. The number is the number that will be used in the SCPI command to address that window, for example, in the WCDMA Mod Accuracy measurement, Code Domain

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

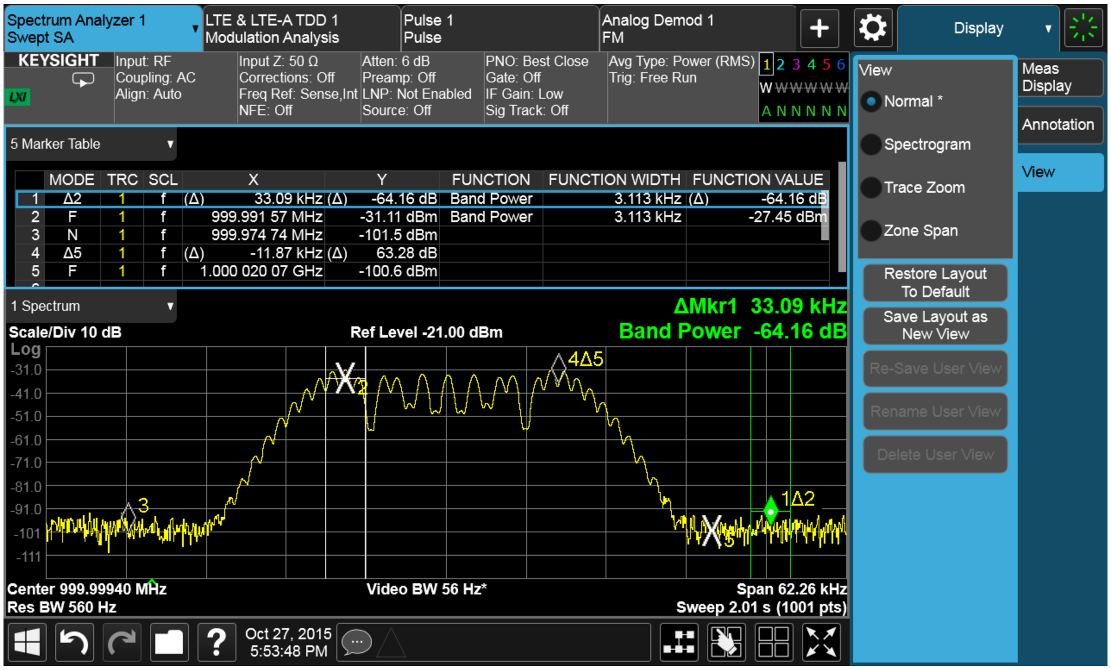
```
:DISP:RHO:WIND6:TRAC:Y:RLEV 0.0
```

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.

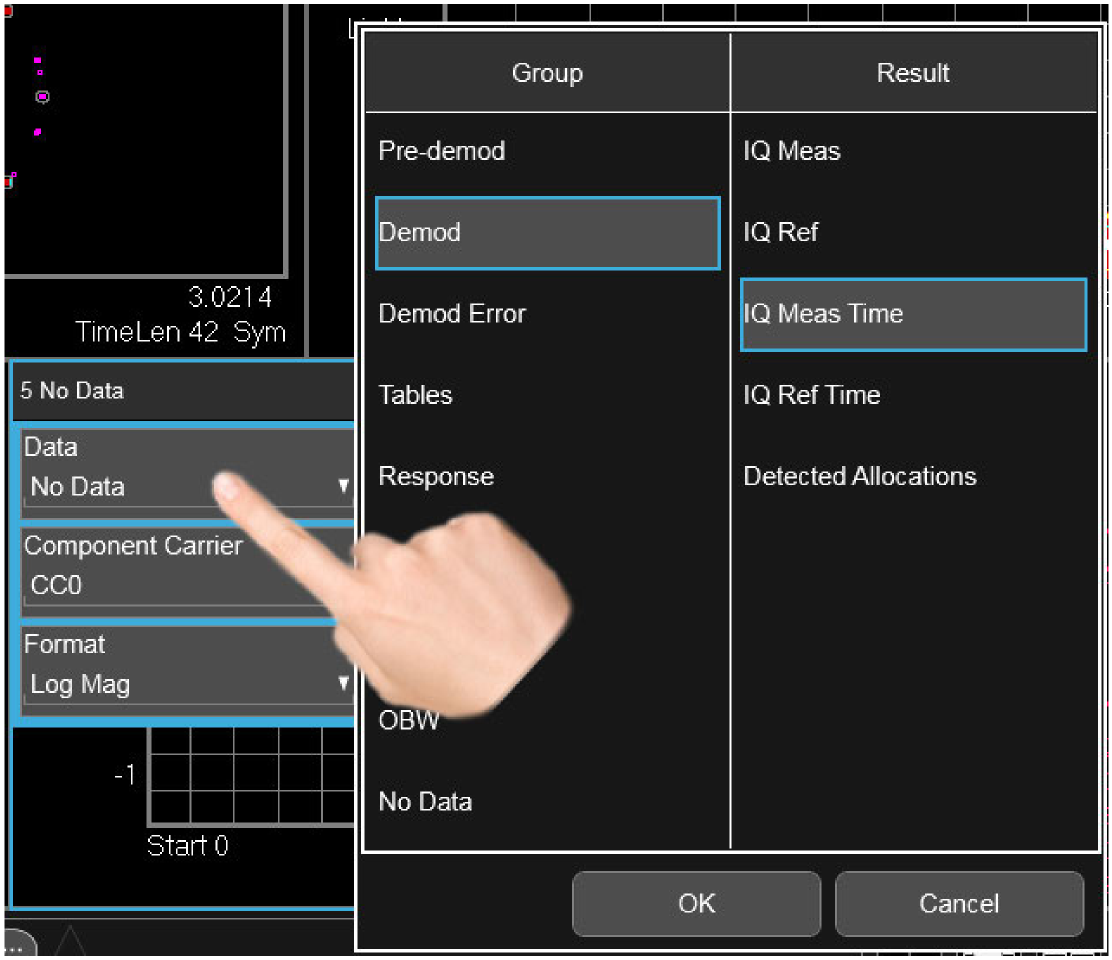
For example, if we wish to assign the results of the upper window in the display below to the Marker Table, we would touch the window title and then the "Data" control that is revealed, as shown:



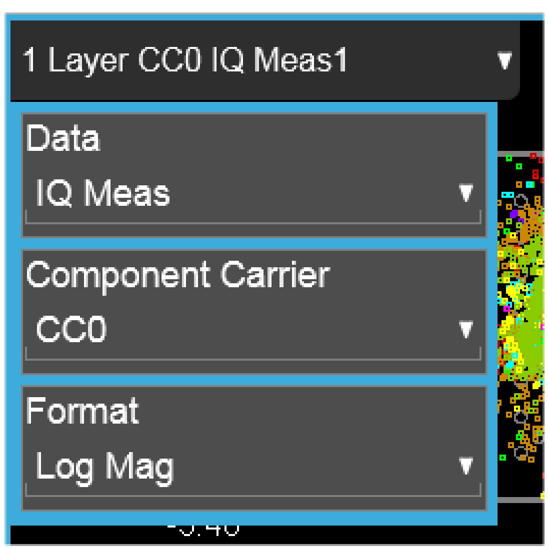
And then select Marker Table, yielding the result below:



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.

3.3.2 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

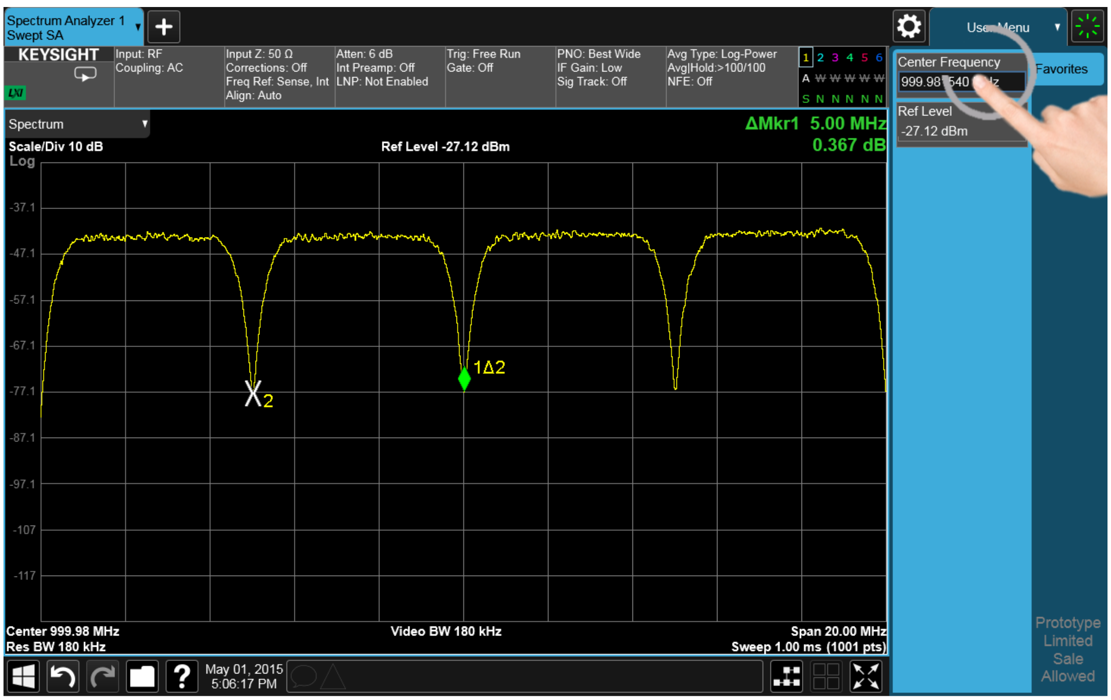
You can also pinch in or out either horizontally or vertically to zoom in the x-axis or y-axis dimension. For example, a pinch horizontally lets you adjust the Span of the

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

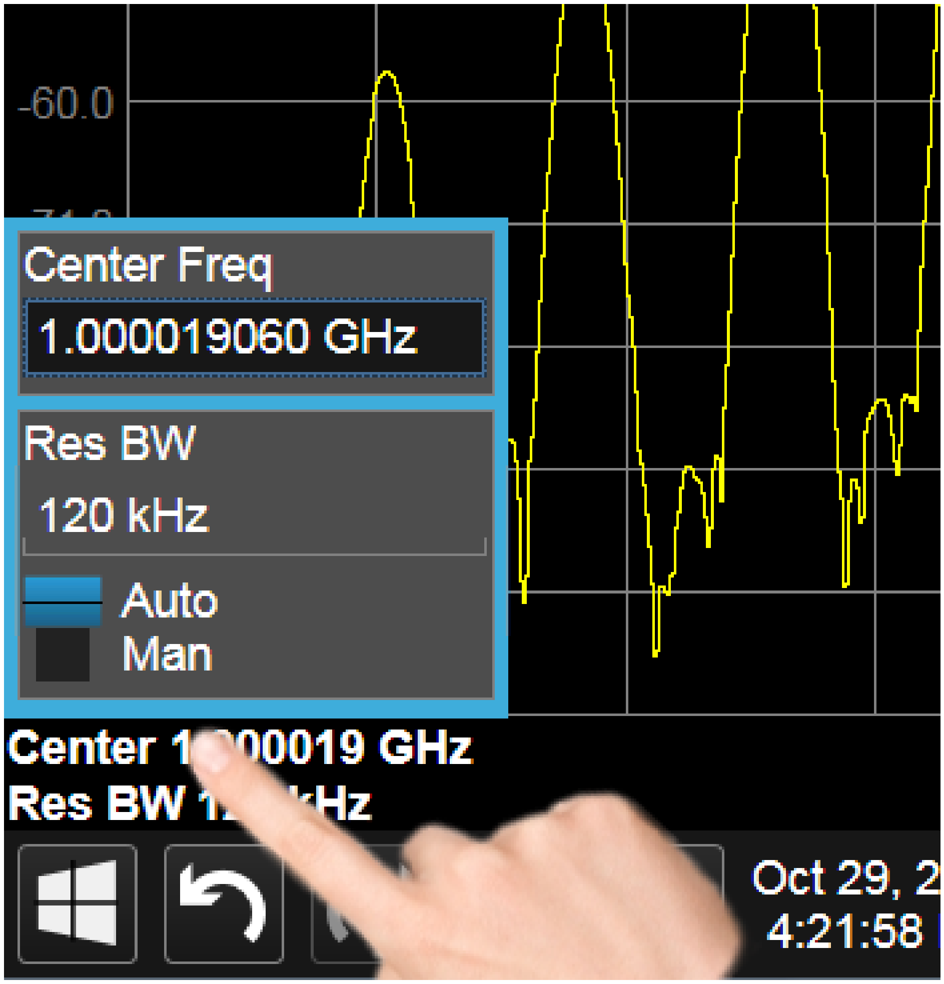
Double Tap

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

Object	Action
Window	Zoom/Unzoom

3.3.3 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.



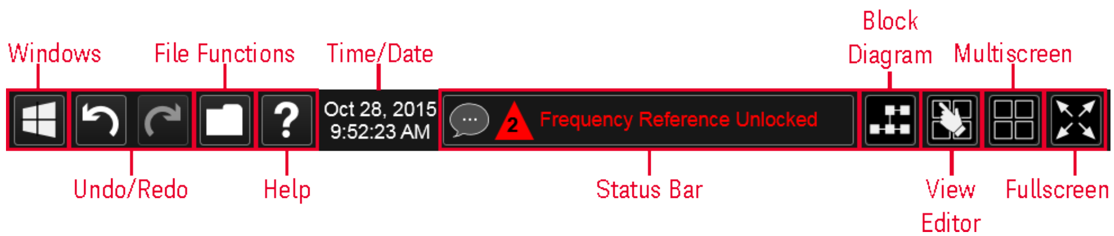
Touching anywhere off the hotspot panel or pressing any hardkey except **Save** or **Quick Save** closes the hotspot panel.

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

3.4 Control Bar

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



3.4.1 Windows

Pressing the Windows icon on the "Control Bar" on page 78 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.

3.4.2 Undo/Redo

The Undo button in the "Control Bar" on page 78,

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 78 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:

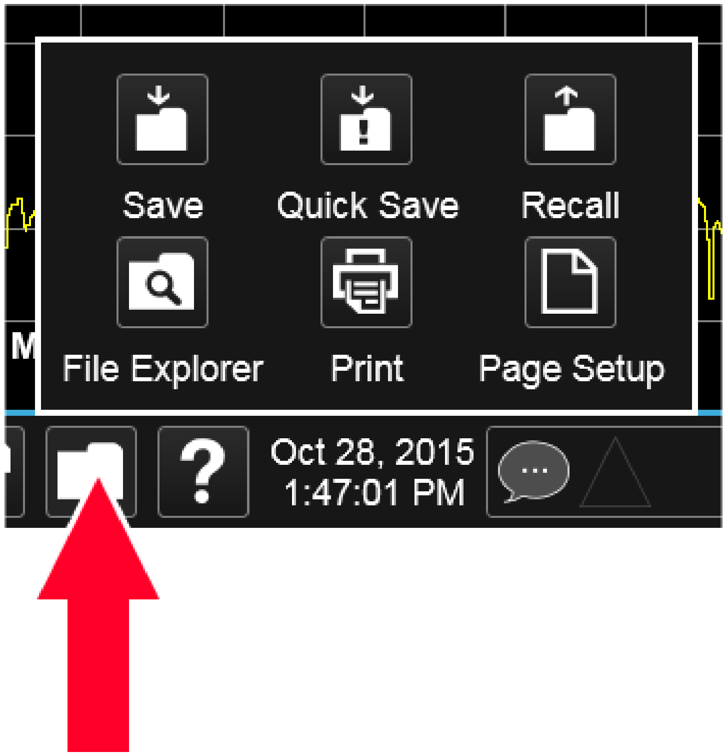
```
REDO: Center Freq 300 MHz -> 1 GHz
```

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

3.4.3 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 78.

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



Tapping this folder icon displays the File Functions popup

3.4.3.1 File Explorer

Pressing the File Explorer button in the "File Functions" on page 81 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.

3.4.4 Help

Pressing the Help button in the "Control Bar" on page 78, 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 78 and also in the banner of full-screen dialogs.

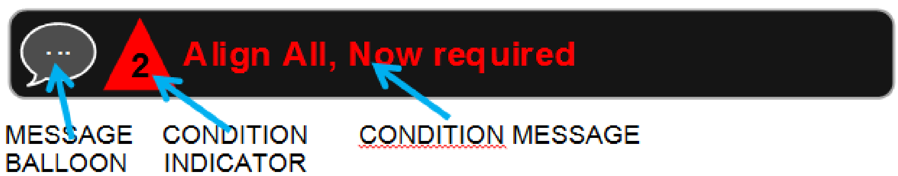
You can also use the Help window's Contents pane to navigate to Help for any function in the instrument.

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.

3.4.5 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 as shown above. Pressing the Message Balloon opens up the Show Status dialog with the Messages tab selected.

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.

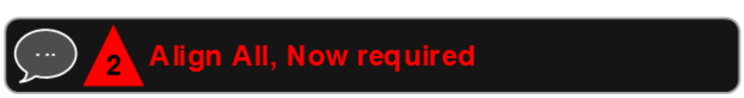
Touching the Message Balloon opens up the Show Status dialog with the History tab selected. Touching anywhere else on the Status Bar opens up the Show Status dialog with the Current Conditions tab selected.

The Condition Indicator appears to the right of the Message Balloon and shows the current number of open conditions, as below:

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

Pressing the Condition Indicator opens up the Show Status dialog with the Current Conditions tab selected.

The Condition Message appears to the right of the Condition Indicator:



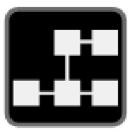
Warning condition messages display in yellow, error condition messages display in red.

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.

Pressing the Condition Message opens up the Show Status dialog with the Current Conditions tab selected.

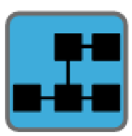
3.4.6 Block Diagram

When you press the Block Diagram button in the "Control Bar" on page 78, 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.



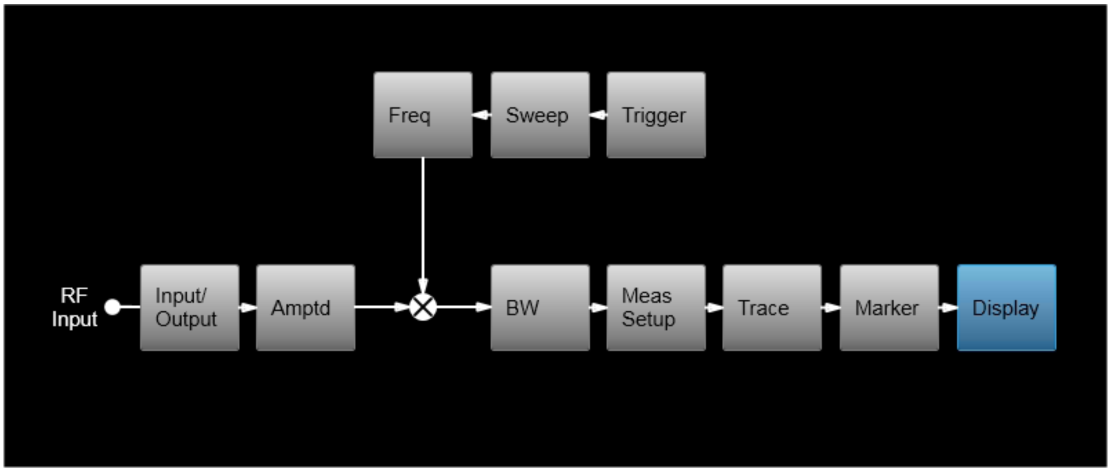
When you press the Block Diagram button, the display changes to a stylized pictorial representation of the current internal hardware setup and signal processing path. When you touch one of the blocks on the Block Diagram, the corresponding menu panel opens.

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

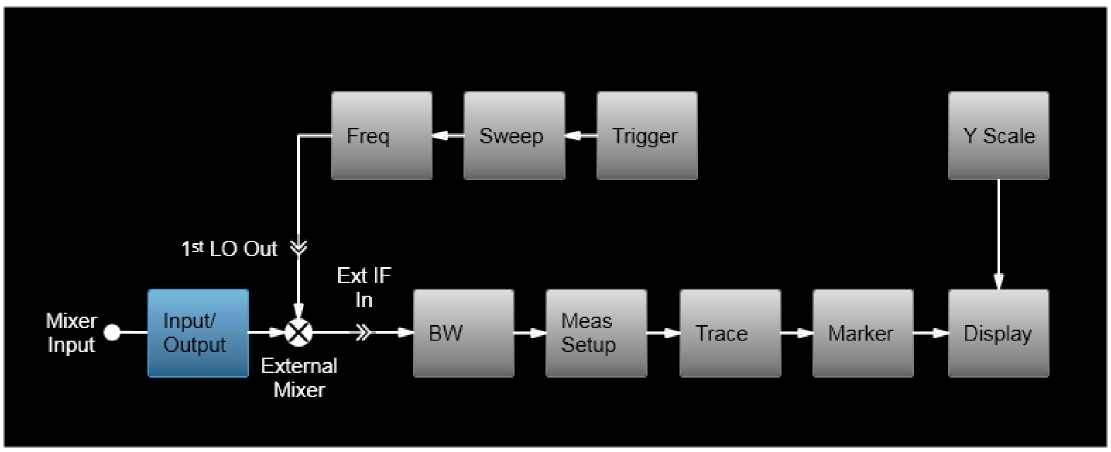


To exit the Block Diagram display, tap the button again.

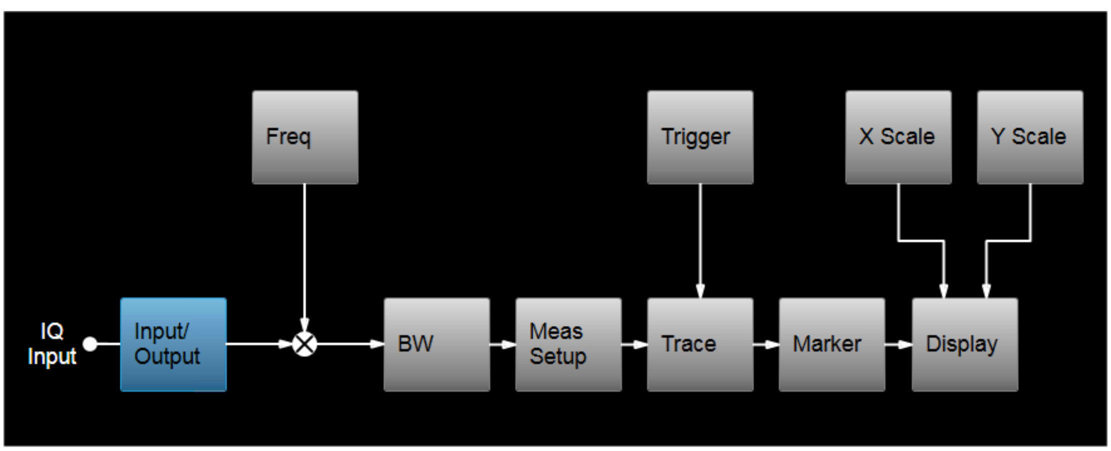
The Block Diagram display is not meant to be a completely accurate representation, but one which can show differences as you change the hardware setup. For example, here is the basic RF Block Diagram:



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



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

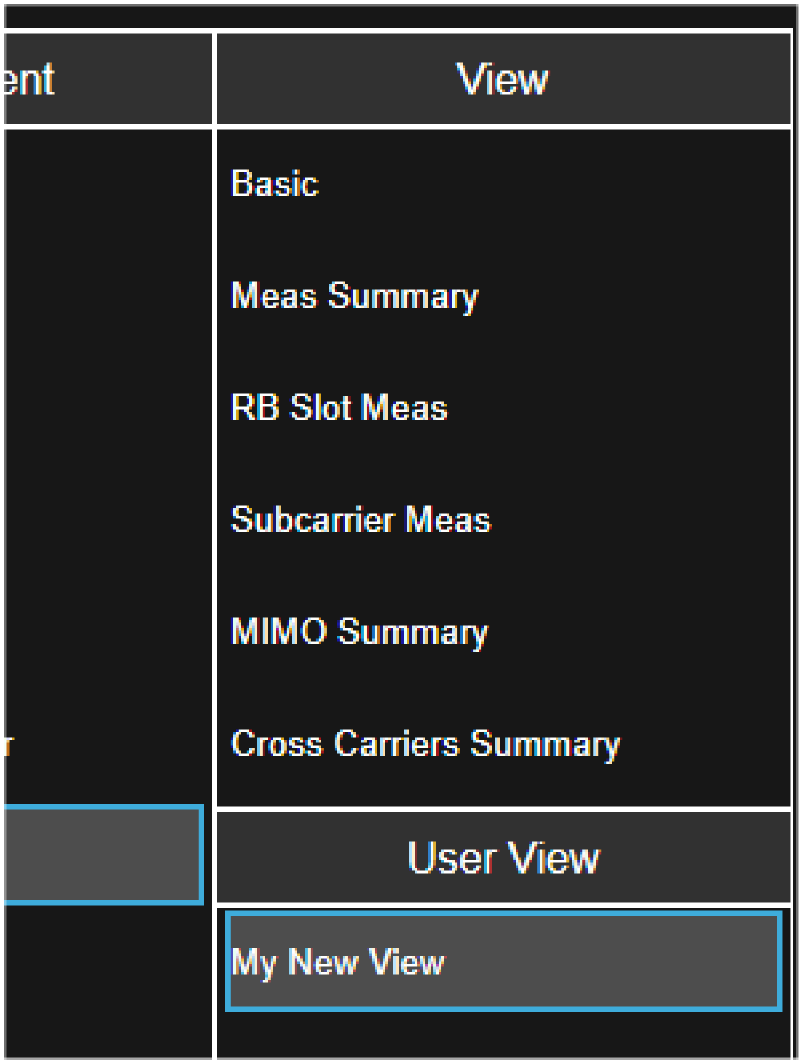


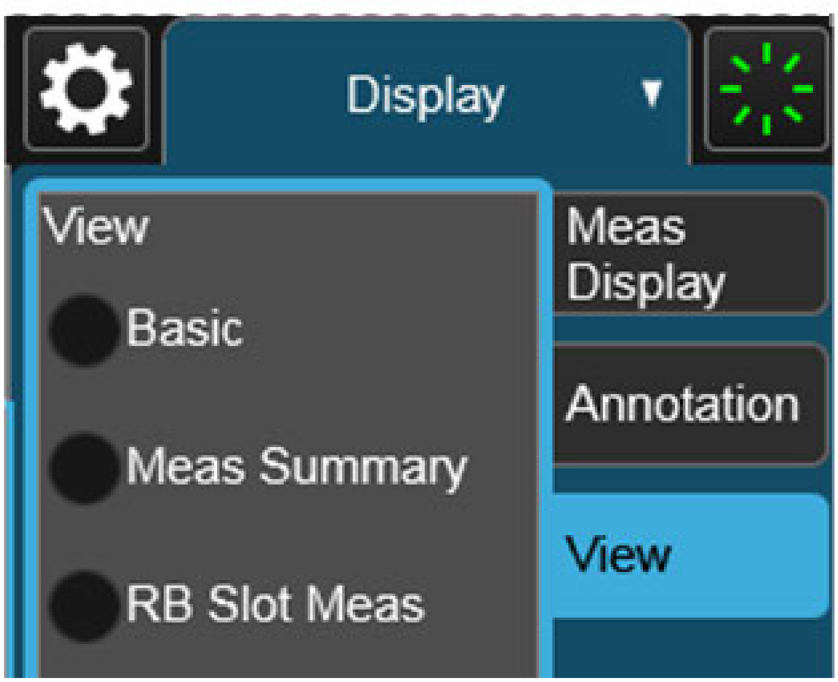
3.4.7 View Editor

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:


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

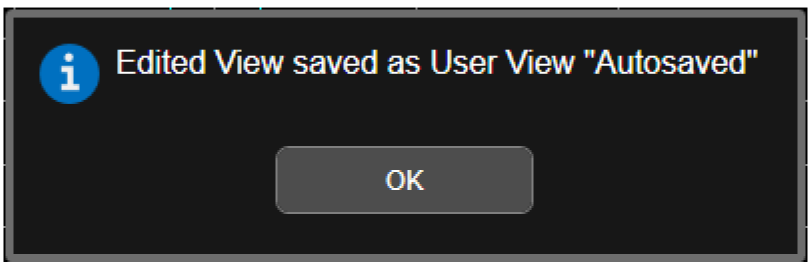

Display
View
Basic
Meas Summary
RB Slot Meas
Meas Display
Annotation
View

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 101).

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 78, 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 48) 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

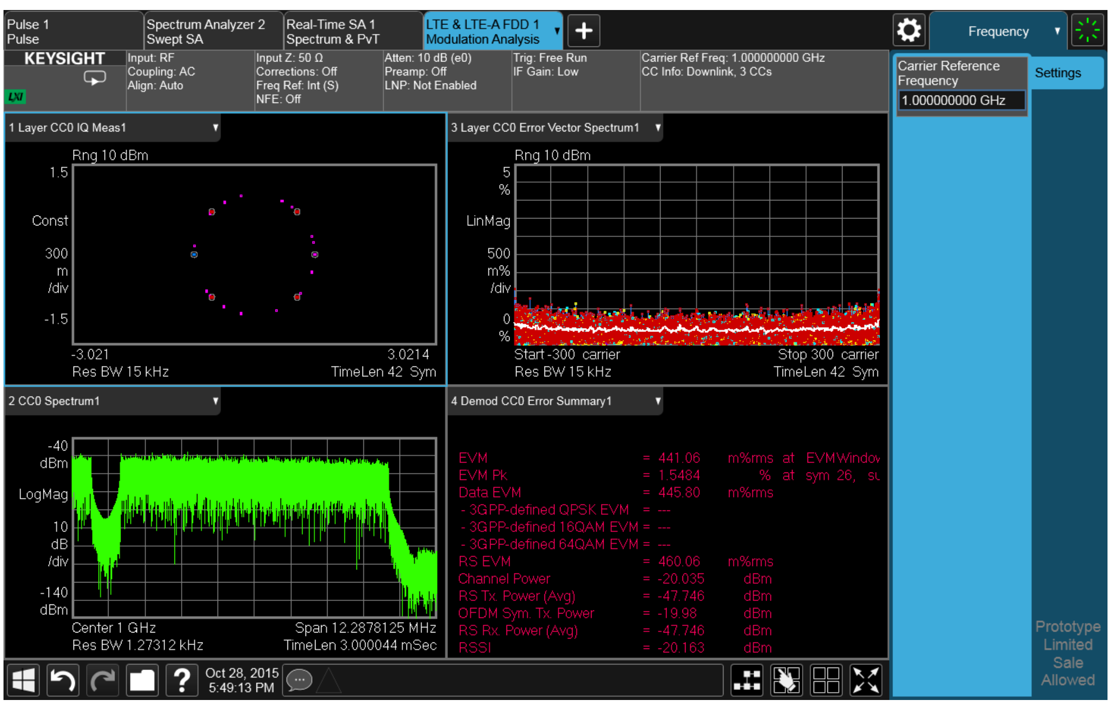
A User View is any View that is not in the list of predefined Views for the current measurement. For example, the Swept SA measurement has four predefined Views: Normal, Spectrogram, Zone Span, and Trace Zoom.

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

3.4.7.1 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.

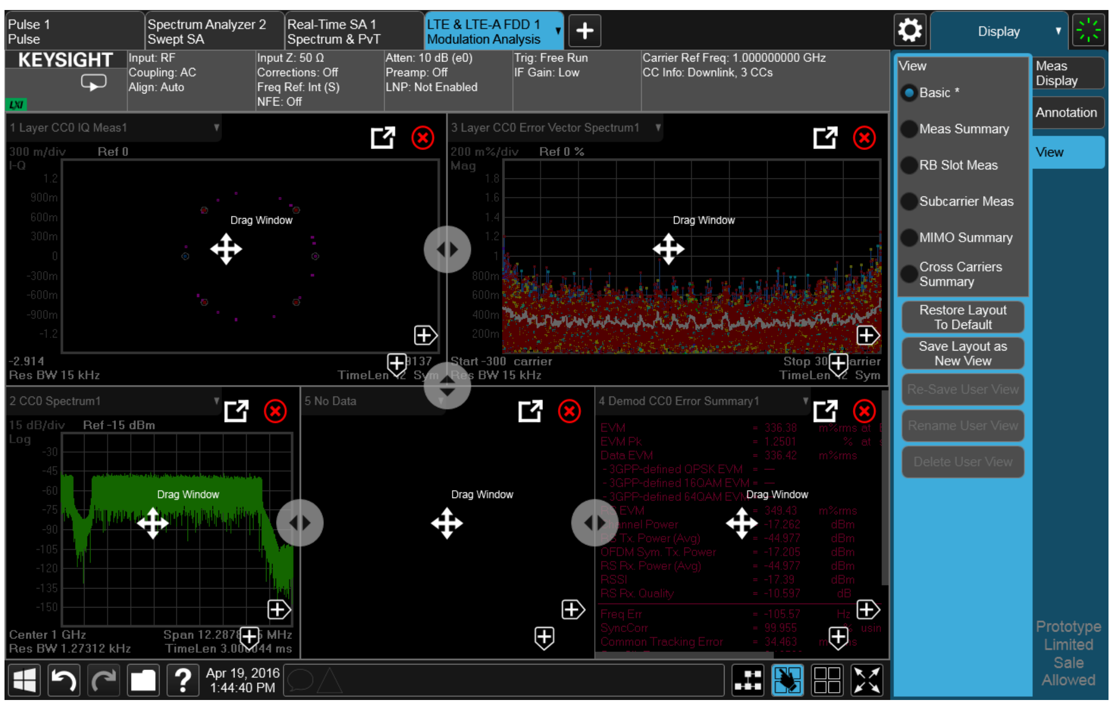
For example, to edit the View shown below, you press the Edit View icon.



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).

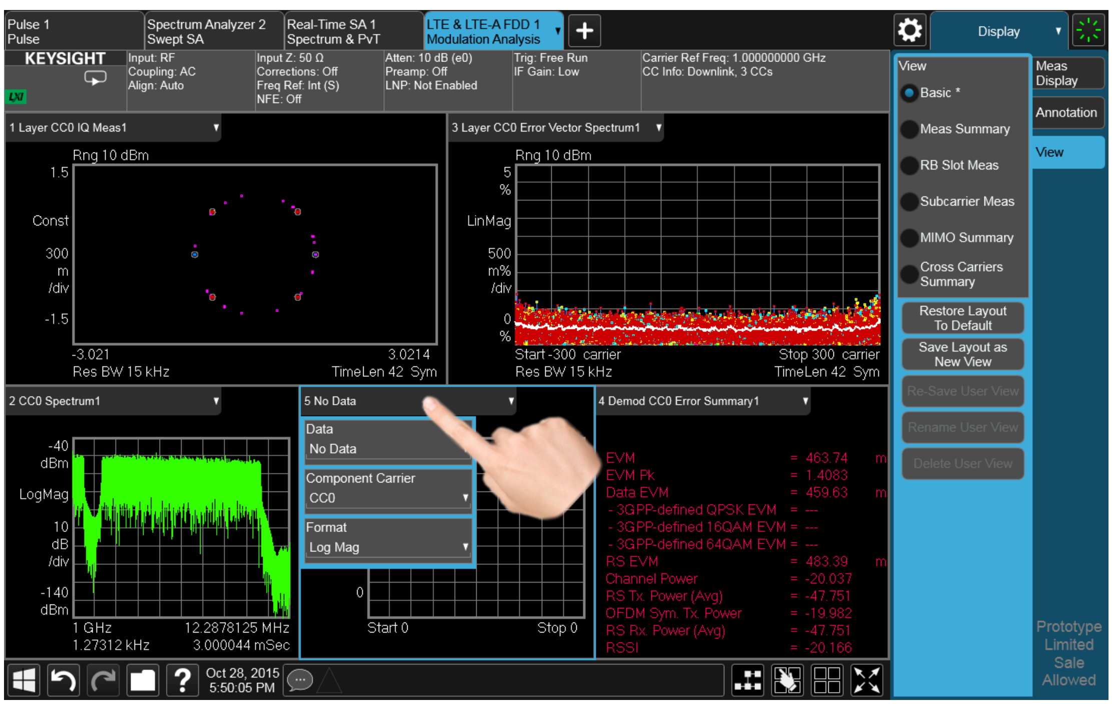
Note the * that now appears next to Basic in the View menu, indicating that you are now in the **modified** Basic View. You see the * if you add, delete or rearrange windows, but simply resizing windows does not display the *. The * means you are in a modified View, which must be saved as a User View 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.

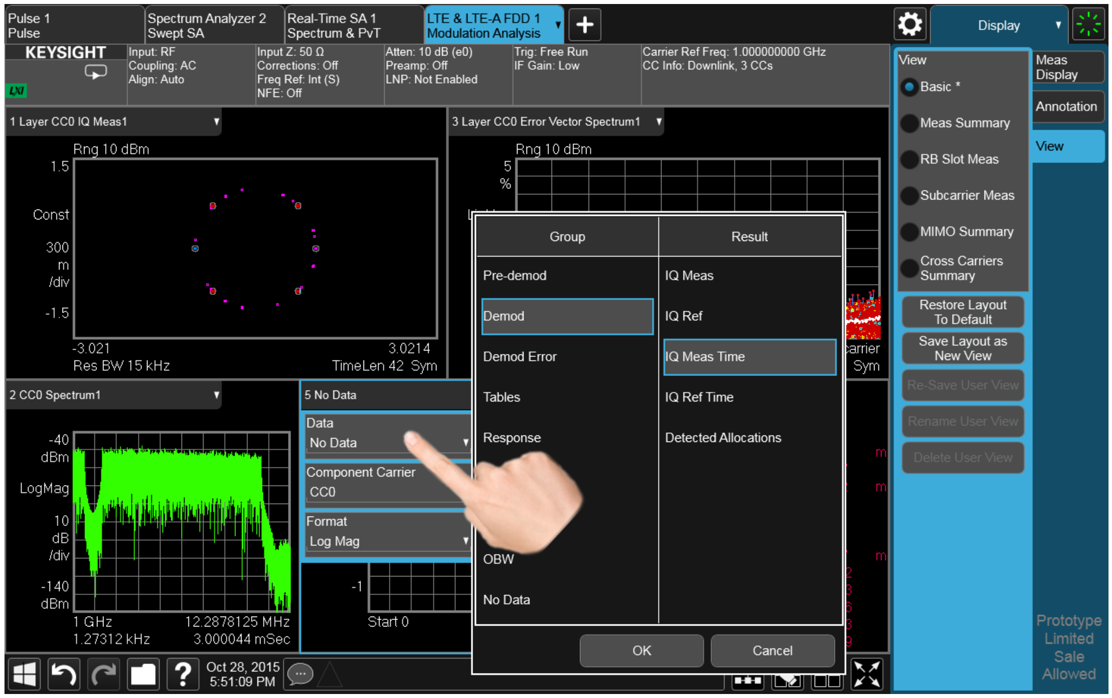
You can add more windows with the “+” arrow symbols. Note that the “+” arrow symbols only appear if the current measurement has more windows available to display. If you are already displaying all the measurement's windows, the “+” symbols disappear.

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

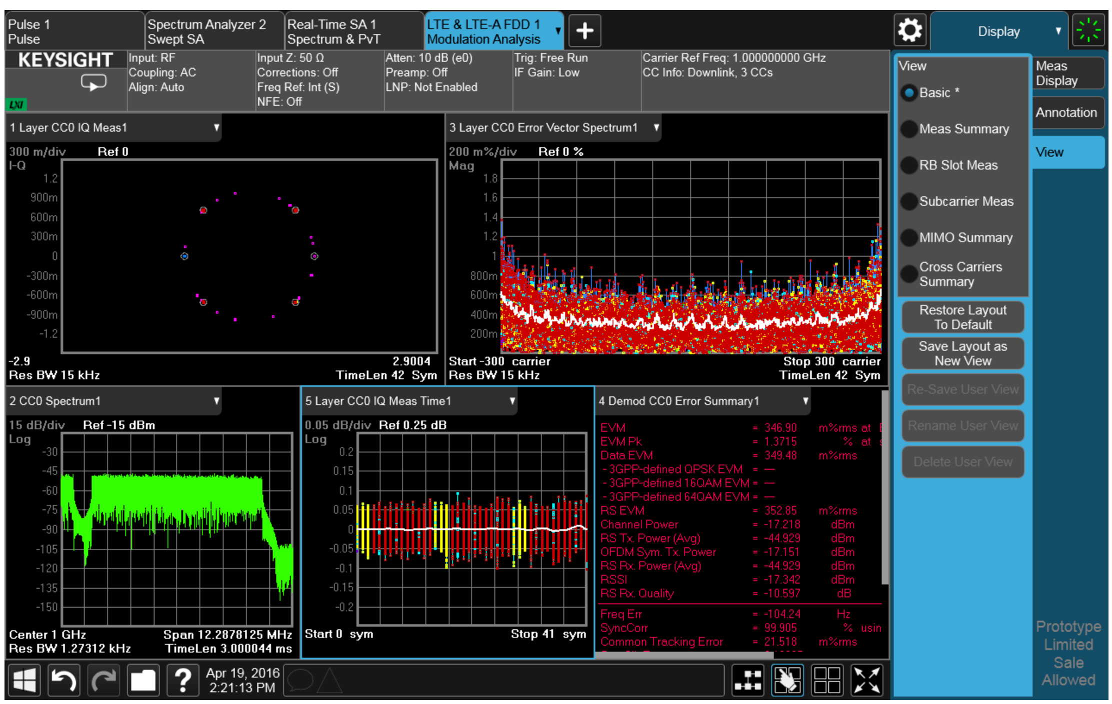
You can specify which result you want to see in the new window by tapping its title region.



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:



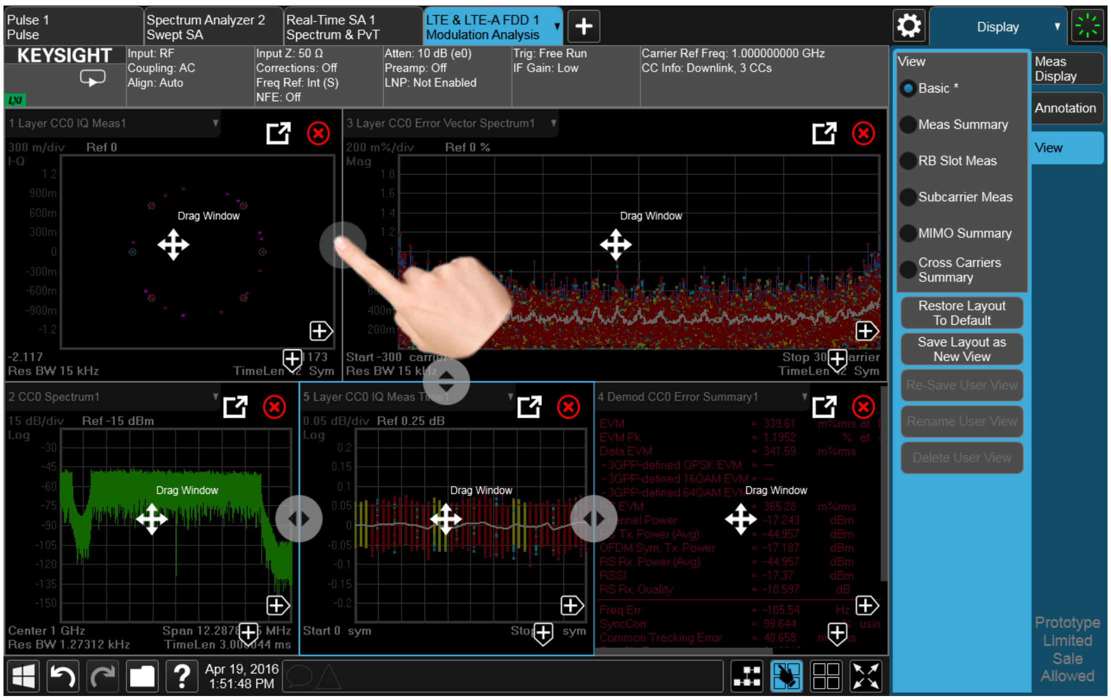
Choose the result you want and tap OK. Here we have chosen IQ Meas Time from the Demod group:



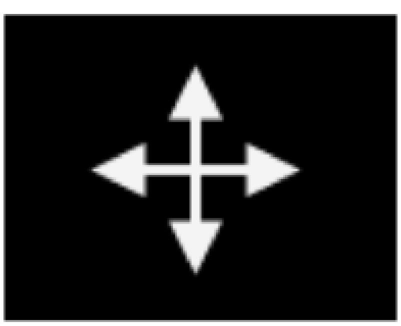
Your new, edited User View is now ready to use.

3.4.7.2 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.

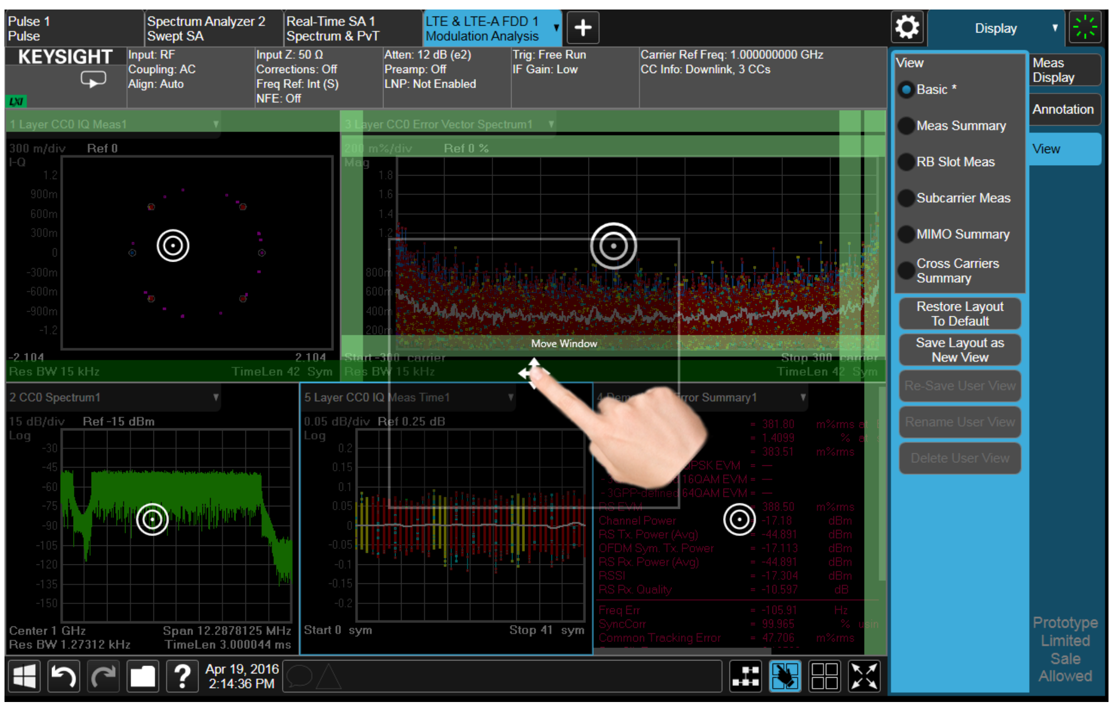


Another feature that comes with the View Editor is the ability to move windows around. You do this by dragging the four-arrow objects in the center of the window; the whole window goes along. Actually you can touch and drag anywhere in the window (except on one of the arrows or the delete circle) and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

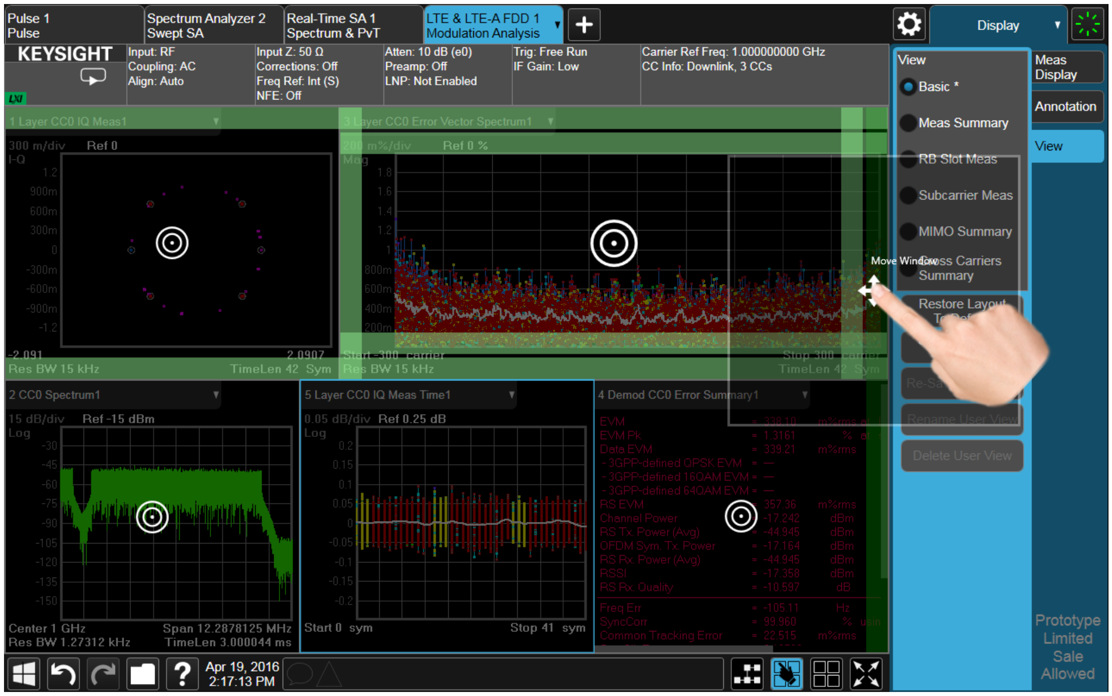


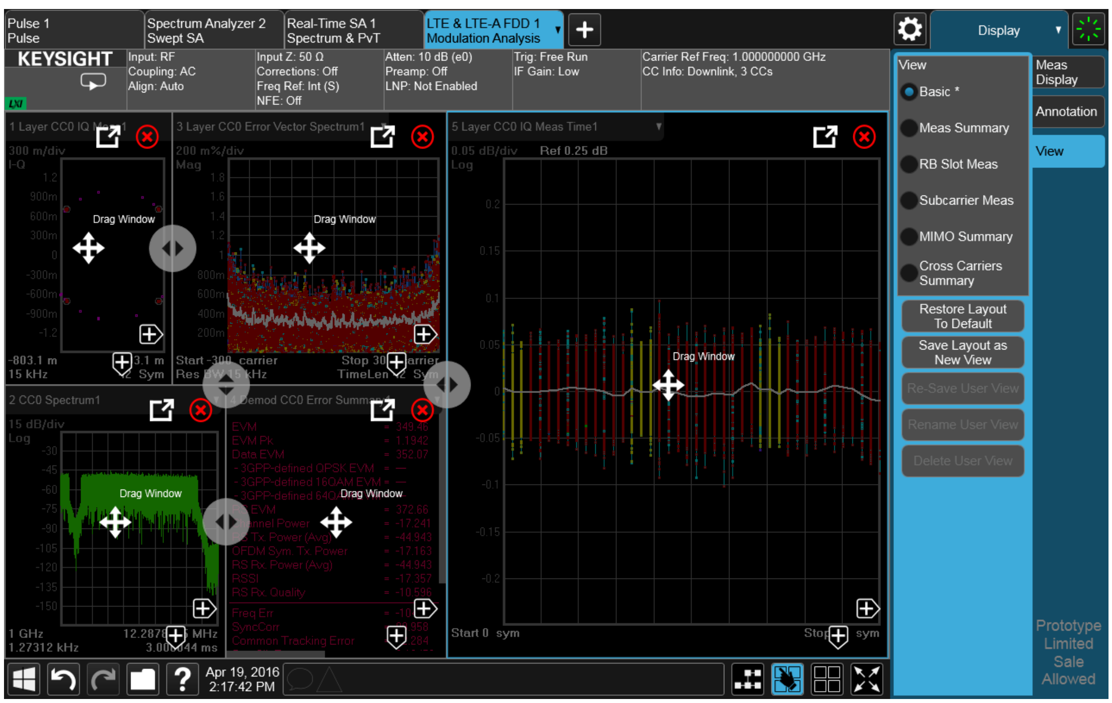
The outline of the window appears as it is being dragged. When you start to drag a window, target symbols appear in the other windows:

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.

3.4.7.3 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":

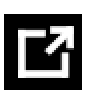
Now release the window and it will undock in place without changing size:

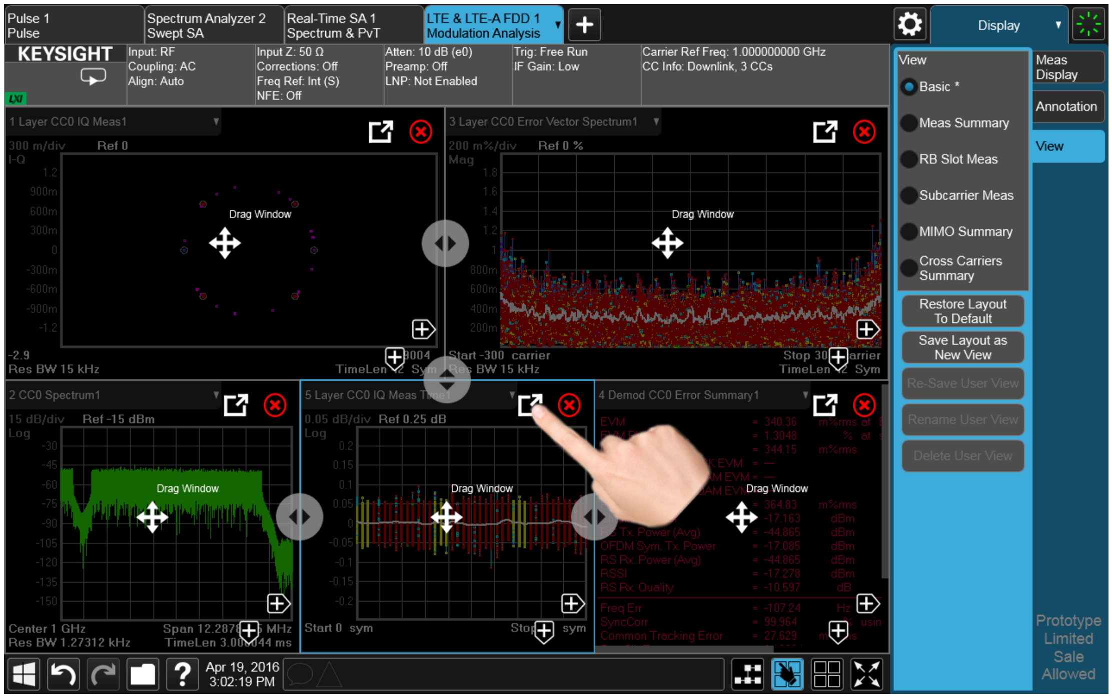
Notice that it now has a banner and a title of its own. The first line of the banner is the Mode name and the second is the Measurement name. If the window is too small, these will be shortened with an ellipsis. The window name and number themselves appear in the upper left corner of the window, as usual.

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.

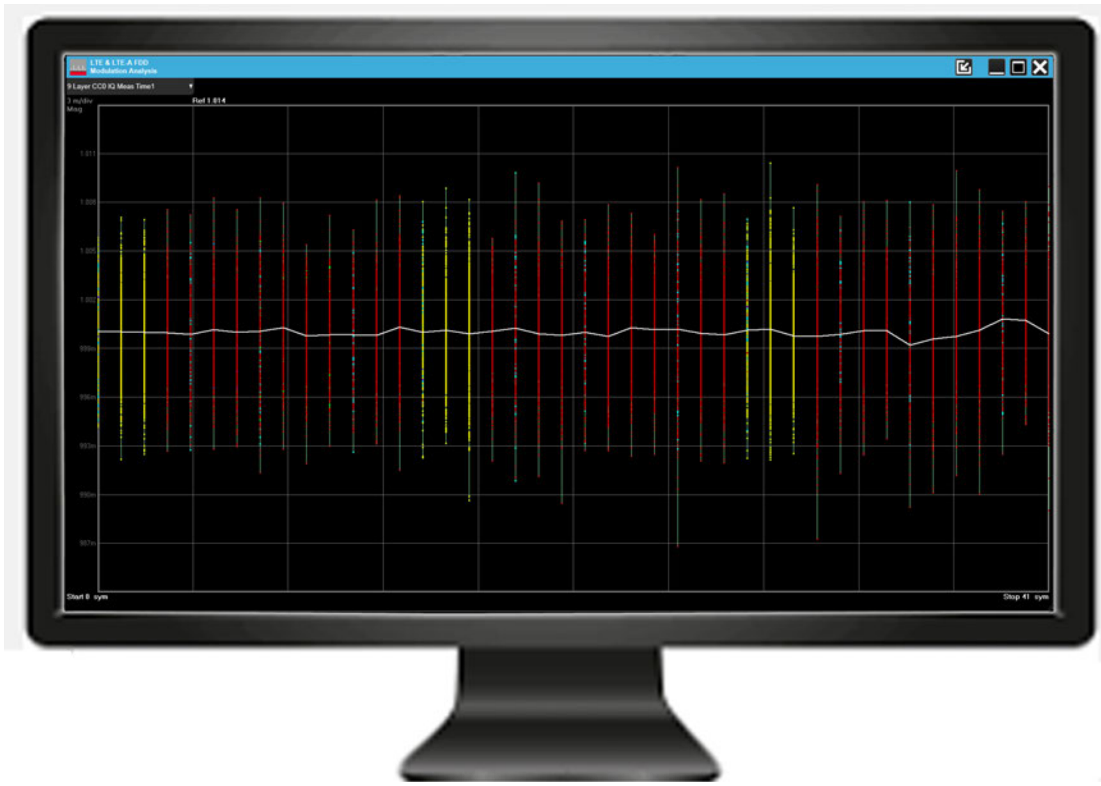
2. Tap the "undock" icon in the corner of the window:





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.

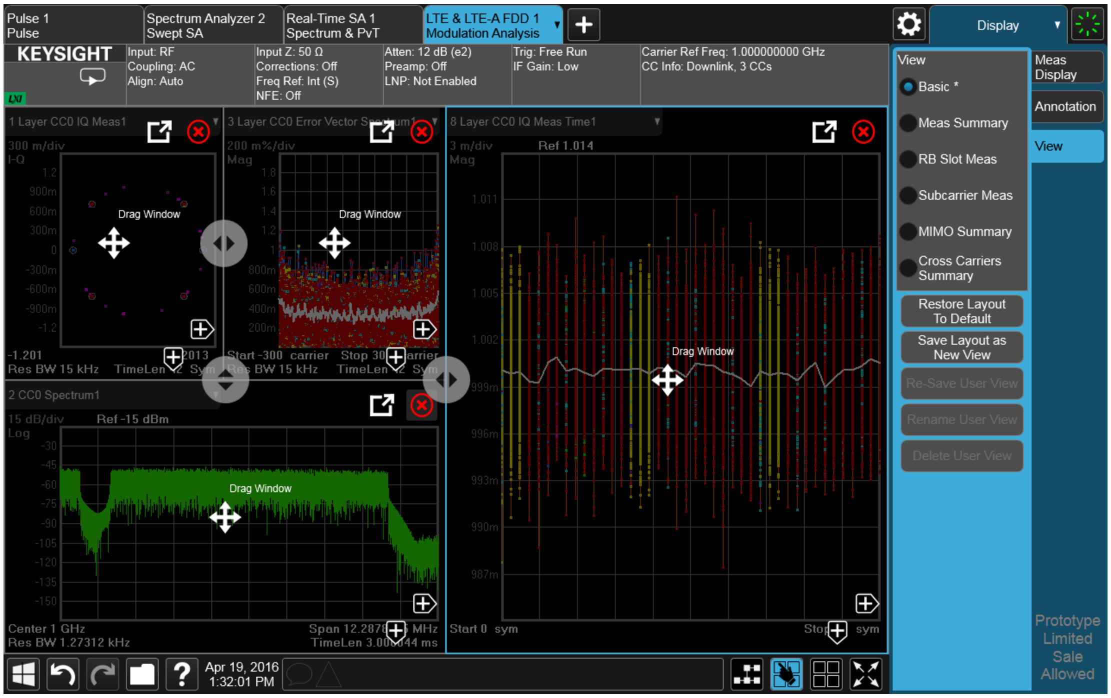
With undocked windows, when you save a Screen Image, the undocked windows are not included in the png.

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.

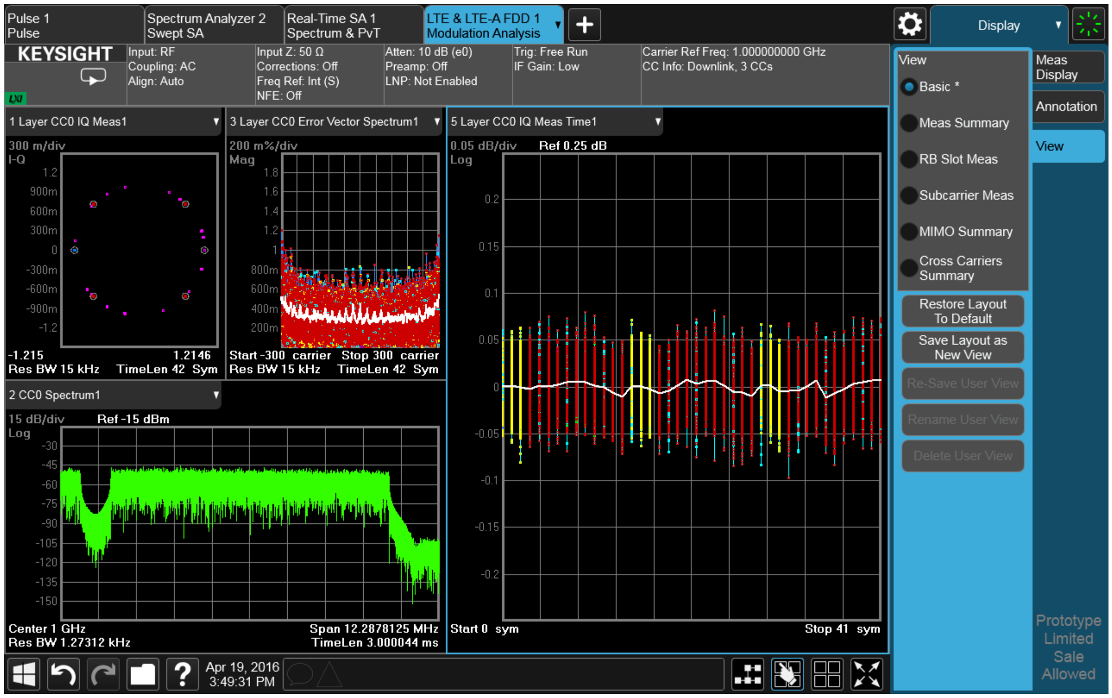
3.4.7.4 To Delete a Window from a View

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:



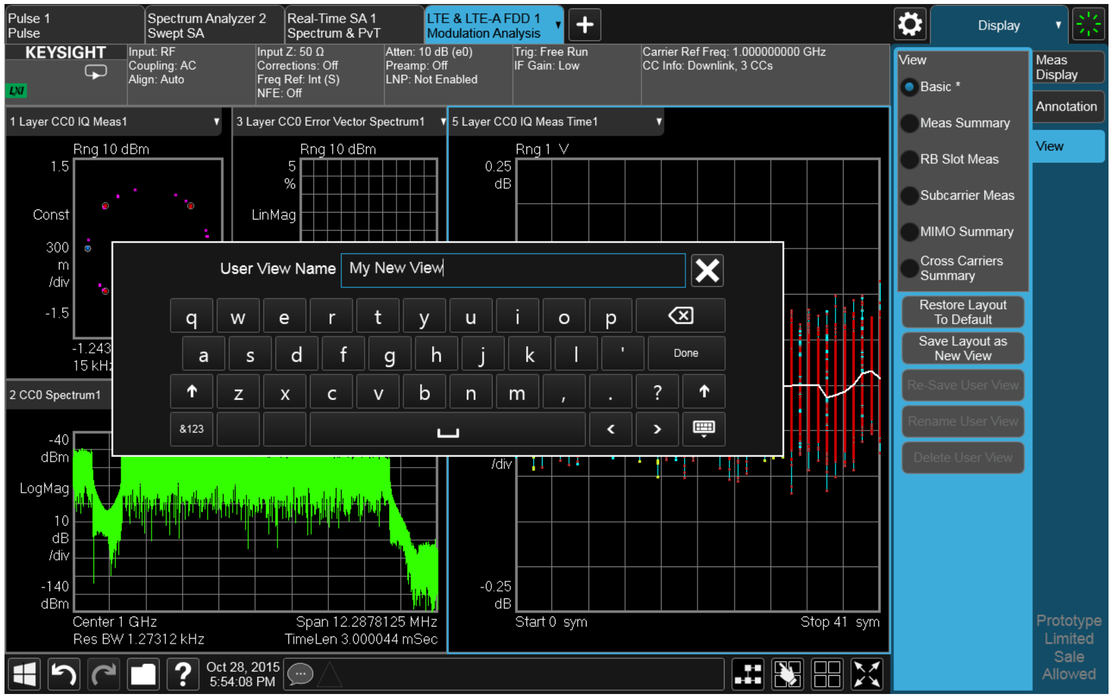
When you are finished with it, you can restore the Layout to the default for Basic by pressing “Restore Layout to Default”. Or you can save your edited View as a “User View” (if you exit the measurement without saving the edited View, the instrument will save it for you as a User View called “Autosaved”).

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.

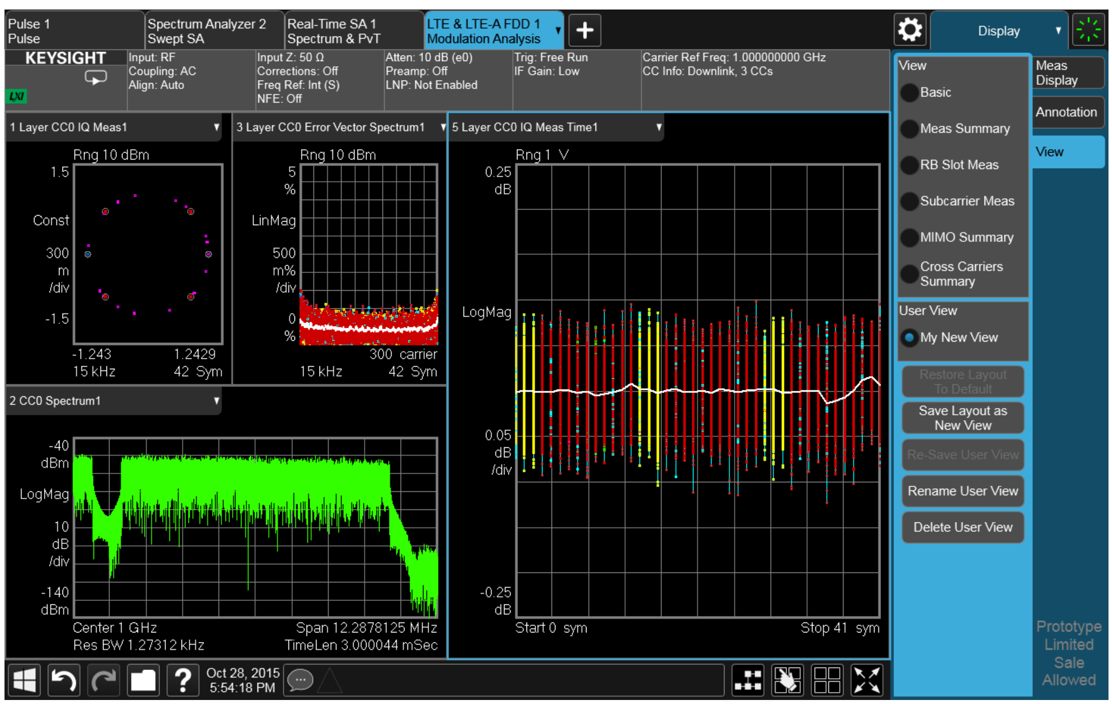
3.4.7.5 To Save a User View

See also "Transferring User Views Between Instruments" on page 103

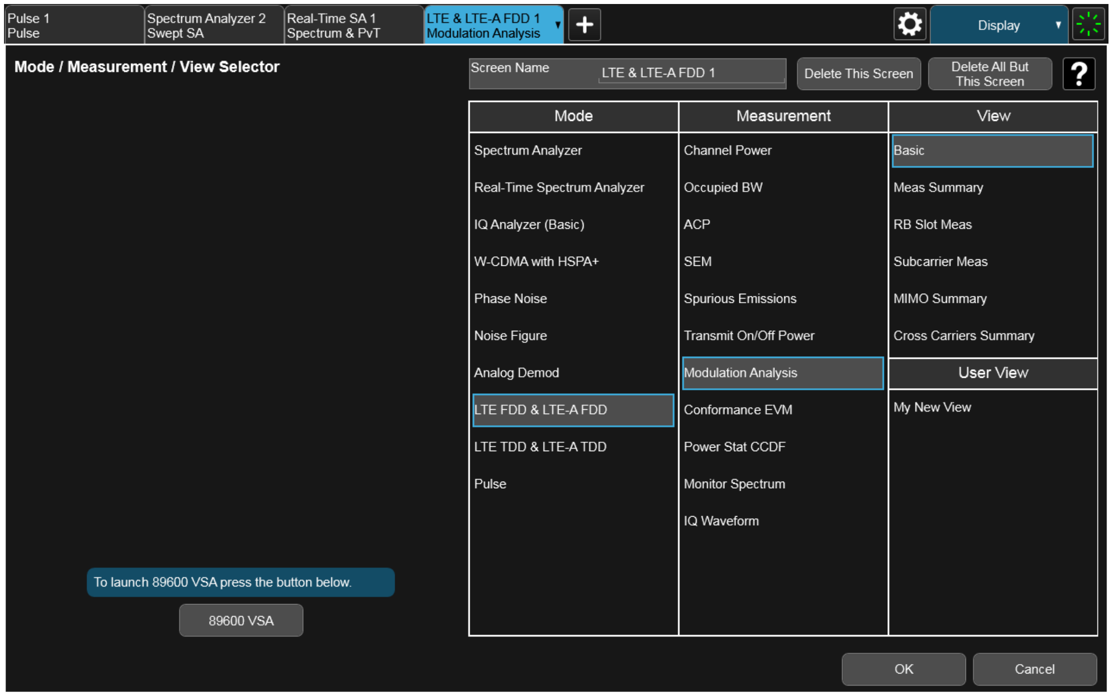
To save your new View as a User View, tap the “Save Layout as New View” control. You will get an alpha keyboard that lets you name your new View; the default is the old View name with a number. Below, we have typed in “My New View”:



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 49.

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.

3.4.7.6 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.

3.4.7.7 To Delete a User View

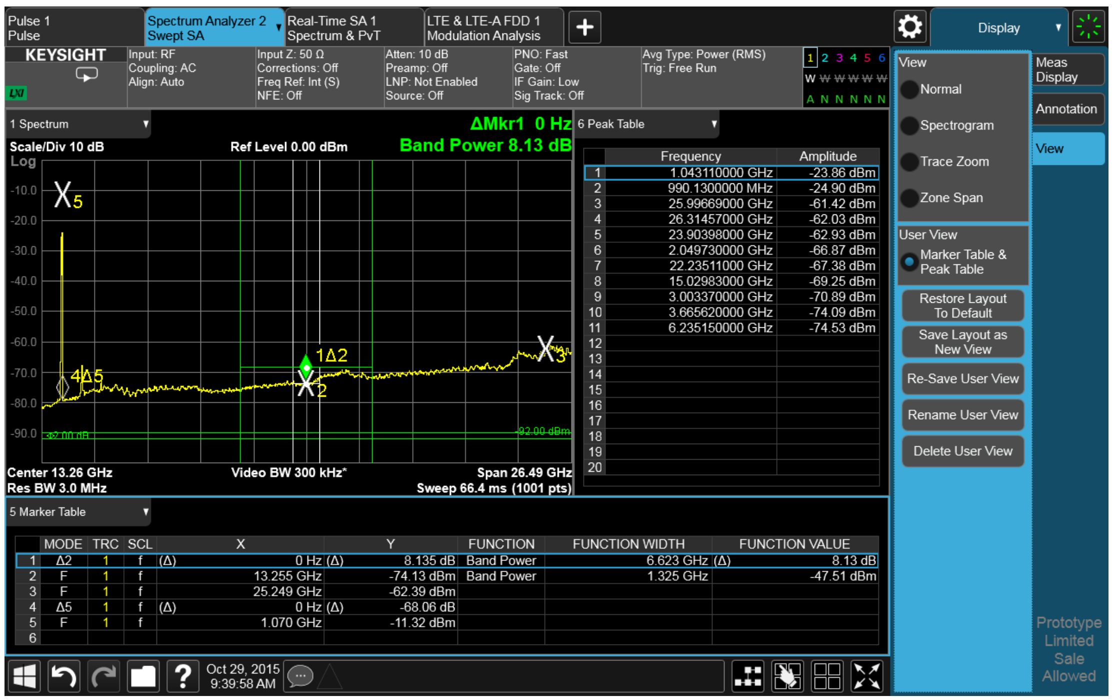
You can delete a User View by doing the following:

1. From the "Mode/Meas/View Dialog" on page 48, *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**

3.4.7.8 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

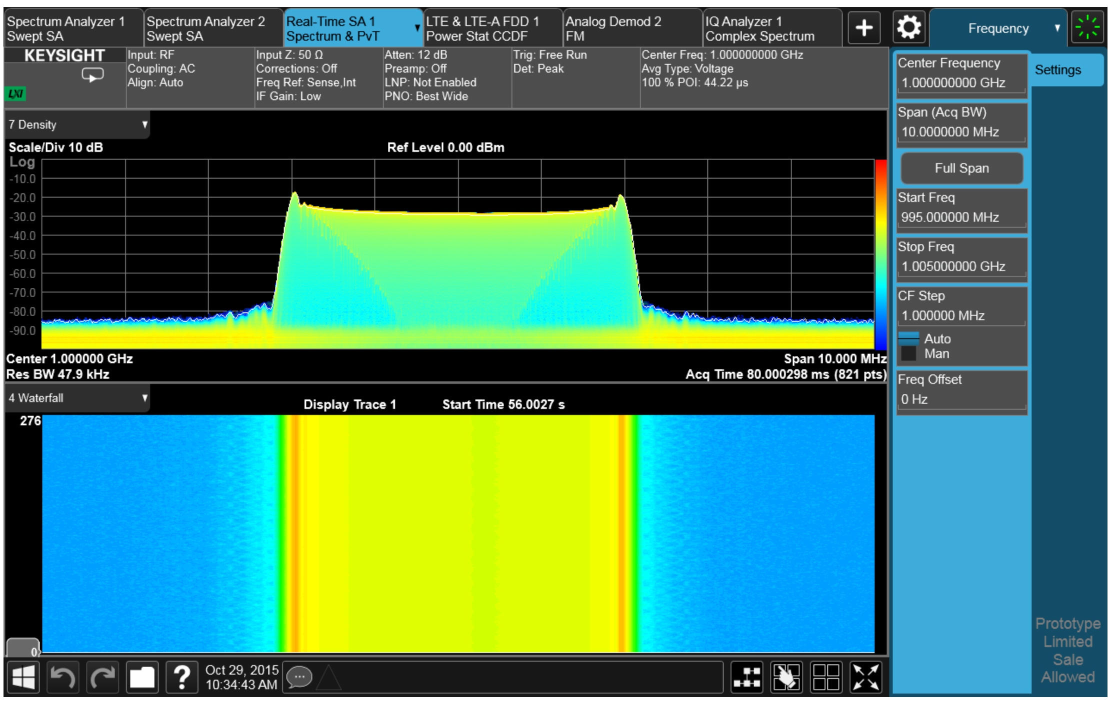
Move icons will not appear. You can still resize the windows and in some cases (e.g. Noise Figure) you can still change window contents.

3.4.7.9 View Editor Remote Commands

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

3.4.8 Multiscreen

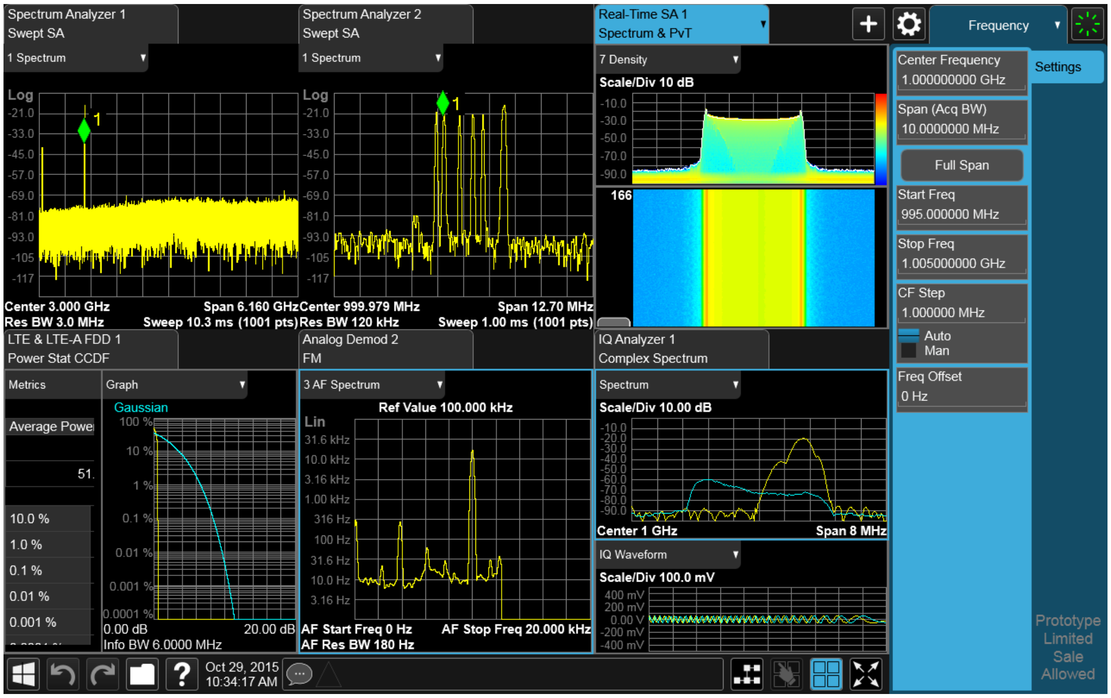
You can configure up to 16 different Screens at a time. Normally, you only see one Screen, and the set of configured screens is shown across the top of the display in a series of "Screen Tabs" on page 47. Touching any screen's tab brings it to the foreground, makes it the current Screen and starts it 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 78 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 48 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 109
- "Screen List (Remote only command)" on page 110

3.4.8.1 Select Screen

You can select a screen by touching its tab or, in "Multiscreen" on page 107 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

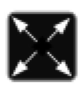
3.4.8.2 Screen List (Remote only command)

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

3.4.8.3 Fullscreen

The Fullscreen button is in the "Control Bar" on page 78, 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)

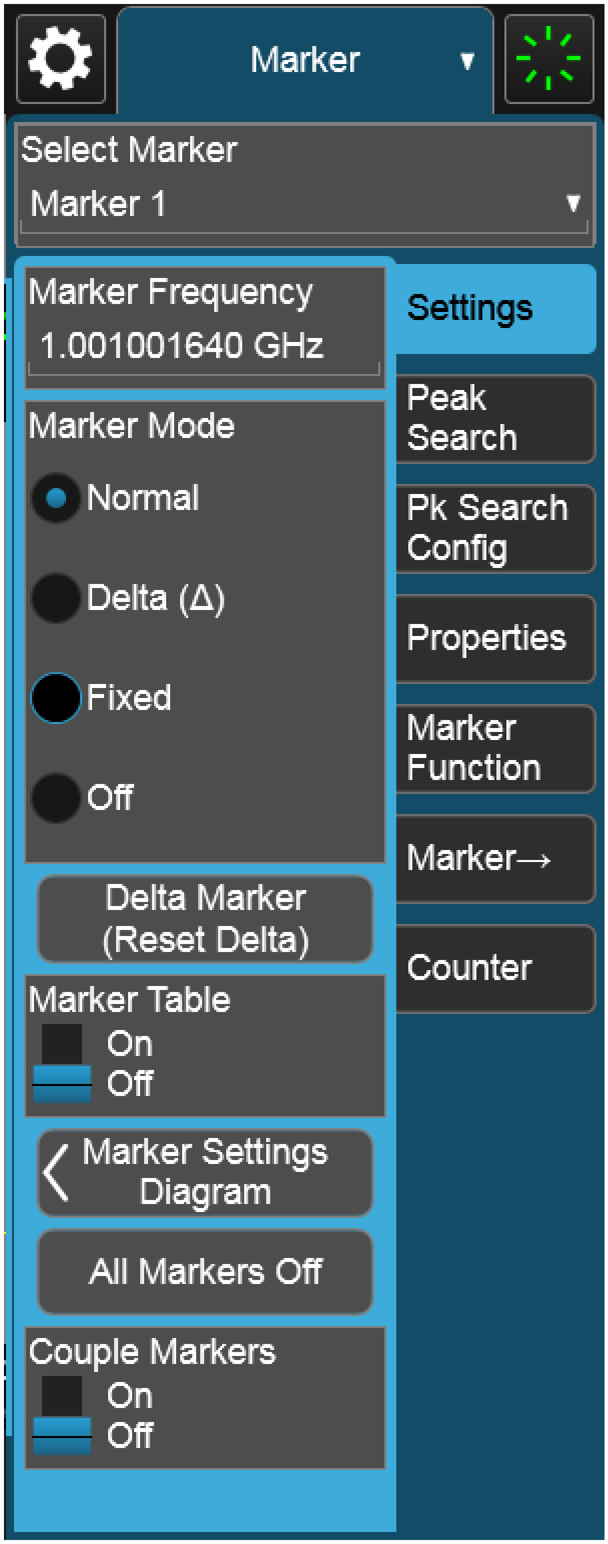
Full Screen is canceled by the **Preset** key.

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

3.5 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.

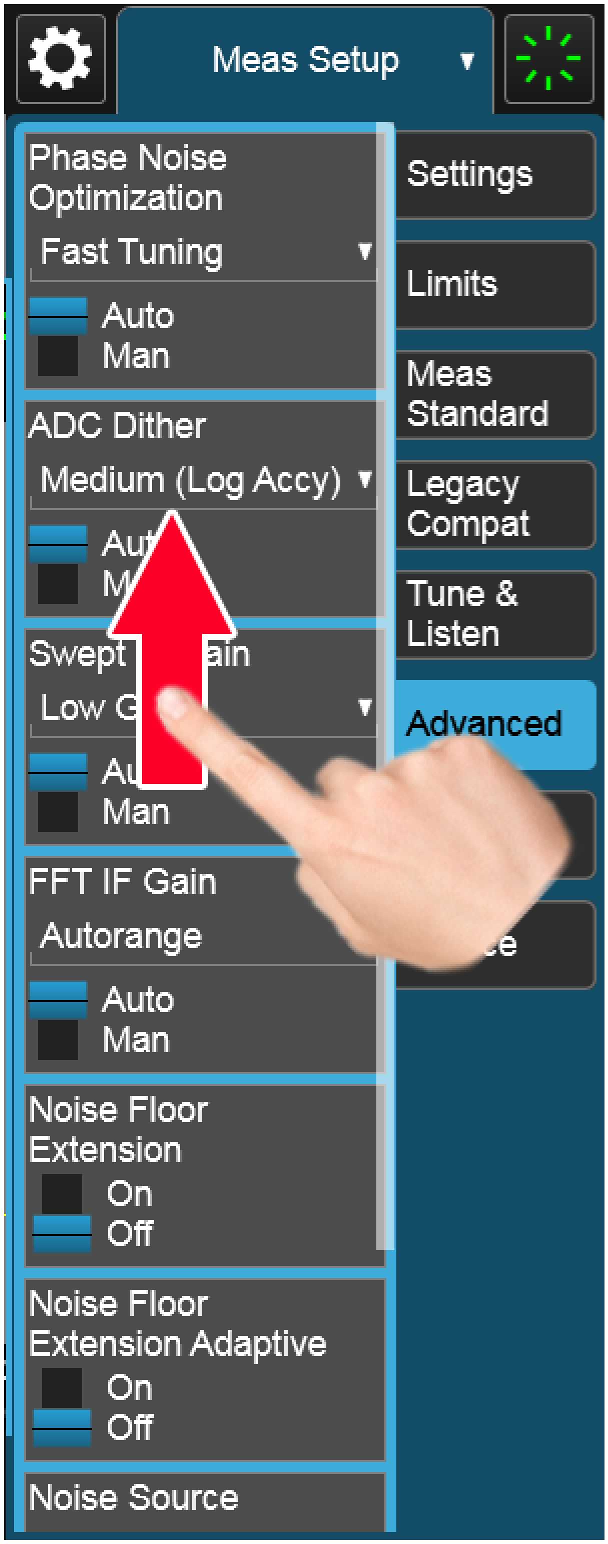


The menu panel normally appears on the right side of the display and consists of a rectangular panel with multiple "sub-panels" lying on top of each other, each sub-panel being accessed by a tab on the right.

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.

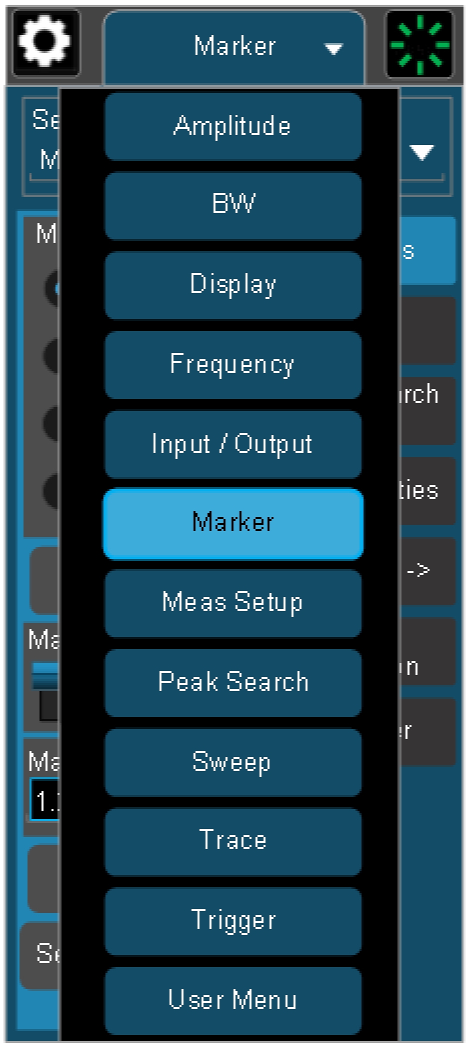
If the number of controls on a panel exceeds the height of the panel, scrolling is enabled, which is indicated by a white bar on the left that fades away after a few seconds. You swipe up or down with your finger to scroll the panel, or you can grab the white bar with a mouse.



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

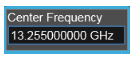
You can access the menu panels without using the front panel keys, as you would need to do if you were operating the instrument using Remote Desktop. Touch or click on the menu title, as shown below. A dropdown containing the twelve measurement hardkeys appears. Selecting a hardkey from the dropdown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

3.6 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.

3.7 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

3.8 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.

3.9 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

4 RLC Swept SA Measurement

To select RLC Mode and its only measurement (RLC Swept SA) using the instrument's front-panel interface, use the "Mode/Meas/View Dialog" on page 48.

To select RLC Mode, and its measurement, programmatically, use either of the following SCPI commands:

– `:INSTrument[:SELect] RLC`

  For more details of this command, see "Mode" on page 49

– `:INSTrument:NSELect 266`

  For more details of this command, see "Mode" on page 49

RLC Mode has only one measurement, so, when you send either of the above commands, the RLC Swept SA Measurement is automatically selected.

4.1 SCPI Support

RLC Mode supports only a limited subset of SCPI commands. The full set of supported commands is provided in "List of Supported SCPI Commands" on page 635.

The topics included in this chapter may apply to multiple instrument modes and measurements. For this reason, some topic content may include SCPI command definitions that are **not** supported by RLC Mode.

4.2 Functions in this Chapter

This chapter provides complete details of the instrument's front-panel measurement functions.

4.3 RLC Swept SA Views

The RLC Swept SA measurement has only one view ("Normal View" on page 129).

Some 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.

For details of the User View-related controls in this menu, see the descriptions under the "View Editor" on page 85.

4.3.1 Normal View

This is a single-window view of the frequency domain or zero span. It is the "classic" SA view, and is also the view into which the instrument switches whenever you do anything that causes the frequency limits to change, for example:

- If you switch inputs (for example, if you switch from the RF Input to External Mixing)
- If, while in External Mixing, you edit the Harmonic Table
- If, while in External Mixing, the Mixer Preset changes (for example, if you change from A-band to V-band etc)

For RLC Mode, this is the only available view, and it has only one window: "Spectrum Window" on page 129.

4.3.1.1 Spectrum Window

Window Number: 1

The Spectrum window displays amplitude versus frequency information (or, in Zero Span, amplitude versus time).

The Spectrum window always displays and cannot be deleted.

4.4 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.

4.4.1 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.

4.4.1.1 Reference Level

Specifies the amplitude represented by the topmost graticule line.

In Swept SA, changing the reference level does not restart a measurement, because it is a display function only. Instead it vertically ‘pans’ all displayed traces and markers to the new value. If a change to the reference level changes the attenuation value (e.g. through an auto coupling), then the measurement will be restarted.

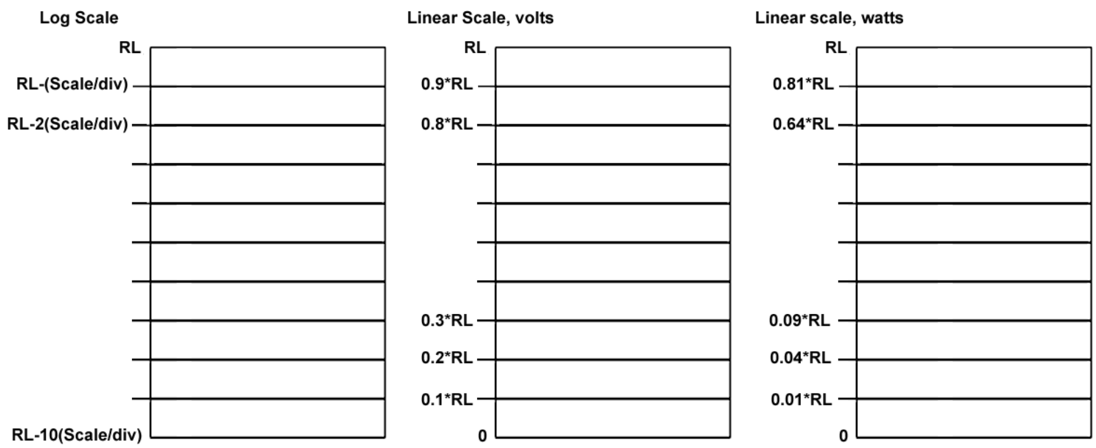
See "Amplitude Representations" on page 131

Remote Command	Not available in RLC Mode
Couplings	If you reduce the attenuation, the instrument may have to lower the reference level to keep it below its allowed maximum. This allowed maximum level is specified in the “Max” row, below, along with other variables that affect it When you increase attenuation, the reference level does not change Note that there is *no* coupling in N9042B
Preset	0 dBm
State Saved	Saved in instrument state
Min/Max	The minimum Ref Level is -170 dBm + RefLevelOffset - ExtGain The maximum Ref Level is typically: N9042B: +250, Note this value does not change EXA (except N9010N), CXA and CXA-m: +23 dBm + RL Offset – External Gain VXT models M9420A/21A: +33 dBm + RL Offset – External Gain VXT models M9410A/11A: +30 dBm + RL Offset – External Gain M8920A:

	Ant Port: +30 dBm + RL Offset – External Gain T/R Port: Low Power Mode: +33 dBm + RL Offset – External Gain High Power Mode: +47 dBm + RL Offset – External Gain All other models: +30 dBm + RL Offset – External Gain The maximum may be further limited by the current value of other parameters, including Mech Atten, Int Preamp Gain, Swept IF Gain, FFT IF Gain, Max Mixer Level, and the total attenuation currently available. This maximum value is determined by the maximum power that can be safely applied to the input circuitry Note that the maximum reference level is unaffected by the input choice of external mixing
Annotation	The reference level is displayed above and to the left of the graticule with the title "Ref"

Amplitude Representations

The following is an illustration of the reference level and Y Axis scales under various conditions:



4.4.1.2 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.

In measurements that support both Log and Lin scales, this function is only available when Display Scale (Log) is selected and the vertical scale is power. When Display Scale (Lin) is selected, Scale/Div is grayed-out.

Remote Command	Not available in RLC Mode
Dependencies	In measurements that support both Log and Lin scales, Scale/Div is grayed out in linear Y scale. Sending the equivalent SCPI command does change the Scale/Div, though it has no affect while in Lin
Preset	10.00 dB / Div
State Saved	Saved in instrument state
Min	0.10 dB
Max	20 dB
Annotation	All measurements unless noted: <value> dB/ left upper of graph In log scale, the Scale/Div is shown in the upper left side of the display. In Lin mode, no annotation is displayed

4.4.1.3 Display Scale

Chooses a linear or logarithmic vertical scale for the display and for remote data readout.

When Display Scale (Log) is selected, the vertical graticule divisions are scaled in logarithmic units. The top line of the graticule is the Reference Level and the Scale/Div value is used to assign values to the other locations on the graticule.

When Display Scale (Lin) is selected, the vertical graticule divisions are linearly scaled with the reference level value at the top of the display and zero volts at the bottom. Each vertical division of the graticule represents one-tenth of the Reference Level.

NOTE **The Y Axis Unit used for each type of display is set by pressing Y Axis Unit. The instrument remembers separate Y Axis Unit settings for both Log and Lin.**

Remote Command	Not available in RLC Mode
Dependencies	If Normalize is ON, Display Scale is forced to Log and is grayed-out
Couplings	Changing the Display Scale always sets the Y Axis unit to the last unit specified for the current amplitude scale
Preset	LOG
State Saved	Saved in instrument state
Annotation	Log or Lin appears to the left of the graticule below the reference level

4.4.1.4 Y Axis Unit

Displays a dropdown menu that enables you to change the vertical (Y) axis amplitude unit.

For measurements that support both Log and Lin scales, the instrument retains the entered Y Axis Unit separately for both Log and Lin amplitude Display Scales. For example, if Display Scale has been set to Log, and you set Y Axis Unit to dBm, pressing Display Scale (Log) sets the Y Axis Unit to dBm. If Display Scale has been set to Lin and you set Y Axis Unit to V, pressing Display Scale (Lin) sets the Y Axis Unit to V. Pressing Display Scale (Log) again sets the Y axis unit back to dBm.

NOTE **If a Transducer Unit is set you will see it displayed as Xducer Unit in the Y Axis Unit dropdown. However, you can only change the Transducer Unit by going to the Input/Output, Corrections, Edit Correction dialog and tapping Settings and Transducer Unit. You can also turn it off there, by selecting None. See "Y Axis Unit" on page 132.**

Remote Command	Not available in RLC Mode
Notes	The Y axis unit has either logarithmic or linear characteristics. The set of units that is logarithmic consists of dBm, dBmV, dBmA, dBmV, dBmA, dBmV/m, dBmA/m, dBpT, and dBG. The set of units that are linear consists of V, W, and A. The chosen unit will determine how the reference level and all the amplitude-related outputs like trace data, marker data, etc. read out
Dependencies	If an amplitude correction with a Transducer Unit other than **None** is applied and enabled, then the Transducer Unit selection is forced and is the only Y Axis Unit available. The specific Transducer Unit is shown in square brackets in the dropdown. All other Y Axis Unit choices are grayed out. See "Y Axis Unit" on page 132 If an amplitude correction with a Transducer Unit other than **None** is applied and enabled, and you then turn off that correction or set **Apply Corrections** to **No**, the Y Axis Unit that existed before the Transducer Unit was applied is restored When Normalize is On (in the Trace, Normalize menu) Y-Axis Unit is grayed out and forced to dBm
Couplings	The instrument retains the entered Y Axis Unit separately for both Log and Lin amplitude Display Scales
Preset	dBm for log scale, V for linear. The true 'preset' value is dBm, since at preset the Y Display Scale is set to logarithmic
State Saved	Saved in instrument state
Annotation	The Y Axis Unit is shown after the Ref Level value at the top of the graticule

4.4.1.5 Reference Level Offset

Adds an offset value to the displayed reference level. The reference level is the absolute amplitude represented by the top graticule line on the display.

The on/off switch turns the Ref Level Offset on and off. Setting a value for Ref Level Offset turns Ref Level Offset ON.

See "More Information" on page 134

Remote Command	Not available in RLC Mode
Preset	0 dBm OFF

State Saved	Saved in instrument state
Min	The range for Ref Lvl Offset is variable. It is limited to values that keep the reference level within the range of -327.6 dB to 327.6 dB
Max	327.6 dB
Annotation	The offset is displayed as “Ref Offset <value>” to the right of the reference level annotation if nonzero. When the offset is zero, no annotation is shown

More Information

Offsets are used when gain or loss occurs between a device under test and the instrument input. Thus, the signal level measured by the instrument may be thought of as the level at the input of an external amplitude conversion device. Entering an offset does not affect the trace position or attenuation value, just the value of the top line of the display and 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, and so forth, are all affected by Ref Level Offset.

NOTE **Changing the offset causes the instrument to immediately stop the current sweep and prepare to begin a new sweep, but 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 Ref Level Offset, the exported data will contain the trace data with the offset applied.**

The maximum reference level available is dependent on the reference level offset. That is, Ref Level - Ref Level Offset must be in the range –170 to +30 dBm. For example, the reference level value range can be initially set to values from –170 dBm to 30 dBm with no reference level offset. If the reference level is first set to –20 dBm, then the reference level offset can be set to values of –150 to +50 dB.

If the reference level offset is first set to –30 dB, then the reference level can be set to values of –200 dBm to 0 dBm. In this case, the reference level is “clamped” at 0 dBm because the maximum limit of +30 dBm is reached with a reference level setting of 0 dBm with an offset of –30 dB. If instead, the reference level offset is first set to 30 dB, then the reference level can be set to values of –140 to +60 dBm.

4.4.1.6 Number of Divisions

Sets the number of divisions vertically in the graticule. For example, set this to 12 to allow 120 dB of dynamic range with a scale of 10 dB/division.

Remote Command	Not available in RLC Mode
Preset	10
State Saved	Saved in instrument state

4.4.2 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 135

– See "Single-Attenuator Configuration" on page 136

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

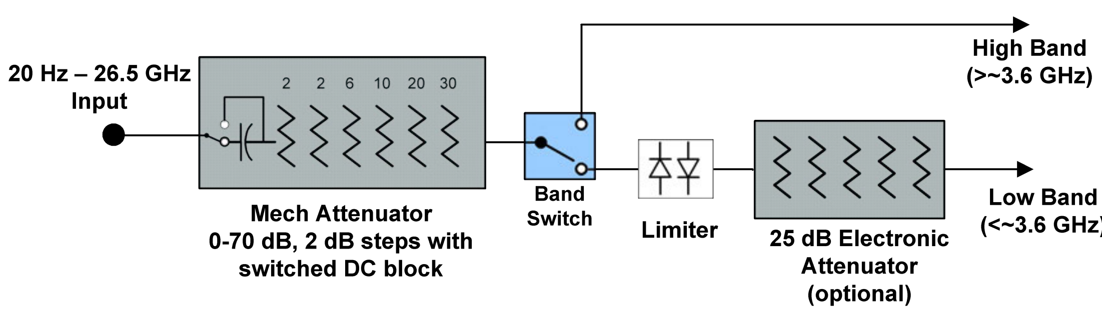
– M9393A

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.

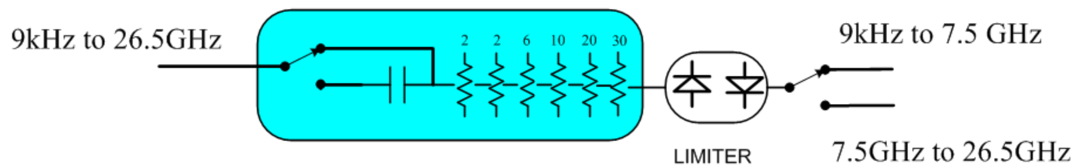
Dependencies	In measurements that support the I/Q inputs, this tab is unavailable when I/Q is the selected input, and is replaced by the Range tab in that case

Dual-Attenuator Configurations

Configuration 1: Mechanical attenuator + optional electronic attenuator

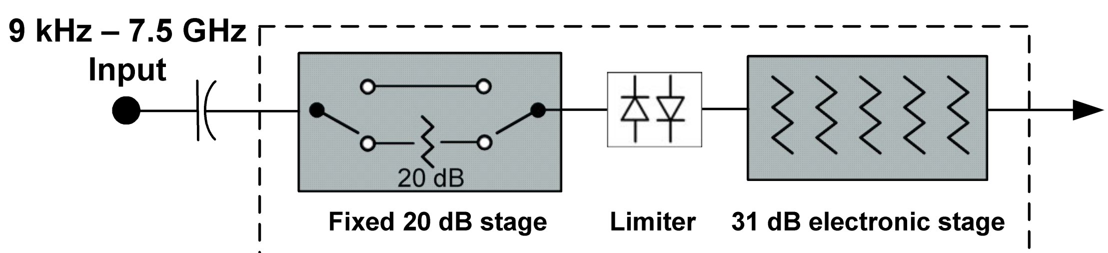


Configuration 2: Mechanical attenuator, no optional electronic attenuator

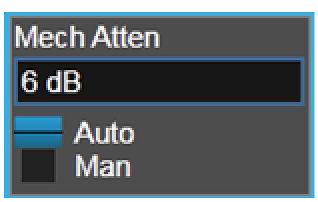


(note that Configuration 2 is not strictly speaking a dual-section attenuator, since there is no electronic section available. However, it behaves exactly like Configuration 1 without the Electronic Attenuator option EA3, therefore for the sake of this document it is grouped into the “Dual-Attenuator”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

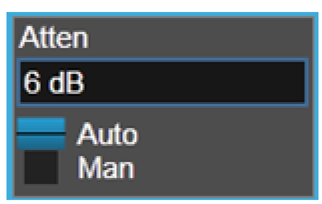
Single-Attenuator Configuration



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.

4.4.2.1 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 138

Remote Command	Not available in RLC Mode
Dependencies	Some measurements do not support the Auto setting of Mech Atten. 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 decribed in more detail in "Elec Atten" on page 139 See "Attenuator Configurations and Auto/Man" on page 138 for more information on the Auto/Man functionality
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 Mixing and BBIQ, where the Attenuator is not in the signal path, the Attenuator setting changes as described above when "Mech Atten" on page 137 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. This protects against setting a dangerously small

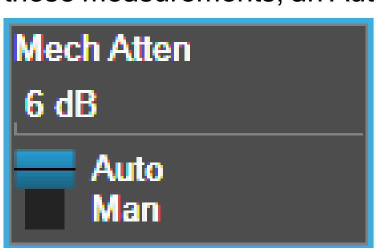
	attenuation value, which can put the instrument at risk of damage to input circuitry. If the current mechanical attenuation is below 6 dB, it can be increased with the knob and step keys, but not decreased
Max	CXA Option 503 or 507: 50 dB EXA: 60 dB All other models: 70 dB Note that, in the Single-Attenuator 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 135 , 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 as the “main” attenuation. Then the current total attenuation is the sum of the main + soft attenuation. See "Elec Atten" on page 139 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.

4.4.2.2 Mech Atten Step

Controls the step 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	Not available in RLC Mode
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

4.4.2.3 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 140

Remote Command	Not available in RLC Mode
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) 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 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
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 138
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

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 141 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 138

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

4.4.2.4 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 thereore 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 142.

Remote Command	Not available in RLC Mode
Preset	-10 dBm
State Saved	Saved in instrument state
Min	-50 dBm
Max	0 dBm

4.4.2.5 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 142, –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	Not available in RLC Mode
Preset	`NORM`

4.4.3 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.

4.4.3.1 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 145 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 144.

Remote Command	Not available in RLC Mode
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 – 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 145 control

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

4.4.3.2 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 144is 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	Not available in RLC Mode
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 – Grayed-out in the Spectrogram View
Preset	0 MHz
State Saved	The **Preselector Adjust** value set by "Presel Center" on page 144, 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

4.4.3.3 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	Note
Off	
Low Band	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	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	Not available in RLC Mode
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 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)

4.4.3.4 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	Note
Standard Path	Normal setting for most measurements. µW Preselector in circuit, Low Noise Path disabled
Low Noise Path Enable	See "Low Noise Path Enable" on page 149
µW Preselector Bypass	See "µW Preselector Bypass" on page 150
Full Bypass Enable	See "Full Bypass Enable" on page 151

Remote Command	Not available in RLC Mode

Notes	If "Presel Center" on page 144 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 will still behave as though it were DC coupled, including all annunciation, warnings, and status bits. 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 **Low Noise Path Enable** and **Full Bypass Enable** are grayed-out if the current measurement does not support them
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

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.

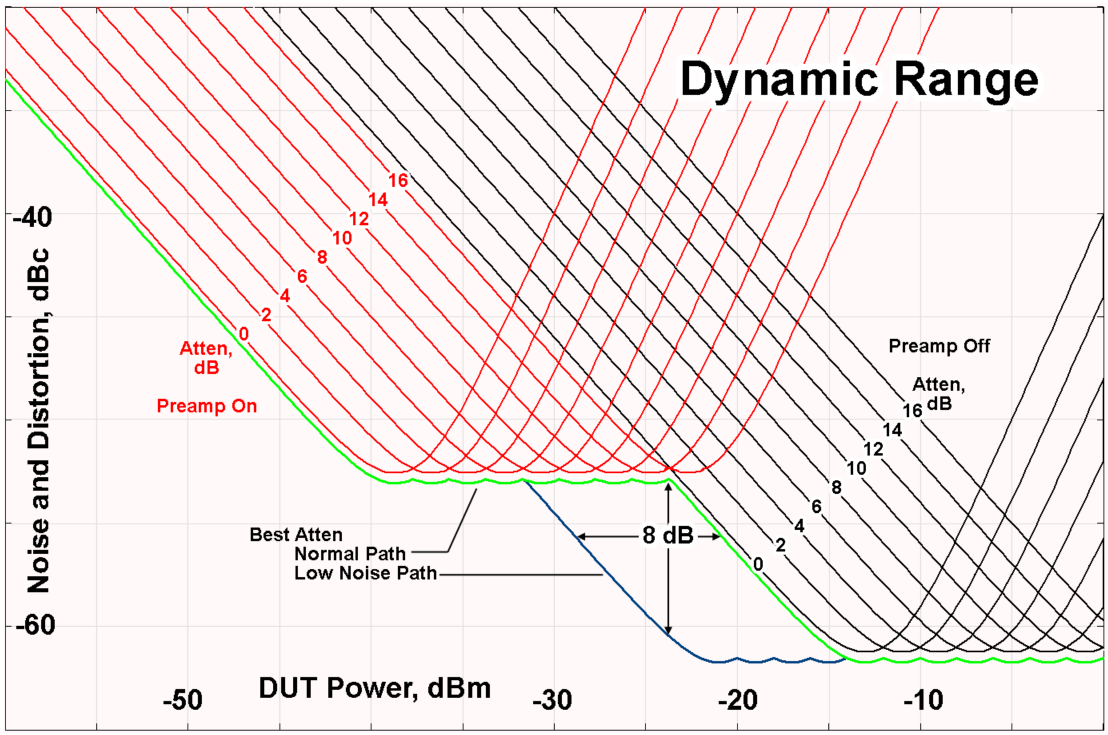
Note that the Low Noise Path, while giving improved DANL, has the disadvantage of decreased TOI performance and decreased gain compression performance relative to the standard path.

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 135is 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

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.

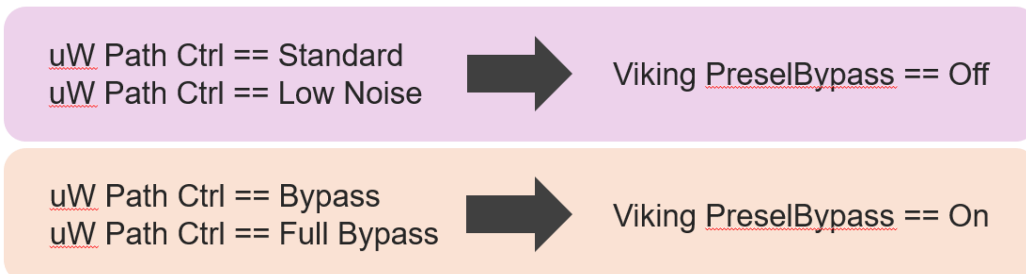
Coupling with Microwave Preselector Control

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 affect, 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

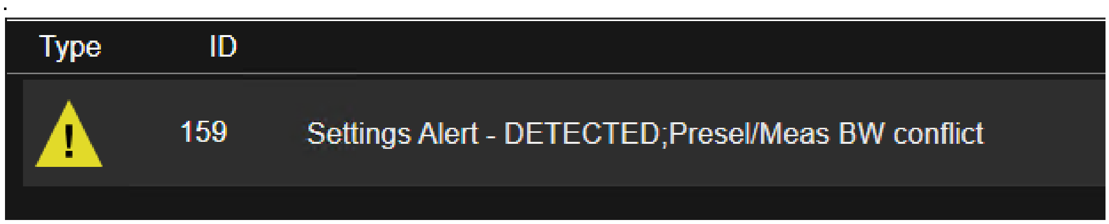
When the Frequency Extender Preselector is applied and the signal bandwidth is greater than 2.5 [GHz], then a settings alert message will show to warn the user that the signal may be distorted due to the limitation of the Frequency Extender Preselector bandwidth.

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

.



4.5 BW

Opens the Bandwidth (**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.

NOTE: The AVERAGE functions, which appeared in the BW menu in earlier instruments, can now be found in the Trace menu and the Meas Setup menu.

NOTE: In the Trace menu, you may turn Trace Averaging on or off for the desired traces (rather than globally as in the past).

NOTE: In the Meas Setup menu you may configure Averaging, by setting the Average Number and the Average Type.

4.5.1 Settings

This is the only tab in the **Bandwidth** menu.

4.5.1.1 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. 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**.

Normally the maximum Res BW is 8 MHz, but the Wide Bandwidths control lets you access a set of Resolution Bandwidths that are wider than the standard RBW's while in Zero Span. See "Wide Bandwidths" on page 164

See "More Information" on page 155

Remote Command	Not available in RLC Mode
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
Dependencies	When in Zero Span with no EMI Standard selected, there is no Auto setting for Res BW. The Auto/Man toggle disappears in this case While using the Tracking Generator, you must make sure the Start Frequency is high enough to avoid capturing LO feedthrough in the trace. How high you must make the Start Frequency to avoid this will depend on the RBW you have set. The instrument displays a condition warning message if the Start Frequency falls below roughly 2.5 times the current RBW. The warning is "Source Uncal; adj Start Freq|RBW|Points". When you see this warning, you should increase the Start Freq, narrow the RBW, or increase the number of Sweep Points For CXA-m, if the requested setting of Res BW is less than 100KHz in Tracking Source mode, a condition warning message is generated. The warning is 301, "Meas Uncal"
Couplings	Res BW is normally coupled to Span; if Res BW is set to Auto, as the Span decreases, so will the Res BW, to maintain the ratio set by the Span:3 dB RBW control (or 106:1 for measurements that do not have a Span:3 dB RBW control). In Zero Span, this coupling is normally turned off and Res BW has no Auto setting. When a CISPR or MIL EMI Standard is in use, the Res BW is coupled to Center Frequency and not to Span, and this is true even in Zero Span
Preset	Auto (unless noted in the table below) `ON`
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 can actually exceed 8 MHz if using a filter other than –3 dB Gaussian For VXT, max -3 dB RBW is limited to the current span or 8 MHz, whichever is smaller
Annotation	In the lower left corner of the screen, "RBW <(type)> <value>" will indicate the current setting of resolution bandwidth where <(type)> summarizes the filter type and bandwidth. <(type)> is not displayed for the –3 dB Filter Type A "#" mark appears before "RBW" in the annotation when it is switched from Auto to Manual coupling. Note that this # does NOT appear when in zero span with an EMC standard of None, as then there is neither an autocoupled nor a manual state in zero span; there is no coupling at all
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

More Information

When **Res BW** is set to **Auto**, the bandwidth selected depends on the Filter Type.

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.

The zero-span case in the Swept SA measurement deserves some mention, because RBW is coupled to Span when in a swept (non-zero) span and in zero span there is normally no meaningful RBW coupling. However, when a MIL or CISPR EMC

Standard is selected, there IS a meaningful coupling for RBW in Zero Span – in fact, it is coupled to Center Frequency, in order to make measurements according to the EMI specifications.

4.5.1.2 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.

NOTE

An * is displayed next to the VBW annotation when certain detector types (Average, EMI Average, Quasi Peak, and RMS Average) are in use. This is because the VBW filter is out of the circuit for these detectors and does not affect any traces which use them. If there is any active trace using one of these detectors the * is displayed. See "Annotation Examples" on page 158.

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	Not available in RLC Mode
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"
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 In VXT, when in Zero Span, this control does not appear
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)

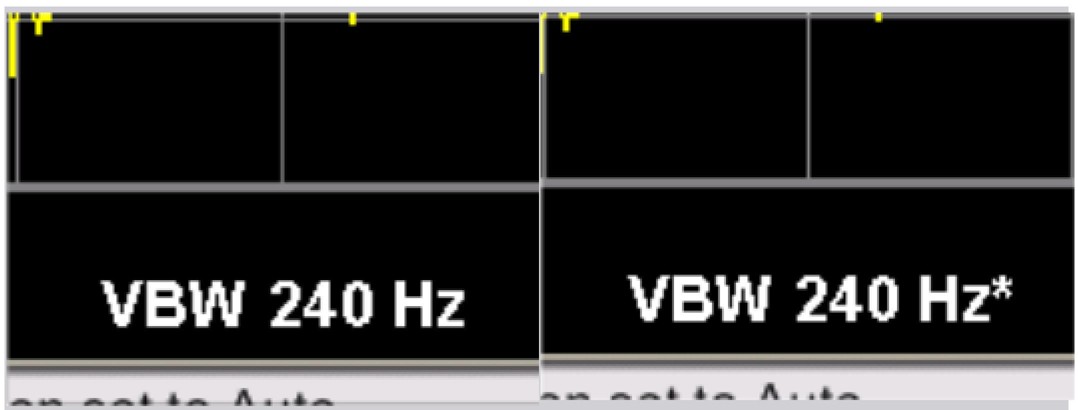
VBW Presets

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

Measurement	Mode	Preset Value
Channel Power	WCDMA	2.40 MHz
	CDMA2K	240 kHz
	1xEVDO	300 kHz
	DVB-T/H	39 kHz
	DTMB (CTTB)	39 kHz
	ISDB-T	300 kHz
	CMMB	39 kHz
	Digital Cable TV	39 kHz
Occupied BW	WCDMA	300 kHz
	C2K	120 kHz
	WIMAX OFDMA	1 MHz
	TD-SCDMA	300 kHz
	1xEVDO	300 kHz
	ISDB-T	300 Hz
	CMMB	3 kHz
	BLUETOOTH	30 kHz
ACP	WCDMA	1 MHz
	WIMAX OFDMA	1 MHz
	CDMA2K, IBW Method	150 kHz
	CDMA2K, RBW Method (grayed out)	(1.2 MHz)
	TD-SCDMA	300 kHz
	1xEVDO	300 kHz
	DVB-T/H	390 kHz
	DTMB (CTTB)	390 kHz
	ISDB-T	390 kHz
	CMMB	390 kHz
	Digital Cable TV	390 kHz

Measurement	Mode	Preset Value
Monitor Spectrum	WIMAX OFDMA	1 MHz
	1xEVDO	300 kHz
	DVB-T/H	39 kHz
	DTMB (CTTB)	39 kHz
	ISDB-T	39 kHz
	CMMB	39 kHz
	Digital Cable TV	39 kHz
	WLAN	1 MHz
	LTE, LTETDD, LTEAFDD, LTEATDD	1 MHz
TOI	SA	Determined by RBW

Annotation Examples



All active traces using VBW | One or more active traces not using VBW

4.5.1.3 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 159. 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	Not available in RLC Mode
Notes	The values shown in this table reflect the conditions after a Mode Preset

Dependencies	In VXT, when in Zero Span, this control does not appear
Couplings	See "Coupling Auto Rules" on page 159
Preset	1 ON
State Saved	Saved in instrument state
Min	0.00001
Max	3000000
Annotation	on control only

Coupling Auto Rules

The Auto Rules for the **VBW:3dB RBW** function follow.

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.

Not 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.

4.5.1.4 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 changes to Man. This enables you to manually select ratios more suitable for certain measurements.

When 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	Not available in RLC Mode
Notes	The values shown in this table reflect the conditions after a Mode Preset
Dependencies	In the Swept SA measurement, this is grayed-out when the EMC Standard is set to CISPR or MIL, since RBW is coupled to Center Frequency rather than Span in this case
Preset	106
State Saved	Saved in instrument state
Min	2
Max	10000
Annotation	on control only

4.5.1.5 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
Gaussian
Flattop

See "More Information" on page 161

Remote Command	Not available in RLC Mode
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 In the ACP measurement, when Meas Method is FAST or Fast Power, this control is disabled. If pressed, an advisory message 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. 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

More Information

Gaussian filters

When the Gaussian filter type is chosen, a set of 160 RBW filters are available whose shape is approximately Gaussian. The actual bandwidths used to realize the X-Series' Gaussian filters are chosen to come as close as possible, within the limitations of the digital IF, to a 24 step per decade series from 1 Hz through 3 MHz, plus the 4, 5, 6 and 8 MHz settings.

For Gaussian filters, the annotation at the bottom of the screen shows the filter bandwidth type (unless it is Normal) parenthetically between the words “Res BW” and the value, for example:

Res BW 10.0 Hz	(Normal bandwidth)
Res BW (Impulse) 14.8 Hz	(Impulse bandwidth)

Flattop filters

When the Flattop filter type is chosen, a new set of 134 RBW hardware settings are available. These settings realize filters that are approximately rectangular in shape. When this shape is chosen the filter bandwidth options are irrelevant and therefore unavailable.

The annotation at the bottom of the screen shows that the Flattop shape is being used, for example:

Res BW (Flattop) 10 Hz

4.5.1.6 RBW Filter BW

Selects the type of filter bandwidth used to specify the width of the Gaussian RBW filters. Historically, the Gaussian Res BW filters in HP/Agilent/Keysight spectrum analyzers were 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. For certain types of applications it can be useful to specify the filter width using points other than the –3 dB points. In the X-Series, the RBW Filter BW function allows you to pick the filter based on its –3 dB (Normal) bandwidth, its –6 dB bandwidth, its Noise bandwidth, or its Impulse bandwidth.Note that in all four cases the –3 dB bandwidth is the same. The filter does not change, but the way you specify it changes.

Example: set the **RBW** to 1.0 kHz with **RBW Filter BW** set to **Normal.** Now set the **RBW Filter BW** to –6 dB. The bandwidth displayed for **RBW** changes to 1.41 kHz. The shape and bandwidth of the filter have not changed, only the way the filter is annotated and the value that appears in the **RBW** active function area have.

Filter BW	Displayed bandwidth of a filter with 1 kHz -3 dB bandwidth
-3 dB (Normal)	1.0 kHz
–6 dB	1.41 kHz
Noise	1.06 kHz
Impulse	1.48 kHz

See "More Information" on page 163

Remote Command	Not available in RLC Mode	
Notes	DB3	–3 dB (Normal)

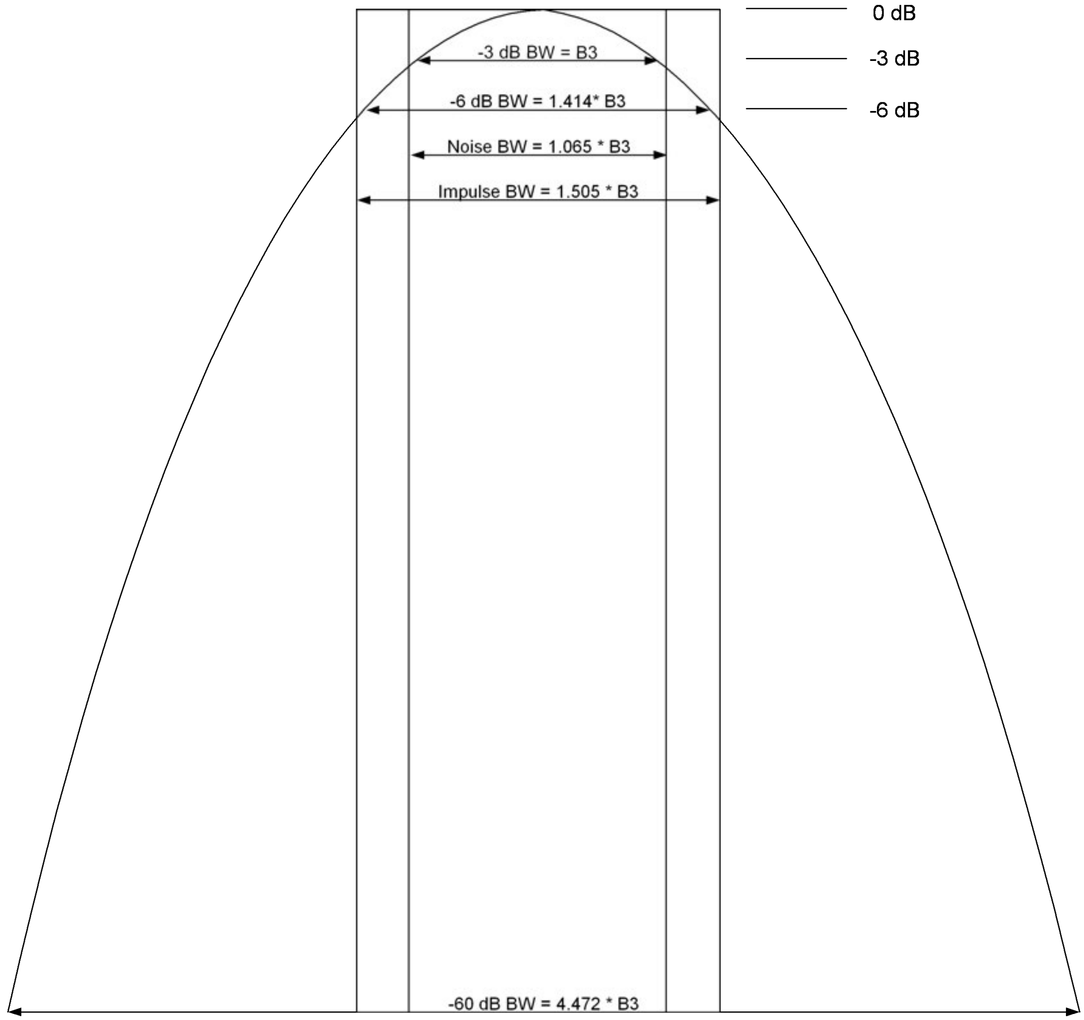
	DB6	–6 dB
	IMPulse	Impulse
	NOISe	Noise
	The use of DB3 instead of NORMal was chosen for compatibility with the EM command: [:SENSe]:BANDwidth|BWIDth:TYPE DB3|DB6|IMPulse	
Dependencies	Grayed out and displays --- if the Flattop filter type is selected When **EMC Standard** is set to **CISPR** or **MIL**, the **RBW Filter BW** control is greyed out. This is because the **RBW Filter BW** is chosen as appropriate for the filter and the standard and not selected by this control.Any attempt to set it otherwise 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

More Information

The instrument provides four ways of specifying the bandwidth of a Gaussian filter:

1. The –3 dB bandwidth of the filter
2. The –6 dB bandwidth of the filter
3. The equivalent Noise bandwidth of the filter, which is defined as the bandwidth of a rectangular filter with the same peak gain which would pass the same power for noise signals
4. The equivalent Impulse bandwidth of the filter, which is defined as the bandwidth of a rectangular filter with the same peak gain which would pass the same power for impulsive (narrow pulsed) signals

The following figure shows the relationships of the various filter bandwidths for filters with the X-Series' shape factor (shape factor is defined as the ratio of the –60 dB bandwidth to the – 3 dB bandwidth):



The Filter Type menu lets you choose the filter bandwidth (–3 dB, –6 dB, Noise or Impulse) that will be used when specifying the width of the filter. Note that for a given Gaussian filter, changing the filter bandwidth specification does not affect the filter width at all but only the means of specifying it. For example, the filter whose –3 dB bandwidth is 1.0 kHz is the same as the filter whose –6 dB bandwidth is 1.41 kHz, whose Noise bandwidth is 1.06 kHz, and whose Impulse bandwidth is 1.48 kHz. As you cycle through these various filter bandwidths the filter does not change, but the way the filter is annotated and the value which appears in the active function area and on the control does.

4.5.1.7 Wide Bandwidths

Lets you access a set of Resolution Bandwidths that are wider than the standard RBWs. These wide bandwidths only appear in the Swept SA measurement. The Wide Bandwidths control is only available when Span is set to Zero Span, otherwise the control is grayed-out.

When Wide Bandwidths are ON:

- The minimum RBW is 10 MHz. The Wide Bandwidths selection must be Off to select RBWs 8 MHz or narrower
- A channel filter shape is used that is nearly square (shape factor 1.2:1), rather than Gaussian or Flattop, and the RBW Filter Type control is grayed out and displays “Channel”
- The RBW Filter BW control is grayed out and shows “–3 dB”
- No VBW filter is used, so VBW averaging is not available. Since VBW averaging is not available, the VBW annotation has the * symbol added (meaning no video averaging). When no VBW averaging is available, this is equivalent to having a VBW setting that is greater than RBW
- The available detectors are Peak or Average. Only one detector can be used at a time
- Gate is not available
- TV Trigger is not available
- The minimum (fastest) sweep time will be limited to a value that is typically between 200-400 us, depending on the bandwidth and number of points you have set. This means you will not be able to set sweep times shorter than this value while the Wide Bandwidths switch is On

The instrument independently remembers the RBW settings for when Wide Bandwidths are set to Off and when Wide bandwidths are set to On. For example, if an RBW of 300 kHz was set before Wide Bandwidths was turned on, then the instrument will go back to an RBW of 300 kHz when Wide bandwidths is turned off.

As with the standard set of RBWs, there is a set of specific RBW’s available when Wide Bandwidths is set to On. Here is the list:

Wideband IFs with information bandwidth less than 160 MHz : 10 MHz, 15 MHz, 20 MHz, 25 MHz, 30 MHz, 40 MHz, 50 MHz, 60 MHz, 70 MHz

Wideband IFs with 160 MHz information bandwidth: add 80 MHz, 100 MHz and 133 MHz RBWs.

Wideband IFs with information bandwidth of 255 MHz or 510 MHz: add 150 MHz, 200 MHz and 212 MHz RBWs.

Remote Command	Not available in RLC Mode
Dependencies	Only appears if at least one of options B85, B1A, B1X, B1Y, B2X, B5X is installed Only appears if option RBE is installed Grayed-out unless in Zero Span
Preset	OFF
State Saved	Saved in instrument state

4.6 Display

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

4.6.1 Meas Display

Contains controls for setting up the display for the current Measurement, View or Window.

4.6.1.1 Display Line

Activates an adjustable horizontal line that is used as a visual reference line. The line’s vertical position corresponds to its amplitude value. The value of the display line (for example, -20.3 dBm) appears right justified above the line itself on the right side of the display, marked “DL” for measurements that support only one Display Line, or marked “DL1” for Display Line 1, “DL2” for display line 2, etc.

In measurements which support multiple Display Lines, this control affects whichever Display Line has been selected by the **Select Display Line** key.

The display 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. The unit of the Display Line is determined by the **Y Axis unit** setting under **Amplitude**. If more than one window has a display line, the display line of the selected window is controlled.

If the display line is off the screen, it shows as a line at the top/bottom of the screen with an arrow pointing up or down. As with all such lines (Pk Thresh, Trigger Level, etc.) it is drawn on top of all traces.

The display line is unaffected by **Auto Couple**.

Remote Command	Not available in RLC Mode
Couplings	When a value is set for the display line, turn it On When the Display Line goes from Off to On, if it is off screen, set it to either the top or bottom of screen, depending on which direction off screen it was The Display Line's value does not change when it is turned off
Preset	Display Line 1 selected, Off, and set to -25 dBm `OFF`
State Saved	Saved in instrument state
Min	–∞ (minus infinity) in current units
Max	+∞ (plus infinity) in current units

4.6.1.2 Freq Line

Activates an adjustable vertical line that is used as a visual reference line. The line's horizontal position corresponds to its frequency value. The value of the frequency line (for example, 2.5 GHz) appears at the top of the display, to the right or left of the line justified as required for it to be on screen, marked "FL1" for Freq Line 1, "FL2" for Freq Line 2, etc.

This control affects whichever Freq Line has been selected by the **Select Freq Line** key.

The Freq 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. If more than one window has a Freq Line, the Freq Line of the selected window is controlled.

If the Freq Line is off the screen, it shows as a line at the left or right of the screen. As with all such lines (Pk Thresh, Trigger Level, etc.) it is drawn on top of all traces.

The Freq Line is unaffected by **Auto Couple**.

Remote Command	Not available in RLC Mode
Dependencies	Freq Lines and this control only display in Swept Spans
Couplings	When a value is set for the Freq Line, turn it On When the Freq Line goes from Off to On, if it is off screen, set it to either the left or right of screen, depending on which direction off screen it was The Freq Line's value does not change when it is turned off
Preset	Freq Line 1 selected, Off, and set to 1 GHz OFF
State Saved	Saved in instrument state

4.6.2 View

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

4.6.2.1 View

See "RLC Swept SA Views" on page 129.

4.6.2.2 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	Not available in RLC Mode

4.6.2.3 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".

4.6.2.4 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	Not available in RLC Mode

4.6.2.5 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.

4.6.2.6 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	Not available in RLC Mode

4.6.2.7 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	Not available in RLC Mode

4.6.2.8 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	Not available in RLC Mode
Notes	Disabled if there are no User Views

4.6.3 Annotation

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

4.6.3.1 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	Not available in RLC Mode
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

4.6.3.2 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	Not available in RLC Mode
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

4.6.3.3 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	Not available in RLC Mode
Preset	`OFF`
State Saved	Saved in instrument state

4.6.3.4 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	Not available in RLC Mode
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

4.6.3.5 Frequency Annotation

Turns on and off the absolute frequency annotation in the main display for all windows in all measurements in the current Mode for which Frequency Annotation on/off is supported.

The affected annotations include Center Frequency, Start/Stop Frequency, Frequency Offset, Marker Frequency. Any relative frequency annotation such as Span and Marker Delta are not affected.

The frequency annotations in any other associated display, such as in Active Function, Softkey label, Limit Editor, Amp Corr Editor and Marker Table are not changed.

Frequency annotations that are not associated with the spectrum, such as RBW, IBW, Sweep Time, are excluded and they are shown regardless of this selection.

Remote Command	Not available in RLC Mode
Preset	ON

4.6.3.6 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	Not available in RLC Mode
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

4.7 Frequency

Allows you to control the Frequency 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.

4.7.1 Settings

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

4.7.1.1 Center Frequency

Sets the frequency that corresponds to the horizontal center of the graticule (when frequency Scale Type is set to linear). While adjusting the Center Frequency the Span 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 Center Freq 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.

Pressing Center Freq also 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**.

When frequency Scale Type is set to log, pressing Center Freq sets the frequency that corresponds to the arithmetic mean of the start frequency and stop frequency, which is not at the horizontal center of the graticule.

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 173

– "Center Frequency" on page 172

– "Center Frequency" on page 172

Remote Command	Not supported in RLC Mode
Dependencies	The Center Frequency can be limited by Start or Stop Freq limits, if the Span is so large that Start or Stop reaches their limit
Couplings	When operating in “swept span”, 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. 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 Coupling between center frequency and span: numeric (keypad) entries are treated differently than changing the value using the step keys (up/down arrows) or the knob. Similarly, for remote operation sending a numeric frequency value is treated differently than the UP|DOWN keywords Numeric entries (keypad or remote) - any value of center frequency or span (within the frequency range of the instrument) is allowed. The other parameter is forced, as necessary, to keep the Start Freq and Stop Freq within the instrument frequency range Knob or Step keys (up/down arrows) or UP|DOWN keywords - the value of the parameter being changed (center frequency or span) is limited so the other parameter is not forced to a new value. Thus, if only the step keys and knob are used, you can get back to the initial Center Freq and Span by changing only the current parameter Note that, since out-of-range Start Freq and Stop Freq are never allowed, markers and trace math work nicely without requiring anything special for out-of-range conditions
Preset	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 173 and "Center Frequency" on page 172
State Saved	Saved in instrument state
Min/Max	Depends on instrument maximum frequency, mode, measurement, and selected input See "Center Frequency Presets" on page 173 and "Center Frequency" on page 172
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 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

4.7.1.2 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.

Pressing Span also 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**.

The Span control also includes a toggle switch to go back and forth between Swept Span and Zero Span. Zero Span is a special sweep type in which the instrument stops sweeping over a range of frequencies and stays at the Center Frequency. In Zero Span, the instrument sweeps in the time domain, showing you the instantaneous amplitude versus time at the Center Frequency. For more about Zero Span, see "Zero Span" on page 178. Selecting Swept Span places the instrument in Center/Span frequency entry mode.

When in Zero Span you can return to your last Swept Span by pressing the Swept Span/Zero Span toggle on the Span control. This replaces the “Last Span” function found on older HP/Agilent/Keysight Analyzers.

NOTE	We use the term "Swept Span" to mean spans other than zero span, even though sometimes when we are in what we call a "swept span" we might be performing an FFT-style sweep, which is not a true "swept 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.

Remote Command	Not supported in RLC Mode
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 If Source Mode is set to Tracking, and the Span is therefore limited by the limits of the source, a warning message is generated, "Data out of range; clipped to source max/min" if these limits are exceeded. Note that for an external source, these limits can be affected by the settings of Source Numerator, Source Denominator, and Power Sweep 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) When operating in "swept span": – 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, the value that is being changed, that is, the Center Frequency or Span, is limited so that the other parameter is not forced to a new value – The Span cannot be set to Zero by setting Start Frequency = Stop Frequency. The value of the last setting will be changed to maintain a minimum value of 10 Hz for the difference between start and stop frequencies
Preset	Depends on instrument maximum frequency, mode, measurement, and selected input See "Span Presets" on page 177
State Saved	Saved in instrument state
Min	10 Hz unless entered directly, then 0 Hz is allowed, but nothing between 0 and 10 is ever allowed If the Zoomed Trace window is present, Zero Span is not allowed, so the Span may not go below 10 Hz If the Zone Spectrum window is present, Zero Span is not allowed in the Spectrum window, so the Span may not go below 10 Hz in the Spectrum window
Max	Depends on instrument maximum frequency, mode, measurement, and selected input. See "Span Presets" on page 177 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 Note that, if the Source Mode is set to Tracking, the effective instrument maximum Span may be limited by the source maximum frequency

Annotation	Span <value> appears on the first line of the annotation in the lower right corner of display
Status Bits/OPC dependencies	Overlapped if Signal Track is on

Span Presets

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

Freq Option	Span after Mode Preset	Max Span (can't set higher than this)
503 (all but CXA)	3.59 GHz	3.7 GHz
503 (CXA), F03 (CXA-m)	2.99 GHz	3.08 GHz
507 (all but CXA)	6.99 GHz	7.1 GHz
507 (CXA), F07 (CXA-m)	7.49 GHz	7.575 GHz
508 (all but MXE)	8.39 GHz	8.5 GHz
508 (MXE)	3.59 GHz	8.5 GHz
513, F13	13.59 GHz	13.8 GHz
526 (all but CXA and MXE)	26.49 GHz	27.0 GHz
526 (MXE)	3.59 GHz	27.0 GHz
526 (CXA), F26 (CXA-m)	26.49 GHz	26.55 GHz
532	31.99 GHz	32.5 GHz
540	39.99 GHz	40.5 GHz
544	43.99 GHz	44.5 GHz
550	49.99 GHz	52 GHz
F06 (VXT models M9410A/11A)	160 MHz	5.77 GHz
F06 & EP6 (VXT models M9410A/11A)	160 MHz	6.27 GHz
F06 & EP6 & LFE (VXT models M9410A/11A)	160 MHz	6.5999935 GHz
F06 (VXT model M9415A)	160 MHz	6.27 GHz
F08 (VXT model M9415A)	160 MHz	8.27 GHz
F12 (VXT model M9415A)	160 MHz	12.27 GHz

N9041B Span Presets:

Input/Freq Option	Span after Mode Preset	Max Span (can't set higher than this)
Input 1, all models	49.99 GHz	52 GHz
Input 2, opt 585	84.99 GHz	86 GHz
Input 2, opt 590	89.99 GHz	92 GHz
Input 2, opt 5CX	109.99 GHz	110 GHz

Input 2:

Model	Span after Mode Preset	Max Span (can't set higher than this)
CXA opt C75	1.499 GHz	1.58 GHz
MXE	1 GHz	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.

Zero Span

While in Swept Span, pressing the **Swept Span/Zero Span** toggle on the Span control puts you in Zero Span. You can also go to Zero Span by setting the span to 0 Hz via the front panel numeric key pad. However, you cannot go to Zero Span by setting Start freq = Stop freq using the numeric keypad, nor by using the Step keys and the RPG to "roll" down to zero, the Span can only go as far down as 10 Hz using this means.

Dependencies	If the Zoomed Trace window is present, Zero Span is not allowed If the Zone Spectrum window is present, Zero Span is not allowed in the Spectrum window Frequency scale type is LOG (for example, Log Sweep is On)
Couplings	Switching to Zero Span: – Turns off Signal Track – Turns off the auto-coupling of RBW and sweep time – Places the instrument in Center/Span frequency entry mode

When you enter Zero Span, the instrument changes the displayed frequency span to 0 Hz. The horizontal axis changes to time rather than frequency. The amplitude displayed is the input signal level at the current center frequency. This is a time-domain mode that changes several measurement functions and couplings. The instrument behavior is similar to an oscilloscope with a frequency selective detector installed in front of the oscilloscope. See Application Note 150 for more information on how to use zero span.

While in zero span, setting the Span to a non-zero value through SCPI or Front Panel puts the instrument back into Sept Span. You can also return to your last Swept Span by pressing the Swept Span/Zero Span toggle on the Span control. This replaces the "Last Span" function found on older HP/Agilent/Keysight Analyzers.

The following table summarizes the differences between Zero Span and Swept Spans:

Zero Span	Swept Spans
X axis is time	X axis is frequency
There is no auto-RBW selectionunless the EMC Standard is CISPR or MIL	RBW coupled to Span when RBW in auto
There is no auto sweep time	Sweep time coupled to RBW when sweep time in auto
Interval Power calculated in Mkr Function	Band Power calculated in Mkr Function
Can only define time limits when in zero span	Can only define frequency limits when in swept SA
Marker Count counts at the center frequency	Marker Count counts at the marker frequency
CF Step Size set to RBW value	CF Step autocouples to 10% of Span
Some "Marker ->" commands not available	Other "Marker ->" commands not available
Freq entry mode always Center/Span	Freq entry mode can be Center/Span or Start/Stop
N dB points reports a time difference	N dB points reports a frequency difference

4.7.1.3 Full Span

Changes the frequency span of the instrument to the Preset frequency span of the instrument and sets the Frequency entry mode to Center/Span.

The span is dependent on the currently selected Input. For example, when using external mixing, it changes the frequency to the Preset frequency range specified for the selected external mixing band.

Pressing this control while in zero span puts the instrument back in swept span.

Remote Command	Not supported in RLC Mode
Couplings	Turns off signal tracking (span zoom). Does *not* turn off the markers, or the current active function
Backwards Compatibility Notes	In the past, **Full Span** turned off all markers. In the X-Series this is not the case

4.7.1.4 Start Freq

Sets the frequency at the left side of the graticule. While adjusting the start frequency, the stop frequency is held constant, which means that both the center frequency and span will change.

Start Freq also sets the frequency entry mode to Start or Stop. In Start or Stop mode, the start frequency and stop frequency values are displayed below the graticule, and the default active function in the Frequency menu is **Start Freq**.

Remote Command	Not supported in RLC Mode
Notes	Max values depends on Hardware Options
Dependencies	By direct entry: You cannot set Start frequency > Stop frequency. You cannot set Start frequency = Stop frequency. You cannot select zero span by setting Start = Stop. You cannot set Start Frequency to a value that would create a span of less than 10 Hz. If you try to do any of these, Stop Frequency will change to maintain a minimum value of 10 Hz for the difference between Start and Stop With the knob or step keys: Cannot increment Start Freq to a value greater than Stop Freq – 10 Hz. If already in zero span, cannot increment at all, and the first decrement will be forced to at least 10 Hz The Start Frequency can be limited by Span limits, if the Stop Frequency is below its preset value If the electronic/soft attenuator is enabled, any attempt to set the Start Frequency such that the Stop Frequency would be >3.6 GHz fails and results in an advisory message If Source Mode is set to Tracking, and the Max or Min Start Freq is therefore limited by the limits of the source, a warning message is generated, “Data out of range; clipped to source max/min” if these limits are exceeded. Note that for an external source, these limits can be affected by the settings of Source Numerator, Source Denominator, and Power Sweep
Couplings	In the Spectrum Analyzer, the four parameters Center Freq, Start Freq, Stop Freq and Span are interdependent, as changing one necessarily affects one or more of the others. The couplings between Center Freq and Span are detailed under the control descriptions for those controls. These couplings also affect Start Freq and Stop Freq
Preset	Start Freq does not preset. On Mode Preset, Span & CF preset, and Start Freq is derived. On a Meas Preset only Span presets, CF does not, so Start Freq will vary depending on CF 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 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. Thus, in this case, the Start Freq will preset to a frequency below the preset Center Freq by ½ of the maximum Span** When Restore Input/Output Defaults is performed, the mixer presets to the 11970A, whose Start frequency is 26.5 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 Start Freq is 26.5 GHz
State Saved	Saved in instrument state
Min	-80 MHz, unless Source Mode is set to Tracking, in which case it is limited by the minimum frequency of the Source For VXT models M9420A/21A, the minimum start frequency is 55 MHz For VXT models M9410A/11A, the minimum start frequency is 330 MHz For VXT models M9410A/11A, the minimum start frequency is 6.5 kHz with option "LFE" (330 MHz without option "LFE") For VXT model M9415A, the minimum start frequency is 330 MHz For the M8920A, the minimum start frequency is 80 kHz If the knob or step keys are being used, depends on the value of the other three interdependent parameters While in External Mixing, the minimum Start Freq you can set is determined by the external mixing parameters. It will be close to the minimum LO frequency (3.8 GHz if undoubled, 8.6 GHz if doubled) times the harmonic number, for the lowest harmonic range in the Harmonic Table for the current mixer setup. It can be queried with the SCPI command `:FREQ:STARt? MIN`
Max	Depends on the instrument maximum frequency – 10 Hz. Note that, if the Source Mode is set to Tracking, the effective instrument maximum frequency may be limited by the source maximum frequency If the knob or step keys are being used, it depends on the value of the other three interdependent parameters While in External Mixing, the maximum Start Freq you can set is determined by the external mixing parameters. It will be close to the maximum LO frequency (7 GHz if undoubled, 14 GHz if doubled) times the harmonic number, for the highest harmonic range in the Harmonic Table for the current mixer setup
Annotation	Start <value> appears in the lower left corner of the display. This replaces Center <value>
Status Bits/OPC dependencies	Non-overlapped

4.7.1.5 Stop Freq

Sets the frequency at the right side of the graticule. While adjusting the stop Frequency, the start frequency is held constant, which means that both the center frequency and span will change.

Stop Freq also sets the frequency entry mode to Start or Stop. In Start or Stop mode, the start frequency and stop frequency values are displayed below the graticule, and the default active function in the Frequency menu is **Start Freq**.

Remote Command	Not supported in RLC Mode
Notes	Preset and Max values are dependent on Hardware Options
Dependencies	By direct entry: You cannot set the Stop frequency < Start frequency. You cannot set Start frequency = Stop frequency. You cannot select zero span by setting Start = Stop. You cannot set Stop Frequency to a value that

	would create a span of less than 10 Hz. If you try to do any of these, Start Frequency will change to maintain a minimum value of 10 Hz for the difference between Start and Stop With the knob or step keys: Cannot decrement Stop Freq to a value less than Start Freq + 10 Hz. If already in zero span, cannot decrement at all, and the first increment will be forced to at least 10 Hz The Stop Frequency can be limited by Span limits, if the Start Frequency is above its preset value If the electronic/soft attenuator is enabled, any attempt to set the Stop Frequency >3.6 GHz fails and results in an advisory message If Source Mode is set to Tracking, and the Max or Min Stop Freq is therefore limited by the limits of the source, a warning message is generated, “Data out of range; clipped to source max/min” if these limits are exceeded. Note that for an external source, these limits can be affected by the settings of Source Numerator, Source Denominator, and Power Sweep
Couplings	In the Spectrum Analyzer, the four parameters Center Freq, Start Freq, Stop Freq and Span are interdependent, as changing one necessarily affects one or more of the others. The couplings between Center Freq and Span are detailed under the control descriptions for those controls. These couplings also affect Start Freq and Stop Freq
Preset	On Mode Preset, Span & CF preset, and Stop Freq is derived. See the table "Center Frequency Presets" on page 173 for the Preset values for various model and option numbers On a Meas Preset only Span presets, CF does not, so Stop Freq will vary depending on CF When a Mode Preset is performed while in External Mixing, the Stop frequency of the current Mode is set to the nominal Max Freq of the highest harmonic range in the Harmonic Table for the current mixer setup 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. Thus, in this case, the Stop Freq will preset to a frequency above the preset Center Freq by ½ of the maximum Span When Restore Input/Output Defaults is performed, the mixer presets to the 11970A, whose Stop frequency is 40 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 Stop Freq is 40 GHz
State Saved	Saved in instrument state
Min	-79.999990 MHz, unless Source Mode is set to Tracking, in which case it is limited by the minimum frequency of the Source For VXT models M9420A/21A, the minimum stop frequency is 55.000010 MHz For VXT models M9410A/11A, the minimum stop frequency is 330.000010 MHz For VXT models M9410A/11A, the minimum stop frequency is 6.510 kHz with option “LFE” (330.000010 MHz without option “LFE”) For VXT models M9415A, the minimum stop frequency is 330.000010 MHz For the M8920A, the minimum stop frequency is 80.010 kHz If the knob or step keys are being used, depends on the value of the other three interdependent parameters While in External Mixing, the minimum Stop Freq you can set is determined by the external mixing parameters. It will be close to the minimum LO frequency (3.8 GHz if undoubled, 8.6 GHz if doubled) times the harmonic number, for the lowest harmonic range in the Harmonic Table for the current mixer

	setup
Max	Depends on instrument maximum frequency. Note that, if the Source Mode is set to Tracking, the effective instrument maximum frequency may be limited by the source maximum frequency If the knob or step keys are being used, depends on the value of the other three interdependent parameters While in External Mixing, the maximum Stop Freq you can set is determined by the external mixing parameters. It will be close to the maximum LO frequency (7 GHz if undoubled, 14 GHz if doubled) times the harmonic number, for the highest harmonic range in the Harmonic Table for the current mixer setup
Annotation	Stop <value> appears in the lower right corner of the display. This replaces Span <value>
Status Bits/OPC dependencies	Non-overlapped

4.7.1.6 Auto Tune

The purpose of **Auto Tune** is to quickly get you to the most likely signal of interest, and position it optimally on the display. It causes the instrument to change Center Frequency to the strongest signal in the tunable span of the instrument, and sets the Ref Level based on the strength of that signal.

Auto Tune is an immediate action control, with no configurable parameters. It operates based on preset values based on real-world situations.

NOTE **Auto Tune performs a Preset as part of its function. It leaves you in your current View and leaves the AC/DC coupling and Single/Cont state unaffected, but it resets most other measurement parameters.**

NOTE **You will see an hourglass, and you may see a slight pause, until the signal of interest is presented at midscreen.**

Remote Command	Not supported in RLC Mode
Dependencies	Auto Tune is not available (grayed-out) when Source Mode=Tracking

4.7.1.7 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 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	Not supported in RLC Mode

Notes	Preset and Max values are depending on Hardware Options
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
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

4.7.1.8 Freq Offset

Enables you to set a frequency offset value to account for frequency conversions outside of the instrument. This value is added to the display readout of the marker frequency, center frequency, start frequency, stop frequency, and all other absolute frequency settings in the instrument including frequency count. When a frequency offset is entered, the value appears below the center of the graticule. To eliminate an offset, perform a Mode Preset, or set the frequency offset to 0 Hz.

Remote Command	Not supported in RLC Mode
Notes	Preset and Max values are dependent on Hardware Options
Dependencies	Freq Offset is not available in External Mixing. In this case the Freq Offset control is grayed out and shows a value of zero. However, the value of CF Offset that was set for the RF Input is retained and restored when the user switches back to the RF Input Freq Offset is not available when the frequency scale is set to Log, or segmented sweep is enabled
Preset	See "Center Frequency Presets" on page 173
State Saved	Saved in instrument state
Min	-500 GHz
Max	500 GHz
Annotation	If Frequency Offset is not zero, “Freq Offset <value>” appears on the upper line of the annotation, below the graticule, in the center
Status Bits/OPC dependencies	Non-overlapped

4.7.1.9 X Axis Scale

Determines how the X-Axis information for the selected marker is displayed in the marker area (top-right of display) and the active function area of the display, and how the marker is controlled. The available settings for the X Axis Scale are Frequency, Period, Time, and Inverse Time.

See "More Information" on page 185.

Remote Command	Not supported in RLC Mode
Notes	If in a delta marker mode, the value used for X Axis Scale of both the marker and the reference marker (for calculating the delta) is that of the marker, independent of what the reference marker is set to
Preset	AUTO Marker Preset (selected when a marker is turned **Off**): **Auto** (see below). In most measurements the Auto settings results in Frequency being the preset readout Note that the marker trace should first be preset according to the Marker Trace rules before this preset is applied ON
State Saved	Saved in instrument state

More Information

Value	Notes
Frequency	Displays the absolute frequency of a normal marker or the frequency of the delta marker relative to the reference marker
Period	Displays the reciprocal of the frequency of the marker, or the reciprocal of the frequency separation of the two markers in a delta-marker mode. The units are those of time (sec, msec, etc.) If the markers are at the same frequency in a delta marker mode, the result is the reciprocal of 0, which is infinitely large. The display shows "---"
Time	Displays the time interval between a normal marker and the start of a sweep or the time of the delta marker relative to the reference marker. Time is the auto setting for time domain traces. In a delta-marker mode it is the (sweep) time interval between the two markers
Inverse Time	Displays the reciprocal time. It is useful in a delta mode to show the reciprocal of (sweep) time between two markers. This function is only meaningful when on a time domain trace and in the **Delta** control mode. If the markers are at the same X Axis value, the time between them is 0, so the reciprocal of sweep time is infinitely large. The display shows "---"

The **X Axis Scale** of a marker is the scale of its X Axis value. This affects the units displayed in the Marker Result block and used to specify the marker's X Axis location. The X Axis Scale is specified using the **Marker, Properties, X Axis Scale** key.

All markers in swept spans have both a time and frequency value. Which of these is used for the result display, and for positioning the marker, depends on the **X Axis Scale** setting. The **X Axis Scale** setting can be **Frequency** or **Time**, as well as the reciprocal of either (**Period** or **Inverse Time**). There is also an **Auto** setting - when in **Auto**, a marker's **X Axis Scale** changes whenever the domain of the trace, upon which it set, changes. All choices for **X Axis Scale** are allowed. Note that this behavior differs from the behavior in previous instruments: previously the instrument remembered a different **X Axis Scale** (formerly called **Readout**) for each domain, and the choices of **X Axis Scale** were restricted. These restrictions were based on the current domain of the instrument.

When in **Auto**, the X-Axis Scale is **Frequency** if the Marker Trace is a frequency domain trace, **Time** if the Marker Trace is a time domain trace. When in Auto, if the marker changes traces, or the domain of the trace the marker is on changes, the auto result is re-evaluated. If the X Axis Scale is chosen manually, that Scale is used regardless of the domain of the trace.

If **Frequency** or **Period** is selected for a time domain trace, all points in the trace will show the same value. Attempting to use the knob or step keys to adjust the X Axis value of the marker or entering an X Axis value from the numeric keypad or remotely will have no effect but will generate no error.

Frequency domain traces taken in FFT mode have no valid time data. Therefore when **Time** or **Inverse Time** is selected for markers on such traces, the X Axis value is taken as the appropriate percentage of the displayed sweep time, which is a calculated estimate.

4.7.1.10 Signal Track (Span Zoom)

When Marker 1 is placed on a signal and Signal Track is pressed, the marker remains on the signal while the instrument re-tunes the center frequency to the marker frequency. The instrument keeps the signal at the center of the display, as long as the amplitude of the signal does not change by more than +/–3 dB from one sweep to another. If Marker 1 is not in Normal or Delta, turning on Signal Track sets it to Normal, perform a peak search, and center the marker on the display.

See "More Information" on page 187.

Remote Command	Not supported in RLC Mode
Dependencies	Signal Track is not available (grayed out) when the Waterfall window is present Signal Track is associated with Marker 1. When marker 1 is turned off or set to Fixed, signal track is turned off as well Signal Track is not available (grayed out) when Source Mode=Tracking Signal Track is not available (grayed out) when Signal ID = on Signal Track and Continuous Peak Search cannot be used with each other. If one is on, the other is grayed out Signal Track is grayed out if in Zero Span But if Zero Span is entered while in Signal Track, Signal Track is turned off Signal Track can only function properly if the trace Marker 1 is on is updating. Therefore if Signal Track is on and the trace Marker 1 is on is put into View, Signal Track is turned off and the Signal Track control grayed out. Whenever the trace Marker 1 is on is not updating, the Signal Track control is grayed out Signal Track is only available in the Swept SA measurement
Couplings	Signal Track can only function properly if the trace Marker 1 is on, is in Trace Update = Active. Therefore if the trace Marker 1 is on is in Update Off when Signal Track is turned on, it is changed to Update On. If the trace Marker 1 is on is set to Update Off while Signal Track is on, it turns off Signal Track
Preset	`OFF`

State Saved	Saved in instrument state
Annunciation	“Sig Track: On” appears in the Meas Bar

More Information

If marker 1 is off when Signal Track is turned on, marker 1 is turned on in the center of the screen and a peak search is performed. If marker 1 is already on, it stays on and is used where it is. If it is Fixed, it is set to Normal.

If you move the marker during Signal Track, a Mkr-> CF is performed and the signal track function starts over.

If the signal is lost, an attempt will be made to find it again and continue tracking. If there are other signals on screen that are near the same amplitude, one of them may be found instead since the algorithm is seeking a signal with amplitude similar to the amplitude of the original signal.

Signals near 0 Hz cannot be tracked effectively as they cannot be distinguished from the LO feed-through, which is excluded by intent from the search algorithm.

As a speed optimization, the center frequency is only changed if it differs from the marker position by 1% or more of the span.

If the instrument is in Single Sweep and Signal Track is turned on, then nothing happens until a sweep is actually initiated (i.e., by a Single key press, and a trigger). Once the sweep is initiated, the entire set of sweeps necessary to complete a pass through the signal track algorithm ensues before the instrument returns *OPC true, returns results to a READ or MEASure, or returns to the idle state.

If the span is changed while in Signal Track, either by you or because moving the instrument to the signal frequency results in Span Limiting (as described under the Frequency key), an “auto-zoom” algorithm is executed to get to the new span without losing the signal. In “auto zoom”, the span is reduced in stages, with a sweep between each stage. You will see this zooming occur as each sweep is performed, and the new span is set.

When auto-zooming, the set of steps necessary to achieve the target span is to be considered a “measurement,” thus the entire process executes even if the instrument is in single sweep. *OPC will not return true until the process is complete nor will results be returned to a READ or MEASure query. Note further that if the instrument is in a measurement such as averaging when this happens, the act of changing the span restarts averaging but the first average trace is the last trace of the auto zoom.

When you increase the span, we go directly to the new span. No zooming is required.

This function is intended to track signals with a frequency that is changing (drifting), and an amplitude that is not changing. It keeps tracking if you are in continuous-sweep mode. If in single-sweep mode, as described above, the instrument only does one center frequency adjustment as necessary.

4.8 Marker

The Marker key accesses the Marker menu. A marker can be placed on a trace to allow the value of the trace at the marker point to be determined precisely.

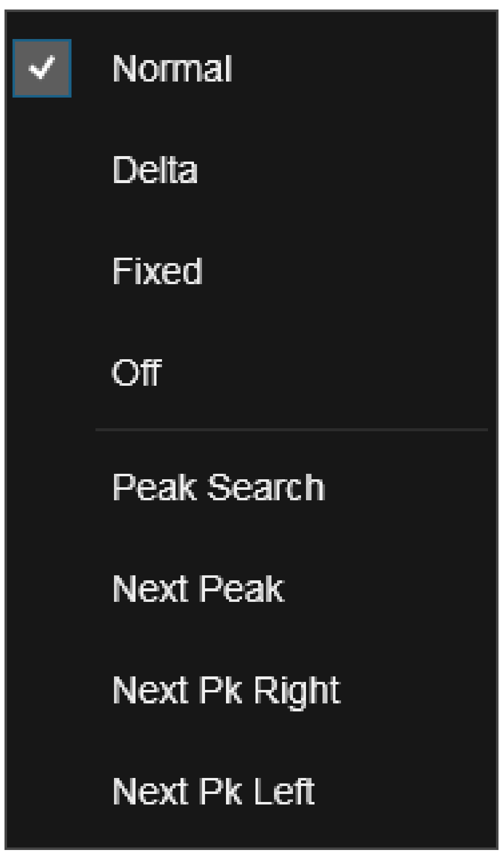
When Marker is pressed, if the selected marker is Off, it is set to Normal and placed it at the center of the screen on the trace determined by the Marker Trace rules. If the selected marker is already On it will remain at the frequency/time and amplitude to which it is already set, even if this means it will be offscreen.

The fundamental marker operation involves setting a Marker's X-Axis value and then reading the marker's Y-Axis value. From the front panel you do this using the Marker menu, the knob and the green marker readout in the upper right corner of the display.

Markers may also be used in pairs to read the difference (or delta) between two data points. They can be used in Marker Functions to do advanced data processing, or to specify operating points in functions like Signal Track and N dB Points.

Marker right-click menu

If you right-click on a marker (or touch and hold a marker and wait for the circle to close) you will see the Marker Right-Click Menu:



If you now tap or click on one of the items in this menu, it will perform the corresponding function. Normal, Delta, Fixed or Off will set the Marker Mode (see "Marker Mode" on page 191). Peak Search, Next Peak, Next Pk Right or Next Pk Left will move the Marker to the appropriate peak (see "Peak Search" on page 195).

NOTE In earlier HP/Agilent/Keysight analyzers, markers stayed at the same position on the display even when you changed frequency. In the X-Series, markers stay at the frequency they are set to, even if you change Center Frequency. So your marker will move, possibly offscreen, when you change frequency. This is a superior method for a number of reasons but it may take some getting used to if you are used to placing a marker at center screen and then changing Center Frequency and having the marker stay there.

NOTE Markers can be on and not be visible if they are offscreen. This may occur if you set a marker to a frequency outside of the current settings of the Start and Stop frequencies, or in Spectrogram View, you place a marker on a Display Trace other than 0.

To move the marker on to the display, press the **Peak Search** hardkey.

4.8.1 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

4.8.2 Settings

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

4.8.2.1 Marker Frequency|Time

This is the fundamental control that you use to move a marker around on the trace. It is the default active function in the **Marker** menu, so 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.

When in Zero Span (for measurements that support Zero Span), the label on this control changes to "Marker Time". When the Marker Mode is Delta, the label changes to "Marker Δ Frequency" or Marker Δ Time"

Remote Command	Not supported in RLC Mode
Notes	If no suffix is sent, Marker Freq|Time 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 invalid suffix message is generated If the specified marker is Fixed and a Marker Function is on, a message is generated. If the control is pressed, an advisory message is generated The query returns the marker's absolute X Axis value if the control mode is **Normal** or **Fixed**, and 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: Hz for **Frequency** and **Inverse Time**, seconds for **Period** and **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 You cannot directly set the X value of a Fixed marker which has a marker function turned on If an attempt is made to actually adjust it while a Marker Function is on, a warning message is generated
Preset	After a preset, if X is queried with no value sent first, the center of screen value will be returned. This will depend on the frequency range of the instrument. 13.255 GHz is correct for the 26 GHz instruments only (Option 526)
Min	–∞ (minus infinity)
Max	+∞ (plus infinity). Unlike legacy analyzers, where the markers were forced to be on screen, X-Series marker values are not limited and do not clip

Marker Backwards Compatibility

– In earlier HP/Agilent/Keysight analyzers, markers were position markers, which means that Normal and Delta markers stayed at the same screen position when X Axis parameters were changed. So a marker at center screen stayed at center screen even if Center Frequency was changed (which means that the marker's frequency changed). In the X-Series, markers are value markers, which means that when the instrument's X Axis settings are changed, the marker's X Axis value in fundamental X Axis units remains unchanged. For example, if you put a marker at a particular frequency, it will stay at that frequency regardless of whether or not you change the Center Frequency of the instrument, even if that means that the marker ends up offscreen.

- While this change resulted in an overall higher level of usability of the marker system, there are some use cases where the user depends on the marker staying at the center of the screen. The most common one is where the user turns on a marker at center screen and uses it to measure the trace amplitude at the center frequency or at a series of center frequencies, without the need to ever move the marker. In the X-Series, to mimic the legacy behavior for this use case, the user must turn the marker off and then back on after changing the center frequency of the instrument. This causes the marker to reappear in the center of the screen.
- Also as a result of the change from position markers to value markers, markers can be at a frequency which is offscreen, whereas in the past, they were clipped to the screen edges and hence were never offscreen. Users who depended on this clipping behavior to force markers to the edges of the screen will have to rewrite their code. Furthermore, since markers could never be offscreen they always returned a valid result. In the X-Series, markers that are offscreen return not a number as a result; hence the potential now exists for not a number to be returned for a marker query.

4.8.2.2 Marker Mode

There are four control modes for markers:

Normal (POSition) - A marker that can be moved to any point on the X Axis by specifying its X Axis value, and who's absolute Y Axis value is then the value of the trace point at that X Axis value.

Delta (DELTa) - A marker that can be moved to any point on the X Axis by specifying its X Axis offset from a reference marker, and whose absolute Y Axis value is then the value of the trace point at that X Axis value.

Fixed (FIXed) - A marker whose X Axis and Y Axis values may be directly or indirectly specified by you, but whose Y Axis value remains fixed, once specified, and does not follow the trace. Fixed markers are useful as reference markers for Delta markers, as operands in a Peak Search operation, and as arbitrary reference points settable by you. These markers are represented on the display by an “X” rather than a diamond. Not every measurement supports Fixed markers.

Off (OFF) - A marker that is not in use.

See "More Information" on page 192

Notes	Two additional parameters, SPAN and BAND, are supported for backwards compatibility only and should not be used for new designs. Both the SPAN and BAND legacy parameters are aliased to POSition. They are never returned to a query. Upon receipt of this command, for any parameter but **Off**, if the selected marker was **Off**, it is set to the specified mode and placed at the center of the screen on the trace specified by the marker’s Trace attribute.
Couplings	The marker addressed by this command becomes the selected marker on the front panel.
Preset	OFF (all markers)

State Saved	The marker control mode (Normal, Delta, Fixed, Off) and X Axis value are saved in instrument state.
Annunciation	Annunciation in the marker result block in the upper-right corner of the display indicates the X Axis value and Y-axis result of the marker.

More Information

Value	Notes
Normal	A **Normal** marker can be moved to any point on the X Axis by specifying its X Axis value. Its absolute Y Axis value is then the value of the trace point at that X Axis value.
Delta	In Delta mode the marker result shows the relative result between the selected (Delta) marker and its reference marker. A delta marker can be moved to any point on the X Axis by specifying its X Axis offset from a reference marker. Its absolute Y Axis value is then the value of the trace point at that X Axis value.
Fixed	A fixed marker is fixed in the sense that it stays where you place it. It can be directly moved in both X and Y. It can be moved with a Peak Search. It can also be indirectly moved by re-zeroing the delta if it is a relative marker. If it is moved, it again becomes fixed at the X Axis point it moved to and it has a Y-axis result that it took on when it moved there. If a Normal or Delta marker is changed to Fixed it becomes fixed at the X Axis point it was at, and with the Y-axis result it had when it was set to Fixed. In Fixed mode the marker result shows: – If no Marker Function is on, the absolute X Axis and Y axis value of the marker – If a Marker Function is on, the X Axis value and the Y-axis function result the marker had when it became fixed.
Off	Off turns off the marker, removes the marker annunciation from the display, turns off any active function and any marker function, and resets the following properties to their default value: – X Axis scale: Auto – Band Span: 0 – Auto Trace: On **Off** does not affect which marker is selected.

Setting Fixed Marker Values

Normal markers:

When an X Axis value is entered, or set using the knob or step keys, the marker moves to the trace point nearest to that X Axis value as specified in “Fractional Trace Points”, above. The value is retained in all its precision whether it is at the center of a trace point or not, and future increments are applied to that value.

Delta markers:

When the Delta control is selected:

- If the selected marker was not already in delta mode:
- the selected marker becomes a delta marker.
- If the marker's reference marker is off, it is turned on as a Fixed marker at the selected marker's X Axis value on the selected marker's trace and takes on the selected marker's X Axis value and Y-axis result. The reference marker's Trace attribute (including Auto, if on) becomes that of the selected marker. Note that if a marker function was on, the result that the reference marker then takes on is that of the function.
- If the marker's reference marker was already on, it is unaffected
- If the selected marker was already in delta mode: the reference marker is moved (even if **Fixed**), to the selected marker's trace at its X Axis value. The reference marker's Trace attribute (including Auto, if on) becomes that of the selected marker.

When an X Axis value is entered, or set using the knob or step keys, the marker moves, relative to its reference marker, to the trace point nearest to that value as specified in "Fractional Trace Points", above. The value is retained in all its precision whether it is at the center of a trace point or not, and future increments are applied to that value.

Fixed markers:

If the selected marker was **Off**, it is placed at the center of the screen on the trace specified by the marker's trace attribute (although subsequent sweeps will not affect its amplitude).

A fixed marker is fixed in the sense that it does not follow the trace. It can be directly moved in both X and Y by the user, and it can be indirectly moved. In the latter case once it moves it again becomes fixed at the X Axis point it moved to and with the Y-axis result it took on when it moved there.

If a Normal or Delta marker is changed to Fixed it becomes fixed at the X Axis point it was at and with the Y-axis result it had when it was set to Fixed.

When a Y Axis value is entered, or set using the knob or step keys, the marker moves vertically to the amplitude specified. When an X Axis value is entered, or set using the knob or step keys, the marker moves to the trace point nearest to that X Axis value as specified in "Fractional Trace Points", above. The value is retained in all its precision whether it is at the center of a trace point or not, and future increments are applied to that value. However, the Y Axis value of the marker does NOT take on that of the trace.

4.8.2.3 Delta Marker (Reset Delta)

Pressing this button has exactly the same effect as pressing the **Delta** selection in **Marker Mode**. 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.

4.8.2.4 Marker Table

When set to On, the display is split into a measurement window and a marker data display window. For each marker which is on, information is displayed in the data display window, which includes the marker number, control mode, trace number, X axis scale, X axis value, and the Y-axis result. Additional information is shown for markers which have marker functions turned on.

Turning on **Marker Table** turns off Peak Table, and *vice versa*.

Remote Command	Not supported in RLC Mode
Dependencies	Only available as a switch in the Normal View. Marker Table is also available as a selection in the Window Data dropdown in all Views
Preset	OFF
State Saved	The on/off state of the Marker Table is saved in instrument state

4.8.2.5 Marker Settings Diagram

Lets you configure the Marker system using a visual utility. It shows you all the markers at once.

The top row (labelled "Marker") shows each of the 12 markers, with a label showing the Mode and also a visual representation of the Mode (diamond for Normal or Delta, X for Fixed, nothing for Off). The selected Marker shows a blue outline and the figure in green.

The second row (Labelled "Reference Marker") shows the Reference Marker for each marker in the top row. If a marker in the top row is a Delta marker, an arrow points down to its Reference Marker. You can drag a top row marker down to any position in the bottom row to make it the reference marker for any other marker.

At the bottom is a large picture of the Selected Marker and dropdowns allowing you to change the Mode and the Trace of the selected Marker. The Marker Trace number appears in the Trace color of the trace in question.

4.8.2.6 All Markers Off

Turns off all markers.

Remote Command	Not supported in RLC Mode
Couplings	In the Swept SA measurement, sets the selected marker to 1

4.8.2.7 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).

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	Not supported in RLC Mode
Preset	`OFF` Presets on Mode Preset and All Markers Off
State Saved	Saved in instrument state

4.8.3 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.

In the Swept SA measurement, for a signal to be identified as a peak it must meet certain criteria. Signals in the negative frequency range and signals very close to 0 Hz are ignored. If either the peak excursion or peak threshold functions are on, then the signal must satisfy those criteria before being identified as a peak.

When peak excursion and peak threshold are both off:

- **Peak Search, Continuous Peak Search,** and maximum part of **Pk-Pk Search** will search the trace for the point with the highest y-axis value which does not violate the LO feedthrough rules. A rising and falling slope are not required for these three peak search functions.
- The remaining search functions **Next Peak, Next Pk Right**, etc. will only consider trace points which have a rising and falling slope on the left and right respectively.

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.

BANDED PEAK SEARCH: For all Peak Search functions, if you are in the Trace Zoom View of the Swept SA measurement, and the bottom window is selected, the search function will operate *only* within that window. This allows you to perform a Peak Search over a specified, limited frequency range, while still viewing the larger frequency range in the top window.

4.8.3.1 Marker Frequency|Time

This is the fundamental control that you use to move a marker around on the trace. It is the default active function in the **Marker** menu, so 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.

When in Zero Span (for measurements that support Zero Span), the label on this control changes to “Marker Time”. When the Marker Mode is Delta, the label changes to “Marker Δ Frequency” or Marker Δ Time”

Remote Command	Not supported in RLC Mode
Notes	If no suffix is sent, Marker Freq|Time 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 invalid suffix message is generated If the specified marker is Fixed and a Marker Function is on, a message is generated. If the control is pressed, an advisory message is generated The query returns the marker’s absolute X Axis value if the control mode is **Normal** or **Fixed**, and 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: Hz for **Frequency** and **Inverse Time**, seconds for **Period** and **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 You cannot directly set the X value of a Fixed marker which has a marker function turned on If an attempt is made to actually adjust it while a Marker Function is on, a warning message is generated
Preset	After a preset, if X is queried with no value sent first, the center of screen value will be returned. This will depend on the frequency range of the instrument. 13.255 GHz is correct for the 26 GHz instruments only (Option 526)
Min	–∞ (minus infinity)
Max	+∞ (plus infinity). Unlike legacy analyzers, where the markers were forced to be on screen, X-Series marker values are not limited and do not clip

Marker Backwards Compatibility

– In earlier HP/Agilent/Keysight analyzers, markers were position markers, which means that Normal and Delta markers stayed at the same screen position when X Axis parameters were changed. So a marker at center screen stayed at center screen even if Center Frequency was changed (which means that the marker’s frequency changed). In the X-Series, markers are value markers, which means that when the instrument’s X Axis settings are changed, the marker’s X Axis value in fundamental X Axis units remains unchanged. For example, if you put a marker at a particular frequency, it will stay at that frequency regardless of whether or not you change the Center Frequency of the instrument, even if that means that the marker ends up offscreen.

- While this change resulted in an overall higher level of usability of the marker system, there are some use cases where the user depends on the marker staying at the center of the screen. The most common one is where the user turns on a marker at center screen and uses it to measure the trace amplitude at the center frequency or at a series of center frequencies, without the need to ever move the marker. In the X-Series, to mimic the legacy behavior for this use case, the user must turn the marker off and then back on after changing the center frequency of the instrument. This causes the marker to reappear in the center of the screen.
- Also as a result of the change from position markers to value markers, markers can be at a frequency which is offscreen, whereas in the past, they were clipped to the screen edges and hence were never offscreen. Users who depended on this clipping behavior to force markers to the edges of the screen will have to rewrite their code. Furthermore, since markers could never be offscreen they always returned a valid result. In the X-Series, markers that are offscreen return not a number as a result; hence the potential now exists for not a number to be returned for a marker query.

4.8.3.2 Peak Search

Moves the selected marker to the trace point that has the maximum y-axis value for that marker's trace, subject to the **Peak Search Mode** setting on the **Pk Search Config** tab.

NOTE

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

The **Pk Search Config** menu enables you to define specific search criteria to determine which signals can be considered peaks, excluding unwanted signals from the search.

BANDED PEAK SEARCH: For all Peak Search functions, if you are in the Trace Zoom View of the Swept SA measurement, and the bottom window is selected, the search function will operate *only* within that window. This allows you to perform a Peak Search over a specified, limited frequency range, while still viewing the larger frequency range in the top window.

Remote Command	Not supported in RLC Mode

More Information

The behavior of a Peak Search is dependent on settings under the **Peak Search Config** tab. If the setting of **Peak Search Mode** is **Use Excursion and Threshold**, and either **Pk Excursion** or **Pk Threshold** are on, a signal must meet those criteriato be considered a peak. If no valid peak is found, a “No peak found” message is generated and the marker is not moved.. When **Highest Peak** is on, or both **Pk Excursion** and **Pk Threshold** are off, the marker is always placed at the point on the trace with the maximum y-axis value, even if that point is on the very edge of the trace (exception: negative frequencies and signals close to the LO are not searched at all).

Pressing **Peak Search** with the selected marker off causes the selected marker to be set to **Normal** at the center of the screen, then a peak search is immediately performed.

Pressing the front panel Peak Search key always does a peak search. Occasionally, you may need to get to the Peak Search menu key functions without doing a peak search. You can do this by first accessing the Marker menu, then pressing the **Peak Search** tab. The **Peak Search** menu will display without performing a **Peak Search.**

4.8.3.3 Next Peak

Moves the selected marker to the peak that is next lower in amplitude than the current marker value. Only peaks that meet all enabled peak criteria are considered (see "Pk Search Config" on page 201). 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	Not supported in RLC Mode
State Saved	Not part of saved state

4.8.3.4 Next Pk Right

Moves the selected marker to the nearest peak right of the current marker that meets all enabled peak criteria (see Peak Search Config). 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	Not supported in RLC Mode
State Saved	Not part of saved state

4.8.3.5 Next Pk Left

Moves the selected marker to the nearest peak left of the current marker that meets all enabled peak criteria (see Peak Search Config). 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	Not supported in RLC Mode
State Saved	Not part of saved state

4.8.3.6 Minimum Peak

Moves the selected marker to the minimum y-axis value on the current trace. Minimum (negative) peak searches are not required to meet the peak search criteria, searching merely for the lowest y-axis value.

If the selected marker is Off, it is turned on before the minimum search is performed.

Remote Command	Not supported in RLC Mode
State Saved	Not part of saved state

4.8.3.7 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.

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.)

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	Not supported in RLC Mode
Notes	Turns on the Marker D active function
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

4.8.3.8 Marker Delta

Pressing this button has exactly the same effect as pressing the **Delta** selection in **Marker Mode** 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.

4.8.3.9 Mkr->CF

Sets the center frequency of the instrument to the frequency of the selected marker. The marker stays at this frequency, so it moves to the center of the display. In Delta marker mode, this function sets the center frequency to the x-axis value of the Delta marker. When the frequency scale is in log mode, the center frequency is not at the center of the display.

If the currently selected marker is not on when this control is pressed, it is turned on at the center of the screen as a Normal type marker.

Remote Command	Not supported in RLC Mode
Dependencies	This function is not available (control is grayed-out) when x-axis is the time domain
Couplings	All the usual couplings associated with setting Center Frequency apply

4.8.3.10 Mkr->Ref Lvl

Sets the reference level to the amplitude value of the selected marker, moving the marked point to the reference level (top line of the graticule). The marker's mode (Normal, Delta, Fixed) doesn't matter in this case. For example, given a Delta marker, if the Delta marker is the selected marker, its amplitude is applied to the reference level. If the reference marker is selected, its amplitude is applied to the reference level.

If the currently selected marker is not on when this control is pressed, it is turned on at the center of the screen as a Normal type marker, and its amplitude applied to the reference level.

Remote Command	Not supported in RLC Mode
Couplings	All the usual couplings associated with setting Reference Level apply
Backwards Compatibility Notes	Mkr-> RefLvl behavior for a delta marker is slightly different from earlier models. ESA would calculate the delta amplitude (difference between reference marker and delta marker in dB) and assign that value to the reference level (in dBm). PSA would just assign the delta marker's amplitude to the reference level, ignoring the reference marker altogether. The X-Series products allow you to select either the reference or the delta marker individually. It is the selected marker's amplitude that will be applied to the reference level

4.8.3.11 Continuous Peak Search

Turns Continuous Peak Search on or off. When Continuous Peak Search is on, a peak search is automatically performed for the selected marker after each sweep. The rules for finding the peak are exactly the same as for **Peak Search**, including the use of the peak criteria rules. If no valid peak is found, a “No peak found” message is generated after each sweep.

See "More Information" on page 201.

Remote Command	`:CALCulate:MARKer[1]|2|...|12:CPSearch[:STATe] ON | OFF | 1 | 0` `:CALCulate:MARKer[1]|2|...|12:CPSearch[:STATe]?`
Example	`:CALC:MARK:CPS ON` Turns on Continuous Peak Search
Notes	Sending this command selects the subopcoded marker
Couplings	The **Continuous Peak Search** control is grayed out when the selected marker is a **Fixed** marker. Also, if **Continuous Peak Search** is on and the selected marker becomes a fixed marker, then Continuous Peak Search is turned off and the control grayed out **Signal Track** and **Continuous Peak Search** are mutually exclusive so if **Signal Track** is on, **Continuous Peak Search** will be grayed out and vice versa
Preset	Mode Preset
State Saved	Saved in instrument state
Status Bits/OPC dependencies	The Measuring bit should remain set while this command is operating and should not go false until the marker position has been updated.

More Information

When Continuous Peak Search is turned on a peak search is immediately performed and then is repeated after each sweep. If Continuous Peak Search is turned on with the selected marker off, the selected marker is set to **Normal** at the center of the screen, and then a peak search is immediately performed and subsequently repeated after each sweep.

When in Continuous Peak Search, `*OPC` will not return true, nor will `:READ` or `:MEASure` return any data, until the sweep is complete and the marker has been re-peaked. Note further that if the instrument is in a measurement such as averaging, and Continuous Peak Search is on, the entire measurement will be allowed to complete (i.e., all the averages taken up to the average number) before the re-peak takes place, and only *then* will `*OPC` go true and `:READ` or `:MEASure` return data.

Note that this function is not the “Continuous Peak” function found in some other instruments. That function was designed to track the signal; this function simply does a Peak Search after each sweep.

When Continuous Peak Search is turned on for a marker, a small “hat” is placed above the marker.

4.8.4 Pk Search Config

Contains controls that allow you to setup the Peak Search functions.

Since the **Pk Search Config** functions are independent of the selected Marker, the Select Marker control does not display while in Pk Search Config.

4.8.4.1 Peak Threshold

Turns the peak threshold requirement on/off and sets the threshold value. The peak threshold value defines the minimum signal level (or min threshold) that the peak identification algorithm uses to recognize a peak.

When both Pk Excursion and Pk Threshold are on, a signal must rise above the Pk Threshold value by at least the **Peak Excursion** value and then fall back from its local maximum by at least the **Peak Excursion** value to be considered a peak.

For example, if a threshold value of –90 dBm is selected, the peak search algorithm will only consider signals with amplitude greater than the –90 dBm threshold. If a threshold value of –90 dBm is selected, and **Peak Excursion** is **On** and set to 6 dB, the peak search algorithm will only consider signals with amplitude greater than the –90 dBm threshold which rise 6 dB above the threshold and then fall back to the threshold.

NOTE **If a signal comes onto the screen falling and falls all the way to the threshold without ever rising, it is considered a peak at the far left edge of the display. Similarly, if a signal rises from the threshold and leaves the screen without ever falling, it is considered a peak at the far right edge of the display. See the diagram below.**

Dependencies	When Ref Level Offset changes, Peak Threshold must change by the same amount.
Couplings	Whenever you adjust the value of Pk Threshold manually, the Peak Threshold Line is turned on and, if Peak Excursion is also on, the Peak Excursion Region is displayed
Preset	–90.0 dBm
State Saved	Saved in instrument state.
Min	The current displayed Ref Level – 200 dB. The current displayed Ref Level is the current Ref Level, offset by the Ref Level Offset.
Max	The current displayed Ref Level. This means the current Ref Level, offset by the Ref Level Offset.

4.8.4.2 Auto Threshold

Toggles whether the **Peak Threshold** is determined automatically or manually.

The default is `ON`, which means that Peak Threshold will be automatically calculated. Manually setting the Peak Threshold value sets Auto Threshold to `OFF`.

Remote Command	:CALCulate:MARKer:PEAK:THReshold:AUTO[:STATe] 0 | 1 | ON | OFF :CALCulate:MARKer:PEAK:THReshold:AUTO[:STATe]?
Example	:CALC:MARK:PEAK:THR:AUTO:STAT ON
Preset	ON
State Saved	Saved in instrument state

4.8.4.3 Peak Excursion

Turns the Peak Excursion requirement on/off and sets the excursion value. The value defines the minimum amplitude variation (rise and fall) required for a signal to be identified as peak. For example, if a value of 6 dB is selected, peak search functions like the marker Next Pk Right function move only to peaks that rise and fall 6 dB or more.

When both Pk Excursion and Pk Threshold are on, a signal must rise above the Pk Threshold value by at least the Peak Excursion value and then fall back from its local maximum by at least the Peak Excursion value to be considered a peak.

NOTE

In the event that a sequence of trace points with precisely the same values represents the maximum, the leftmost point is found. If a signal comes onto the screen falling and falls all the way to the threshold without ever rising, it is considered a peak at the far left edge of the display. Similarly, if a signal rises from the threshold and leaves the screen without ever falling, it is considered a peak at the far right edge of the display.

See "More Information" on page 203.

Remote Command	Not supported in RLC Mode
Dependencies	Available only when Y axis unit is amplitude units, otherwise grayed-out
Couplings	Whenever you adjust the value of Pk Excursion manually(with the knob, step keys, or by completing a numeric entry), if the Peak Threshold is turned ON, the Peak Threshold Line is turned on and the Peak Excursion Region is displayed
Preset	6.0 dB ON
State Saved	Saved in instrument state
Min	0.0 dB
Max	100.0 dB

More Information

If two signals are very close together and the peak excursion and threshold criteria are met at the outside edges of the combined signals, this function finds the highest of these two signals as a peak (or next peak). However, if a signal appears near the edge of the screen such that the full extent of either the rising or falling edge cannot be determined, and the portion that is on screen does not meet the excursion criteria, then the signal cannot be identified as a peak.

When measuring signals near the noise floor, you can reduce the excursion value even further to make these signals recognizable. To prevent the marker from identifying noise as signals, reduce the noise floor variations to a value less than the peak-excursion value by reducing the video bandwidth or by using trace averaging.

4.8.4.4 Auto Excursion

Toggles whether **Peak Excursion** will be determined automatically or manually.

The default is `ON`, which means that Peak Excursion will be automatically calculated. Manually setting the Peak Excursion value sets Auto Peak Excursion to `OFF`.

Remote Command	`:CALCulate:MARKer:PEAK:EXCursion:AUTO[:STATe] 0 | 1 | ON | OFF` `:CALCulate:MARKer:PEAK:EXCursion:AUTO[:STATe]?`
Example	`:CALC:MARK:PEAK:EXC:AUTO:STAT ON`
Preset	`ON`
State Saved	Saved in instrument state

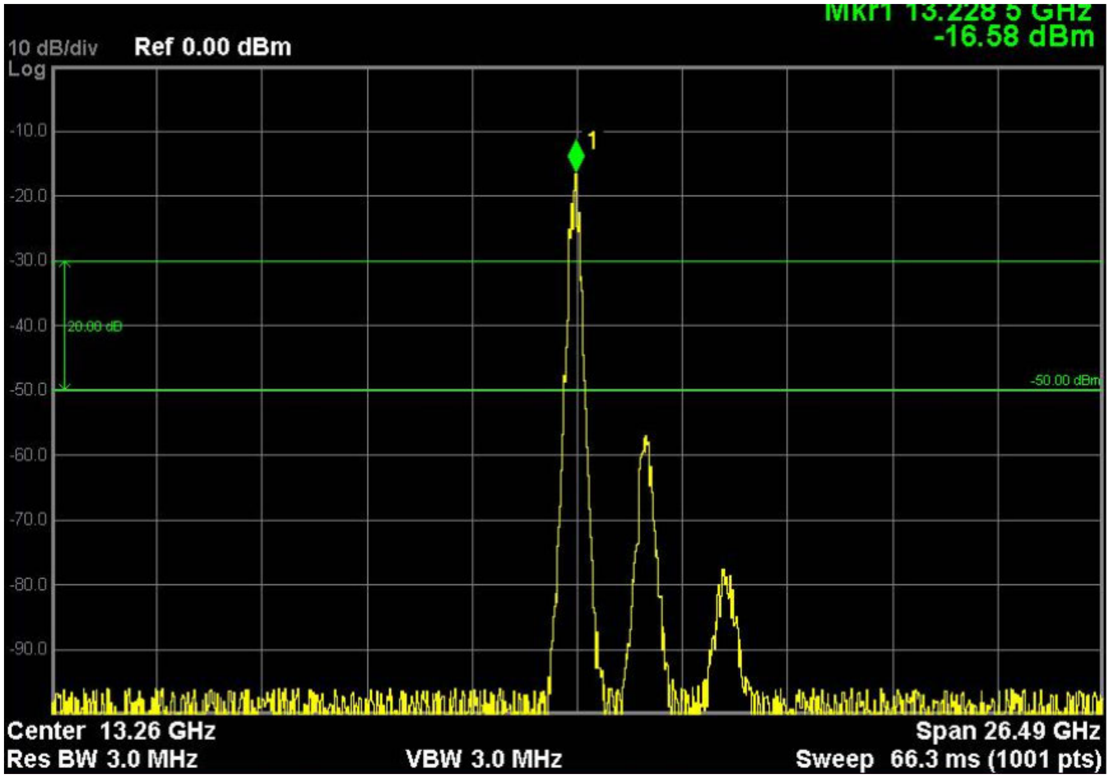
4.8.4.5 Pk Threshold Line

Turns the peak threshold line on or off. Preset state is `OFF`.

Remote Command	`:CALCulate:MARKer:PEAK:THReshold:LINE[:STATe] OFF | ON | 0 | 1` `:CALCulate:MARKer:PEAK:THReshold:LINE[:STATe]?`
Example	`:CALC:MARK:PEAK:THR:LIN:STAT 1` turns the Peak Threshold Line on

The Peak Threshold line is green and has the value of the peak threshold (for example, “–20.3 dBm”) written above its right side, above the line itself. If Peak Excursion is ON it shows on the left side as a region above the Peak Threshold line. As with all such lines (Display Line, Trigger Level line, etc.) it is drawn on top of all traces.

The Peak Threshold and Peak Excursion lines can be adjusted using the step keys, knob, or numeric keypad. They can also be dragged on the display with your finger or with a mouse.



This function is automatically set `ON` (thus turning on the Peak Threshold line) whenever the value of Peak Threshold or Peak Excursion becomes the active function, unless Peak Threshold is `OFF`. It is automatically set `OFF` whenever Peak Threshold is set to `OFF`. Manually turning it `ON` automatically turns on Pk Threshold.

The Peak Excursion part is on whenever the Pk Threshold part is on, unless Peak Excursion is `OFF`.

4.8.4.6 Peak Search Mode

Lets you specify what kind of search you want to do when **Peak Search** is pressed.

Note that there are two "types" of peak search functions: "Peak Search", and "Next Peak". "Next Peak" searches (for example, Next Peak, Next Pk Left, Next Pk Right) are qualified by using the Excursion and Threshold criteria. The "Peak Search" type of search simply finds the highest point on the trace.

However, using the **Peak Search Mode** control, you can change the "Peak Search" type so that it also uses the Excursion and Threshold criteria. This allows you to find the Maximum point on the trace that also obeys the Excursion and/or Threshold criteria. This would be useful if, for example, you did not want to perform the Peak Search at all unless there was a signal on the screen above a certain level.

When **Highest Peak** is selected, pressing **Peak Search** simply finds the highest peak on the marker's trace. When **Use Excursion & Threshold** is selected, the search is also qualified by the Excursion and Threshold values (as long as these criteria are On).

Note that this control also affects the Continuous Peak Search and the Peak Search half of Pk-Pk search.

Remote Command	Not supported in RLC Mode
Preset	`MAXimum`
State Saved	Saved in instrument state
Range	Highest Peak | Excursion & Thr

4.8.4.7 Peak Table On/Off

Turns Peak Table on or off. When turned on, the display is split into a measurement window and a peak table display window.

Turning the Peak Table on turns the Marker Table off and *vice versa*.

Remote Command	Not supported in RLC Mode
Dependencies	Only available as a switch in the Normal View. Peak Table is also available as a selection in the Window Data dropdown in all Views When the Peak Table turns on, if Peak Threshold is On then it becomes the active function
Preset	`OFF`
State Saved	Saved in instrument state

4.8.4.8 Peak Table Sort

Sets the peak table sorting routine to list the peaks in order of descending amplitude, ascending frequency or descending “Delta to Limit” value.

You can also sort the table and change the order between ascending and descending by tapping a column header once or twice.

Remote Command	Not supported in RLC Mode
Preset	`AMPLitude`
State Saved	Saved in instrument state

4.8.4.9 Peak Table Readout

Shows up to twenty signal peaks as defined by the setting:

All	Lists all the peaks defined by the peak criteria, in the current sort setting
Above Display Line	Lists the peaks that are greater than Display Line 1, and that meet the peak criteria. They are listed in the current sort order
Below Display Line	Lists the peaks that are less than Display Line 1, and that meet the peak criteria. They are listed in the current sort order

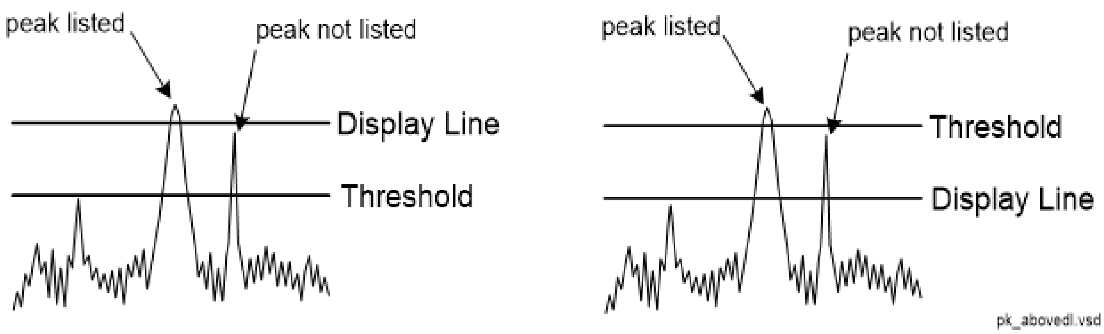
If the Peak Threshold and/or the Peak Excursion are turned on, then only peaks that meet the defined criteria will be found.

See "More Information" on page 207.

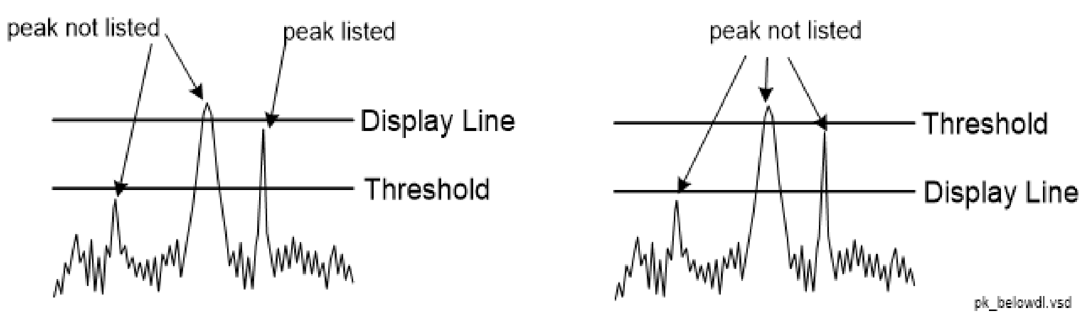
Remote Command	Not supported in RLC Mode
Dependencies	Turning Display Line 1 off forces Readout to ALL
Couplings	If GTDL or LTDL, then if Display Line 1 is not already on, it is turned on (it has to be on or it cannot be used to exclude peaks)
Preset	ALL
State Saved	Saved in instrument state

More Information

If the Display Line (see “Display”) is turned on, the Peak Table can be selected to include all peaks, only those above the Display Line, or only those below the Display Line. See the figures below to understand what happens if both Display Line and Pk Threshold are turned on.



Above Display Line Peak Identification



Below Display Line Peak Identification

4.8.4.10 Δ to Limit

Selects the Limit to be used for the Δ to Limit column in the Peak Table and turns the Δ to Limit column on and off.

When on, this column shows the difference between each peak and the specified Limit.

Remote Command	Not supported in RLC Mode
Preset	`LLINE1` `OFF`

4.8.5 Properties

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

4.8.5.1 Marker Frequency|Time

This is the fundamental control that you use to move a marker around on the trace. It is the default active function in the **Marker** menu, so 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.

When in Zero Span (for measurements that support Zero Span), the label on this control changes to “Marker Time”. When the Marker Mode is Delta, the label changes to “Marker Δ Frequency” or Marker Δ Time”

Remote Command	Not supported in RLC Mode
Notes	If no suffix is sent, Marker Freq|Time 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 invalid suffix message is generated If the specified marker is Fixed and a Marker Function is on, a message is generated. If the control is pressed, an advisory message is generated The query returns the marker’s absolute X Axis value if the control mode is **Normal** or **Fixed**, and 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: Hz for **Frequency** and **Inverse Time**, seconds for **Period** and **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 You cannot directly set the X value of a Fixed marker which has a marker function turned on If an attempt is made to actually adjust it while a Marker Function is on, a warning message is generated
Preset	After a preset, if X is queried with no value sent first, the center of screen value will be returned. This will depend on the frequency range of the instrument. 13.255 GHz is correct for the 26 GHz instruments only (Option 526)
Min	–∞ (minus infinity)

Max	+∞ (plus infinity). Unlike legacy analyzers, where the markers were forced to be on screen, X-Series marker values are not limited and do not clip

Marker Backwards Compatibility

- In earlier HP/Agilent/Keysight analyzers, markers were position markers, which means that Normal and Delta markers stayed at the same screen position when X Axis parameters were changed. So a marker at center screen stayed at center screen even if Center Frequency was changed (which means that the marker's frequency changed). In the X-Series, markers are value markers, which means that when the instrument's X Axis settings are changed, the marker's X Axis value in fundamental X Axis units remains unchanged. For example, if you put a marker at a particular frequency, it will stay at that frequency regardless of whether or not you change the Center Frequency of the instrument, even if that means that the marker ends up offscreen.
- While this change resulted in an overall higher level of usability of the marker system, there are some use cases where the user depends on the marker staying at the center of the screen. The most common one is where the user turns on a marker at center screen and uses it to measure the trace amplitude at the center frequency or at a series of center frequencies, without the need to ever move the marker. In the X-Series, to mimic the legacy behavior for this use case, the user must turn the marker off and then back on after changing the center frequency of the instrument. This causes the marker to reappear in the center of the screen.
- Also as a result of the change from position markers to value markers, markers can be at a frequency which is offscreen, whereas in the past, they were clipped to the screen edges and hence were never offscreen. Users who depended on this clipping behavior to force markers to the edges of the screen will have to rewrite their code. Furthermore, since markers could never be offscreen they always returned a valid result. In the X-Series, markers that are offscreen return not a number as a result; hence the potential now exists for not a number to be returned for a marker query.

4.8.5.2 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	Not supported in RLC Mode
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

4.8.5.3 X Axis Scale

Determines how the X-Axis information for the selected marker is displayed in the marker area (top-right of display) and the active function area of the display, and how the marker is controlled. The available settings for the X Axis Scale are Frequency, Period, Time, and Inverse Time.

See "More Information" on page 210.

Remote Command	Not supported in RLC Mode
Notes	If in a delta marker mode, the value used for X Axis Scale of both the marker and the reference marker (for calculating the delta) is that of the marker, independent of what the reference marker is set to
Preset	AUTO Marker Preset (selected when a marker is turned **Off**): **Auto** (see below). In most measurements the Auto settings results in Frequency being the preset readout Note that the marker trace should first be preset according to the Marker Trace rules before this preset is applied ON
State Saved	Saved in instrument state

More Information

Value	Notes
Frequency	Displays the absolute frequency of a normal marker or the frequency of the delta marker relative to the reference marker
Period	Displays the reciprocal of the frequency of the marker, or the reciprocal of the frequency separation of the two markers in a delta-marker mode. The units are those of time (sec, msec, etc.) If the markers are at the same frequency in a delta marker mode, the result is the reciprocal of 0, which is infinitely large. The display shows "---"
Time	Displays the time interval between a normal marker and the start of a sweep or the time of the delta marker relative to the reference marker. Time is the auto setting for time domain traces. In a delta-marker mode it is the (sweep) time interval between the two markers
Inverse Time	Displays the reciprocal time. It is useful in a delta mode to show the reciprocal of (sweep) time between two markers. This function is only meaningful when on a time domain trace and in the **Delta** control mode. If the markers are at the same X Axis value, the time between them is 0, so the reciprocal of sweep time is infinitely large. The display shows "---"

The **X Axis Scale** of a marker is the scale of its X Axis value. This affects the units displayed in the Marker Result block and used to specify the marker's X Axis location. The X Axis Scale is specified using the **Marker, Properties, X Axis Scale** key.

All markers in swept spans have both a time and frequency value. Which of these is used for the result display, and for positioning the marker, depends on the **X Axis Scale** setting. The **X Axis Scale** setting can be **Frequency** or **Time**, as well as the reciprocal of either (**Period** or **Inverse Time**). There is also an **Auto** setting - when in **Auto**, a marker's **X Axis Scale** changes whenever the domain of the trace, upon which it set, changes. All choices for **X Axis Scale** are allowed. Note that this behavior differs from the behavior in previous instruments: previously the instrument remembered a different **X Axis Scale** (formerly called **Readout**) for each domain, and the choices of **X Axis Scale** were restricted. These restrictions were based on the current domain of the instrument.

When in **Auto**, the X-Axis Scale is **Frequency** if the Marker Trace is a frequency domain trace, **Time** if the Marker Trace is a time domain trace. When in Auto, if the marker changes traces, or the domain of the trace the marker is on changes, the auto result is re-evaluated. If the X Axis Scale is chosen manually, that Scale is used regardless of the domain of the trace.

If **Frequency** or **Period** is selected for a time domain trace, all points in the trace will show the same value. Attempting to use the knob or step keys to adjust the X Axis value of the marker or entering an X Axis value from the numeric keypad or remotely will have no effect but will generate no error.

Frequency domain traces taken in FFT mode have no valid time data. Therefore when **Time** or **Inverse Time** is selected for markers on such traces, the X Axis value is taken as the appropriate percentage of the displayed sweep time, which is a calculated estimate.

4.8.5.4 Lines

When ON, displays a vertical line of graticule height and a horizontal line of graticule width, intersecting at the indicator point of the marker (that is, the center of the X or the bottom tip of the diamond. The lines are blue in color.

If the marker is offscreen, the lines should be extended from the marker so that they go thru the screen area if possible. This is really useful for off screen Fixed markers as it lets you see their amplitude even though they are off the X Axis.

Remote Command	Not supported in RLC Mode
Preset	`OFF`
State Saved	Saved in instrument state

4.8.5.5 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, even **Fixed** markers; 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.

In measurements that support Auto Initialize, if Auto Initialize is `ON` (the default state) the trace is automatically chosen when the Marker is turned on, based on rules described under "Auto Initialize" on page 212.

Specifying a Marker Trace manually or with this command associates the marker with the specified trace and turns Auto Initialize `OFF` for that marker. 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.

Remote Command	Not supported in RLC Mode
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** If a Marker Trace is chosen manually, Auto Initialize goes to `OFF` for that marker
Preset	1 (Presets on Meas Preset or All Markers Off)
State Saved	The Marker Trace and state of **Auto Init** for each marker is saved in instrument state
Min	1
Max	6

4.8.5.6 Auto Initialize

When **Auto Initialize** is true for a given marker, the marker's trace is re-determined automatically by the analyzer whenever the marker turns on (Normal, Delta or Fixed) from an Off state. This is the default state of Markers. (The trace attribute is also determined for all markers that are on, whenever **Auto Init** is turned on).

When **Auto Initialize** is turned off for a given marker, the Marker remains associated with the trace it is currently on regardless of whether the marker and/or the marker's trace is subsequently turned on or back off. If the marker is **Off** it stays off but is now associated with the specified trace.

Auto Initialize is turned off automatically whenever Marker Trace is used to directly specify a marker's trace.

For more details, see "Auto Init Rules Flowchart" on page 213 below.

Remote Command	Not supported in RLC Mode
Notes	Turning Marker Trace Auto Init off has no effect on the trace on which the marker is currently placed
Couplings	The state of Auto Init is not affected by Auto Couple Auto Init is set to True on a Preset or All Markers Off If Auto Init is set to On for a marker and that marker is on, that marker's Marker Trace is immediately set

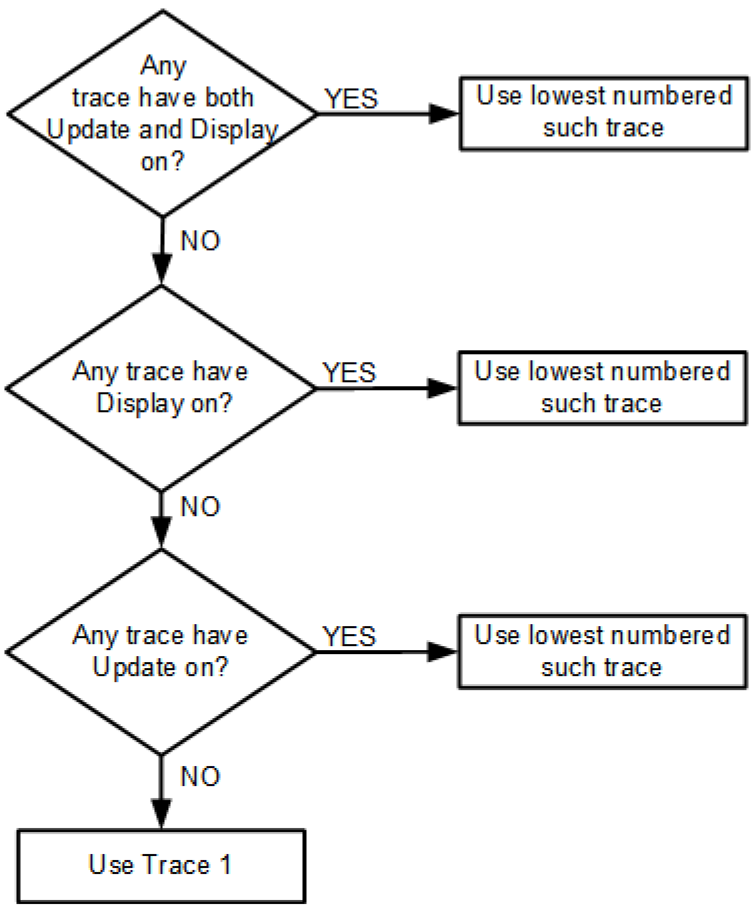
	according to the above flowchart
Preset	ON

When the marker moves between traces the marker's X position in trace points is retained as it moves. For moving between active traces this generally means the x-axis value of the marker does not change. But for moving to or from an inactive trace, the x-axis value takes on that of the new trace at the bucket the marker was on the old trace (and is still on, on the new trace, since the bucket doesn't change).

Note this is true even if the marker is off screen. Thus, a marker that is at the center of the screen on the old trace stays at the center of the screen on the new trace. A marker that is off screen one whole screen to the left on the old trace remains off screen one whole screen to the left on the new trace – even if this means it will be at negative time!

Auto Init Rules Flowchart

The following flowchart depicts the Auto Init rules:



This flowchart makes it clear that putting all lower-numbered traces in View is the simplest way to specify which trace you want the markers to go to when they turn on.

For example, if you want all Markers to go to trace 2 when they turn on, put trace 1 in View.

4.8.5.7 Marker Settings Diagram

Lets you configure the Marker system using a visual utility. It shows you all the markers at once.

The top row (labelled ”Marker”) shows each of the 12 markers, with a label showing the Mode and also a visual representation of the Mode (diamond for Normal or Delta, X for Fixed, nothing for Off). The selected Marker shows a blue outline and the figure in green.

The second row (Labelled “Reference Marker”) shows the Reference Marker for each marker in the top row. If a marker in the top row is a Delta marker, an arrow points down to its Reference Marker. You can drag a top row marker down to any position in the bottom row to make it the reference marker for any other marker.

At the bottom is a large picture of the Selected Marker and dropdowns allowing you to change the Mode and the Trace of the selected Marker. The Marker Trace number appears in the Trace color of the trace in question.

4.8.6 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
- Interval Power
- Interval Density
- Off

4.8.6.1 Marker Frequency|Time

This is the fundamental control that you use to move a marker around on the trace. It is the default active function in the **Marker** menu, so 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.

When in Zero Span (for measurements that support Zero Span), the label on this control changes to “Marker Time”. When the Marker Mode is Delta, the label changes to “Marker Δ Frequency” or Marker Δ Time”

Remote Command	Not supported in RLC Mode
Notes	If no suffix is sent, Marker Freq|Time 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 invalid suffix message is generated If the specified marker is Fixed and a Marker Function is on, a message is generated. If the control is pressed, an advisory message is generated The query returns the marker's absolute X Axis value if the control mode is **Normal** or **Fixed**, and 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: Hz for **Frequency** and **Inverse Time**, seconds for **Period** and **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 You cannot directly set the X value of a Fixed marker which has a marker function turned on If an attempt is made to actually adjust it while a Marker Function is on, a warning message is generated
Preset	After a preset, if X is queried with no value sent first, the center of screen value will be returned. This will depend on the frequency range of the instrument. 13.255 GHz is correct for the 26 GHz instruments only (Option 526)
Min	$-\infty$ (minus infinity)
Max	$+\infty$ (plus infinity). Unlike legacy analyzers, where the markers were forced to be on screen, X-Series marker values are not limited and do not clip

Marker Backwards Compatibility

– In earlier HP/Agilent/Keysight analyzers, markers were position markers, which means that Normal and Delta markers stayed at the same screen position when X Axis parameters were changed. So a marker at center screen stayed at center screen even if Center Frequency was changed (which means that the marker's frequency changed). In the X-Series, markers are value markers, which means that when the instrument's X Axis settings are changed, the marker's X Axis value in fundamental X Axis units remains unchanged. For example, if you put a marker at a particular frequency, it will stay at that frequency regardless of whether or not you change the Center Frequency of the instrument, even if that means that the marker ends up offscreen.

– While this change resulted in an overall higher level of usability of the marker system, there are some use cases where the user depends on the marker staying at the center of the screen. The most common one is where the user turns on a marker at center screen and uses it to measure the trace amplitude at the center frequency or at a series of center frequencies, without the need to ever move the marker. In the X-Series, to mimic the legacy behavior for this use case, the user must turn the marker off and then back on after changing the center frequency of the instrument. This causes the marker to reappear in the center of the screen.

– Also as a result of the change from position markers to value markers, markers can be at a frequency which is offscreen, whereas in the past, they were clipped to the screen edges and hence were never offscreen. Users who depended on this clipping behavior to force markers to the edges of the screen will have to rewrite their code. Furthermore, since markers could never be offscreen they always returned a valid result. In the X-Series, markers that are offscreen return not a number as a result; hence the potential now exists for not a number to be returned for a marker query.

4.8.6.2 Band Function

Band Functions are Marker Functions that allow you to define a band of frequencies around the marker. The band defines the region of data used for the numerical calculations. These marker functions also allow you to perform mathematical calculations on trace and marker data and report the results of these calculations in place of the normal marker result.

NOTE **Unlike regular markers, Band Function markers are not placed directly on the trace. They are placed at a location which is relative to the result of the function calculation.**

See:

– "More Information" on page 217

– "Fixed marker functions" on page 217

– "Interval Markers" on page 218

– "Offscreen Markers and Band Functions" on page 218

Remote Command	Not supported in RLC Mode
Notes	The zero-width case and the case of a width less than .499 buckets is treated as one bucket wide although it shows a width of 0 When the trace the marker is on crosses domains, the width crosses domains as well, to remain the same percentage of the trace
Dependencies	Fixed markers: It is not possible to change the Band Function for a Fixed marker; so the Band Function selections are grayed out for a Fixed marker If a marker function was already on when the marker became Fixed, then the selected Band Function is shown but cannot be changed. Therefore, you cannot directly set the X or Y value of a Fixed marker that has a marker function turned on. To turn off the function, turn off the marker Average detector and Power Averaging are auto selected when Marker Noise on If the selected (specified) marker is off, selecting Marker Noise via front panel turns the marker on
Couplings	When you choose any Band Function and **Band Span Auto/Man** is in the **Auto** state, the **Band Span** is set to 5% of the screen width Adjusting the Band Span sets **Band Span Auto/Man** to Man While in **Marker Noise** and with **Band Span Auto/Man** in the **Auto** state, if the analyzer Span is changed, **Band Span** stays at 5% of the new span If the selected (specified) marker is off, selecting a Band Function via front panel turns the marker on If the detector mode for the detector on the marker's trace is set to Auto, the average detector is

	selected. If the Average type is set to Auto, Power Averaging is selected. Other choices for the detector or Average type may cause measurement inaccuracy
Preset	`OFF`
State Saved	The band function for each marker is saved in instrument state
Annunciation	The band function for the selected marker appears in the Marker Result block and in the Marker Table

More Information

The Band Functions are **Marker Noise**, **Band Power**, and **Band Density,** only one of which can be on for a given marker.

Value	Notes
Marker Noise	When **Marker Noise** is on, the marker's Y Axis Result is the average noise level, normalized to a 1 Hz noise power bandwidth, in the band specified under the **Band Adjust** key To guarantee accurate data for noise-like signals, a correction for equivalent noise bandwidth is made by the instrument The **Marker Noise** function accuracy is best when the detector is set to Average or Sample, because neither of these detectors will peak-bias the noise. The tradeoff between sweep time and variance of the result is best when Average Type is set to Power Averaging. Therefore, Auto coupling chooses the Average detector and Power Averaging when Marker Noise is on. Though the Marker Noise function works with all settings of detector and Average Type, using the positive or negative peak detector gives less accurate measurement results Noise Markers assume that the signal to be measured is noise-like. Based on this assumption, we can actually make reasonable measurements under very non-ideal conditions: any detector may be used, any averaging type, any VBW. In contrast, the Band Power and Band Density markers make no assumption about the statistics of the signal
Band Power	The band power marker computes the total power within a span in a nonzero span. The results computation must include the RBW In zero span the band power marker measures the average power across a time interval. This is sometimes referred to as the interval power
Band Density	On frequency domain traces, the band density across a band is the total band power divided by the bandwidth over which it is measured In zero span the band density marker measures the average power across a time interval, divided by Bn. Bn is the noise bandwidth of the RBW filter, as noted and used within the Band Power computation. This is sometimes referred to as the interval density It may seem like the band density marker function is exactly like a function of a noise marker with variable width. But they are somewhat different. The Noise marker assumes that the signal to be measured is noise-like and applies a correction based on that assumption. The Band Density markers make no assumption about the statistics of the signal
Off	Off turns off all Band Functions Turning off the marker function has no effect on the band span nor does it turn the marker off

The unit to be used for displaying Band Function results is automatically chosen based on the control mode (Normal, Delta, Fixed) of the marker and the reference marker. For example, dB/Hz is used when the marker is a noise marker and the reference marker is a band power marker.

If the selected marker is off, pressing Marker Function sets it to Normal and places it at the center of the display on the trace determined by the Marker Trace rules. However, if the selected marker was **Off**, **Marker Function Off** had to be the selected function, and it remains so even after the marker is thus turned on, although you may then change it.

Fixed marker functions

In the case of a fixed marker, it is not possible to turn on or change a band function. This is because a Fixed marker holds the value it had when it became fixed; the trace it was on may keep on changing, so the function value, which depends on trace data, could not be calculated on an ongoing basis.

It is possible to have a Marker Function on for a Fixed marker, in the case where a function was already on when the marker became Fixed. In this case the function value is retained in the marker. It is also possible to have a Marker Function on for a Fixed marker in the case when the marker was off and was turned on as **Fixed** because **Delta** was pressed to create a reference marker - in which case the marker function, marker function width, Y Axis value and marker function result that the **Delta** marker had when **Delta** was pressed are copied into the Fixed marker. If **Delta** is pressed again, causing the fixed reference marker to move to the delta marker's position, the marker function, marker function width, Y Axis value and marker function result that the **Delta** marker had when **Delta** was pressed are again copied into the fixed reference marker.

If a Marker Function is on for a Fixed marker, the marker's reported value is derived by the function. Therefore you cannot directly set the X or Y value of a Fixed marker which has a marker function turned on. Indirect setting as detailed above or when a Peak Search is performed is allowed, as the Fixed marker is always placed on a trace and can derive its function value from the trace at the moment when it is placed.

Interval Markers

What is an interval marker?

The interval power marker measures the average power across some time interval in zero span.

Interval Density is defined to be Interval Power divided by Bn. Bn is the noise bandwidth of the RBW filter, as noted and used within the Band Power computation.

In older instruments, Band Power and Band Density were actually referred to as Interval Power and Interval Density when the instrument was in Zero Span but this practice is no longer observed, however it should be understood that in Zero Span (and other time domain measurements), the Band Power and Band Density functions are actually Interval Power and Interval Density functions.

Offscreen Markers and Band Functions

If a **Normal** or **Delta** noise marker is so near to the left or right edge of the trace that some of the band is off the screen, then it uses only that subset of the Band Width that is on-trace.

Neither Band power nor Band density markers are defined if any part of the band is off the screen (unless they are Fixed with a stored function value in them), except that when the edges of the bandwidth are trivially off-screen, due to mathematical limitations in the instrument or in the controlling computer, the result is still considered valid.

4.8.6.3 Band Span Auto/Man

Determines whether the Band Span for Marker Noise will track the instrument's Span.

When you choose any Band Function and **Band Span Auto/Man** is in the **Auto** state, the **Band Span** is set to 5% of the screen width.

Adjusting the Band Span sets **Band Span Auto/Man** to Man.

This function only affects **Marker Noise**. While in **Marker Noise** and with **Band Span Auto/Man** in the **Auto** state, if the instrument Span is changed **Band Span** will stay at 5% of the new span.

If **Band Span Auto/Man** is in the **Man** state, the **Band Span** does not change when the **Span** is changed. Also, if any Band Function but **Marker Noise** is in effect, the **Band Span** does not change when the **Span** is changed.

The Band Span is set to 5% regardless of whether or not this would place part of the Band offscreen. The Marker Noise function is well able to function with part of the band offscreen.

Note that, if in Zero Span, "Span" replaces "Sweep Time" in the discussion above.

Remote Command	Not supported in RLC Mode
Dependencies	This only appears when the Marker Function for the selected marker is Marker Noise
Couplings	When Auto Band Span is turned on, it immediately adjusts the band span to 5% of the Span. If you select Marker Noise, and Auto Band Span is on, the Band Span will immediately change to 5% of Span If the Band Span is changed, either by the Band Span key, the Band Left key, or the Band Right key, this function is set to Man This function is set to Auto when the Marker is turned off, and is also set to Auto on Preset and when Auto Couple is pressed
Preset	Auto
State Saved	Saved in instrument state
Backwards Compatibility Notes	In legacy instruments, the Noise Marker had a width that was always equal to 5% of the span. But in the X-Series it is possible for the user to change the span of the Marker Noise band using the Band Adjust function. To preserve the legacy behavior, the Band Span Auto/Man function is provided. When it is in Auto, which it is by default, the Maker Noise band is always held at 5% of Span, even if the Span changes. When the user adjusts the Marker Noise Band Span, Band Span Auto/Man is set to Manual. So the legacy behavior is preserved, but now the user can set the Marker Noise Span as well and that setting will be preserved when Span is changed

4.8.6.4 Band Left

Sets the left edge frequency or time for the band of the selected marker. The right edge is unaffected.

Remote Command	Not supported in RLC Mode
Notes	Units are those of the trace's domain, Hz for frequency domain, s for time domain. When the left edge is moved, the right edge stays anchored; thus, the marker's frequency will change Excess Active Function resolution may require up to 15 digits to allow sub-bucket resolution in narrow spans with many points. Our calculations indicate 15 digits plus decimal point may be required. This will not fit on the control; so the control value can only display to 12 digits, but the value in the active

	function area should display to the full sub-bucket resolution Sending this command selects the subopcoded marker The unit of the parameter must match the current domain of the trace the selected marker is on, or an invalid suffix error will be generated. If no unit is sent the fundamental unit for the trace domain will be used (Hz for freq domain traces, s for time domain traces) Note that all the values provided in this table are only valid for frequency domain traces. If the current domain of the trace is time domain, values and unit will be different. In frequency domain, the Preset value is dependent on the frequency range of the instrument. The default value 1.3245 GHz is appropriate only if the instrument is a 26.5 GHz instrument (Option 526). In a 26.5 GHz Instrument, the default span is 26.49 GHz, so 5% of the span corresponds to 1.3245 GHz
Couplings	Changing the Band Left necessarily changes the Band Span and Band Center values Band Span is set to 0 when the marker is turned off so that means Band Left is set to the center value at this time Band Span is set to 5% of span when any marker function is turned on if and only if it is zero at that time
Preset	If 0, Band Span is set to 5% of span, when a marker function is turned on, which affects Band Left
State Saved	Saved in instrument state
Min	0 Hz
Max	Infinity. Unlike legacy instruments, where the markers were forced to be on screen, X-Series marker values are not limited and do not clip

4.8.6.5 Band Right

Sets the right edge frequency or time for the band of the selected marker. The left edge is unaffected

Remote Command	Not supported in RLC Mode
Notes	Units are those of the trace’s domain, Hz for frequency domain, s for time domain. When the right edge is moved, the left edge stays anchored; thus, the marker’s frequency will change Excess Active Function resolution may require up to 15 digits to allow sub-bucket resolution in narrow spans with many points. Our calculations indicate 15 digits plus decimal point may be required. This will not fit on the control; so the control value can only display to 12 digits, but the value in the active function area should display to the full sub-bucket resolution Sending this command selects the subopcoded marker The unit of the parameter must match the current domain of the trace the selected marker is on, or an invalid suffix error will be generated. If no unit is sent the fundamental unit for the trace domain will be used (Hz for freq domain traces, s for time domain traces) Note that all the values provided in this table are only valid for frequency domain traces. If the current domain of the trace is time domain, values and unit will be different. In frequency domain, the Preset value is dependent on the frequency range of the instrument. The default value 1.3245 GHz is appropriate only if the instrument is a 26.5 GHz instrument (Option 526). In a 26.5 GHz Instrument, the default span is 26.49 GHz, so 5% of the span corresponds to 1.3245 GHz
Couplings	Changing the Band Right necessarily changes the Band Span and Band Center values Band Span is set to 0 when the marker is turned off so that means Band Right is set to the center value

	at this time Band Span is set to 5% of span when any marker function is turned on if and only if it is zero at that time
Preset	If 0, Band Span is set to 5% of span, when a marker function is turned on, which affects Band Right
State Saved	Saved in instrument state
Min	0 Hz
Max	Infinity. Unlike legacy instruments, where the markers were forced to be on screen, X-Series marker values are not limited and do not clip

4.8.6.6 N dB Points

Turns N dB points on and off and allows you to set the N dB value. N dB uses the selected marker. If the selected marker is not on when N dB is turned on, the selected marker turns on, as a Normal marker, at center screen, and is used by N dB.

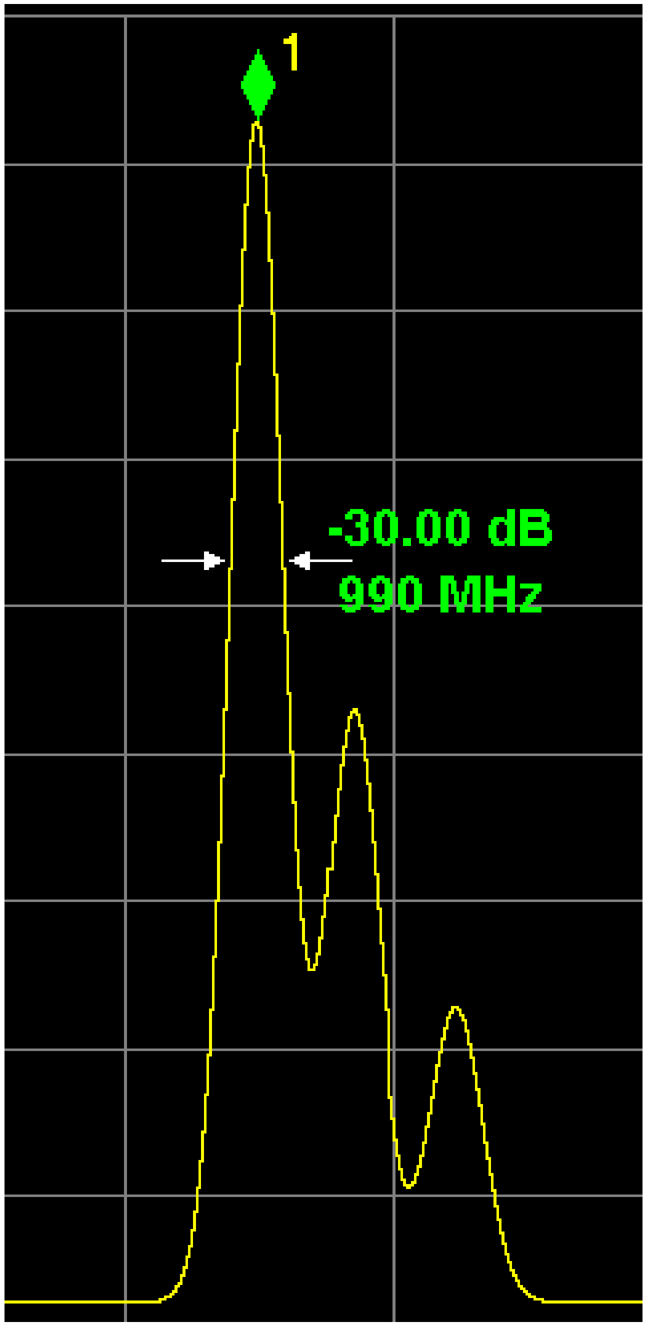
See "More Information" on page 221

Remote Command	Not supported in RLC Mode
Notes	If the selected marker is turned **Off** it turns off N dB Points N DB Points is unaffected by Auto Couple
Preset	–3.01dB Off, –3.01 dB OFF
State Saved	The on/off status and the offset value are both saved in instrument state
Min	–140 dB
Max	–0.01 dB

More Information

A marker should be placed on the peak of interest before turning on N dB points. The N dB points function looks for the two points on the marker's trace closest to the marker's X Axis value that are N dB below the marker's amplitude, one above and the other below the marker's X Axis value. (That is, one point is to the right and one is to the left of the selected marker.) The selected N dB value is called the offset. The function reports the frequency difference (for frequency domain traces) or time difference (for time domain traces) between those two points.

Each point is identified by a horizontal arrow pointing towards the marker, next to the trace. The arrows used by the N dB Points function will be as shown in the figure below (where each square represents one pixel). They point in, horizontally, at the trace below a peak, on either side of its skirts.

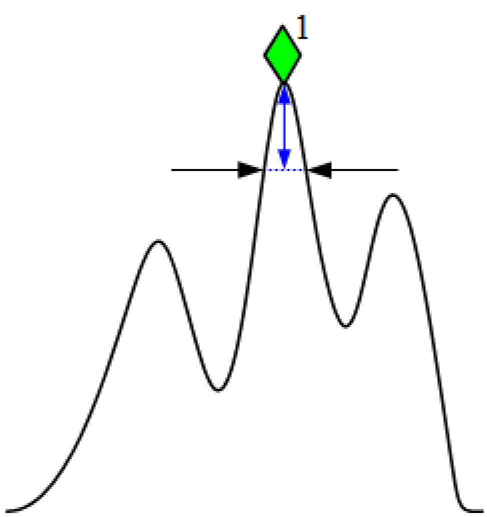


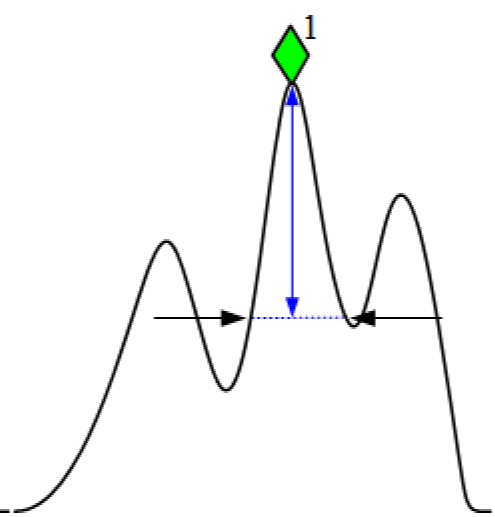
N dB Points can be used to measure the bandwidth of a signal; it is commonly used in conjunction with a tracking generator to measure filter bandwidths.

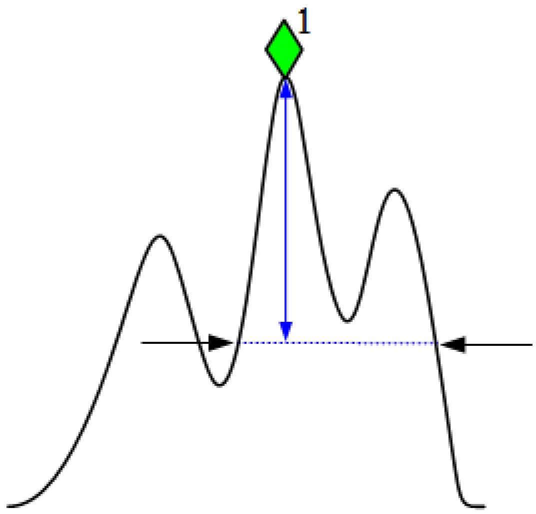
In one of the common use cases, the marker is placed on a peak, and the arrows are displayed N dB down the skirt from the marker on either side of the peak. The N dB value and the frequency difference between the two arrows is displayed around the arrow as shown in the figure above. Normally this displays on the right arrow, but if this would place any part of the text offscreen to the right then it displays on the left arrow.

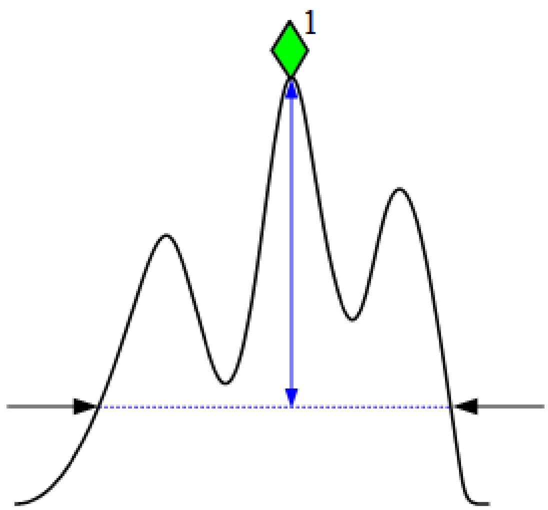
If the instrument is unable to find data that is N dB below the marker on either side of the marker, the arrows are displayed at the indicator point of the marker, no value (---) will be displayed as the result and –100 Hz returned remotely (see figure below):

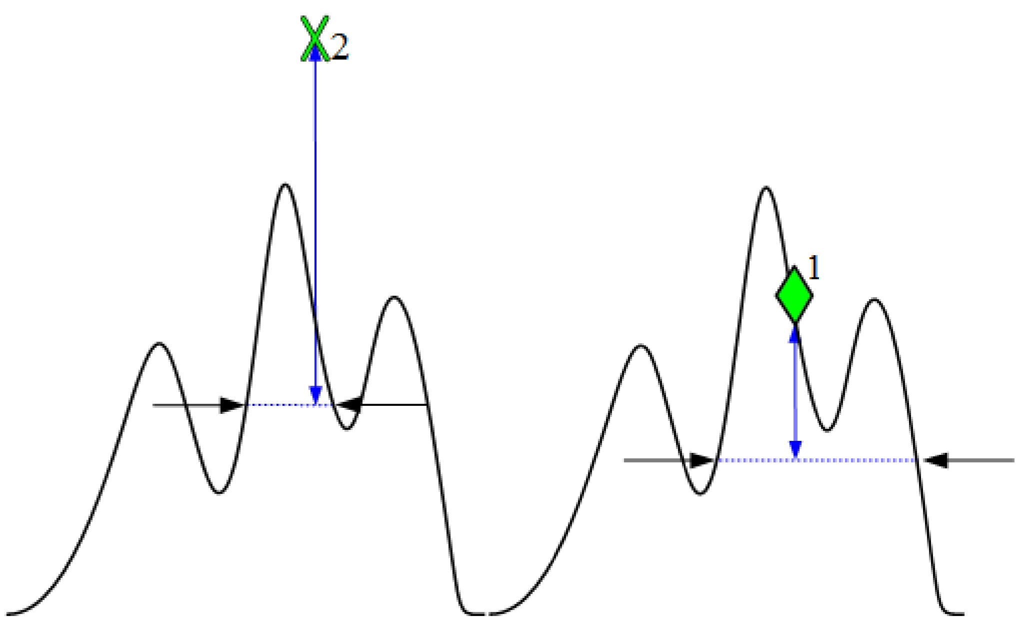
Some sample N dB scenarios are shown below to illustrate how the function works in various cases. In each case, the two-headed blue arrow represents N dB of amplitude.

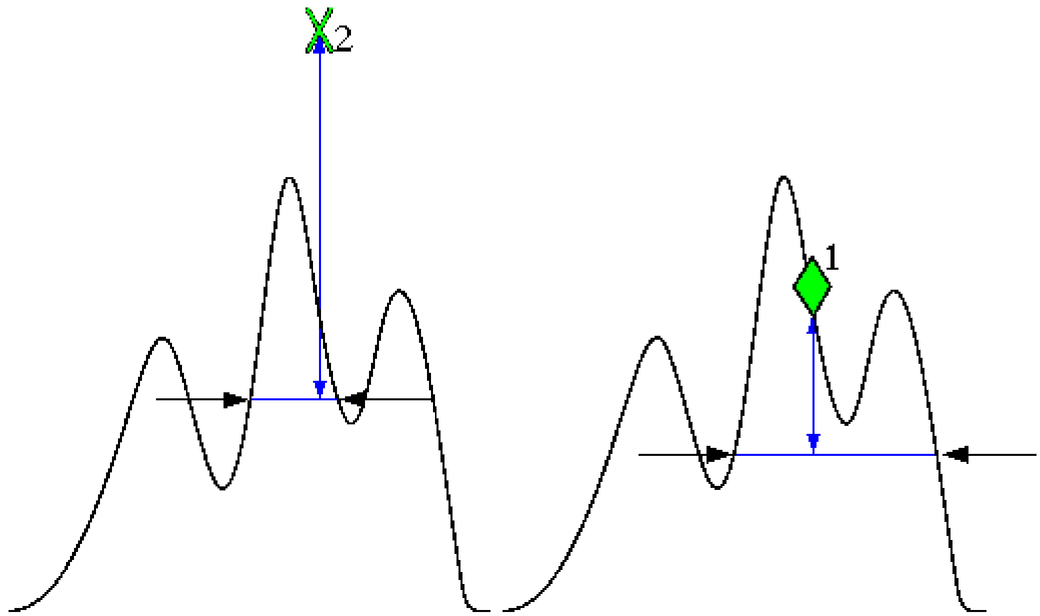





1


1


2
1



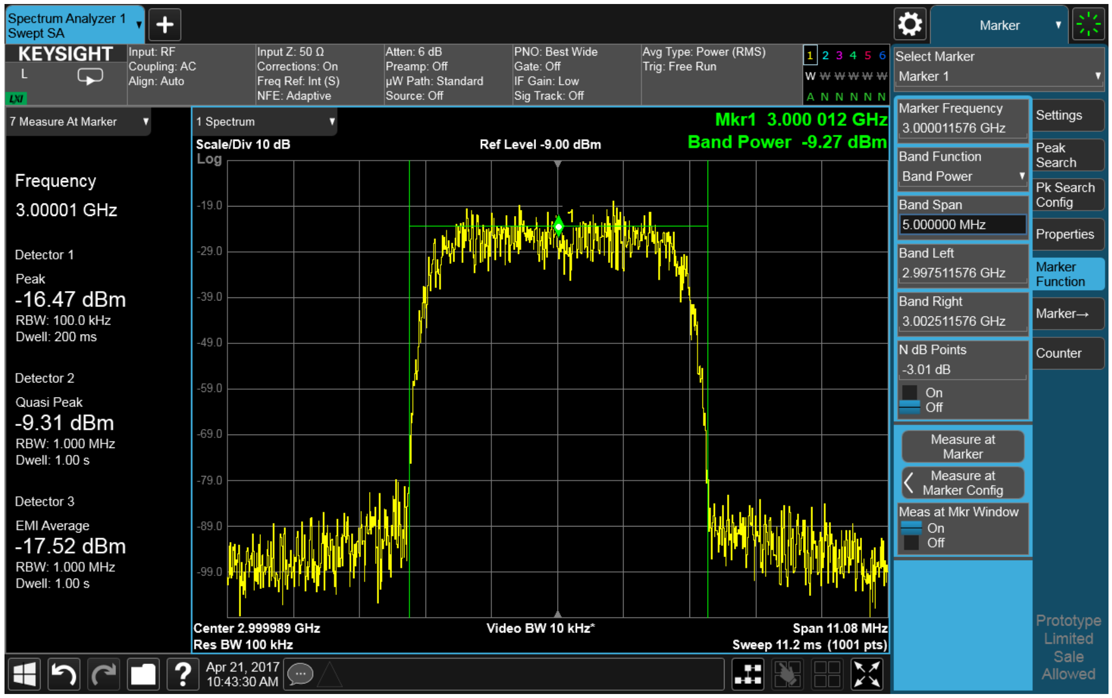
4.8.6.7 Measure at Marker

When this control is pressed, the instrument executes one **Measure at Marker** function and then returns. **Measure at Marker** goes to the frequency of the selected marker and takes a reading with each of the three detectors selected in the **Detectors** menu, using the dwell times specified there, then displays the readings in a window on the display, using the current Y-Axis Unit.

When the measurement is complete, the instrument restores all settings to their previous values, and normal sweeps resume.

Remote Command	Not supported in RLC Mode
Dependencies	This control only appears with the N6141 application, or when Option EMC is installed and licensed If **BW & Avg Type** is in an Autocoupled state, the (up to three) measurements taken by Measure at Marker are taken with Auto Coupled settings for the functions in the **BW** menu, even if those functions are in manual
Couplings	If the specified Marker is not on, the instrument turns it on at the center of the screen and does a peak search before performing the function
Annunciation	In the status line messages indicate the progress of the function
Annotation	In the Measure at Marker Window
Status Bits/OPC dependencies	OPC goes true when the measurement is complete

Measure at Marker presents its information in a separate window, which normally appears to the left of the measurement window.



The Measure at Marker box shows the detector name for the selected detectors and "Off" for those not selected. The marker frequency is shown in the "Frequency" field. The measured value is shown for all detectors except those that are "Off." For these, --- is displayed. The current Y-Axis unit is used, and the precision that is used for the detector value displays is exactly the same as for the Marker. The precision used for the Frequency display is six significant digits.

The sequence of steps in the measurement is as follows:

- Any sweep in progress is aborted
- If in Zero Span, the Center Frequency is used as the frequency at which to take the reading, since in Zero Span, all markers are by definition at the Center Frequency
- If not in Zero Span:
  - If the selected marker is Off, it is first turned on in the center of the screen and a peak search performed
  - If the selected marker is on, but offscreen, it is first moved to the center of the screen and a peak search performed
  - A frequency "zoom" function is performed to determine the frequency of the selected marker to the required precision. If you are operating with too large a value of (span/sweep points) then the Measure at Marker window will not display, but instead an advisory message, "Span per point too large, narrow span or increase RBW or number of points".This means you have chosen a combination of RBW, span and sweep points that makes each trace point much wider than the RBW, so that the trace point in which the signal appears

is an inadequately precise measure of its frequency—for example, with a 30 MHz to 1000 MHz span, 601 trace points and 120 kHz RBW, each trace point is 13 times as wide as the RBW. In this case, a SCPI query of the results will yield –999 dBm for each detector.

  – If the zoom is successful, the instrument goes to zero span at this frequency.

– Each detector is then read in successive single-point zero span sweeps, using a sweep time equal to the specified dwell time. The value displayed by Measure at Marker represents the maximum value output by the detector during the dwell timeAutocoupled bandwidth and average type settings are used for each detector unless the **BW & Avg Type** control is set to **As Set**, in which case the current bandwidth and average type settings are used.

– Each result is then displayed in the measure at marker window as it becomes available.

– The instrument returns to its pre-Measure at Marker span and settings after executing a Measure at Marker function, including Bandwidth, Avg Type, and EMC Std - regardless of the setting of **BW & Avg Type**.

– Finally, if the sweep had to be aborted, the aborted sweep is restarted.

4.8.6.8 Measure at Marker Config

Opens a dialog that allows you to configure the Measure at Marker Function.

The two most important settings are the detectors and the dwelltime associated with each. Any of the instrument's detectors (up to three) can be used as the Measure at Marker detectors, or any of the three can be turned off. The dwell time for each detector is also settable.

When performing a Meas at Marker, the dwell time settings that you select will depend on the characteristics of the emission you are measuring. The default dwell time (200 ms) should work well for typical EUT emissions, but sometimes you will encounter emissions for which the defaults are not optimal. This is especially the case for emissions that vary slowly over time or have a slow repetition rate. By lengthening the dwell times you can increase the likelihood of accurately measuring these low repetition rate signals.

When Measure at Marker is activated, the receiver makes a zero span measurement for each of the (up to) three detectors selected, using the Dwell Time set for each detector. If the signal's repetition period is greater than 200 ms (the default setting), the dwell time should be increased to capture at least two and preferably more repetitions of the signal. Additionally, if you do not need or do not wish to use a detector to make a measurement, that specific detector may be turned off.

If the Measure at Marker window is being displayed, and one of the detectors is changed, any value being displayed for that detector changes to "---" until the next successful reading from that detector.

Dependencies	This control and the dialog it calls only appear with the N6141A or W6141A application or when Option EMC is installed and licensed

4.8.6.9 Measure at Marker Window On/Off

Turns the Measure at Marker window on and off. It turns ON automatically when Measure at Marker is initiated and turns OFF on Preset. If the Window is turned on without a Measure at Marker result, "---" is displayed for each result for which the detector is not OFF.

Remote Command	`:DISPlay:WINDow:MAMarker[:STATe] ON | OFF | 1 | 0` `:DISPlay:WINDow:MAMarker[:STATe]?`
Example	`:DISP:WIND:MAM ON`
Couplings	The window turns ON automatically when Measure at Marker is initiated and turns OFF on Preset
Preset	OFF
State Saved	Saved in instrument state

4.8.7 Marker To

The controls on this 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.

4.8.7.1 Marker Frequency|Time

This is the fundamental control that you use to move a marker around on the trace. It is the default active function in the **Marker** menu, so 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.

When in Zero Span (for measurements that support Zero Span), the label on this control changes to "Marker Time". When the Marker Mode is Delta, the label changes to "Marker Δ Frequency" or Marker Δ Time"

Remote Command	Not supported in RLC Mode
Notes	If no suffix is sent, Marker Freq|Time 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 invalid suffix message is generated If the specified marker is Fixed and a Marker Function is on, a message is generated. If the control is pressed, an advisory message is generated The query returns the marker's absolute X Axis value if the control mode is **Normal** or **Fixed**, and 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: Hz for **Frequency** and **Inverse Time**, seconds for **Period** and **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 You cannot directly set the X value of a Fixed marker which has a marker function turned on If an attempt is made to actually adjust it while a Marker Function is on, a warning message is generated
Preset	After a preset, if X is queried with no value sent first, the center of screen value will be returned. This will depend on the frequency range of the instrument. 13.255 GHz is correct for the 26 GHz instruments only (Option 526)
Min	–∞ (minus infinity)
Max	+∞ (plus infinity). Unlike legacy analyzers, where the markers were forced to be on screen, X-Series marker values are not limited and do not clip

Marker Backwards Compatibility

– In earlier HP/Agilent/Keysight analyzers, markers were position markers, which means that Normal and Delta markers stayed at the same screen position when X Axis parameters were changed. So a marker at center screen stayed at center screen even if Center Frequency was changed (which means that the marker's frequency changed). In the X-Series, markers are value markers, which means that when the instrument's X Axis settings are changed, the marker's X Axis value in fundamental X Axis units remains unchanged. For example, if you put a marker at a particular frequency, it will stay at that frequency regardless of whether or not you change the Center Frequency of the instrument, even if that means that the marker ends up offscreen.

– While this change resulted in an overall higher level of usability of the marker system, there are some use cases where the user depends on the marker staying at the center of the screen. The most common one is where the user turns on a marker at center screen and uses it to measure the trace amplitude at the center frequency or at a series of center frequencies, without the need to ever move the marker. In the X-Series, to mimic the legacy behavior for this use case, the user must turn the marker off and then back on after changing the center frequency of the instrument. This causes the marker to reappear in the center of the screen.

– Also as a result of the change from position markers to value markers, markers can be at a frequency which is offscreen, whereas in the past, they were clipped to the screen edges and hence were never offscreen. Users who depended on this clipping behavior to force markers to the edges of the screen will have to rewrite their code. Furthermore, since markers could never be offscreen they always returned a valid result. In the X-Series, markers that are offscreen return not a number as a result; hence the potential now exists for not a number to be returned for a marker query.

4.8.7.2 Mkr->CF

Sets the center frequency of the instrument to the frequency of the selected marker. The marker stays at this frequency, so it moves to the center of the display. In Delta marker mode, this function sets the center frequency to the x-axis value of the Delta marker. When the frequency scale is in log mode, the center frequency is not at the center of the display.

If the currently selected marker is not on when this control is pressed, it is turned on at the center of the screen as a Normal type marker.

Remote Command	Not supported in RLC Mode
Dependencies	This function is not available (control is grayed-out) when x-axis is the time domain
Couplings	All the usual couplings associated with setting Center Frequency apply

4.8.7.3 Mkr->CF Step

Sets the center frequency (CF) step size of the instrument to the marker frequency, or in a delta-marker mode, to the frequency difference between the delta and reference markers.

If the currently selected marker is not on when this control is pressed, it is turned on at the center of the screen as a Normal type marker.

Remote Command	Not supported in RLC Mode
Dependencies	Not available (control is grayed-out) when x-axis is the time domain
Couplings	All the usual couplings associated with setting CF Step apply

4.8.7.4 Mkr->Start

Changes the start frequency to the frequency of the selected marker. The marker stays at this frequency, so it moves to the left edge of the display. In delta marker mode, this function sets the start frequency to the x-axis value of the delta marker.

If the currently selected marker is not on when this control is pressed, it is turned on at the center of the screen as a Normal type marker.

Remote Command	Not supported in RLC Mode
Dependencies	Not available (control is grayed-out) when x-axis is the time domain
Couplings	All the usual couplings associated with setting Start Frequency apply

4.8.7.5 Mkr->Stop

Changes the stop frequency to the frequency of the selected marker. The marker stays at this frequency, so it moves to the right edge of the display. In delta marker mode, this function sets the stop frequency to the x-axis value of the delta marker.

If the currently selected marker is not on when this control is pressed, it is turned on at the center of the screen as a Normal type marker.

Remote Command	Not supported in RLC Mode
Dependencies	Not available (control is grayed-out) when x-axis is the time domain
Couplings	All the usual couplings associated with setting Stop Frequency apply

4.8.7.6 Mkr->Ref Lvl

Sets the reference level to the amplitude value of the selected marker, moving the marked point to the reference level (top line of the graticule). The marker's mode (Normal, Delta, Fixed) doesn't matter in this case. For example, given a Delta marker, if the Delta marker is the selected marker, its amplitude is applied to the reference level. If the reference marker is selected, its amplitude is applied to the reference level.

If the currently selected marker is not on when this control is pressed, it is turned on at the center of the screen as a Normal type marker, and its amplitude applied to the reference level.

Remote Command	Not supported in RLC Mode
Couplings	All the usual couplings associated with setting Reference Level apply
Backwards Compatibility Notes	Mkr-> RefLvl behavior for a delta marker is slightly different from earlier models. ESA would calculate the delta amplitude (difference between reference marker and delta marker in dB) and assign that value to the reference level (in dBm). PSA would just assign the delta marker's amplitude to the reference level, ignoring the reference marker altogether. The X-Series products allow you to select either the reference or the delta marker individually. It is the selected marker's amplitude that will be applied to the reference level

4.8.7.7 MkrΔ->CF

Sets the center frequency to the frequency difference between the selected marker and its reference marker. The marker is then changed to a Normal marker and placed at the center of span.

Remote Command	Not supported in RLC Mode
Dependencies	Only available when the selected marker is a delta marker. Otherwise the control is grayed-out In addition, this function is not available when x-axis is the time domain

4.8.7.8 MkrΔ->Span

Sets the start and stop frequencies to the values of the delta markers. That is, it moves the lower of the two marker frequencies to the start frequency and the higher of the two marker frequencies to the stop frequency. The Marker Mode is unchanged and the two markers (delta and reference) end up on opposite edges of the display.

Remote Command	Not supported in RLC Mode
Dependencies	Only available when the selected marker is a delta marker. Otherwise the control is grayed-out In addition, this function is not available when x-axis is the time domain
Couplings	All the usual couplings associated with setting Span apply (see the Freq key documentation)

4.8.8 Counter

Accesses controls on the Marker Counter tab. Does not appear in certain instruments, such as VXT.

4.8.8.1 Marker Count

Turns the marker frequency counter on or off. The selected marker is counted, and if the selected marker is a delta marker and its reference marker is not fixed, the reference marker is counted as well.

See "Understanding the Marker Counter" on page 233

Remote Command	Not supported in RLC Mode
Notes	Fixed markers are not counted, but a Fixed marker will have a count stored in it if it is selected or is the reference marker for the selected marker. The count already in the marker is stored when the marker becomes fixed and if there is none or the marker moves (for example, Pk Search) it is counted and stored after the next sweep If a Fixed marker has a count stored in it, that count will be displayed when the marker is selected, and used as the reference count when that marker is a reference marker If a Fixed marker has a count stored in it, that count will be deleted if the marker X is adjusted If a Fixed marker has a count stored in it, and a Search function is performed using the Fixed marker, while the counter is on, the count stored in the marker will be updated If a Fixed marker has a count stored in it, and is a reference marker, and the reference is moved to a valid trace point by re-zeroing the delta (by pressing **Delta** again or sending the `DELTa` command), while the counter is on, the count stored in the marker will be updated
Dependencies	Unavailable (grayed-out and Off) if the Gate function is on
Couplings	If the selected marker is `OFF` when the counter is turned on, the selected marker is set to Normal and placed at center of screen on the trace determined by the Marker Trace rules If a marker that is `OFF` is selected while the counter is on, the counter remains on, but since the marker is off, the count is undefined The counter is turned `OFF` when the selected marker is turned `OFF`

Preset	OFF
State Saved	The state of the counter (on/off) is saved in instrument state. In the case of Fixed markers, the count stored in the marker is saved in instrument state
Annotation	The absolute count is displayed for **Normal** markers. The difference between the count and the reference marker's count is displayed for **Delta** markers. A **Fixed** marker with no saved count, or a non-**Fixed** marker on a trace that is not updating, shows three dashes in the count block (---). This is true when the marker is selected or when it is a reference marker and its Delta marker is selected Note that when the count is undefined, the Count value (result) itself will display as "---" but any text before or after the value will be retained. Hence, an undefined count for Marker 1 (for example) would display as "Cnt1 --- Hz" as long as the value is undefined The format of the frequency counter display is: Cnt<n> <value> where n is the marker number, for example Cnt1 25 386 243 226.493 Hz If the marker is a delta marker then a leading delta symbol appears, as: ΔCnt1 –25 386 243 226.493 Hz The resolution of the frequency counter display is set by the following equation: LSDDisplayed = 10 ^ (floor (–4.7 - log (Gate_Time)) with the further restriction that the displayed resolution must always fall in the 1 Hz to .001 Hz range. Thus, for 2 ms (log 2 ms = –2.69897) and longer gate times, the counter resolution is 0.001 Hz The decimal point location is fixed, without trailing zero suppression. It displays in units of Hz. The digits to the left of the decimal have leading zero suppression. For understandability, with more than 4 digits to the left of the decimal point, the digits are grouped in threes, from the decimal point left, with spaces between those groups of three. For negative numbers there is no space between the minus and the number Examples: ΔCnt1 –2226.493 Hz ΔCnt1 –22 226.493 Hz
Backwards Compatibility Notes	In some legacy analyzers (e.g., the 8560 series) the FreqOffset value was applied to the Marker Count. In others (e.g., ESA and PSA) it was not. X-Series follows the ESA/PSA model and does not apply Freq Offset to the Marker Count In ESA and PSA the reference marker for Delta markers was always counted. In the X-Series the marker is counted for Normal and Delta markers; but for the reference marker, if it is a Fixed marker, we use the count stored in the Fixed marker. This enhanced capability may require a change to some user code and/or test procedures

Understanding the Marker Counter

See:

– "Counting Off-screen Markers" on page 234
– "Delta Marker" on page 234
– "Fixed Markers" on page 235
– "More Information on "Counter"" on page 235

Using the internal counter we can count the frequency of a marker, but we cannot count while we are actually sweeping. So, once we are done with a sweep, we move to the selected marker frequency and count that frequency. Then, if the marker is a Delta marker, the count is also taken for its reference marker. The count is actually performed by moving the LO to the frequency (or frequencies in the case of a delta marker) we wish to count. The count is executed on a marker by marker basis and no further count is taken until after the next sweep (even if the marker moves before another sweep has completed).

The Marker Count is taken by tuning the instrument to the frequency of the marker and counting the IF, with the instrument not sweeping. The count is adjusted for display by adding or subtracting it (as appropriate) from the LO frequency, so that you see a count that represents the signal frequency. This is true even if External Mixing is on. Since all this happens between sweeps, you never see the instrument retuning to do the counts.

If you wish to see the entered frequency of a counted marker it will appear in the active function area when that marker is selected (for Fixed markers, you have to press the Marker, Fixed control to select Fixed markers and then press it a second time to view or adjust the x or y marker values).

Counting Off-screen Markers

If the selected marker is off the X-axis the instrument can still be tuned to the marker (unless it is outside the current range of the instrument), so the count can still be displayed. This means you can see a count for an off-screen marker even though there may be no valid Y-value for the marker. If the marker frequency is outside the range of the instrument, the display shows three dashes in the count block (---).

Delta Marker

When a Delta Marker is selected while Marker Count is on:

- If the reference marker is not a fixed marker, the display shows the difference between the count of the selected marker and the count of the reference marker
- If the reference marker is a fixed marker and there is a count stored in the marker (because Marker Count was on when the marker became a fixed marker), the display shows the difference between the count at the marker and the count stored in the reference marker

Marker Count works in zero span as well as in Swept SA. The instrument tunes to the frequency of the selected marker, which, for active zero span traces, is simply the center frequency of the instrument.

Fixed Markers

Fixed markers have a count stored in them that is generally kept fixed and not updated. If a fixed marker is selected, or used as a reference, the signal at the marker frequency is not counted; rather the stored count is seen or used as the reference. The count is stored, if Count is on, when the marker becomes fixed or when, while fixed, the marker is moved by re-zeroing the reference (if it is the reference marker) or via a peak search (since both of these, by definition, use valid trace data). The count stored in a Fixed marker is lost if the counter is turned off, if the marker is moved to an inactive trace, or if the marker is moved by adjusting its x-value.

More Information on "Counter"

When the counter is on, the count (or the delta count) for the selected marker is displayed.

The invalid data indicator (*) will turn on until the completion of the first count.

Marker Count frequency readings are corrected using the **Freq Offset** function (in some previous instruments, they were not). Note however that Marker Delta readings are not corrected, as any offset would be applied to both.

In zero span on active traces the counter continues to function, counting any signal near the center frequency of the instrument.

NOTE **No signal farther from the marker frequency than the Res BW will be seen by the counter.**

4.8.8.2 Counter Gate

Controls the length of time during which the frequency counter measures the signal frequency. Longer gate times allow for greater averaging of signals whose frequency is “noisy”, though the measurement takes longer. If the gate time is an integer multiple of the length of a power-line cycle (20 ms for 50 Hz power, 16.67 ms for 60 Hz power), the counter rejects incidental modulation at the power line rate. The shortest gate time that rejects both 50 and 60 Hz modulation is 100 ms, which is the value chosen in Auto, or on Preset or when "Auto Couple" on page 251 is pressed.

The start time of the Gate Time of the counter must be controlled by the same trigger parameters as controls the sweep. Thus, if the Trigger is not in Free Run, the counter gate must not start until after the trigger is received and delayed.

Remote Command	Not supported in RLC Mode
Notes	When Auto Couple is pressed, Gate Time is set to 100 ms
Preset	100 ms ON

State Saved	Saved in instrument state
Min	1 us
Max	500 ms

4.9 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.

NOTE In the Meas Setup menu you may configure Averaging, by setting the Average Number and the Average Type.

4.9.1 RLC Config Tab

This tab appears only when the RLC Mode Remote Language Compatibility Measurement Application is selected. It contains controls that are specific to this application.

4.9.1.1 Compatibility Model

This key selects which legacy instrument to emulate. The selected instrument determines the response to the `ID?` remote command, and affects the behavior of commands such as IP. You can use any command offered by any of the legacy instruments regardless of the language setting, but if the command is not correct for the selected legacy instrument, there is no guarantee that the command will work as expected. This does not affect the response to the SCPI command `*IDN?`

The remote command `ID?` or `:SYST:LANG?` returns exactly which legacy model is being emulated.

In cases where a language is selected with implied different frequency range than the current base box supports, the frequency range will be clipped to the outer limits of the base box.

For example, if 8566B 2GHz to 22 GHz language is selected on a N9020A 20Hz – 3.6 GHz option, then the frequency range will be clipped to 0Hz – 3.6GHz.

Note that an X-Series that is emulating a legacy instrument continues to emulate that legacy instrument even when the X-Series instrument is rebooted, and will restart in the startup state of the legacy instrument.

Remote Command	`SYSTem:LANGuage HP8566A | HP8566B | HP8568A | HP8568B | HP8560E | HP8561E| HP8562E | HP8563E | HP8564E | HP8565E | HP8590L | HP8592L | HP8594L | HP8591E | HP8593E | HP8594E | HP8595E | HP8596E` `SYSTem:LANGuage?`
Example	SYST:LANG HP8566A
Range	HP8560E/EC | HP8561E/EC | HP8562E/EC | HP8563E/EC | HP8564E/EC | HP8565E/EC | HP8566A | HP8566B | HP8568A | HP8568B
Preset	HP8563E/EC. Unaffected by power cycle or mode preset, but preset by Restore Mode Defaults. Pressing

	X-Series's instrument preset key will result in a legacy-equivalent preset.
Couplings	The selected language has the following impact: 1. It determines the response to the "ID?" remote command. 2. It affects the behavior of any command which had different implementation in the different boxes, such as "KS" 3. It affects the frequency range of commands such as FS and LF. 4. It changes defaults to match the appropriate instrument, for purposes of instrument preset (note that the instrument will automatically preset on language switch). 5. It will NOT affect the Preferences parameters in the Preference menu or the Logging parameters in the Logging menu. As we do not expect customers to use commands which their selected legacy instrument never supported, we do not need to block customers from using commands which a different instrument supported. For example, the "CR" command may work even if the selected language is HP8563E. Note HP856xE and HP856xEC analyzers both respond as HP856xE to the "ID?" command. As such they will share the same softkey front panel.
State Saved	Saved in instrument state.

Changing the RLC Language performs a mode preset into the new mode, which includes the following:

RLC App	Behavior
All	– Base Instrument Preset – Internal oscillator [:ROSC:SOUR:TYPE INT] – RBR set to 0.011 – Trace update on recall
HP8566A/B	– Sets the number of trace points to 1001 – Start frequency to 2GHz – Stop frequency to 22GHz – RF coupling to DC – Restrict Sweep Type to swept [:SWE:TYPE SWE] – Sets the Video Bandwidth one step higher than the resolution bandwidth – Sets DL to –45 dBm
HP8568A/B	– Sets the number of trace points to 1001 – Start frequency to 0Hz – Stop frequency to 1.5GHz

RLC App	Behavior
	– RF coupling to DC – Restrict Sweep Type to swept [:SWE:TYPE SWE] – Sets the Video Bandwidth one step higher than the resolution bandwidth – Sets DL to –45 dBm
HP8560E HP8561E HP8562E HP8563E HP8564E HP8565E	– Sets the number of trace points to 601 – Sets the start frequency to 2.75 GHz 62A and 63A all others 0 Hz – Sets the stop frequency: 2.9 GHz (60A, 62B, 60E), 6.5 GHz (61A, 61B, 61E), 13.2 GHz (62E), 22GHz (62A, 62B) 26.5GHz (62A#026, 63A#026, 63E), 40 GHz (64E), or 50 GHz (65E) – Sets the instrument in CF/SP mode – Sets the Video Bandwidth to Resolution Bandwidth Ratio to 1 – RF coupling to DC (62A, 62A#026, 62B, 63A, 63A#026, 63E, 64E, 65E) or AC (60A, 60E, 61A, 61B, 61E, 62E). – Set Sweep Type to auto [:SWE:TYPE AUTO] – Sets DL to 0 dBm

4.9.1.2 Cmd Error

Enables or disables the display of the “CMD ERR” error messages, which appear in the Message bar as an advisory message, `ERR?` message buffer and Cmd error log.

The format of the errors are as follows:

```
CMD ERR, <string>
```

This occurs if either the command syntax or any of its parameters are incorrectly formed.

The length of `<string>` is limited to the first 20 characters of the input string (message unit).

Further details of these errors, after they have occurred, can be reviewed in the Command Error Log, provided that Cmd Error Logging has been enabled.

The selected value is preserved after presetting or power cycling the instrument.

Disabling the display of command errors disables the display of all error types.

Preset	Previously selected value

4.9.1.3 Logging

Pressing the **Logging** button takes you to the Logging screen. When you are in the logging screen, the log is displayed, obscuring the main screen display. This display does not update as new items are added to the log file, unless the Refresh control is pressed.

The Command Error Log records details of command errors and known legacy commands that have been received, but that are not supported by the Remote Language application.

If enabled, the RLC Command Error Log may be displayed onscreen or accessed in the file `Logfile.txt`. The Log file is located in the D: drive at location `\User_My_Documents\[USERNAME]\My Documents\RLC\data folder` of the base instrument as a plain text file, and is accessible to users. The log is not cleared on power-up, language switch, or mode switch. If the log file becomes full, the first 10% of the log will be discarded without notification. The log file has a maximum capacity of 10M.

Command Error Log

Enables or disables the RLC Command Error Log. This log keeps track of command errors and unsupported commands. The log may be disabled to allow operation in a secure environment where any record of commands used is undesirable.

If enabled, the Command Error Log may be displayed onscreen or accessed in the file `Logfile.txt`.

Preset	Off Unaffected by power cycle or mode preset, but can be preset using Restore Mode Defaults

Refresh

Refreshes the RLC Command Error Log display with commands sent since the display was opened. New entries added to the log since the display was opened will be added to the displayed log. If there are new entries, the log will be scrolled to the bottom.

Clear Log

Clears the RLC Command Error Log, erasing the contents of the log file. The log can only be cleared by using the clear log function. The log is not cleared on power-up, language switch, or mode switch.

4.9.1.4 Preferences

In RLC Mode, each preference is a configurable feature. The default value for each parameter in the Preferences menu is the closest emulation of legacy behavior.

Preferences are persistent. If you set a preference, the setting is unaffected by mode switching, language switching, mode preset, or power on. Preferences are only preset to their default state using the "Restore Mode Defaults" on page 458 key, `INST:DEF` command or `SYST:PRES:PERS`.

Limit RBW/VBW

Limits the valid resolution bandwidth and video bandwidth values to those appropriate for the currently selected remote language.

The restriction on resolution and video bandwidth ranges is solely intended to avoid situations where RBW or VBW is significantly lower than legacy, as significant increases in sweep time could result in timeouts in legacy code.

Limit Resolution Bandwidth / Video Bandwidth limits the valid resolution bandwidth and video bandwidth values to those appropriate for the currently selected language. While this limitation reduces measurement flexibility, it helps to ensure that the measurement time in emulation mode is the same as the legacy measurement time, and ensures that the responses to RB? and VB? match the legacy instrument.

Note that limiting the resolution bandwidths on HP8590-series analyzers prevents usage of the EMI bandwidths 200 Hz, 9 kHz, and 120 kHz which were available as options. If your measurement requires those bandwidths, turn this option off.

Remote Command	`[:SENSe]:RLC:BANDwidth:LIMit ON|OFF|1|0`
Example	`:RLC:BAND:LIM ON`
Preset	`ON` Unaffected by power cycle or mode preset, but can be preset using Restore Mode Defaults
Couplings	If the selected RLC Language is HP8566A/B or HP8568A/B, setting this to ON causes the resolution and video bandwidths to be limited to the following range of values: – Resolution Bandwidth Range: 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300kHz, 1 MHz, 3 MHz – Video Bandwidth Range: 1 Hz, 3 Hz, 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300kHz, 1 MHz, 3 MHz If the selected RLC Language is HP856x, setting this to ON causes the resolution and video bandwidths to be limited to the following range of values: – Resolution Bandwidth Range: 1 Hz, 3 Hz, 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300kHz, 1 MHz, 2 MHz

- Video Bandwidth Range: 1 Hz, 3 Hz, 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300kHz, 1 MHz, 3 MHz

If the selected RLC Language is HP859x, setting this to ON causes the resolution and video bandwidths to be limited to the following range of values:

- Resolution Bandwidth Range: 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300kHz, 1 MHz, 3 MHz
- Video Bandwidth Range: 1 Hz, 3 Hz, 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300kHz, 1 MHz, 3 MHz

Note: This restriction on resolution & video bandwidth range changes to use the base X-Series range of bandwidths if the detector type is set to Quasi Peak, EMI Peak, MIL Peak, EMI Average or Average

Setting this to OFF causes the resolution & video bandwidth filters to use the base X-Series range of values

Note that limiting the resolution bandwidths on 9x-series analyzers prevents usage of the EMI bandwidths 200 Hz, 9 kHz, and 120 kHz

Atten Offset

Adds an offset to any attenuation selected from the front panel, remote interface, or auto coupling rule. Display and query results will continue to return the old value. Attenuation Offset will allow greater input power to the spectrum analyzer, while significantly increasing the noise floor. Since many of the older spectrum analyzers had noise floor 10 dB higher than the X-Series, this will give the most accurate emulation.

Remote Command	`[:SENSe]:RLC:ATTenuation:OFFSet <val>`
Example	`RLC:ATT:OFFS 10` Set mechanical attenuation offset to 10
Preset	0 dB, Off Unaffected by power cycle or mode preset, but can be preset using Restore Mode Defaults.
Couplings	All attenuation values from any source (GUI, RUI, or Auto coupling rules) are increased by 10 dB when setting the actual attenuator, up to the maximum allowed by the instrument. The GUI and RUI will continue to report the same value that they previously reported (which will now be incorrect by 10 dB).
Backwards Compatibility SCPI	`[:SENSe]:RLC:ATTenuation:STATe ON|OFF|1|0`

Sweep Type Rules

Changes the Auto rules for determining whether the instrument uses FFT or Swept mode (this can be manually overridden).

FFT mode offers substantially faster measurements in some cases. The HP8566/68 series and the HP8590 series did not have FFT mode capability, so most accurate emulation requires that the instrument preserves Swept mode unless the user manually overrides that setting.

HP8560-series analyzers used both FFT and Swept mode, in which case “Legacy” is equivalent to “Dynamic range”.

Remote Command	`[:SENSe]:RLC:SWEep:TYPE:AUTO:RULes AUTO|SPEed|DRANge|LEGACY`
Example	`:RLC:SWE:TYPE:AUTO:RUL SPE`
Range	Auto | Best Speed | Best Dynamic Range | Legacy
Preset	Auto. Unaffected by power cycle or mode preset, but can be preset using Restore Mode Defaults
Couplings	See Couplings below

Couplings

This is identical to the Sweep/Control->Sweep Setup->Sweep Type Rules menu, except for one additional setting; Legacy. For 8560-series, this is identical to DRange; for 8590-series and 8566/68-series, Legacy rules indicate that FFT sweeps should not be used unless set explicitly.

Sweep Type Rules	856x	859x / 8566 / 8568
Speed	GPSA Sweep Type: AUTO	GPSA Sweep Type: AUTO
	FFT Width : Auto	FFT Width : N/A
	GPSA S.T. Rules: BEST SPEED	GPSA S.T. Rules: BEST SPEED
Dynamic Range	GPSA Sweep Type: AUTO	GPSA Sweep Type: AUTO
	FFT Width : Auto	FFT Width : N/A
	GPSA S.T. Rules: BEST D. RANG	GPSA S.T. Rules: BEST D. RANGE
Legacy	GPSA Sweep Type: AUTO	GPSA Sweep Type: SWEPT
	FFT Width : <4.01	FFT Width : N/A
	GPSA S.T. Rules: BEST D. RANG	GPSA S.T. Rules: N/A
Auto	GPSA Sweep Type: AUTO	GPSA Sweep Type: SWEPT
	FFT Width : Auto	FFT Width : N/A
	GPSA S.T. Rules: BEST D. RANG	GPSA S.T. Rules: N/A

Sweep Time Rules

Allows the choice of AUTO, or one of three distinct sets of sweep time rules. Note that these rules only apply when in the Swept Sweep Type (either manually or automatically chosen) and not when in FFT sweeps.

See "More Information" on page 244.

Remote Command	`[:SENSe]:RLC:SWEep:TIME:AUTO:RULes AUTO | NORMal | ACCuracy | SRESponse`
Example	`:RLC:SWE:TIME:AUTO:RUL NORMal`

Dependencies	NORMal and ACCuracy are not available (grayed-out) when Source Mode=Tracking Grayed-out in Zero Span Grayed-out in FFT sweeps. Pressing this selection while the instrument is in FFT sweep generates an advisory message Does not appear in certain instruments without sweeping hardware, such as VXT
Couplings	Set to Auto on Auto Couple NORMal is automatically selected unless Source is on Stimulus/Response is automatically selected when the Source is on (Source Mode not OFF) Set on Preset or Auto Couple
Preset	AUTO
Range	AUTO|NORMal|ACCuracy|SRESponse
State Saved	Saved in instrument state

More Information

Value	Option	Notes
Auto	AUTO	When in Auto, the Sweep Type Rules are set to Best Dynamic Range
SA - Normal	NORMal	Selects auto rules for optimal speed and generally sufficient accuracy
SA - Accuracy	ACCuracy	Selects auto rules for specified absolute amplitude accuracy
Stimulus/Response	SRESponse	Selects auto rules for the case where the instrument is sweeping in concert with a source Automatically selected when the Source is on (Source Mode not OFF)

The first set of rules is called **Normal**. **Sweep Time Rules** is set to **Normal** on a **Preset** or **Auto Couple**. These rules give optimal sweep times at a loss of accuracy. Note that this means that in the Preset or Auto Coupled state, instrument amplitude accuracy specifications do not apply.

Setting **Sweep Time Rules** to **Accuracy** will result in slower sweep times than **Normal**, usually about three times as long, but with better amplitude accuracy for CW signals. The instrument absolute amplitude accuracy specifications only apply when **Sweep Time** is set to **Auto**, and **Sweep Time Rules** are set to **Accuracy**. Additional amplitude errors, which occur when **Sweep Time Rules** are set to **Normal**, are usually well under 0.1 dB with non-EMI detectors (though this is not guaranteed). With EMI detectors (Quasi Peak, EMI Average and RMS Average), the errors are usually well under 0.5 dB. For best accuracy when using EMI detectors, zero span is the preferred measurement technique; for the EMI detectors, zero span measurements will not fully agree with swept measurements except at extremely slow sweep rates.

Because of the faster sweep times and still low errors, **Normal** is the preferred setting of **Sweep Time Rules**.

The third set of sweep time rules is called **Stimulus/Response** and is automatically selected when an integrated source is turned on, such as a Tracking Generator or a synchronized external source.

Note that there are two types of source-synchronized sweeping, one where the source sweeps (as with a built in tracking generator) and one where the source steps. The former is usually much faster than even general purpose sweeps because when sweeping along with a swept source the RBW and VBW filters do not directly interact with the Span. However, sweeping in concert with a stepped source usually slows the sweep down because it is necessary to wait for the stepped source and the instrument to settle at each point. The instrument chooses one of these methods based on what kind of a source is connected or installed; it picks the former if there is no source in use, which means that by selecting Stimulus/Response rules manually when there is no source in use, you can achieve faster sweep times than SA – Normal.

Stimulus-response auto-coupled sweep times are typically valid in stimulus-response measurements when the system's frequency span is less than 20 times the bandwidth of the device under test. As noted above you can select these rules manually (even if not making Stimulus-Response measurements) which will allow you to sweep faster before the "Meas Uncal" warning comes on, but you are then not protected from the over-sweep condition and may end up with uncalibrated results. However, it is commonplace in measuring non-CW signals such as noise to be able to get excellent measurement accuracy at sweep rates higher than those required for CW signal accuracy, so this is a valid measurement technique.

As always, when the X-series instrument is in Auto Sweep Time, the sweep time is estimated and displayed in the Sweep/Control menu as well as in the annotation at the bottom of the displayed measurement. Since this can be dependent on variables outside the instrument's control, the actual sweep time may vary slightly from this estimate.

AC/DC Preset Default

Allows you to define the behavior for AC and DC coupling mode when presetting the instrument. This command is needed because legacy instruments had AC cutoff frequency of 100 kHz, whereas X-Series has AC cutoff frequency at 10 MHz.

Typically, when you want to perform a measurement, you first send `IP`, to preset the system. This function defines the RF coupling after `IP`. You can choose AC coupled, DC coupled or the default value of the X-Series instrument.

Range	As X-Series | AC Coupled | DC Coupled
Preset	As X-Series Unaffected by power cycle or mode preset, but can be preset using Restore Mode Defaults

Limit Sweep Time

Allows the user to constrain the sweep time to no less than the minimum sweep time of the legacy boxes. If set to On, the sweep time will be constrained no less than the value listed in the table below. If set to Off, no constraint is applied.

Instrument	Non Zero Span	Zero Span
HP8566/68	20ms	1 µs
HP856x	50ms	50 µs

In general the X-Series has sweep times much faster than legacy instruments, and this can cause problems in test systems with critical timing dependencies. This control keeps the analyzer from sweeping faster than the legacy product was capable of.

Remote Command	`[:SENSe]:RLC:SWEep:TIME:LIMit ON|OFF|1|0`
Example	`:RLC:SWE:TIME:LIM ON`
Preset	`ON` Unaffected by power cycle or mode preset, but can be preset using Restore Mode Defaults

ID Response

Allows you to define the exact response to the query `ID?`, because scripts may sometimes require a specific response.

Range	System Option | User Option
Preset	As X-Series. Unaffected by power cycle or mode preset, but can be preset using Restore Mode Defaults

User ID

Lets you enter an ID string to be returned when you have selected “User Option” on the System/User Option control. When you tap this control, the onscreen keyboard opens, allowing you to enter a text string.

Dependencies	60 characters max
Preset	“” (null String), not affected by Mode Preset, preset by Restore Mode Defaults

Persistent Auto Align

Defines the desired behavior of `ADJIF ON|OFF`. See also "ADJIF" on page 702

Determined by “ADJIF ON|OFF”	During power cycle, when entering Remote Language Compatibility application:

	– If you previously sent “ADJIF ON”, Auto Align is automatically set to Normal – If you previously sent “ADJIF OFF”, auto align is automatically set to Partial
Normal	Auto Align is always set to Normal, irrespective of whether you send “ADJIF ON” or “ADJIF OFF” During power cycle, when entering Remote Language Compatibility application, nothing happens
Partial	Auto Align is always set to Partial, irrespective of whether you send “ADJIF ON” or “ADJIF OFF” During power cycle, when entering Remote Language Compatibility application, nothing happens

Preset	Determined by “ADJIF ON|OFF” Unaffected by power cycle or mode preset, but can be preset using Restore Mode Defaults
Range	Determined by “ADJIF ON|OFF”, Normal, Partial

KSK Tolerance

Allows you to define the tolerance for `KSK` when searching the next peak. Because the accuracy of the X-Series instrument is much higher than that of the legacy instruments, scripts may sometimes be unable to find the correct next peak.

Preset	0.1 dB, Off Unaffected by power cycle or mode preset, but can be preset using Restore Mode Defaults

Analog Out Preset Default

Allows you to define the behavior for analog out mode when presetting the instrument. This command is needed because legacy instruments have different behaviors when presetting.

In 6x series, the preset default is Screen Video. In other models, it is OFF.

Range	As X-Series | As Legacy
Preset	As X-Series Unaffected by power cycle or mode preset, but can be preset using Restore Mode Defaults

No Terminator

Allows you to accept a command stream that has no terminator, such as “\r” or “ ”.

Currently, only `ERR?` is accepted as a terminator.

Preset	Off Unaffected by power cycle or mode preset, but can be preset using Restore Mode Defaults

4.9.2 Settings

Contains frequently used Meas Setup functions to which you will want the fastest access.

4.9.2.1 Average Hold Number

Sets the terminal count number N for **Average, Max Hold** and **Min Hold** trace types. This number is an integral part of how the average trace is calculated. Basically, increasing N results in a smoother average trace.

See "More Information" on page 248.

Remote Command	Not supported in RLC Mode
Couplings	Restarting any of these functions (**Average, Max Hold** or **Min Hold)** restarts all of them, as there is only one count
Preset	100
State Saved	Saved in instrument state
Min	1
Max	10000
Annotation	The current average/hold count K is displayed, up to the terminal count N, in the Meas Bar, as **Avg|Hold: K/N** when any active (updating) trace is in Average, Max Hold or Min Hold For example, Trace 2 in Average:, 10 of 100 counts so far: **Avg|Hold: 10/100** If in Continuous, and the Terminal count has been surpassed, the annotation shows as **Avg|Hold: >N/N** For example, Continuous sweep, Trace 2 in Average, Avg/Hold number is 100, but 150 averages have been taken so far: **Avg|Hold: >100/100** No count is displayed if no trace is in Average or Hold
Status Bits/OPC dependencies	See the **Sweep** key descriptionfor a discussion of the Sweeping, Measuring, Settling and OPC bits, and the Hi Sweep line. All are affected when a sequence is reset
Backwards Compatibility Notes	In older instruments, when changing the **Average Count** (now **Average/Hold Number**), you had to re-start the trace at the beginning of a sweep to ensure valid average data. Now, the system will ensure valid results when changing the count limit

More Information

When in **Single**, the sweep stops when N is reached. You can add more sweeps by increasing the Average/Hold Number. For example, if you want to add one more Average, or one more trace to Max Hold or Min Hold, simply increment this number by one, which you can do by pressing the Up key while Average/Hold Number is the active function.

In **Cont** (continuous), averaging and holding continues even after N is reached. Therefore, using doing trace holding in **Cont**, the value of N is irrelevant. But for averaging, each new sweep is exponentially averaged in with a weighting equal to N.

For details of how the average trace is calculated and how this depends on the **Average/Hold Number**, see "Average Type" on page 249, below. For details on how the various control functions in the instrument start and restart averaging, see "Average Type" on page 249.

Average/Hold Number is not affected by Auto Couple.

4.9.2.2 Average Type

Lets you control the way averaging is done by choosing one of the following averaging scales: Log-Power (Video), Power (RMS), or Voltage averaging. Also lets you choose Auto Average Type (default).

There are four different averaging processes in the Swept SA measurement, and all of them are affected by this setting: Trace Averaging, the Average detector, the Noise Marker, and VBW filtering.

See "More Information" on page 249.

Remote Command	Not supported in RLC Mode
Preset	LOG ON
Range	Log-Power (Video) | Power (RMS) | Voltage
Annunciation	Log-Power | Power (RMS) | Voltage Found in the Meas Bar under **Avg Type** When not in Auto, label changes to **#Avg Type**

More Information

These are the averaging processes within the Swept SA measurement, and all of them are affected by this setting:

1. Trace averaging (see the Trace chapter under Trace Type) averages signal amplitudes on a trace-to-trace basis. When performing Trace Averaging, the equation that is used to calculate the averaged trace depends on the average type. The average type applies to all traces in Trace Average (it is not set on a trace-by-trace basis)

2. Average detector (see the Trace chapter under Detector) averages signal amplitudes during the time or frequency interval represented by a particular measurement point

3. Noise Marker (see the Marker chapter under Marker Function) averages signal amplitudes across measurement points to reduce variations for noisy signals
4. VBW filtering (see the BW chapter under VBW) adds video filtering which is a form of averaging of the video signal

Details of each averaging type appear below:

Auto

When **Auto** is selected, the instrument chooses the optimum type of averaging for the current instrument measurement settings. 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** toggle.

Here are the auto-select rules for **Average Type:**

Auto selects **VoltageAveraging** if the Detector for any active trace is **EMI Average** or **QPD or RMS Average**; otherwise it selects **Power (RMS)** Averaging if a **Marker Function** (**Marker Noise**, **Band/Intvl Power**) is on, or **Detector** is set to **Man** and **Average**; otherwise if **Amplitude**, **Scale Type** is set to **Lin** it selects **Voltage** Averaging; otherwise, if the EMC Standard is set to CISPR, it selects Voltage; otherwise **Auto** selects **Log-Power** Average.

Note that these rules are only applied to active traces. Traces which are not updating do not impact the auto-selection of Average Type. When you select log-power averaging, the measurement results are the average of the signal level in logarithmic units (decibels). When you select power average (RMS), all measured results are converted into power units before averaging and filtering operations, and converted back to decibels for displaying. Remember: there can be significant differences between the average of the log of power and the log of the average power.

Log-Pwr Avg (Video)

The Log-Power averaging type selects the logarithmic (decibel) scale for all filtering and averaging processes. This scale is sometimes called “Video” because it is the most common display and analysis scale for the video signal within a spectrum instrument. This scale is excellent for finding CW signals near noise, but its response to noise-like signals is 2.506 dB lower than the average power of those noise signals. This is compensated for in the Marker Noise function.

The equation for trace averaging on the log-pwr scale is shown below, where K is the number of averages accumulated. (In continuous sweep mode, once K has reached the Average/Hold Number, K stays at that value, providing a continuous running average.)

New avg = ((K−1)Old avg + New data)/K

This equation assumes all values in decibel scale.

Pwr Avg (RMS)

In this average type, all filtering and averaging processes work on the power (the square of the magnitude) of the signal, instead of its log or envelope voltage. This scale is best for measuring the true time average power of complex signals. This scale is sometimes called RMS because the resulting voltage is proportional to the square root of the mean of the square of the voltage.

In the equation for averaging on this scale (below), K is the number of averages accumulated. (In continuous sweep mode, once K has reached the Average/Hold Number, K stays at that value, providing a running average.)

New avg = 10 log ((1/K)((K−1)($10^{\text{Old avg}/10}$)+$10^{\text{New data}/10}$))

This equation assumes all values are in the decibel scale.

Voltage Avg

In this Average type, all filtering and averaging processes work on the voltage of the envelope of the signal. This scale is good for observing rise and fall behavior of AM or pulse-modulated signals such as radar and TDMA transmitters, but its response to noise-like signals is 1.049 dB lower than the average power of those noise signals. This is compensated for in the **Marker Noise** function.

In the equation for averaging on this scale (below), K is the number of averages accumulated. (In continuous sweep mode, once K has reached the Average/Hold Number, K stays at that value.)

New avg = 20 log ((1/K)((K−1)($10^{\text{Old avg}/20}$)+$10^{\text{New data}/20}$))

This equation assumes all values are in the decibel scale.

4.9.2.3 Meas Setup Summary Table

Lets you view and access many of the parameters in the Meas Setup menus on one screen.

4.9.2.4 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 252 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

4.9.2.5 Meas Preset

Resets the local measurement variables for the currently active measurement to their factory default values. The measurement settings that get reset are a subset of the ones that are reset during a Mode Preset. This function keeps the instrument in the current measurement and the current mode and does not affect the settings for other measurements, but does abort the currently running measurement and restarts it.

Remote Command	`:CONFigure:SANalyzer`
Example	`:CONF:SAN`
Notes	Clears the Measuring bit

4.9.3 Limits

Contains controls for the Limit Lines of the current measurement. Limits arrays can be entered by the user, sent via SCPI, or loaded from a file.

Dependencies	This tab only appears if you have the proper option installed in your instrument
Preset	Limits are turned off by a Preset, but the Limits arrays (data) are only reset (deleted) by Restore Mode Defaults. They survive shutdown and restarting of the instrument application, which means they will survive a power cycle

4.9.3.1 Select Limit

Specifies the *selected limit*. The term "selected limit" is used throughout this document to specify which limit will be affected by the functions.

Notes	The selected limit is remembered even when not in the Limit Menu
Preset	Limit 1, not affected by Mode Preset, preset by Restore Mode Defaults
State Saved	Saved in instrument state

4.9.3.2 Limit On/Off

Selects whether the limit and margin are displayed. If Test Limits is on, this also determines whether the test trace will be tested against the limit. If **Limit On/Off** is **On**, the following occurs:

- The limit line is displayed, in the same color as the limited trace, but paler. Portions of traces which fail the limits will be displayed in red
- The margin line is displayed if Margin is on and the Margin Value is non-zero (see "Margin" on page 255). The margin line is displayed in the same color as the limit line, but paler still and dashed. Portions of traces which pass the limits but fail the margin will be displayed in amber
- The trace is tested for the purpose of the "Trace Pass/Fail" indication in the graticule if, in addition to **Limit On/Off** being **On,** the trace is displayed and **Test Limits** is on (see "Test Limits" on page 256). If the trace is not tested, no report of the trace passing or failing is seen on the graticule

The PASS/FAIL box in the corner of the Meas Bar is only displayed if there is at least one "Trace Pass/Fail" indication displayed in the graticule.

Note that the red and amber coloring of traces which fail the limits and/or margins only applies to traces whose X-axis corresponds to the current instrument X-axis. Traces which are not updating (in View, for example) will not change color if the instrument X-axis settings (e.g., start and stop frequency) do not match those of the trace, for example if they have been changed since the trace stopped updating. In this case, the Invalid Data indicator (*) will appear in the upper right hand corner.

When the limits are frequency limits but the trace is a zero-span trace, the limit trace is drawn at the limit amplitude of the center frequency. When the limits are time limits but the trace is a frequency domain trace, the limit trace is drawn according to the current time axis, with the left of the screen being 0 and the right being equal to sweep time.

Remote Command	Not supported in RLC Mode
Couplings	Limit display ON selects the limit Testing is done on all displayed limits if **Test Limits (All Limits)** is ON

	Entering the limit menu from the user interface turns on the selected limit
Preset	OFF
State Saved	Saved in instrument state

4.9.3.3 Margin

Selects a **Margin** for this limit, which will cause a trace to Fail Margin when the trace is between the limit line and the margin line. Portions of the traces which pass the limit but fail the margin will be displayed in an amber color.

A margin is always specified in dB relative to a limit – an upper limit will always have a negative margin, and a lower limit will always have a positive margin. If a value is entered with the incorrect sign, the system will automatically take the negative of the entered value.

If the limit type is switched from lower to upper while margin is present, the margin will reverse sign.

When the Margin is selected, it may be turned off by pressing the Margin control until the toggle is next to Off. This may also be done by performing a preset. Margin is the default active function whenever the margin is on, and it is not the active function whenever the margin is off.

The margin lines are displayed in the same color as limit lines, but paler. If the limited trace is blanked then the limit line and the margin line will be blanked as well.

Remote Command	Not supported in RLC Mode
Preset	Not affected by Mode Preset, set to 0 dB for all Limits by Restore Mode Defaults OFF
State Saved	Saved in instrument state
Min	–40 dB (Upper); 0 dB (Lower)
Max	0 dB (Upper); 40 dB (Lower);

4.9.3.4 Type

Selects whether the limit you are editing is an upper or lower limit. An upper limit fails if the trace exceeds the limit. A lower limit fails if the trace falls below the limit.

Remote Command	Not supported in RLC Mode
Couplings	If a margin has already been set for this limit line, and this control is used to change the limit type, then the margin value reverses sign
Preset	Upper for Line 1, 3, and 5; Lower for Line 2, 4, 6 Not affected by Mode Preset, preset by Restore Mode Defaults
State Saved	Saved in instrument state

4.9.3.5 Edit Limit

Allows you to edit the content and the properties of the Limit Line.

When entering the menu, the editor window (with the limit table) turns on, the selected Limit is turned On and the amplitude scale is set to Log. The display of the trace to which the selected limit applies is turned on (thus, traces in Blank are set to View and traces in Background are set to On). Turning on the Limit means its display will be on, and it's testing mode will be on as well. You should turn off any other limits that are on if they interfere with the editing of the selected limit.

NOTE **The table editor will only operate 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 it will be sluggish during compute-intensive operations like narrow-span FFT sweeps.**

After exiting the editor, the Limit is still on and displayed, and the amplitude scale remains Log.

Limits are turned off by Preset, but the Limits arrays (data) are only reset (deleted) by Restore Mode Defaults. They survive shutdown and restarting of the instrument application, which means they will survive a power cycle.

When editing a limit, the editor remembers which limit and which element in the limit array you were editing, and returns you to that limit and that element when you return to the editor after leaving it.

Couplings	Turns the ΔLimit Peaks table off

4.9.3.6 Edit Limit Settings

Opens another menu page that lets you set certain properties of the selected Limit, such as Test Trace, Interpolation, Reference, Fixed/Relative, Description and Comment.

The facility to build a Limit from a Trace and to Copy Limits to other Limits is also found here.

4.9.3.7 Test Limits

Selects whether displayed traces are tested against displayed limits (i.e., those for which Limit On/Off is set to On).

For each displayed trace for which a Limit is turned on, a message will be displayed in the upper-left corner of the graticule to notify whether the trace passes or fails the limits.

If the trace is at or within the bounds of all applicable limits and margins, the text "Trace x Pass" will be displayed in green, where x is the trace number. A separate line is used for each reported trace.

If the trace is at or within the bounds of all applicable limits, but outside the bounds of some applicable margin, the text "Trace x Fail Margin" will be displayed in amber, where x is the trace number. A separate line is used for each reported trace.

If the trace is outside the bounds of some applicable limits, the text "Trace x Fail" will be displayed in red, where x is the trace number. A separate line is used for each reported trace.

If the trace has no enabled limits, or the trace itself is not displayed, no message is displayed for that trace.

The PASS/FAIL box in the corner of the Meas Bar is only displayed if there is at least one "Trace Pass/Fail" indication displayed in the graticule.

If two amplitude values are entered for the same frequency, a single vertical line is the result. In this case, if an upper line is chosen, the lesser amplitude is tested. If a lower line is chosen, the greater amplitude is tested.

Remote Command	Not supported in RLC Mode
Preset	`ON` Not affected by Mode Preset, preset by Restore Mode Defaults
State Saved	Saved in instrument state
Annotation	If this is on, the active limit window displays the information above regarding pass/fail for each displayed limit

4.9.3.8 X-Axis Unit

Selects how the limit-line segments are defined. Pressing **X Axis Unit** selects whether the limit lines will be entered using frequency (Freq) or sweep time (Time) to define the segments. They can be specified as a table of limit-line segments of amplitude versus frequency, or of amplitude versus time. When the X-Axis Unit is set to Time, a time value of zero corresponds to the start of the sweep, which is at the left edge of the graticule, and the column and control in the Limit Table Editor will read Time instead of Frequency.

Switching the limit-line definition between Freq and Time erases all current limit lines. When you do this, a warning dialog appears, letting you know that you are about to erase all the limit lines, and prompting you to hit **OK** only if you are sure.

Remote Command	Not supported in RLC Mode
Couplings	Affects all limit lines simultaneously, and resets all limit line data except the `.wav` file and email address stored in the Actions
Preset	`FREQ`

	Not affected by Mode Preset, preset by Restore Mode Defaults
State Saved	Saved in instrument state

4.9.3.9 Delete All Limits

Deletes all limit lines. Pressing **Delete All Limits** purges the data from all limit line tables.

All limit data will be cleared and returned to factory preset settings.

When this control is pressed a prompt is placed on the screen that says “Please press Enter or OK to delete all limits. Press **ESC** or **Cancel** to close this dialog”

The deletion is only performed if you press **OK** or **Enter**. Following deletion, the informational message “All Limits deleted” appears in the MSG line.

Remote Command	Not supported in RLC Mode

4.9.4 Meas Standard

Includes controls for setting the Radio Standard for PowerSuite measurements, as well as controls for setting the EMC Standard and CISPR Preset to which the current measurement will be made.

The EMC Standard and CISPR Preset controls only appear with Option EMC or the N6141A application or the W6141A application installed and licensed.

Dependencies	This tab only appears if you have the proper option installed in your instrument

4.9.4.1 Radio Standard Presets

Allows you to specify the Radio Standard to be used. This Mode supports many Radio Standards. You can select the desired Radio Standard using the **Radio Std Presets** dialog, which is a cascading list of standards. When you have the selected the desired standard, press **OK** to change the measurement settings to that standard.

Remote Command	Not supported in RLC Mode
Dependencies	Some selections appear only when support license is valid
Couplings	By changing the radio standard, the measurement parameters will be automatically set to an appropriate default value
State Saved	Saved in instrument state

The **Radio** column in the table allows you to specify the device to be used. It is a global setting that affects the Device selection, between Mobile (MS) and Base Station (BTS) settings, for all relevant Power Suite measurements.

General Radio Standards

The table below lists the settings for each general Radio Standard.

None	IBW	2 MHz
	Span	3 MHz
	RBW	Auto rules
	VBW	Auto rules
TETRA	IBW	18 kHz
	Span	27 kHz
	RBW	1.2 kHz
	VBW	Auto rules
	RRC Filter	On
	RRC Filter Alpha	0.35

Video Radio Standards

The table below lists the settings and provides an example for each video Radio Standard.

DVB-T L/SECAM/NICAM	IBW	7.61 MHz
	Span	24 MHz
	RBW	3.9 kHz
	VBW	Auto rules
	Sweep Points	8001
DVB-T G/PAL/NICAM	IBW	7.61 MHz
	Span	24 MHz
	RBW	3.9 kHz
	VBW	Auto rules
	Sweep Points	8001
DVB-T I/PAL/NICAM	IBW	7.61 MHz
	Span	24 MHz
	RBW	3.9 kHz
	VBW	Auto rules
	Sweep Points	8001
S-DMB System E	IBW	25 MHz
	Span	37.5 MHz
	RBW	360 kHz
	VBW	Auto rules

RRC Filter	Off
RRC Filter Alpha	0.22

Radio Standard Presets Hierarchy

General	None	
	TETRA	BTS
		MS
	FCC Part 15 Subpart F	
	APCO-25	
	DMR	
	dPMR	
Video	DVB-T	L/SECAM/NICAM
		G/PAL/NICAM
		I/PAL/NICAM
	S-DMB System E	

Cellular	3GPP 5G NR	BTS	FR1 100 MHz
		MS	FR1 100 MHz
	3GPP LTE	BTS	1.4 MHz (6 RB)
			3 MHz (15 RB)
			5 MHz (25 RB)
			10 MHz (50 RB)
			15 MHz (75 RB)
			20 MHz (100 RB)
		MS	1.4 MHz (6 RB)
			3 MHz (15 RB)
			5 MHz (25 RB)
			10 MHz (50 RB)
			15 MHz (75 RB)
			20 MHz (100 RB)
	3GPP W-CDMA	BTS	
		MS	
	GSM/EDGE	BTS	
		MS	
	cdma2000 1x	BTS	
		MS	
	IS-95A	BTS	
		MS	
	J-STD-008	BTS	
		MS	
	IS-97D/98D	BTS	Band Class 0
			Band Class 1
		MS	Band Class 0
			Band Class 1
	NADC	BTS	
		MS	
	PDC	BTS	
		MS	

Wireless	W-LAN	802.11a	
		802.11b	
		802.11g	
		802.11n	20 MHz
			40 MHz
		802.11ac	20 MHz
			40 MHz
			80 MHz
			160 MHz
		802.11ad	
		802.11ay	2.16 GHz
			4.32 GHz
			6.48 GHz
			8.64 GHz
		HiperLAN/2	
	Bluetooth	DH1	
		DH3	
		DH5	
	UWB Indoor		

4.9.4.2 Enable Non-Std Meas

Allows you to specify whether all measurements and radio standards are enabled or not.

By default, **Enable Non-Std Measurements** is set to `NO`, so you can select only valid combinations of preset available standards and measurements. Combinations of measurement and standard that would have no valid preset value are grayed-out.

When **Enable Non-Std Measurements** is set to `YES`, all measurements and standard selections are enabled, so you can select any combination.

NOTE: If you select an unavailable measurement or unavailable radio standard using the **Enable Non-Std Meas** control, the measurement results may not conform to the selected standard.

Remote Command	Not supported in RLC Mode
Preset	`NO`
State Saved	Saved in instrument state
Range	`YES`|`NO`

4.9.4.3 EMC Standard

Allows you to select one of:

- None (no EMI standard)
- CISPR (CISPR 16-1-1)
- MIL (MIL-461A)

Each standard has a unique way of determining the couplings between detectors and RBWs, as well as its own set of available RBWs.

Note that "Auto Couple" on page 251 has no effect on the EMC Standard setting.

Remote Command	Not supported in RLC Mode
Dependencies	When the **EMC Standard** changes to **CISPR** or **MIL**, the **RBW Filter Type** and **RBW BW** controls are grayed out. The **Filter Type** is then always Gaussian; the **Filter BW** is chosen as appropriate for the filter and the standard.See the **BW** key description When the EMC Standard changes to **None**, the **Filter Type** is set to Gaussian and the Filter BW is set to -3 dB Only appears with the N6141A or W6141A application or Option EMC installed and licensed. If not, the command generates a message
Couplings	The auto rules for detector select Peak for any trace in Auto when the EMI Standard is CISPR or MIL Choosing a CISPR detector or CISPR presets automatically picks the CISPR Standard, however switching from a CISPR detector has no impact on EMC Standard
State Saved	Saved in instrument state

4.9.4.4 CISPR Presets

This group of controls lets you easily set up the instrument for CISPR measurements.

This topic contains the following sections:

- "Controls in the CISPR Group" on page 263
- "Band Setup" on page 264
- "Sweep Points in Band E" on page 264

Remote Command	Not supported in RLC Mode
Couplings	Selecting a CISPR preset sets the EMI Standard to CISPR, performs an autocouple all, and sets the Y Axis Unit to dBμV (unless dBuV is grayed-out, in which case it will leave the Y Axis Unit unaffected)

Controls in the CISPR Group

This group contains controls to set the following Presets:

- CISPR A 9 kHz – 150 kHz
- CISPR B 150 kHz – 30 MHz
- CISPR C 30 MHz – 300 MHz
- CISPR C/D 30 MHz – 1 GHz
- CISPR D 300 MHz – 1 GHz
- CISPR E 1 GHz – 18 GHz

Band Setup

The number of sweep points for each band is roughly calculated by the formula 2*(Stop Frequency-Start Frequency)/RBW, so that you get two points for every RBW width. This number is increased as necessary to make it an odd integer, so that you always end up with an odd number of sweep points. This is desirable so that you always have a sweep point at the Center Freq.

Band Setup	Band A	Band B	Band C	Band D	Band C&D	Band E
Start Frequency	9 kHz	150 kHz	30 MHz	300 MHz	30 MHz	1 GHz
Stop Frequency	150 kHz	30 MHz	300 MHz	1 GHz	1 GHz	Max freq of instrument or 18 GHz, whichever is lower
Sweep Points	1411	6635	4501	11667	16167	See below

The table above is based on the fact that the Res BW auto-couples to the center frequency when in the CISPR EMC standard as follows:

Center Frequency	RBW
<150 kHz	200 Hz
150 kHz to 30 MHz	9 kHz
>30 MHz to 1 GHz	120 kHz
>1 GHz	1 MHz

Sweep Points in Band E

Note that the Res BW will be 1 MHz in band E. The number of sweep points for band E is dependent on the maximum frequency of the instrument. The formula above gives the following values for Band E:

Option	Max Instrument Freq (nominal)	Width of Band E	Number of Points
503 (3.0 GHz models)	3.0 GHz	2.0 GHz	4001
503 (3.6 GHz models	3.6 GHz	2.6 GHz	5201
507 (7 GHz models)	7.0 GHz	6.0 GHz	12001
507 (7.5 GHz models)	7.5 GHz	6.5 GHz	13001
508	8.4 GHz	7.4 GHz	14801
513	13.2 GHz	12.2 GHz	24401
526	26.5 GHz	17 GHz	34001
544 (and above)	44 GHz	43 GHz	40001 (max)

4.9.5 Legacy Compat (Compatibility)

Contains controls for setting the Legacy Compatibility functions, which let you modify certain behaviors to exactly match our legacy products.

Certain behaviors in the X-Series instruments were changed from legacy HP/Agilent analyzers, in order to give users access to new, more powerful functionality. Keysight recognizes that from time to time, it is necessary to *exactly* match legacy behaviors, which is what the controls on this tab are for.

4.9.5.1 Average/Hold

In the past you could stop and start Max Hold by going back and forth between Single and Continuous. Currently, neither the X-Series nor the legacy instruments like ESA and PSA clear the Max or Min Hold when going from Cont to Single and vice versa; so you can go to Single to stop temporarily and then resume the Max or Min Hold by going back to Cont. However, in the X-Series, because Max and Min Hold obey the Average/Hold number, this is not an effective method for stopping a sweep, until you have reached the terminal count. Also, Restart is sometimes used as part of this method and in the X-Series, Restart clears the accumulated Max/Min Hold, whereas in the PSA (for example) it does not.

The Average/Hold switch in the Legacy Compatibility menu solves this problem. When this switch is in the “On” position, the following is true for traces in Max Hold or Min Hold:

- They pay no attention to the Average/Hold number; “Single” for Max Hold and Min Hold causes one sweep only, so going to Single stops after the current sweep, and going to Cont starts you going again without clearing the accumulated result
- They don’t clear the Max or Min Hold on a Restart or Single or INIT:IMM (changing a measurement parameter like frequency or bandwidth, etc. would still restart the max/min hold)

Note that whenever any trace is in Average, the Single/Cont controls *do* tie in to the Avg/Hold number and pressing **Single** *will* cause a set of sweeps (100 by default).

Remote Command	Not supported in RLC Mode
Preset	Unaffected by Mode Preset. Set to `OFF` by Restore Mode Defaults
State Saved	Saved in State

4.9.5.2 Detector

In the HP/Agilent ESA Spectrum Analyzer, the default detector is the Peak detector. In later instruments the Normal detector (which does alternate peak and pit detection) is the default, but ESA did not have this detector. For ESA compatibility, the Detector switch in the Legacy Compatibility menu causes the Detector Auto Rules to choose the Peak detector instead of the Normal detector for the conditions under which the Normal detector would otherwise be chosen.

This means that when you have this switch on, performing a Mode Preset will cause the Peak detector to be chosen, rather than the Normal detector, just like ESA.

Remote Command	`:CONTrol:COMPatible:DETector ON | OFF | 1 | 0` `:CONTrol:COMPatible:DETector?`
Example	`:CONT:COMP:DET ON` `ON` means exhibit ESA detector behavior
Preset	Unaffected by Mode Preset. Set to `OFF` by Restore Mode Defaults
State Saved	Saved in State

4.9.5.3 *RST

In older HP/Agilent/Keysight Spectrum Analyzers, sending `*RST` (to preset the analyzer) puts the analyzer in **Continuous** sweep mode. In order to be compliant with the IEEE-488.2 specification, the X-Series instruments put the instrument into **Single** sweep mode on `*RST`.

For backwards compatibility, when the `*RST` switch in the Legacy Compatibility menu is `ON`, the `*RST` command puts the instrument into **Continuous** sweep mode.

Remote Command	`:CONTrol:COMPatible:RST ON | OFF | 1 | 0` `:CONTrol:COMPatible:RST?`
Example	`:CONT:COMP:RST ON` `ON` means exhibit pre-X-series *RST behavior
Preset	Unaffected by Mode Preset. Set to `OFF` by Restore Mode Defaults
State Saved	Saved in State

4.9.6 Tune & Listen

Contains controls to turn the demod function on and off and select modulation type and configure the demod bandwidth. This tab only appears if the N9063C Analog Demod mode, the N6141C mode, or Option EMC is installed and licensed.

This tab does not appear in instruments that do not contain a speaker, such as VXT, EXM, UXM and CXA-m.

When the function is ON (set to AM, FM, or ΦM), the demodulated signal is fed to the instrument's speaker. Muting and volume control functions are done through the standard Windows speaker volume control interface.

Certain behaviors in the X-Series instruments were changed from legacy HP/Agilent analyzers, in order to give users access to new, more powerful functionality. Keysight recognizes that from time to time, it is necessary to *exactly* match legacy behaviors. The Legacy Compat tab contains controls for setting the Legacy Compatibility functions, which let you modify certain behaviors to exactly match our legacy products.

4.9.6.1 Demod Type

Sets the type of Demod to be performed for the Tune & Listen function.

Remote Command	Not supported in RLC Mode
Dependencies	When Tune & Listen is turned on, all active traces are forced to use the same detector CISPR detectors (QPD, EMI Avg, RMS Avg) and Tune & Listen are mutually exclusive. No sound output will be heard if one of these detectors is selected
Preset	OFF
State Saved	Saved in instrument state

4.9.6.2 Demod Time

Sets the amount of time the instrument demodulates the signal after each sweep for the Tune & Listen function. The demodulated signal can be heard through the speaker during demodulation. In zero span, demodulation can be performed continuously, making this parameter not applicable, hence it is grayed-out in zero span.

Remote Command	Not supported in RLC Mode
Notes	This control is grayed-out in zero span
Dependencies	Unavailable in zero span
Preset	500 ms
State Saved	Saved in instrument state

Min	2 ms
Max	100 s

4.9.6.3 AM Channel BW

Sets the RBW setting used by the hardware during the demodulation period in nonzero spans for the Tune & Listen function. Note that this is a separate parameter only for the demodulation function and does not affect the RBW setting in the BW menu which is used during the normal sweep. The flat top filter type must be used during the demodulation period. A 5 kHz Video Bandwidth filter is used.

In Zero Span, the instrument's RBW & VBW filters are used for the demodulation; thus, the Channel BW (and RBW filter type) will match those of the instrument. This allows gap-free listening. The Channel BW control is grayed out and the value displayed on the control matches the current RBW of the instrument. Upon leaving zero span, the non-zero-span setting of Channel BW is restored as well as the flattop filter type.

Remote Command	Not supported in RLC Mode
Notes	Grayed-out in zero span
Dependencies	Unavailable in zero span
Couplings	In zero span only, the value is set equal to the instrument's current RBW value and it displays that value on the control, but the control is grayed-out
Preset	30 kHz
State Saved	Saved in instrument state
Min	390 Hz
Max	8 MHz

4.9.6.4 FM Channel BW

Sets the RBW setting used by the hardware during the demodulation period in nonzero spans for the Tune & Listen function. Note that this is a separate parameter only for the demodulation function and does not affect the RBW setting in the BW menu which is used during the normal sweep. The flat top filter type must be used during the demodulation period. A 5 kHz Video Bandwidth filter is used.

In Zero Span, the instrument's RBW & VBW filters are used for the demodulation; thus, the Channel BW (and RBW filter type) will match those of the instrument. This allows gap-free listening. The Channel BW control is grayed out and the value displayed on the control matches the current RBW of the instrument. Upon leaving zero span, the previous setting of Channel BW and the flattop filter type are restored.

Remote Command	Not supported in RLC Mode
Notes	This control is grayed-out in zero span

Dependencies	Unavailable in zero span
Couplings	In zero span only, the value is set equal to the instrument's current RBW value and it displays that value on the control, but the control is grayed-out
Preset	150 kHz
State Saved	Saved in instrument state
Min	390 Hz
Max	8 MHz

4.9.6.5 PM Channel BW

Sets the RBW setting used by the hardware during the demodulation period in nonzero spans for the Tune & Listen function. Note that this is a separate parameter only for the demodulation function and does not affect the RBW setting in the BW menu which is used during the normal sweep. The flat top filter type must be used during the demodulation period. A 5 kHz Video Bandwidth filter is used.

In Zero Span, the instrument's RBW & VBW filters are used for the demodulation; thus, the Channel BW (and RBW filter type) will match those of the instrument. This allows gap-free listening. The Channel BW control is grayed out and the value displayed on the control matches the current RBW of the instrument. Upon leaving zero span, the previous setting of Channel BW and the flattop filter type are restored.

Remote Command	Not supported in RLC Mode
Notes	This control is grayed-out in zero span
Dependencies	Unavailable in zero span
Couplings	In zero span only, the value is set equal to the instrument's current RBW value and it displays that value on the control, but the control is grayed-out
Preset	100 kHz
State Saved	Saved in instrument state
Min	390 Hz
Max	8 MHz

4.9.6.6 FM Demod De-emphasis

This setting controls a single-pole filter (6 dB/octave roll off) for the Tune & Listen function, usually to counter intentional pre-emphasis in the transmitter. When De-emphasis state is `OFF` the hardware digital filter is bypassed, otherwise the setting is applied.

The choices are Off, 25 µs, 50 µs, 75 µs, and 750 µs.

The De-emphasis control is only available when FM is the demod selected. It is grayed-out for AM and PM.

Remote Command	Not supported in RLC Mode
Dependencies	Only available in FM. Grayed-out for AM and PM
Preset	US75 recommended for US commercial FM 75 µs pre-emphasis
State Saved	Saved in instrument state

4.9.7 Advanced

Contains controls for setting advanced functions of the instrument.

This tab does not appear in instruments that do not contain Advanced functions. Most of the modular instruments (including VXT models M9410A/11A) fall into this category, as does UXM.

4.9.7.1 Phase Noise Optimization

Selects the LO (local oscillator) phase noise behavior for various desired operating conditions.

For full details, see "Parameter Options, Installed Options, Auto Rules & Ranges" on page 270 below.

Remote Command	Not supported in RLC Mode
Dependencies	Does not appear in all models
Preset	Because this function is in Auto after preset, and because Span after preset > 314.16 kHz, the state of this function after Preset will be 2 ON
Range	See "Ranges" on page 281 below
Annotation	Found in the Meas Bar under **PNO** When not in Auto, label changes to **#PNO**

Parameter Options, Installed Options, Auto Rules & Ranges

Note that SCPI examples below are *not* available in RLC Mode.

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 272	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 272	2	Optimizes phase noise for wide frequency offsets from the carrier
"Fast Tuning" on page 272	3	Optimizes LO for tuning speed
"Best Close-in" on page 271	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 272	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 271 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 272 is identical in effect to "Best Close-in" on page 271.

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 272 setting, parameter 1 selects "Balanced" on page 272 in EP0 instruments, in the interests of optimizing code compatibility across the family. Parameter 4 selects "Best Close-in" on page 271, which is usually not as good a choice as "Balanced" on page 272.

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 272 case close to the carrier, but the configuration has 11 dB worse phase noise than the "Best Close-in" on page 271 case mostly within ±1 octave around 300 kHz offset. Spurs are even lower than in the "Balanced" on page 272 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 272 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 272. It is available with the "Fast Tuning" on page 272 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 272 option, the settings for "Best Close-in" on page 271 are used if "Fast Tuning" on page 272 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 272
	Span > 114.1 MHz, *or* RBW > 800 kHz	"Fast Tuning" on page 272
	RBW > 290 kHz, *or* Span > 4.2 MHz	"Best Wide-offset" on page 272
	Other conditions	"Balanced" on page 272
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 272
	Center frequency is < 195 kHz, *or* CF >= 1 MHz *and* Span <= 1.3 MHz *and* RBW <= 75 kHz	"Best Close-in" on page 271
	All other conditions	"Best Wide-

Models with Option	Conditions	Selection
		"Best Wide-offset" on page 272
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 271; 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 271
	Span > 22 MHz, *or* RBW > 400 kHz, *or* CF ≤ 12 MHz *and* Span < 495 kHz *and* RBW < 23 kHz	"Fast Tuning" on page 272
	All other conditions	"Best Wide-offset" on page 272
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 272
	CF is < 109 kHz *or* CF >= 4.95 MHz *and* Span <= 666 kHz *and* RBW < 28 kHz	"Best Close-in" on page 271
	All other conditions	"Best Wide-offset" on page 272
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 272 are actually the same as "Best Close-in" on page 271, 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 272
	Center frequency is < 25 kHz, *or* CF >= 1 MHz *and* Span <= 141.4 kHz *and* RBW <= 5 kHz	"Best Close-in" on page 271
	All other conditions	"Best Wide-offset" on page 272

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

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 272	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 272	2	Optimizes phase noise for wide frequency offsets from the carrier
"Fast Tuning" on page 272	3	Optimizes LO for tuning speed
"Best Close-in" on page 271	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 272	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 271 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 272 is identical in effect to "Best Close-in" on page 271.

Best Close-in

Without option EP0

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

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 272 setting, parameter 1 selects "Balanced" on page 272 in EP0 instruments, in the interests of optimizing code compatibility across the family. Parameter 4 selects "Best Close-in" on page 271, which is usually not as good a choice as "Balanced" on page 272.

Balanced

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

In instruments with EP0, the LO is configured for better phase noise than the "Best Wide-offset" on page 272 case close to the carrier, but the configuration has 11 dB worse phase noise than the "Best Close-in" on page 271 case mostly within ±1 octave around 300 kHz offset. Spurs are even lower than in the "Balanced" on page 272 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

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

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 272 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 272. It is available with the "Fast Tuning" on page 272 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 272 option, the settings for "Best Close-in" on page 271 are used if "Fast Tuning" on page 272 is selected. This gives the fastest possible tuning for that hardware set.)

Auto

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 272
	Span > 114.1 MHz, *or* RBW > 800 kHz	"Fast Tuning" on page 272
	RBW > 290 kHz, *or* Span > 4.2 MHz	"Best Wide-offset" on page 272
	Other conditions	"Balanced" on page 272
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 272
	Center frequency is < 195 kHz, *or* CF >= 1 MHz *and* Span <= 1.3 MHz *and* RBW <= 75 kHz	"Best Close-in" on page 271
	All other conditions	"Best Wide-offset" on page 272
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 271; this is useful when you have to look across a wide range of spans	CF < 130 kHz , *or* CF > 12 MHz *and* Span < 495 kHz *and* RBW < 40	"Best Close-in" on page 271

Models with Option	Conditions	Selection
(available, for example, in MXA for excellent phase noise)	kHz	
	Span > 22 MHz, *or* RBW > 400 kHz, *or* CF ≤ 12 MHz *and* Span < 495 kHz *and* RBW < 23 kHz	"Fast Tuning" on page 272
	All other conditions	"Best Wide-offset" on page 272
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 272
	CF is < 109 kHz *or* CF >= 4.95 MHz *and* Span <= 666 kHz *and* RBW < 28 kHz	"Best Close-in" on page 271
	All other conditions	"Best Wide-offset" on page 272
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 272 are actually the same as "Best Close-in" on page 271, 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 272
	Center frequency is < 25 kHz, *or* CF >= 1 MHz *and* Span <= 141.4 kHz *and* RBW <= 5 kHz	"Best Close-in" on page 271
	All other conditions	"Best Wide-offset" on page 272

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 272
	Span > 114.1 MHz, *or* RBW > 800 kHz	"Fast Tuning" on page 272
	RBW > 290 kHz, *or* Span > 4.2 MHz	"Best Wide-offset" on page 272
	Other conditions	"Balanced" on page 272
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*	"Fast Tuning" on page 272

Models with Option	Conditions	Selection
	Source Mode is set to “Tracking”	
	Center frequency is < 195 kHz, *or* CF >= 1 MHz *and* Span <= 1.3 MHz *and* RBW <= 75 kHz	"Best Close-in" on page 271
	All other conditions	"Best Wide-offset" on page 272
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 271; 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 271
	Span > 22 MHz, *or* RBW > 400 kHz, *or* CF ≤ 12 MHz *and* Span < 495 kHz *and* RBW < 23 kHz	"Fast Tuning" on page 272
	All other conditions	"Best Wide-offset" on page 272
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 272
	CF is < 109 kHz *or* CF >= 4.95 MHz *and* Span <= 666 kHz *and* RBW < 28 kHz	"Best Close-in" on page 271
	All other conditions	"Best Wide-offset" on page 272
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 272 are actually the same as "Best Close-in" on page 271, 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 272
	Center frequency is < 25 kHz, *or* CF >= 1 MHz *and* Span <= 141.4 kHz *and* RBW <= 5 kHz	"Best Close-in" on page 271
	All other conditions	"Best Wide-offset" on page 272

Models with Option	Conditions	Selection
EP0	Center frequency	"Balanced" on

Models with Option	Conditions	Selection
Models with option EP0 have a two stage local oscillator, which switches to a single loop for fast tuning (available in UXA)	is < 699.9 kHz	page 272
	Span > 114.1 MHz, *or* RBW > 800 kHz	"Fast Tuning" on page 272
	RBW > 290 kHz, *or* Span > 4.2 MHz	"Best Wide-offset" on page 272
	Other conditions	"Balanced" on page 272
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 272
	Center frequency is < 195 kHz, *or* CF >= 1 MHz *and* Span <= 1.3 MHz *and* RBW <= 75 kHz	"Best Close-in" on page 271
	All other conditions	"Best Wide-offset" on page 272
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 271; 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 271
	Span > 22 MHz, *or* RBW > 400 kHz, *or* CF ≤ 12 MHz *and* Span < 495 kHz *and* RBW < 23 kHz	"Fast Tuning" on page 272
	All other conditions	"Best Wide-offset" on page 272
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 272
	CF is < 109 kHz *or* CF >= 4.95 MHz *and* Span <= 666 kHz *and* RBW < 28 kHz	"Best Close-in" on page 271
	All other conditions	"Best Wide-offset" on page 272
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 272 are actually the same as "Best Close-in" on page 271, but the rules are implemented this way so that the user who doesn't	Span > 12.34 MHz, *or* RBW > 250 kHz,	"Fast Tuning" on page 272

Models with Option	Conditions	Selection
care about phase noise but does care about tuning speed doesn't have to remember which of the other two settings gives faster tuning	*or* Source Mode is set to "Tracking"	
	Center frequency is < 25 kHz, *or* CF >= 1 MHz *and* Span <= 141.4 kHz *and* RBW <= 5 kHz	"Best Close-in" on page 271
	All other conditions	"Best Wide-offset" on page 272

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]

Option	Option #	Phase Noise Option	Range
No EPx Option	1	"Best Close-in" on page 271	[offset < 20 kHz]
	2	"Best Wide-offset" on page 272	[offset > 30 kHz]
	3	"Fast Tuning" on page 272	[same as Best Close-In]
EP0	4	"Best Close-in" on page 271	[offset < 600 kHz]
	1	"Balanced" on page 272	[offset < 600 kHz]
	5	"Best Spurs" on page 272	[offset < 600 kHz]
	2	"Best Wide-offset" on page 272	[offset > 800 kHz]
	3	"Fast Tuning" on page 272	[same as Best Close-In]
EP1	1	"Best Close-in" on page 271	[offset < 140 kHz]
	2	"Best Wide-offset" on page 272	[offset > 160 kHz]
	3	"Fast Tuning" on page 272	[single loop]
EP2, EP3, EP5	1	"Best Close-in" on page 271	[offset < 70 kHz]
	2	"Best Wide-offset" on page 272	[offset > 100 kHz]
	3	"Fast Tuning" on page 272	[medium loop bw]
EP4	1	"Best Close-in" on page 271	[offset < 90 kHz]
	2	"Best Wide-offset" on page 272	[offset > 130 kHz]
	3	"Fast Tuning" on page 272	[same as Best Close-In]

4.9.7.2 ADC Dither

Controls the ADC Dither function, which enhances linearity for low level signals at the expense of reduced clipping-to-noise ratio. The reduced clipping-to-noise ratio results in higher noise, because we work to ensure that the clipping level of the ADC relative to the front terminals remains unchanged with the introduction of dither, and this results in reduced ADC dynamic range. So making measurements with ADC dither gives you better amplitude linearity, but turning ADC dither off gives you a lower noise floor (better sensitivity).

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.

When ADC Dither is on, the linearity of low-level signals is improved. The enhanced linearity is mostly improved scale fidelity. The linearity improvements of dither are most significant for RBWs of 3.9 kHz and less in swept mode, and FFT widths of 4 kHz and less in FFT mode.

The increased noise due to turning dither on is most significant in low band (0 to 3.6 GHz) with IF Gain set to Low, where it can be about 0.2 dB.

See "More Information" on page 283

Remote Command	Not supported in RLC Mode
Dependencies	In some models, the HIGH parameter is not available. In some instruments, the HIGH parameter is accepted, and the HIGH state is set and returned to a query, but the Medium (ON) dither level is actually used
Preset	ON
Range	OFF|ON|HIGH

More Information

Detail on the settings follows:

Auto

Sets the ADC dither to automatic. The instrument then chooses the dither level according to which is most likely to be the best selection, based on other settings within the digital IF.

When in Auto, the instrument sets the dither to Medium whenever the effective IF Gain is Low by this definition of IF Gain = Low:

- When Sweep Type = Swept, IF Gain = Low whenever Swept IF Gain is set to Low Gain, whether by autocoupling or manual selection
- When Sweep Type = FFT, IF Gain = Low whenever FFT IF Gain is set to "Low Gain," which cannot happen by autocoupling

Whenever the IF Gain is not Low by this definition, Auto sets the dither to Off.

High (Best Log Accy)

When ADC Dither is set to High, the scale fidelity is especially good, most notably the relative scale fidelity. The tradeoff is that there is a modest loss of noise floor performance, up to about a decibel.

Medium (Log Accy)

The Medium setting of ADC Dither (known as “On” in earlier versions of the instrument software) improves the linearity of low-level signals at the expense of some noise degradation.

Off (Best Noise)

When ADC Dither is Off, the instrument noise floor is improved, because without the need to make room for the dither, you get a lower noise floor and better sensitivity.

4.9.7.3 Swept IF Gain

To take full advantage of the RF dynamic range of the instrument, there is an added switched IF amplifier with approximately 10 dB of gain. When you can turn it on without overloading the instrument, the dynamic range is always better with it on than off. The **Swept IF Gain** control can be used to set the IF Gain function to Auto, or to High Gain (the extra 10 dB), or to Low Gain. These settings affect sensitivity and IF overloads.

This function is only active when in Swept sweeps. In FFT sweeps, the FFT IF Gain function is used instead.

– "Auto" on page 285
– "Low Gain (Best for Large Signals)" on page 285
– "High Gain (Best Noise Level)" on page 285

Remote Command	Not supported in RLC Mode
Notes	ON = high gain OFF = low gain
Dependencies	The IF Gain keys (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 keys grayed 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 keys
Couplings	The 'auto' rules for Swept IF Gain depend on attenuation, preamp state, start and stop frequency and the setting of FFT IF Gain. Set the Swept IF Gain to High (On) when the total input attenuation is 0 dB, the preamp is off, the start frequency is 10 MHz or more, and the FFT IF Gain is autocoupled, or manually set to Autorange, or manually set to High. Also set the Swept IF Gain to High (On) when the total input attenuation is 2 dB or less, the preamp is on, the start frequency is 10 MHz or more, and the stop frequency is 3.6 GHz or less and the FFT IF Gain is autocoupled, or manually set to Autorange, or manually set to High. Under all other circumstances, set the Swept IF Gain to Low (Off) If the sweep type is Swept, the start frequency of the instrument is less than 10 MHz, and you put Swept IF Gain in Manual On, a warning condition is generated and remains in effect as long as this condition exists. The warning message is about a possible IF overload As with most parameters with an AUTO state, "Auto Couple" on page 251 sets it to Auto, and setting any specific value (for example on or off) will set the AUTO state to false
Preset	Auto after a Preset, which yields Off unless the Preamp is on Auto and Off after Meas Preset ON
State Saved	Saved in instrument state
Range	Low Gain | High Gain
Annunciation	Low | High Found in the Meas Bar under **IF Gain** when in Swept sweep type When not in Auto, label changes to **#IF Gain**

Auto

Activates the auto rules for Swept IF Gain

Low Gain (Best for Large Signals)

Forces Swept IF Gain to be off.

High Gain (Best Noise Level)

Dependencies	The High setting for **Swept IF Gain** is grayed out when **FFT IF Gain** is manually set to Low (not when Low is chosen by the auto-rules)

4.9.7.4 FFT IF Gain

Accesses the keys to set the ranging in the digital IF when doing FFT sweeps. When in Autorange mode, the IF checks its range once for every FFT chunk, to provide the best signal to noise ratio. You can specify the range for the best FFT speed, and optimize for noise or for large signals.

When the sweep type is FFT and this function is in Autorange, the IF Gain is set ON initially for each chunk of data. The data is then acquired. If the IF overloads, then the IF Gain is set OFF and the data is re-acquired. Because of this operation, the Auto setting uses 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 be sure that your measurement conditions will not overload the IF (in the high gain range) and that your signals are well above the noise floor (for the low gain range), and that the signals are not changing.

– "Auto" on page 286

– "Autorange (Slower: Follows Signals)" on page 286

– "Low Gain (Best for Large Signals)" on page 286

– "High Gain (Best Noise Level)" on page 286

Remote Command	Not supported in RLC Mode
Dependencies	The IF Gain keys (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 keys 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 keys
Couplings	As with most parameters with an `AUTO` state, "Auto Couple" on page 251 sets it to Auto, which then picks `AUTOrange`, and setting any specific value (`AUTOrange`, `LOW` or `HIGH`) will set the `AUTO` state to false
Preset	`AUTOrange` `ON`
State Saved	Saved in instrument state

Range	`AUTOrange|LOW|HIGH`
Annunciation	Autorange | Low | High Found in the Meas Bar under **IF Gain** when in FFT sweep type When not in Auto, label changes to **#IF Gain**

Auto

Allows the instrument to pick the FFT IF Gain method as appropriate. When in Auto, the FFT IF Gain is set as follows:

– When the Sweep Type Rules are set to “Best Speed,” the instrument selects `LOW` Gain as the auto choice

– When the Sweep Type Rules are set to “Best Dynamic Range”, the instrument selects `AUTOrange` as the auto choice

“Auto” is selected when "Auto Couple" on page 251 is pressed.

Autorange (Slower: Follows Signals)

Turns the ADC ranging to automatic, which provides the best signal to noise ratio. `AUTOrange` is usually preferred over the manual range choices.

NOTE: In the N9041B, when the Software Preselection switch in the Amplitude, Signal Path menu is set to On, and RF Input 2 is selected, Autorange always selects high gain. This provides the best signal-to-noise ratio, at the risk of overloading in the presence of stronger signals. If you experience overloads with Software Preselection set to On, set FFT IF Gain to Low manually. See the documentation for the Software Preselection On/Off switch in the Amplitude, Signal Path menu for more details about Software Preselection.

Low Gain (Best for Large Signals)

Forces FFT IF Gain to be `LOW`.

High Gain (Best Noise Level)

Forces FFT IF Gain to be `HIGH`.

4.9.7.5 Noise Floor Extension

Allows you to turn on the **Noise Floor Extension** function in either of two states, Full or Adaptive.

In 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 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 may be set to Full or Adaptive, regardless of what Input is chosen. However, currently Noise Floor Extension has no effect if the Input is set to External Mixing or BBIQ.

With the introduction of Adaptive NFE, in firmware version A.18.00, the default state of NFE is now Adaptive. Before the introduction of Adaptive NFE, NFE was Off by default.

With the introduction of Adaptive NFE, the menu control is changed from On|Off to Full|Adaptive|Off.

See "More Information" on page 288

Remote Command	Not supported in RLC Mode
Dependencies	This control only appears in instruments with the NFE or NF2 license installed. In all others, the control does not appear, but the command is accepted without error (but has no effect)
Couplings	When NFE is enabled in any mode manually, a prompt is displayed reminding you to perform the Characterize Noise Floor operation if it is needed. If NFE is enabled via 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 Note that, in S/W versions prior to A.18.00, this function was turned OFF at startup and by Restore

	Mode Defaults
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
	`:CORR:NOIS:FLO:ADAP ON`
	Then set it to Adaptive

Dependencies	Only appears in instruments with the NFE or NF2 license installed. In all others, the control does not appear, but the command is accepted without error (but has no effect)
Couplings	Sending `:CORR:NOIS:FLO ON` turns NFE Adaptive `OFF` for backwards compatibility. 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 select **Cancel**, you will be prompted again the next time you turn NFE on. If you select **Postpone**, you will be prompted again after a week passes and you then turn NFE on.

4.9.7.6 Noise Source

This control allows you to turn the noise source power on or off and select the type of Noise Source to be used when making manual noise figure measurements.

See "More Information" on page 290.

Remote Command	`:SOURce:NOISe:TYPE NORMal | SNS`
	`:SOURce:NOISe:TYPE?`
	`:SOURce:NOISe[:STATe] ON | OFF | 1 | 0`
	`:SOURce:NOISe[:STATe]?`

Example	`:SOUR:NOIS:TYPE NORM` `:SOUR:NOIS OFF`
Couplings	If no SNS is connected, this parameter will be set to “Normal” When Type is set to `SNS` and the SNS is disconnected, this parameter gets bumped to `NORMal` When an SNS is not connected, the SNS type is grayed-out (disabled) If an SNS is connected, and the Type is set to SNS, this parameter turns the SNS on and off When an SNS is not connected this parameter turns the BNC 28V output on and off When the SA mode is first entered this parameter is set to `OFF` and the 28v drive turned `OFF` When the SA mode is exited this parameter is set to `OFF` and the 28v drive turned `OFF`
Preset	`NORMal` `OFF`
State Saved	Saved in instrument state
Range	`NORMal | SNS`
Backwards Compatibility Notes	In previous Noise Figure analysis applications, this command could optionally be preceded with the `:SENSe` keyword. The optional `:SENSe` keyword is no longer supported

More Information

There are several types of noise sources:

– 346/7 Series

– N4000 series Smart Noise Source (SNS)

– USB Noise Source (connects via USB rather than via the Noise Source connector on the rear panel)

This menu allows the user to control any of these.

When an SNS is connected the user can then select it from the “Type” dropdown, allowing the State parameter to then control the SNS. The "Normal" source is controlled by a BNC connector that supplies 28V. If SNS is NOT connected then the “state” parameter controls the "Normal" noise source 28V BNC port. If both are connected the “Type” parameter will determine which source the “State” parameter will control. Two sources can never be controlled together. The “SNS attached” SCPI query detailed below can be used remotely to determine if an SNS is connected. SNS functionality is limited to turning on and off only. The SNS ENR data and temperature cannot be queried, unless the Noise Figure application is installed. The SNS ENR data is issued in printed form when an SNS is purchased or can be read from the instrument’s Noise Figure application if installed, or other Keysight noise figure instruments that support the SNS (NFA and ESA with option 219).

Only one SNS is supported at a time. To switch to a different SNS (a USB SNS or an N4000 series SNS), disconnect the one that is no longer being used prior to connecting a new one.

When first entering the Swept SA measurement the “State” will be set to OFF and the 28v BNC drive and SNS turned off to ensure the two are in sync. When the Swept SA measurement is exited, the “State” parameter will be set to OFF and the 28v BNC and SNS drive turned off.

For making manual noise figure measurements the following setup is recommended:

- Set the SPAN to Zero
- Set attenuation to 0 dB
- Set the PRE-AMP ON
- Set the RBW to 4 MHz
- Set the Detector to AVERAGE
- Set the sweep time to 16 ms - sets the variance correctly for good results.
- Set a Band/Interval Power Marker function and set the interval over the full width of trace i.e. Left to 0s and Right to 16 ms

4.9.7.7 ACP Enhanced Dynamic Range

The ACP Enhanced Dynamic Range function causes a 300 kHz SAW filter (also called the “ACP Filter”) to be switched into the signal path to allow third-order critical measurements, such as ACP measurements, to be made with improved dynamic range when the spectrum is substantially wider than 300 kHz. When ACP Enhanced Dynamic Range is on:

- When RBW ≤ 300 kHz, the “ACP filter” is switched in. This means that the RBW shape is affected, but not excessively

– When RBW > 300 kHz, ACP Enhanced Dynamic Range causes no changes in the signal path

NOTE **This function should be used only under specific measurement scenarios, such as ratio measurements of intermodulation, to avoid adding other measurement inaccuracies, such as Frequency Readout Accuracy, RBW amplitude accuracy, power bandwidth accuracy and absolute amplitude accuracy.**

Preset	`OFF`
State Saved	Saved in instrument state

4.9.8 Source

Accesses menus for controlling a Tracking Source in Tracking Source mode.

This tab does not appear in instruments that do not support Tracking Source functions. This includes most of the modular instruments (including VXT), as well as UXM.

Some instruments (such as VXT) contain an Independent Source, which is controlled using the **RF Source** tab in the **Input/Output** menu.

Dependencies	Only appears in the Swept SA measurement of Spectrum Analyzer Mode Operation with a tracking source requires a license, such as ESC or TG3. If the proper license is not installed, the Source tab does not appear, and if any command in the `:SOURce` subsystem is sent, it generates a message, "Settings conflict; option not installed"

NOTE **Option T03 or T06 is required for the Tracking Generator function in CXA.**

Option T03, T07, T13 or T26 is required for the Tracking Generator function in CXA-m.

CXA-m TG Uncalibrated Amplitude Range

When using the CXA-m Tracking Generator, if the Source Frequency is in the frequency range of the below table, and the Source Amplitude is in the corresponding amplitude range of the below table, a warning status message is generated, +313 "Source Uncal". This is also true if Power Sweep is on and any amplitude in the Power Sweep (as calculated by Amplitude, Power Sweep, and Amptd Offset) is in that range.

Frequency Range	Amplitude Range
2 MHz ≤ frequency < 10 GHz	-40 dBm ≤ amplitude < -35 dBm
10 GHz ≤ frequency < 20 GHz	-40 dBm ≤ amplitude < -35 dBm or -5 dBm < amplitude ≤ 0 dBm

Frequency Range	Amplitude Range
20 GHz ≤ frequency ≤ 26.55 GHz	-12 dBm < amplitude ≤ 0 dBm

4.9.8.1 RF Output

Turns the source RF Power on or off.

NOTE

As stated below, when the RF Output is turned on, the Source Mode is set to Tracking. See the Source Mode control description for special considerations when configuring the N5172B or N5182B source for use with External Source Control.

Remote Command	Not supported in RLC Mode
Dependencies	Grayed-out in measurements that do not support a source. If you switch to such a measurement the output will be forced to Off Grayed-out if there is no valid source selection, in this case go to the **Select Source** menu to choose, configure and/or verify your source When there is no available Source Mode (other than Off), due to other couplings, then RF Output is grayed-out
Couplings	When RF Output is turned On, Source Mode is set to Tracking When Source Mode is turned Off, RF Output is turned Off When Source Mode is turned Off (or forced to Off by another coupling), RF Output is turned Off Turning RF Output Off does not affect Source Mode or other settings
Preset	`OFF` On either Mode Preset, Source Preset, or Restore Input/Output Defaults
State Saved	Part of the Input/Output system, which means it is Loaded and Saved with state
Range	`ON` | `OFF`
Annunciation	The Source annotation in the Meas Bar shows Off if Source Mode is Off, “Trk, RF off” if Source Mode is Tracking but RF is off, and “Trk, RF on” if Source Mode is Tracking and the RF output is on

4.9.8.2 Source Amplitude

Adjusts the power level of the selected source. Note that the actual amplitude is also affected by the Amplitude Offset and Power Sweep parameters.

Remote Command	Not supported in RLC Mode
Dependencies	If the requested setting of Source Amplitude causes the calculated external source start or stop Amplitude to exceed the external source capability, a warning status message is generated, “Data out

	of Range; clipped to source max/min" The "Show Source Capabilities and Settings" menu can then be examined to check the source capabilities This parameter test and clip is also performed at source acquisition See also "CXA-m TG Uncalibrated Amplitude Range" on page 292
Preset	-10.00 dBm (On Source Preset and Restore Input/Output Defaults) Not affected by Mode Preset
State Saved	Part of the Input/Output system, which means it is Loaded and Saved with state
Min/Max	The range of the amplitude parameter is dependent on the amplitude range of the source that is selected, and the settings of Amplitude Offset and Power Sweep

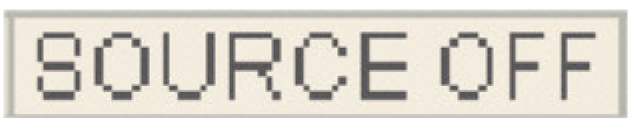
4.9.8.3 Source Mode

Lets you select Tracking mode for the Source, and also allows you to set the Source Mode to `OFF`

The Source Mode can be set to Tracking without the user setting it directly. There are several couplings that cause Source Mode to be automatically set to Tracking (detailed in the table below). One important coupling is that Source Mode is forced to Tracking when the RF Output is turned on if the measurement supports Tracking. Since Source Mode is set to Off on a Mode Preset, this means that you will rarely need to change the Source Mode setting directly.

NOTE **When Source Mode is set to Tracking, the instrument acquires control of the source. When this happens the source is told to save its state and then perform a preset. Usually both of these operations take very little time; however, on an N5172B or an N5182B, if many Source real-time apps are in use, both save and preset can take many seconds. If it takes longer than the instrument expects to acquire control, you will see an error: "Source connection lost, check interface connection". If you see this error, and you are using an N5172B or an N5182B, you can shorten the acquire time by presetting your MXG before attempting to use External Source Control.**

Remote Command	Not supported in RLC Mode
Dependencies	Grayed-out if no Source is selected, in this case go to the Select Source menu to choose, configure and/or verify your source Grayed-out and forced to Off if either BBIQ or External Mixing are selected Grayed-out in Measurements that do not support a source Grayed out when Manual FFT is selected Grayed-out when the RF Preselector is on (in models that support the RF Preselector)
Couplings	When RF Output is turned On, Source Mode is set to Tracking. When Source Mode is turned Off, RF Output is turned Off Whenever you switch to an application (Mode) in which the Source Mode was previously set to Tracking, it is again set to Tracking. That is, the last setting of the Source Mode is remembered when you leave an application (Mode) and restored when you return

	Source Mode is forced to Tracking when the RF Output is turned on if the measurement supports Tracking If Source Mode is set to Tracking, then it is forced to Off when you select a measurement that does not support Tracking. If Source Mode is set to Tracking, then it is forced to Off when you turn on the RF Preselector (in models which support the RF Preselector) Whenever the Source Mode is set to Tracking, the instrument acquires the Source. Similarly, the Source is released whenever the Source Mode is set to Off. This is true whether the Source Mode was set directly by you, was set indirectly through a coupling, if you switched to an application (Mode) that had previously been set to Tracking, or if you switched to an application (Mode) in which the Source Mode is not set to Tracking For an external source, “acquiring the source” involves contacting the external instrument over the remote interface (which puts it into Remote) and taking control of it When you set the Source Mode to OFF, it releases the Source (and puts it into Local). For an external source, this means you are now free to operate the source for other purposes When the Source is acquired, its previous state is saved, and when it is released, that state is restored, so that you can acquire and then release the source and it will return to the state it was in before you acquired it
Preset	`OFF`
State Saved	Saved in instrument state
Annunciation	If the Source Mode is off, the settings panel at the top of the screen shows:  See the RF Output control for the case where the Source Mode is Tracking

When the instrument acquires the Source, the following things happen:

1. The instrument will attempt to verify communication with the selected source. If the communication somehow fails, the Source Mode is set to Off, and the instrument will report a message “System Error; source connection lost, check interface connection”. This will also happen if at any time, during normal operation, the source connection fails after having been successfully acquired Note that even if this happens the current Source is not removed from the list of available sources

2. If the communication succeeds, the source will go to Remote. The instrument then commands the external source to save its current state in one of its own internal state registers (Seq 0, state 99)

3. The instrument examines its current Source State and if the settings for the sweep exceed the capabilities of the configured source it clips the settings and displays an informational message, “Some source settings changed to match source limits.” The sweep setting will be forced to a setting that allows the source to sweep. The user can then reconfigure the sweep settings one at a time to see which is in conflict. The menu: Show Source Capabilities and Settings... can be used to show potential settings conflicts with the source capabilities

4. The following clip is performed to ensure that the instrument's current settings of max and/or min frequency do not exceed the capabilities of the source:

   Instrument start frequency = max{instrument current frequency, source minimum frequency}

   Instrument stop frequency = min{instrument current frequency, source maximum frequency}

In other words, if the instrument's current state contains a frequency that is outside the frequency range of the Source, the instrument State is clipped to conform to the capabilities of the source. If this happens, an informational message is displayed, "Some analyzer settings changed to match source limits."

1. Once the Source is acquired, other Auto coupled instrument sweep parameters are changed to perform the Stimulus/Response measurement
2. Additionally, once the Source is acquired, some Source State variables will need to be Preset if they cannot be supported by the current source. These include Multiplier Numerator , Multiplier Denominator, Reverse Sweep, and Source Freq Offset
3. The instrument writes its current (updated) Source State to the source

After this has been done, the source and instrument will operate together in "tracking" mode, which, for an external source, includes a software or hardware handshake for synchronization

If any subsequent setting change of the instrument causes a conflict regarding the calculated source settings (for example, frequency/amplitude/trace point beyond the source ranges), the instrument will clip to the source max/min and generate a warning message, -221 "Data out of Range; clipped to source max/min".

When the Source is released, the instrument commands the external source to recall its state from its own internal state register (Seq 0, state 99) thus leaving the source in its pre-acquisition state, and the instrument measurement couplings and dependencies are removed, allowing the measurement to return to its normal, non-tracking state. It also puts the Source in Local.

4.9.8.4 Source Setup Table

Accesses various setup parameters for the Source. In addition, the results of the source control sweep algorithms can be viewed. This gives information of the source range required for a given instrument sweep range. This can be used dynamically as a way of configuring the sweep settings.

Point Trigger: Lets you set up how you want to trigger the source as it steps from frequency to frequency.

Amplitude parameters: Power Sweep, Amplitude Offset, Amplitude Step. The resolution of the Source amplitude parameters is coupled to match the minimum resolution of the source when the source is acquired. When the source is released, the amplitude parameter resolution reverts to default values.

Frequency parameters: Multiplier (Numerator and Denominator), Reverse Sweep, Freq Offset. These controls give you added flexibility when using a stepped tracking source for stimulus/response measurements.

- Because with a stepped source, the source frequency does not need to track 1:1 with the instrument LO frequency, it is possible to measure scalar harmonic and subharmonic responses of devices. For example, the second harmonic response is measured by stepping the instrument and source so that the instrument is always at twice the source frequency
- In addition, the frequency offset capability allows the measurement of frequency conversion devices (like mixers)
- In tracking mode, the source frequency tracks the instrument frequency according to the source frequency equation:

  Source Frequency = (Analyzer Frequency *Multiplier Numerator / Multiplier Denominator) + Source Frequency Offset

NOTE

In the above equation, Analyzer Frequency is the frequency to which the instrument is set, which is the instrument's displayed frequency, offset by any Freq Offset set under the Frequency hardkey. Source Frequency Offset is the value set under Source, Frequency, Freq Offset.

For some Stimulus/Response measurements you may wish to bypass the Microwave Preselector. For information on bypassing the Microwave Preselector, see "Use of the YTF (Microwave or mm Preselector) with External Source Control" on page 298

Example calculations:

Source Frequency = (Analyzer Frequency * Multiplier Numerator / Multiplier Denominator) + Offset Frequency				
Analyzer Start Freq (Hz)	Analyzer Stop Freq (Hz)	Multiplier (Num/Den)	Offset Freq (Hz)	Source Freq (Hz)
1.0e6	2.0e6	1/1	0.0	1.0e6 – 2.0e6
2.0e6	4.0e6	1/1	100.0e6	102.0e6 – 104.0e6
2.0e6	4.0e6	-1/1	100.0e6	98.0e6 – 96.0e6
102.0e6	104.0e6	1/1	-100.0e6	2.0e6 – 4.0e6
98.0	96.0e6	-1/1	100.0e6	2.0e6 – 4.0e6
3.0e6	4.0e6	3/1	0.0	9.0e6 – 12.0e6
4.0e6	6.0e6	5/1	100.0e6	120.0e6 – 130.0e6
4.0e6	6.0e6	-5/1	100.0e6	80.0e6 – 70.0e6

Use of the YTF (Microwave or mm Preselector) with External Source Control

In most stimulus/response measurements that utilize External Source Control, the source exactly tracks the tuned analyzer frequency. Consequently, preselection is not needed, and you can achieve greatly superior amplitude accuracy and repeatability by bypassing the YTF (Preselector) using the Microwave Preselector Bypass control in the Amplitude, uW Path Control menu (note: this control is only available if option MPB is installed).

There are rare but important cases, however, where the source is tuned to a different frequency than the analyzer, using the Multiplier and Reverse controls in the Source, Frequency menu. For example, you might be tuning the source to ½ of the analyzer frequency when looking at second harmonic distortion in a DUT. In these cases, it would be commonplace for there to be an undesired signal at the analyzer input that is at an image frequency that you will want to reject with the YTF.

Understanding these cases is important for proper operation of the Microwave Preselector with External Source Control, so that you only bypass it when it will improve accuracy but not hinder the measurement.

Point Trigger

Shows point trigger type selected and navigates to the **Point Trigger** menu, which lists all instrument point trigger types.

The instrument and source point trigger synchronization can be achieved by using external trigger output and input lines.

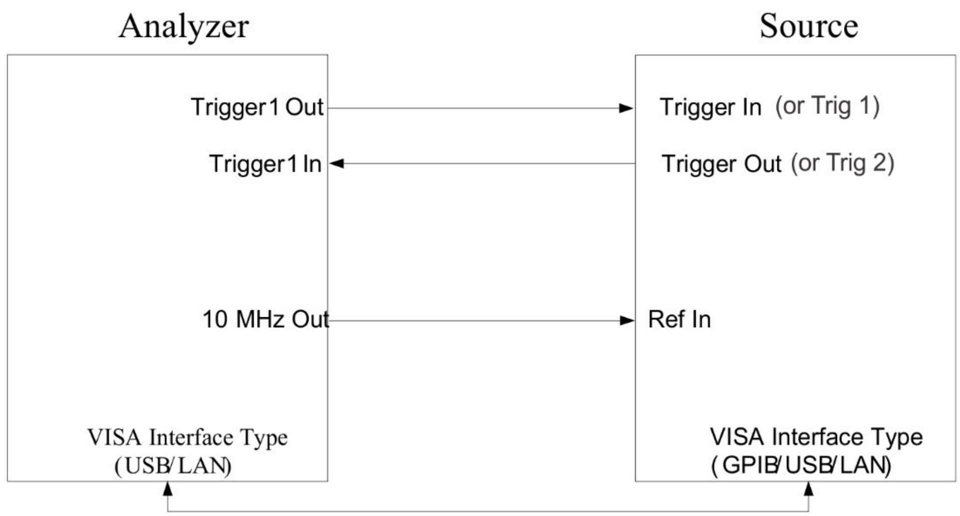
NOTE

For X-Series software versions earlier than A.10.01, hardware triggering was unavailable in stepped tracking at frequencies above 3.6 GHz, so above 3.6 GHz, software triggering was always used. This is no longer the case.

Remote Command	Not supported in RLC Mode
Dependencies	If an internal Tracking Generator is selected, then this menu is unavailable, Additionally, the External 1 and External 2 Trigger keys on the Spectrum Analyzer are released from any grayout that may have been forced on them by the external source Point Trigger selection In some models, there is no second External input. In these models, the External 2 selection does not appear
Couplings	The source control point trigger selection can select external trigger 1 or 2 in for synchronized point triggering. This can conflict with the selection under **Trigger**, if External 1 or 2 is selected. If there is a conflict when the selection is made under the Point Trigger menu, the Trigger selection under **Trigger** will be changed to Free Run
Preset	This is unaffected by **Mode Preset** but is set to `EXTernal1` on **Source Preset** or **Restore Input/Output Defaults**
State Saved	Part of the Input/Output system, which means it is Loaded and Saved with state

Tracking Setup Details

When an external source is operating in Tracking Mode, operation can be greatly enhanced by using hardware triggers. Below is a typical connection diagram showing a hardware handshake using Trigger 1 inputs and outputs on the instrument (trigger 2 in and out is also a valid connection).



Typical Analyzer-Source connection

Analyzer Trigger 1 Out: Triggers the external source to step to next point in the frequency step/list.

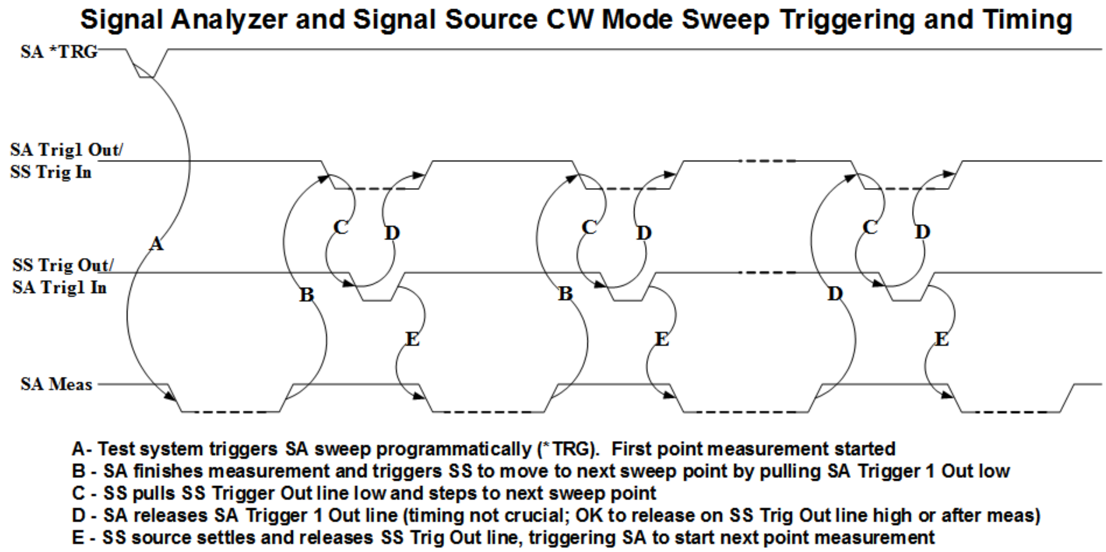
Analyzer Trigger 1 In: Triggers the analyzer to make a measurement on this point

Source Trigger In (or “Trig 1” at default setting for N5181B/82B,N5183B MXG or N5171B/72B, N5173B EXG):

Triggers the source to step to the next point.

Source Trigger Out (or “Trig 2” at default setting for N5181B/82B,N5183B MXG or N5171B/72B, N5173BEXG): Indicates that the source has settled.

IO interface Connection: instrument can connect to sources with its GPIB, USB or LAN interface.



Notes:

- Trigger sync connections are optional – synchronization can be done via remote commands if Bus Trigger is enabled in the Source Setup menu
- Connection from the SA external frequency reference output to the source frequency reference input (10 MHz Out to Ref In) is not required, but may improve the measurement accuracy

SW Trigger

Analyzer and source point trigger synchronization is setup using the SCPI commands. Source is stepped via SCPI commands. Analyzer waits for source to settle by polling source.

Ext Trigger 1

Analyzer and source point trigger synchronization is setup using the analyzer Trigger 1 Output and Trigger 1 Input. The Source is stepped via Trigger 1 Output. The Analyzer waits for source to settle via Trigger 1 Input.

With an acquired source, selecting this point trigger mode overrides existing external trigger 1 output level, slope, and delay, and external trigger 1 type and polarity.

External trigger 1 input level = 1.20 V

External trigger 1 input slope = Positive

External trigger 1 input delay = Off

External trigger 1 output type = Source Point Trigger

External trigger 1 output polarity = Positive

When this selection is made:

– The External 1 selection in the Trigger menu (under the Trigger hardkey) does not appear and, if External 1 was previously selected, it will be changed to Free Run

– Trig 1 Out selected under Output Config in the Input/Output menu will be changed to Source Point Trigger

If the user subsequently goes into the Trig 1 Out menu and selects a different Trigger Output, the Point Trigger will revert to SW Trigger.

Ext Trigger 2

Analyzer and source point trigger synchronization is setup using the analyzer Trigger 2 Output and Trigger 2 Input. The Source is stepped via Trigger 2 Output. The Analyzer waits for source to settle via Trigger 2 Input.

SCPI example: `:SOUR:TRIG:TYPE EXT2`

With an acquired source, selecting this point trigger mode overrides existing external trigger 2 output level, slope, and delay, and external trigger 2 type and polarity.

External trigger 2 input level = 1.20 V

External trigger 2 input slope = Positive

External trigger 2 input delay = Off

External trigger 2 output type = Source Point Trigger

External trigger 2 output polarity = Positive

When this selection is made:

– The External 2 selection in the Trigger menu (under the Trigger hardkey) does not appear and, if External 2 was previously selected, it will be changed to Free Run

– Trig 2 Out selected under Output Config in the Input/Output menu will be changed to Source Point Trigger

If the user subsequently goes into the Trig 2 Out menu and selects a different Trigger Output, the Point Trigger will revert to SW Trigger.

Power Sweep

Sets up a Power Sweep. Power Sweep is useful for measuring saturation behavior in a test device, such as a power amplifier.

The source will sweep the power between the start power defined by the Amplitude function and the stop power = start power + power sweep value:

Source (start) amplitude = Amplitude – Amplitude Offset

Source (stop) amplitude = Amplitude – Amplitude Offset + Power Sweep

In Stepped Tracking, such as is used with an external source or the CXA-m TG, the instrument controls the source with step sweep mode, which provides a linear progression from one selected frequency, amplitude, or both, to another, pausing at linearly spaced points (steps) along the sweep. The instrument continues to sweep the specified frequency range when power sweep is on, although generally Power Sweep is performed in Zero Span.

With CXA options T03, T06 , the hardware is capable of continuous power sweeps. This makes it possible to use the swept sweep time rules and should be employed for faster sweeps. Care should be taken to limit the sweep time you use as there are no sweep time couplings to Power Sweep settings. The recommended minimum sweep time depends on the RBW and power-sweep range. Start by computing (1.28/RBW)*(abs(startPower – stopPower)/(5 dB)). The recommended minimum sweep time is the larger of this value and 50 ms.

Some external Sources have mechanical attenuators, which are not used in Power Sweep in order to save wear on the attenuators. To allow an acceptable range of Power Sweep without changing the mechanical attenuation, the Sources are put in a mode that allows the Source to handle a wide amplitude range without switching the attenuators. When the Power Sweep settings put the Source in an amplitude range that requires the mechanical attenuators, the instrument displays a condition warning message:

Settings Alert; Src pwr ramp>ALC range

Remote Command	Not supported in RLC Mode
Dependencies	If the requested setting of Power Sweep causes the calculated external source start or stop Amplitude to exceed the external source capability, a warning status message is generated, "Data out of Range; clipped to source max/min". The Show Source Capabilities and Settings menu can then be examined to check the source capabilities This parameter test and clip is also performed at source acquisition See also "CXA-m TG Uncalibrated Amplitude Range" on page 292
Preset	This is unaffected by Mode Preset but is set to `OFF` on Source Preset or Restore Input/Output Defaults
State Saved	Part of the Input/Output system, which means it is Loaded and Saved with state
Min	-500 dB
Max	+500 dB

Amptd Offset

Offsets the displayed power of the source in the Amplitude parameter. Using the amplitude offset allows you to take into account any system losses or gains (for example, due to cable loss), thereby displaying the actual power delivered to the device under test.

See the equations under Source, Amplitude, Power Sweep.

Remote Command	Not supported in RLC Mode
Dependencies	If the requested setting of **Amptd Offset** causes the calculated external source start or stop Amplitude

	to exceed the external source capability, a warning status message is generated, "Data out of Range; clipped to source max/min". The Show Source Capabilities and Settings menu can then be examined to check the source capabilities This parameter test and clip is also performed at source acquisition
Preset	This is unaffected by Mode Preset but is set to 0.00 dBm on a Source Preset or Restore Input/Output Defaults
State Saved	Part of the Input/Output system, which means it is Loaded and Saved with state
Min	-1000 dB
Max	+1000 dB

Amptd Step

Sets the step size associated with **Source Amplitude**. When auto-coupled, the step size is the current Scale/Div setting under **Amplitude** (note that this is true even if the instrument is currently in Linear amplitude scale).

Once a step size has been selected and the Source Amplitude function is active, the step keys change the Source Amplitude by the step-size value.

You may change the step size manually by pressing **Amptd Step** and entering a value. The function (and the step size) will return to Auto when a Mode Preset or Auto Couple is performed.

Remote Command	Not supported in RLC Mode
Couplings	In Auto, coupled to the size of one logarithmic vertical graticule division
Preset	Auto ON
State Saved	Part of the Input/Output system, which means it is Loaded and Saved with state In Input/Output state
Min	0.1 dB
Max	20 dB

Multiplier Numerator

This parameter offsets the source frequency from the instrument frequency. The source frequency tracks the SA frequency according to the source frequency equation shown at the bottom of the Source Setup Table.

Remote Command	Not supported in RLC Mode
Dependencies	If the currently selected source does not support this capability (for example, an internal Tracking Generator which must track the LO), this control is forced to its Preset value and grayed-out
Preset	This is unaffected by Mode Preset but is set to 1 on Source Preset or Restore Input/Output Defaults
State Saved	Part of the Input/Output system, which means it is Loaded and Saved with state

Min	1
Max	1000

Multiplier Denominator

This parameter offsets the source frequency from the instrument frequency. The source frequency tracks the SA frequency according to the source frequency equation shown at the bottom of the Source Setup Table.

Remote Command	Not supported in RLC Mode
Dependencies	If the currently selected source does not support this capability (for example, an internal Tracking Generator which must track the LO), this control is forced to its Preset value and grayed-out
Preset	This is unaffected by Mode Preset but is set to 1 on Source Preset or Restore Input/Output Defaults
State Saved	Part of the Input/Output system, which means it is Loaded and Saved with state
Min	1
Max	1000

Source Sweep Reverse

Allows you to reverse the source sweep direction

Normally, the source will sweep from a lower frequency to a higher frequency. However, there are test scenarios in which the source sweep needs to be “reversed”. In this case, it sweeps from a higher frequency to a lower frequency. For example, when the DUT is a frequency converter and a measurement of the Lower Side Band characteristics is desired, a reverse sweep is employed. Reverse sweeps are supported for such scenarios, but two cautions are in order:

1. Reverse Sweep only reverses the direction of the source’s sweep, not the instrument’s sweep. Unless you are actually using a device like a frequency converter and looking at the lower sideband, thus effectively reversing the direction of the source’s sweep, the source will be sweeping in the opposite direction from the instrument, and it will not be possible track the desired device output frequency

2. If you are using a frequency converter, care must be taken in setting up all of the sweep parameters, including instrument start/stop frequency and source multiplier, to make sure that the instrument’s sweep tracks the output of the converter device

Remote Command	Not supported in RLC Mode
Notes	You must be in Spectrum Analyzer mode to use this command
Dependencies	If the currently selected source does not support this capability (for example, an internal Tracking Generator which must track the LO), this control is forced to its Preset value and grayed-out
Preset	This is unaffected by Mode Preset but is set to `OFF` on Source Preset or Restore Input/Output Defaults

State Saved	Part of the Input/Output system, which means it is Loaded and Saved with state
Range	ON|OFF

Freq Offset

This parameter offsets the source frequency from the instrument frequency. The source frequency tracks the SA frequency according to the equations at the bottom of the Source Setup Table.

Remote Command	Not supported in RLC Mode
Dependencies	If the currently selected source does not support this capability (for example, an internal Tracking Generator which must track the LO), this control is forced to its Preset value and grayed-out
Preset	This is unaffected by Mode Preset but is set to OFF on Source Preset or Restore Input/Output Defaults
State Saved	Part of the Input/Output system, which means it is loaded and saved with state
Min	-500 GHz
Max	500 GHz

4.9.8.5 Select Source

Allows you to maintain a list of available external and internal Sources, and choose the Source that you want to use from the list. The controls for adding sources to the list are shown at the top of the screen, the list of available sources in the middle of the screen, and the currently selected source at the bottom of the screen.

The sources in the Available Source List are as follows:

– Any internal sources that are installed and licensed

NOTE Only one internal source can be installed, displayed at address "INTERNAL"

– Any external sources that you have previously configured, whether or not they are currently connected, displayed with their VISA address

The list of available sources includes any sources that you have previously used (unless you have deleted them) and any found using the "Add Source to List" controls.

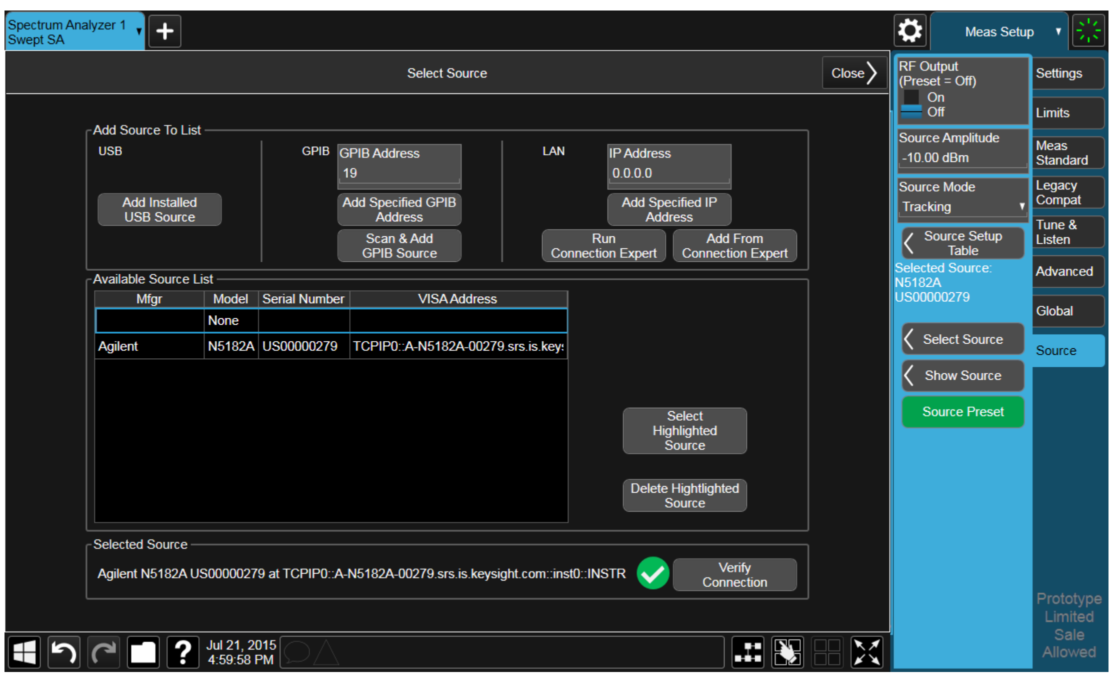
Double-tap the source you want to use, or use the up and down arrows to move to the source that you want and press Select Highlighted Source" or "Enter". The source you have selected shows up at the bottom of the screen as the "Selected Source". Press "Verify Connection" to make sure that the interface connection to the Source is functional.

At any time you may use the "Add Source to List" controls to find new sources or "Delete Highlighted Source" to remove a source from the list of available sources.

Note that only external sources that are supported by the Tracking Source Mode are displayed in the Available Source List. Here are the Keysight/Agilent sources currently supported:

Source	UXA	PXA	MXA	EXA	CXA	MXE (Presel off)
MXG N5161A	X	X	X	X	X	X
MXG N5162A	X	X	X	X	X	X
EXG N5171B	X	X	X	X	X	X
EXG N5172B	X	X	X	X	X	X
EXG N5173B	X	X	X	X	X	X
MXG N5181A	X	X	X	X	X	X
MXG N5182A	X	X	X	X	X	X
MXG N5183A	X	X	X	X		X
MXG N5181B	X	X	X	X	X	X
MXG N5182B	X	X	X	X	X	X
MXG N5183B	X	X	X	X	X	X
PSG E8257C	X	X	X	X		
PSG E8257D	X	X	X	X		
PSG E8257N	X	X	X	X		
PSG E8267C	X	X	X	X		
PSG E8267D	X	X	X	X		

The display while in the Select Source menu is as follows:



Note that in this example, the source that is highlighted in the table is *not* the currently selected source. The user has previously selected the 5182A source but has navigated the highlight to "None". If the user were to now press "Select Highlighted Source" then the Current Source shown at the bottom of the screen would change to "None"

Add Installed USB Source

Sources on USB (once installed) can be added to the list by pressing **Add Installed USB Sources**. Any supported source found will be added to the list.

Press this control to add USB sources to the Available Source List. Note that this function will *only* find sources that have previously been installed onto the USB. For information on how to install a USB source, see "Installing a USB source" on page 307

Notes	If no installed USB device is found which is a supported source, an error message is generated

Installing a USB source

USB is the only interface that requires no runtime action by the user in the Select Source menu, but does require "installation" when a source is plugged in.

You start by connecting the USB source to the instrument. You will see a series of messages indicating that the instrument is installing required device software.

When the installation is complete, you will see a message to that effect. You can then use **Add Installed USB Sources** (above) to add the source to the list of sources in the Available Source List.

GPIB Address

Lets you enter the GPIB address of a GPIB source. After you enter the address press **Add Specified GPIB Address** to add the source at that address to the Available Source List.

NOTE **For the GPIB interface to work properly when controlling a Source, it must be configured as a Controller. You can find this setting in the System menu under System, I/O Config, GPIB. Set the GPIB Controller function to Enabled.**

Preset	Unaffected by Mode Preset but set to 19 by "Restore Input/Output defaults"
State Saved	No
Min	0
Max	30

Add Specified GPIB Address

Add the source at the entered GPIB address to the Available Source List. If a supported source is found at that address it will be added to the list.

Notes	If GPIB controller mode is not enabled, an error message is generated If no supported source is found at the specified address, an error message is generated

Scan & Add GPIB Source

Sources on GPIB can be added by pressing **Scan & Add GPIB Source**. Any supported source found will be added to the Available Source List.

NOTE **This will cause any older, non-SCPI compatible devices on your GPIB to generate error messages.**

Notes	If the GPIB controller mode is not enabled, an error message is generated If no GPIB device is found which is a supported source, an error message is generated

IP Address

Lets you enter the IP address of a source om the LAN. After you enter the address, press **Add** to add the source at that address to the Available Source List.

Preset	Unaffected by Mode Preset but set to 0.0.0.0 by Restore Input/Output defaults
State Saved	No

Add Specified IP Address

Adds the source at the entered IP address to the Available Source List. If a supported source is found at that address it will be added to the list.

Notes	If no supported source is found at the specified address, an error message is generated

Run Connection Expert...

The LAN cannot be scanned directly from the instrument software, but if you want to discover sources on the LAN, you can open Keysight Connection Expert by pressing **Run Connection Expert...**. You can import the list of currently configured devices from Keysight Connection Expert by pressing **Add From Connection Expert**.

The Connection Expert list depends on which instruments have been discovered by the Keysight Connection Expert application. Any connected, supported sources in that list will be added.

Add From Connection Expert

You can import the list of currently configured devices from Keysight Connection Expert by pressing **Add From Connection Expert**. The Connection Expert list depends on which instruments have already been discovered by the Keysight Connection Expert application. Any connected, supported sources in that list will be added.

Notes	If no supported source is found in the Connection Expert list, an error message is generated

Select Highlighted Source

You can navigate up and down in the list with the up and down arrow keys, and select any entry by pressing **Select Highlighted Source** (or by double-tapping on the entry in the table). The highlighted source becomes the Current Source and is prominently displayed at the bottom of the screen.

At any given time there is only one selected Source for the entire system; once a Source is selected, it becomes the Current Source and will be used by all applications that support Source Control.

For example, if no Source has yet been selected, the statement at the bottom of the screen would say

Selected Source

None

If an N5182A connected via USB were the Current Source, the statement at the bottom of the screen might say:

Selected Source

Keysight N5182A US00000258 at USB0::2931::7937::US00000258::0::INSTR

The command defined below allows the programmatic user to directly define the VISA address via a string parameter. The parameter is checked for proper syntax, the connection to the instrument is verified, and the source is added to the Available Source List if it verifies. If it does not verify or no source is found at that address, an error message is generated.

Normally the source selection activities should be performed only when the user changes the hardware connection configuration or activates/deactivates a source option license; shutdown and startup of the application will not cause source re-selection.

The Keysight IO Libraries Suite includes a “Keysight VISA Help” document, which specifies the syntax for valid VISA address strings in the `ViOpen` function definition.

Remote Command	Not supported in RLC Mode
Dependencies	Operation with a source requires a license. If the proper license is not installed, the command generates an error message, “Settings conflict; option not installed”
Preset	The current source selection is unaffected by Mode Preset and Source Preset but reverts to [None] on Restore Input/Output Defaults If an internal Tracking Generator is installed, then instead of None, the default selection will be `INTERNAL`
State Saved	Selected Source is saved Power On Persistent (survives power cycle) Part of the Input/Output system, which means it is Loaded and Saved with state

Delete Highlighted Source

Deletes the highlighted source from the list of available sources. You will be prompted with a dialog box to make sure you *really* want to do this. The prompt says:

“The highlighted source will be permanently deleted from the list. Are you sure you want to do this? Press Enter to proceed, or Cancel (ESC) to cancel”

Verify Connection

This control verifies the interface connection to the Current Source (it does *not* verify any signal connections!)

Until the selected source is verified, a statement appears at the bottom of the screen which says (in red):

This Source has not been verified. Press “Verify Source” to check the interface connection.

When you press this key, the connection is checked to the selected source. If all is well, the statement is changed to (in green):

This connection to this source has been verified.

If the verification fails, the statement at the bottom will change to (in red):

Verification of this source failed. Check the interface connection

The selected source is also verified whenever it is acquired. If a Source’s connection has been verified by any means, then that Source is considered to have been verified until either the instrument software is shut down or if, in attempting to use the Source, communication with it fails.

4.9.8.6 Show Source

Shows the capabilities of the currently selected Source. The menu is useful for displaying source capabilities such as frequency and amplitude ranges.

Dependencies	If no source is selected this control is grayed out

4.9.8.7 Source Preset

Forces all the settings in the instrument's Source State to their preset condition.

The Source State is the set of Source settings that is maintained and remembered by the instrument for use in the Tracking Source Mode. The Source State variables are controlled and set in the menus under the Source front panel key. These settings include:

- RF Output Off
- Amplitude = - 10 dBm
- Amplitude Step = Auto
- Power Sweep = 0 dB
- Amplitude Offset = 0 dB
- Source Sweep Reverse = Off
- Multiplier Numerator = 1
- Multiplier Denominator = 1
- Freq Offset = 0 Hz
- Point trigger is set to "Ext1"

The Source State is saved along with the state of the current Mode when you save a State, and is recalled when that Mode State is recalled.

When the instrument first starts up, a Source Preset is performed. In the Input/Output menu, Restore Input/Output Defaults also performs a Source Preset.

A Mode Preset, from modes that support the External Source, turns the RF Off but does *not* perform a Source Preset. By the same token, Source Preset does *not* perform a Mode Preset.

Source Preset does *not* change the Source Mode nor the selection of which physical source is being used, nor does it release the current source (the source remains under the control of the instrument) nor exit the Source menu.

Remote Command	Not supported in RLC Mode
Preset	Initiates a Source Preset
State Saved	No

4.10 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.

4.10.1 Sweep/Control

Contains controls for the Sweep and Control functions of the instrument, such as Sweep Time and Continuous/Single.

4.10.1.1 Sweep Time

Controls the time the instrument takes to sweep the current frequency span when the Sweep Type is Swept, displays the sweep time in swept measurements, and displays the equivalent Sweep Time when the Sweep Type is FFT.

NOTE **In instruments without sweeping hardware, such as some modular instruments, 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 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. The number of measurement points can also be reduced to speed the measurement (at the expense of frequency resolution).

You might need to specify a specific sweep speed to accommodate a specific condition in your transmitter. For example, you may have a burst signal and need to measure an exact portion of the burst.

Because there is no "Auto Sweep Time" when in zero span, the Auto/Man toggle on this control disappears when in Zero Span.

When Sweep Type is FFT, you cannot control the sweep time, it is simply reported by the instrument to give you an idea of how long the measurement is taking. The Auto/Man toggle therefore disappears when in an FFT sweep. In this case the sweep time function is grayed out.

NOTE

In VXT Models M9410A/11A/15A, the Sweep Type is *always* set to FFT, as these models do not have sweeping hardware. Therefore, in VXT Models M9410A/11A/15A, the Sweep Time control is *always* grayed out unless you are in Zero Span. The value reported on the control is the approximate time that will be taken to acquire the trace data for one measurement cycle. This is basically the acquisition time for each frequency segment ("chunk") multiplied by the number of segments. The "chunk" time is determined by other parameters, such as RBW and VBW. The value displayed represents, as close as can be estimated, the time to "take one sweep".

When the control is grayed-out, sending the Sweep Time SCPI command generates an error.

Note that although some overhead time is required by the instrument to complete a sweep cycle, the sweep time reported when Sweep Type is Swept does not include the overhead time, just the time to sweep the LO over the current Span. When Sweep Type is FFT, however, the reported Sweep Time takes into account both the data acquisition time and the processing time, in order to report an equivalent Sweep Time for a meaningful comparison to the Swept case.

NOTE

Significantly faster sweep times are available for the Swept SA measurement with Option FS1.

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.

On occasion other factors such as the Tracking Generator's maximum sweep rate, the YTF sweep rate (in high band) or the LO's capability (in low band) can cause a Meas Uncal condition. The most reliable way to correct it is to return the Sweep Time to Auto.

If the instrument calculates that the Auto Sweep Time would be greater than 4000s (which is beyond its range), the warning message "Settings Alert; Sweep Rate Unavailable" is displayed. In this case increase the RBW or reduce the span.

If the instrument's estimated sweep time in an FFT sweep is greater than 4000s, the warning message "Settings Alert; Span:RBW Ratio too big" is displayed. In this case reduce the span or increase the RBW and/or FFT Width.

NOTE

When using a Tracking Source (**Source**, **Source Mode** set to "**Tracking**"), the sweep time shown includes an estimate of the source's settling time. This estimate may contain inaccuracies, particularly when software triggering is used for the source. This can result in the reported sweep time being shorter than the actual sweep time.

Remote Command	`[:SENSe]:SWEep:TIME <time>`
	`[:SENSe]:SWEep:TIME?`
	`[:SENSe]:SWEep:TIME:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:SWEep:TIME:AUTO?`

Example	`:SWE:TIME 500 ms`
	`:SWE:TIME?`
	`:SWE:TIME:AUTO OFF`
	`:SWE:TIME:AUTO?`

Notes	The values shown in this table reflect the “swept spans” conditions, which are the default settings after a preset. See “Couplings” for values in the zero span domain
Dependencies	The Auto/Man toggle disappears in Zero Span. Sending `:SWEep:TIME:AUTO ON` in Zero Span generates an error message In FFT sweeps, the Sweep Time control is grayed out. Pressing the control or sending the SCPI for sweep time while the instrument is in FFT sweep generates a -221, “Settings Conflict;” error In certain instruments without sweeping hardware, such as VXT and UXM, the Auto/Man toggle disappears and the Sweep Time control is grayed out Sending `:SWEep:TIME:AUTO ON` in FFT sweeps generates an error Grayed-out while in Gate View, to avoid confusion with GATE VIEW Sweep Time Grayed-out in Measurements that do not support swept mode Not displayed in Modes that do not support swept mode Set to Auto when "Auto Couple" on page 251 is pressed or sent remotely
Couplings	Sweep time is coupled to RBW when in a non-zero span. If **Sweep Time** is set to Auto, then 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 Although the VBW filter is not “in-circuit” when using the average detector and the EMI detectors, the Video BW control can have an effect on (Auto) sweep time in these cases, and is not disabled. Because the purpose of the average detector and the VBW filter are the same, either can be used to reduce the variance of the result. In this case, reducing the VBW setting increases the sweep time, which increases the averaging time, producing a lower-variance trace Span, Center Frequency, and the number of sweep points also can have an effect. So changing these parameters may change the Sweep Time The Sweep Time used upon entry to Zero Span is the same as the Sweep Time that was in effect before entering Zero Span. The Sweep Time can be changed while in Zero Span. Upon leaving Zero Span, the Auto/Man state of Sweep Time that existed before entering Zero Span is restored If Sweep Time was in Auto before entering Zero Span, or if it is set to Auto while in zero span (which can happen via remote command or if "Auto Couple" on page 251 is pressed) it returns to Auto and recouples when returning to non-zero spans

	If Sweep Time was in Man before entering Zero Span, it returns to Man when returning to non-zero spans, and any changes to Sweep Time that were made while in Zero Span are retained in the non-zero span (except where constrained by minimum limits, which are different in and out of zero span)
Preset	Auto ON
State Saved	Saved in instrument state
Min	In zero span: 1 ms In swept spans: 1 ms In Stepped Tracking (as with option ESC): same as auto sweep time In Swept Tracking, with Tracking Generator option T03 or T06, the minimum sweep time is 1 ms, but the Meas Uncal indicator is turned on for sweep times faster than 50 ms
Max	In zero span: 6000 s In swept spans: 4000 s In VXT: depends on current settings in Swept spans
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) If in an FFT sweep, the word (FFT) is added in parentheses and a ~ is used to indicate “approximate”, as Sweep (FFT) ~13 ms (1001 points) A “#” mark appears before “Sweep” in the annotation when it is switched from Auto to Manual coupling. Note that this # does NOT appear when in zero span, as there is neither an autocoupled nor a manual state in zero span; there is no coupling at all
Status Bits/OPC dependencies	Meas Uncal is Bit 0 in the STATus:QUEStionable:INTegrity:UNCalibrated register

4.10.1.2 Sweep Time Annotation

Lets you specify whether you want to see, for Sweep Time, an estimate of the total time the instrument is taking to make a sweep, or 1/(Sweep Rate) as has traditionally been the case.

In previous instruments, Sweep Time has always been displayed, when taking a sweep by the swept method (as opposed to the FFT method), as 1/(Sweep Rate), even though that may be shorter than the time it actually takes to perform a sweep. This value of 1/(Sweep Rate) is an excellent indication of how fast the local oscillator is moving, and the experienced user can infer much from this quantity about the optimal value of other settings, like Res BW.

However, 1/(Sweep Rate) can be much less than the total time it takes the instrument to do a multi-band sweep over a wide frequency range, due to band switching and settling times that may add to the total sweep time.

Because of this, you are now given the option of which value the instrument will display. The Sweep Time Annotation gives you two choice, Normal and Estimated. If you prefer the traditional method (that is, always display 1(sweep rate)), choose Normal (1/Sweep Rate). If instead you choose “Estimated”, the estimated actual sweep time is displayed, which is the time from start to finish of a sweep, as well as it can be estimated. This is displayed in the Sweep Time annotation area and is still called “Sweep Time”, as always. To show you that this is the estimated actual sweep time instead of 1/(Sweep Rate), it is preceded by a tilde (~), so it will look like this (for example):

Sweep ~5.3 s (1001 pts)

instead of

Sweep 440 ms (1001 pts)

Note that this value does *not* include the time *between* sweeps, so it not a measure of “cycle time”.

Note also that Estimated Sweep Time only applies when Sweep Type=Swept; when Sweep Type=FFT, the behavior remains as it always has for FFT sweeps, the display is (for example):

Sweep (FFT) ~1.2 s (1001 pts)

Sweep Time Annotation is an Auto/Man control. In Auto (the default state), Normal is chosen unless when unless there is a band crossing or software preselection is being performed, in which case Estimated is chosen.

The Sweep Time control and Sweep Time query set and return the traditional values; but if you want to query the estimated sweep time via SCPI, there is a new query:

`[:SENSe]:SWEep:ETIMe?`

which returns the estimated sweep time.

Remote Command	`[:SENSe]:SWEep:TIME:ANNotation NORMal:ESTimated`
	`[:SENSe]:SWEep:TIME:ANNotation?`
	`[:SENSe]:SWEep:TIME:ANNotation:AUTO ON | OFF | 1 | 0`
	`[:SENSe]:SWEep:TIME:ANNotation:AUTO?`

Example	`:SWE:TIME:ANN NORM`
	`:SWE:TIME:ANN?`
	`:SWE:TIME:AUTO:ANN OFF`

Couplings	If you manually choose a value, the Auto/Man selection will change to Manual. You can set it back to auto by tapping the Auto/Man switch
Preset	Auto ON
State Saved	Saved in instrument state
Annotation	If Estimated, Sweep Time displays as: Sweep ~5.3 s (1001 pts)

4.10.1.3 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

See "More Information" on page 317

Remote Command	Not available in RLC Mode
Preset	ON
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 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).

4.10.1.4 Restart

The **Restart** function restarts the current sweep, or measurement, or set of averaged/held sweeps or measurements.

See "More Information" on page 318

Remote Command	Not supported in RLC Mode
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

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.

4.10.2 Sweep Config

Accesses controls that enable you to configure the Sweep and Control functions of the instrument, such as Sweep Rules.

4.10.2.1 Sweep Type

Chooses between the FFT and Sweep types of sweep.

Sweep Type refers to whether or not the instrument is in Swept or FFT analysis. When in Auto, the selection of sweep type is governed by two different sets of rules, depending on whether you want to optimize for dynamic range or for speed.

FFT “sweeps” should not be used when making EMI measurements; therefore, when a CISPR detector (Quasi Peak, EMI Average, RMS Average) is selected for any active trace (one for which Update is on), the FFT control in the Sweep Type menu is grayed out, and the Auto Rules only choose Swept. If Sweep Type is manually selected to be FFT, the CISPR detectors are all grayed out.

FFT sweeps will never be auto-selected when Screen Video, Log Video or Linear Video are the selected Analog Output.

Value	Example	Notes
Auto	`:SWE:TYPE:AUTO ON`	When in Auto, the selection of sweep type is governed by two different sets of rules, depending on whether you want to optimize for dynamic range or for speed. These rules are chosen under the **Sweep Type Rules** control
FFT	`:SWE:TYPE FFT`	Manually selects FFT analysis, so it cannot change automatically to Swept
Swept	`:SWE:TYPE SWE`	Manually selects swept analysis, so it cannot change automatically to FFT This selection is chosen automatically if any of the CISPR detectors is chosen for any active trace, in which case the FFT Sweep Type selection is also grayed out

Remote Command	`[:SENSe]:SWEep:TYPE FFT | SWEep`
	`[:SENSe]:SWEep:TYPE?`
	`[:SENSe]:SWEep:TYPE:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:SWEep:TYPE:AUTO?`

Example	`:SWE:TYPE FFT`
	`:SWE:TYPE?`
	`:SWE:TYPE:AUTO ON`
	`:SWE:TYPE:AUTO?`

Dependencies	Grayed-out in Zero Span, but the setting can be changed remotely with no error indication Does not appear in certain instruments without sweeping hardware, such as VXT

	Grayed-out or not displayed in measurements that do not support swept mode When Gate is ON, Gate Method selection affects Sweep Type availability: – When Gate Method is FFT, **Swept** grayed-out and rules choose FFT – When Gate Method is Video or LO, **FFT** grayed-out and rules choose Swept Swept is grayed-out while in Gated FFT (meaning Gate is ON and Gate Method is FFT) When a CISPR detector (Quasi Peak, EMI Average, RMS Average) is selected for any active trace, the FFT selection is grayed-out When the RF Preselector is on, the FFT selection is grayed-out When Source Mode is set to Tracking, the FFT selection is grayed-out When Signal ID is on, Manual FFT is grayed-out While in Gated LO (meaning Gate is ON and Gate Method is LO), the FFT selection is grayed-out While in Gated Video (meaning Gate is ON and Gate Method is Video), the FFT selection is grayed-out The ratio of span to RBW must be checked by the dependencies manager and subjected to a limit such that (FFT Width)/RBW < 105000 . Higher ratios than this limit result in excessive length FFTs that are inefficiently slow, use excessive memory, and have not been checked for functionality
Couplings	Pressing "Auto Couple" on page 251 always sets Sweep Type to Auto Swept is always selected whenever any form of Signal ID is on, or the Source Mode is set to Tracking, or any EMI detector is selected, or the RF Preselector is ON
Preset	AUTO ON
Annotation	The indication of sweep time includes a #Swp to indicate manual selection, as: Sweep (#Swp) 13.33 ms (1001 points) The indication of sweep time includes parenthetical notes to indicate sweep type unless in Auto, Swept, as: Auto, Swept: Sweep 13.33 ms (1001 points) Manual, Swept: Sweep (#Swp) 13.33 ms (1001 points) Auto, FFT: Sweep (FFT) ~13 ms (1001 points) Manual, FFT: Sweep (#FFT) ~13 ms (1001 points) The indication of (FFT) includes a # to indicate manual selection, as: Sweep (#FFT) ~13 ms (1001 points)

Backwards Compatibility Notes	Two additional parameters, `AUTO` and `SWP`, are supported for backwards compatibility only and should not be used for new designs
	`[:SENSe]:SWEep:TYPE AUTO`
	sets sweep type Auto to ON but the query returns either `FFT` or `SWE` depending on the auto setting.
	`[:SENSe]:SWEep:TYPE SWP`
	selects sweep type Swept but returns `SWE` to a query

4.10.2.2 Sweep Type Rules

Selects which set of rules will be used for automatically choosing the Sweep Type when Sweep Type is in Auto.

Value	Example	Notes
Auto	`:SWE:TYPE:AUTO:RUL:AUTO ON`	When in Auto, the Sweep Type Rules are set to Best Dynamic Range. It seems like a very simple Auto function but the use of this construct allows a consistent statement about what the Auto Couple control does
Best Dynamic Range	`:SWE:TYPE:AUTO:RUL DRAN`	This selection tells the instrument to choose between swept and FFT analysis with the primary goal of optimizing dynamic range. If the dynamic range is very close between swept and FFT, then it chooses the faster one. This auto selection also depends on RBW Type
Best Speed	`:SWE:TYPE:AUTO:RUL SPE`	This selection tells the instrument to choose between FFT or swept analysis based on the fastest instrument speed

Remote Command	`[:SENSe]:SWEep:TYPE:AUTO:RULes SPEed | DRANge`
	`[:SENSe]:SWEep:TYPE:AUTO:RULes?`
	`[:SENSe]:SWEep:TYPE:AUTO:RULes:AUTO[:STATe] OFF | ON | 0 | 1`
	`[:SENSe]:SWEep:TYPE:AUTO:RULes:AUTO[:STATe]?`

Example	`:SWE:TYPE:AUTO:RUL SPE`
	`:SWE:TYPE:AUTO:RUL?`
	`:SWE:TYPE:AUTO:RUL:AUTO ON`
	`:SWE:TYPE:AUTO:RUL:AUTO?`

Dependencies	Grayed-out in Zero Span, however, the setting can be changed remotely with no error indication Does not appear in certain instruments without sweeping hardware, such as VXT
Couplings	Pressing "Auto Couple" on page 251 always sets Sweep Type Rules to Auto
Preset	DRANge ON
State Saved	Saved in instrument state

In determining the Swept or FFT setting, the auto rules use the following approach:

- If the RBW Filter Type is Gaussian, use the RBW for the Normal Filter BW and if that RBW > 210 Hz, use swept; for RBW <= 210 Hz, use FFT
- If the RBW Filter Type is Flat Top, use the same algorithm but use 420 Hz instead of 210 Hz for the transition point between Swept and FFT

If any of the CISPR detectors is chosen for any active trace, always use Swept.

4.10.2.3 Sweep Time Rules

Allows the choice of AUTO, or one of three distinct sets of sweep time rules. Note that these rules only apply when in the Swept Sweep Type (either manually or automatically chosen) and not when in FFT sweeps.

See "More Information" on page 322.

Remote Command	[:SENSe]:RLC:SWEep:TIME:AUTO:RULes AUTO | NORMal | ACCuracy | SRESponse
Example	:RLC:SWE:TIME:AUTO:RUL NORMal
Dependencies	NORMal and ACCuracy are not available (grayed-out) when Source Mode=Tracking Grayed-out in Zero Span Grayed-out in FFT sweeps. Pressing this selection while the instrument is in FFT sweep generates an advisory message Does not appear in certain instruments without sweeping hardware, such as VXT
Couplings	Set to Auto on Auto Couple NORMal is automatically selected unless Source is on Stimulus/Response is automatically selected when the Source is on (Source Mode not OFF) Set on Preset or Auto Couple
Preset	AUTO
Range	AUTO|NORMal|ACCuracy|SRESponse
State Saved	Saved in instrument state

More Information

Value	Option	Notes
Auto	AUTO	When in Auto, the Sweep Type Rules are set to Best Dynamic Range
SA - Normal	NORMal	Selects auto rules for optimal speed and generally sufficient accuracy
SA - Accuracy	ACCuracy	Selects auto rules for specified absolute amplitude accuracy
Stimulus/Response	SRESponse	Selects auto rules for the case where the instrument is sweeping in concert with a source Automatically selected when the Source is on (Source Mode not OFF)

The first set of rules is called **Normal**. **Sweep Time Rules** is set to **Normal** on a **Preset** or **Auto Couple**. These rules give optimal sweep times at a loss of accuracy. Note that this means that in the Preset or Auto Coupled state, instrument amplitude accuracy specifications do not apply.

Setting **Sweep Time Rules** to **Accuracy** will result in slower sweep times than **Normal**, usually about three times as long, but with better amplitude accuracy for CW signals. The instrument absolute amplitude accuracy specifications only apply when **Sweep Time** is set to **Auto**, and **Sweep Time Rules** are set to **Accuracy**. Additional amplitude errors, which occur when **Sweep Time Rules** are set to **Normal**, are usually well under 0.1 dB with non-EMI detectors (though this is not guaranteed). With EMI detectors (Quasi Peak, EMI Average and RMS Average), the errors are usually well under 0.5 dB. For best accuracy when using EMI detectors, zero span is the preferred measurement technique; for the EMI detectors, zero span measurements will not fully agree with swept measurements except at extremely slow sweep rates.

Because of the faster sweep times and still low errors, **Normal** is the preferred setting of **Sweep Time Rules**.

The third set of sweep time rules is called **Stimulus/Response** and is automatically selected when an integrated source is turned on, such as a Tracking Generator or a synchronized external source.

Note that there are two types of source-synchronized sweeping, one where the source sweeps (as with a built in tracking generator) and one where the source steps. The former is usually much faster than even general purpose sweeps because when sweeping along with a swept source the RBW and VBW filters do not directly interact with the Span. However, sweeping in concert with a stepped source usually slows the sweep down because it is necessary to wait for the stepped source and the instrument to settle at each point. The instrument chooses one of these methods based on what kind of a source is connected or installed; it picks the former if there is no source in use, which means that by selecting Stimulus/Response rules manually when there is no source in use, you can achieve faster sweep times than SA – Normal.

Stimulus-response auto-coupled sweep times are typically valid in stimulus-response measurements when the system’s frequency span is less than 20 times the bandwidth of the device under test. As noted above you can select these rules manually (even if not making Stimulus-Response measurements) which will allow you to sweep faster before the “Meas Uncal” warning comes on, but you are then not protected from the over-sweep condition and may end up with uncalibrated results. However, it is commonplace in measuring non-CW signals such as noise to be able to get excellent measurement accuracy at sweep rates higher than those required for CW signal accuracy, so this is a valid measurement technique.

As always, when the X-series instrument is in Auto Sweep Time, the sweep time is estimated and displayed in the Sweep/Control menu as well as in the annotation at the bottom of the displayed measurement. Since this can be dependent on variables outside the instrument’s control, the actual sweep time may vary slightly from this estimate.

4.10.2.4 FFT Width

Displays and controls the width of the FFTs performed while in FFT mode. The “FFT width” is the range of frequencies being looked at by the FFT, sometimes referred to as the “chunk width” -- it is not the resolution bandwidth used when performing the FFT.

It is important to understand that this function does not directly set the FFT width, it sets the limit on the FFT Width. The actual FFT width used is determined by several other factors including the Span you have set. Usually the instrument picks the optimal FFT Width based on the current setup; but on occasion you may wish to limit the FFT Width to be narrower than that which the instrument would have set.

NOTE

This function does not allow you to widen the FFT Width beyond that which the instrument might have set; it only allows you to narrow it. You might do this to improve the dynamic range of the measurement or eliminate nearby spurs from your measurement.

Note that this setting has no effect unless in an FFT sweep.

See "More Information" on page 324

Remote Command	Not supported in RLC Mode
Notes	The parameter is in units of frequency
Dependencies	Does not appear in VXT models M9420A/21A/10A/11A/15A In some models, the analog prefilters are not provided. In these models the **FFT Width** function is always in **Auto**. The FFT Width control is not displayed in these models Grayed-out in Zero Span
Couplings	The FFT Width affects the **ADC Dither** function, "Meas Setup" on page 237 and the point at which the instrument switches from Swept to FFT acquisition Pressing "Auto Couple" on page 251 always sets **FFT Width** to Auto
Preset	The Preset is Auto, but Preset also selects Best Dynamic Range and this function will be set to ~Maximum ON
State Saved	Saved in instrument state
Min	4.01 kHz
Max	The maximum available FFT width is dependent on the IF Bandwidth option. The maxim available width is: Standard, 10 MHz Option B25, 25 MHz Option B40, 40 MHz Option B2X, 255 MHz

More Information

An FFT measurement can only be performed over a limited span known as the "FFT segment". Several segments may need to be combined to measure the entire span. For advanced FFT control in the X-Series, you have direct control over the segment width using the **FFT Width** control. Generally, in automatic operation, the X-Series sets the segment width to be as wide as possible, as this results in the fastest measurements.

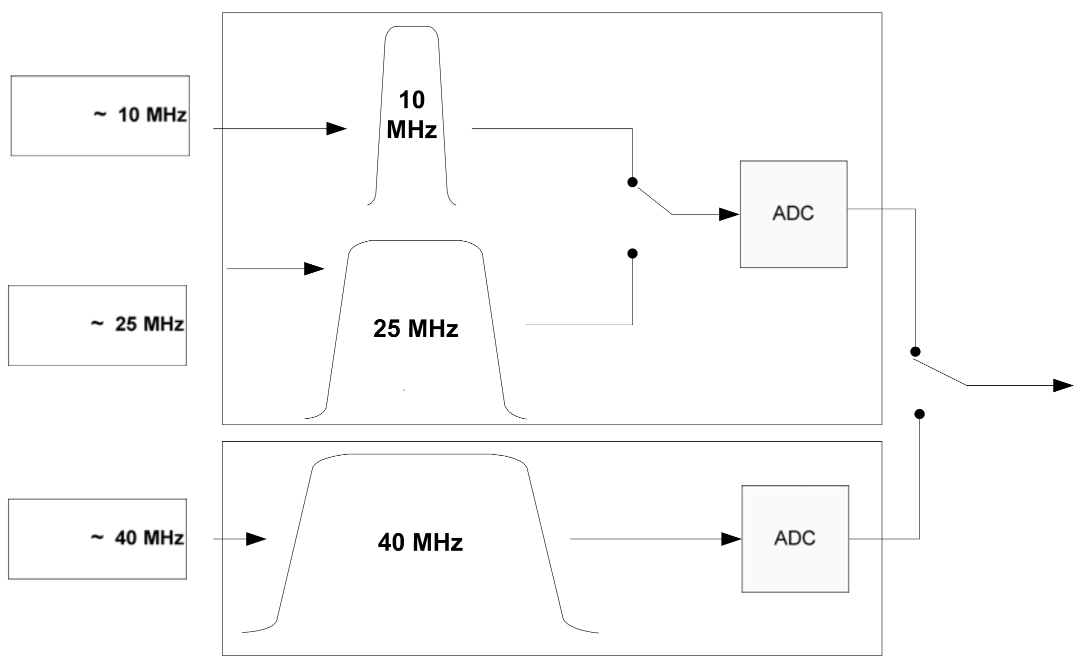
However, to increase the dynamic range, most X-series models provide a set of analog prefilters that precede the ADC. Unlike swept measurements, which pass the signal through a bandpass before the ADC, FFT measurements present the full signal bandwidth to the ADC, making them more susceptible to overload, and requiring a lower signal level. The prefilters act to alleviate this phenomenon - they allow the signal level at the ADC to be higher while still avoiding an ADC overload, by eliminating signal power outside the bandwidth of interest, which in turn improves dynamic range.

Although narrowing the segment width can allow higher dynamic ranges in some cases, this comes at the expense of losing some of the speed advantages of the FFT, because narrower segments require more acquisitions and proportionately more processing overhead.

However, the advantages of narrow segments can be significant. For example, in pulsed-RF measurements such as radar, it is often possible to make high dynamic range measurements with signal levels approaching the compression threshold of the instrument in swept spans (well over 0 dBm), while resolving the spectral components to levels below the maximum IF drive level (about –8 dBm at the input mixer). But FFT processing experiences overloads at the maximum IF drive level even if the RBW is small enough that no single spectral component exceeds the maximum IF drive level. If you reduce the width of an FFT, an analog filter is placed before the ADC that is about 1.3 times as wide as the FFT segment width. This spreads out the pulsed RF in time and reduces the maximum signal level seen by the ADC. Therefore, the input attenuation can be reduced and the dynamic range increased without overloading the ADC.

Further improvement in dynamic range is possible by changing the **FFT IF Gain** (in the **Meas Setup** menu of many measurements). If the segments are reduced in width, **FFT IF Gain** can be set to High, improving dynamic range.

Depending on what IF Bandwidth option you have ordered, there can be up to three different IF paths available in FFT sweeps, as seen in the diagram below:



The 10 MHz path is always used for Swept sweeps. It is always used for FFT sweeps as well, unless the user specifies ~25 MHz in which case the 25 MHz path will be

used for FFT sweeps, or ~40 MHz, in which case the 40 MHz path will be used for FFT sweeps. Note that, although each of these control s picks the specified path, the instrument may choose an FFT width less than the full IF width to optimize speed, trading off acquisition time versus processing time.

If the 255 MHz IF (option B2X) is installed, it may also be used for FFT sweeps, but only if the user specifies ~255 MHz for the FFT Width.

4.10.2.5 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. If limit lines are set to On, the limit lines are updated.

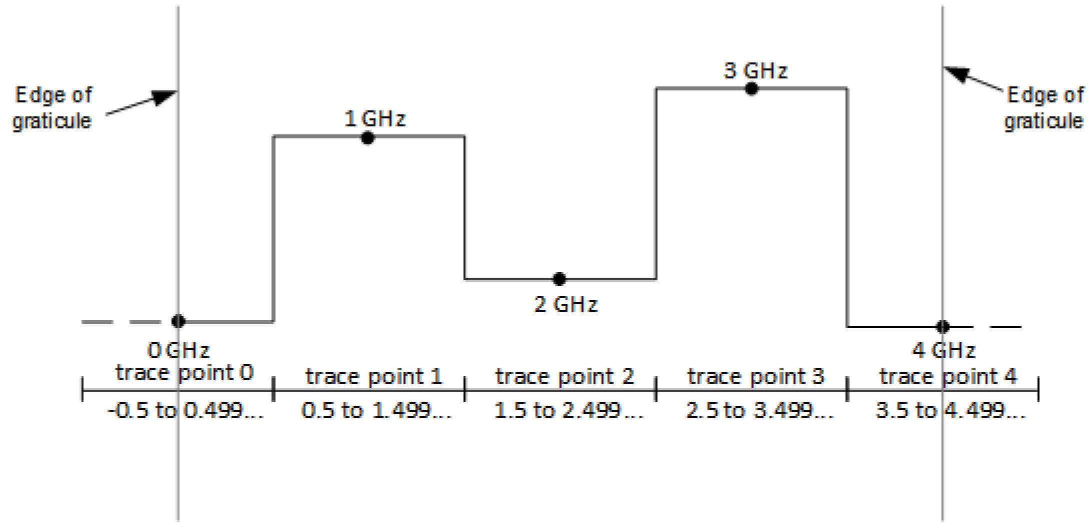
When in a split screen display each window may have its own value for points.

When sweep points is changed, an informational message is displayed, "Sweep points changed, all traces cleared."

Remote Command	Not supported in RLC Mode
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 attempted, a warning is given Clipped to 1001 whenever you are in the Spectrogram View in all models but MXE, clipped to 20001 whenever you are in the Spectrogram View in MXE Grayed-out in measurements that do not support swept Not displayed in modes that do not support Swept Grayed-out if Normalize is on; you can't change the number of sweep points with Normalize on, as it will erase the reference trace
Couplings	When Source Mode is set to Tracking, and Stepped Tracking is used (as with option ESC), 201 source steps are used to achieve optimal speed. The number of sweep points in the instrument is then set to

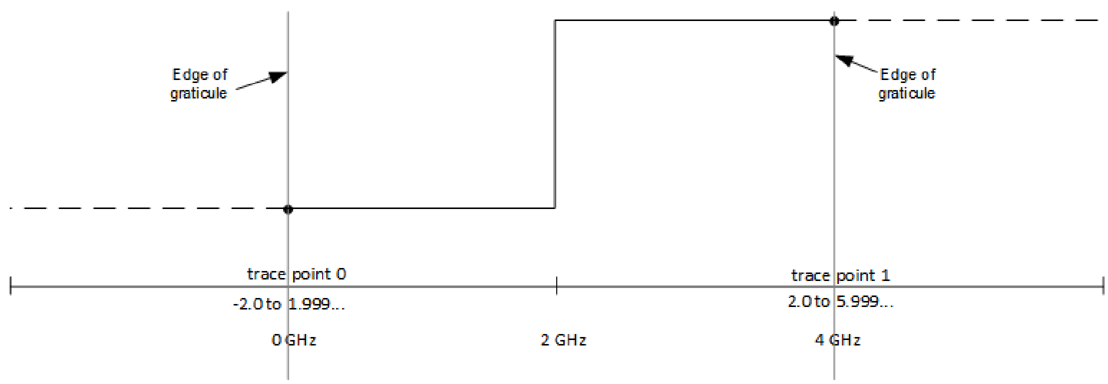
	match the number of steps in the source. When Source Mode is set to Off, the previous number of points (the value that existed when Source Mode was Off previously) is restored, even if the user has changed the Points value while the Source Mode was set to Tracking. Whenever the number of sweep points 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	Normally the minimum is 1, but in Tracking Source Mode, the minimum value of Points is 101. If you go into Tracking Source Mode with fewer points than 101, it sets Points to 101
Max	20001 all measurements unless noted below 100,001 when not in Tracking Source mode In Tracking Source mode: – in Stepped Tracking (e.g., External Source), 1601 or the maximum number of points supported by the source, whichever is less – in Swept Tracking with the CXA TG, 10000 – in Stepped Tracking with the CXA-m TG, 16000
Annotation	On second line of annotations, in lower right corner in parenthesis behind the sweep annotation

Traces are drawn by connecting the trace points, so below is what a 5 point trace with start frequency of 0 and stop frequency of 4 GHz would look like. Note that the black dots at the bucket centers are not actually drawn, but are for illustrative purposes only.



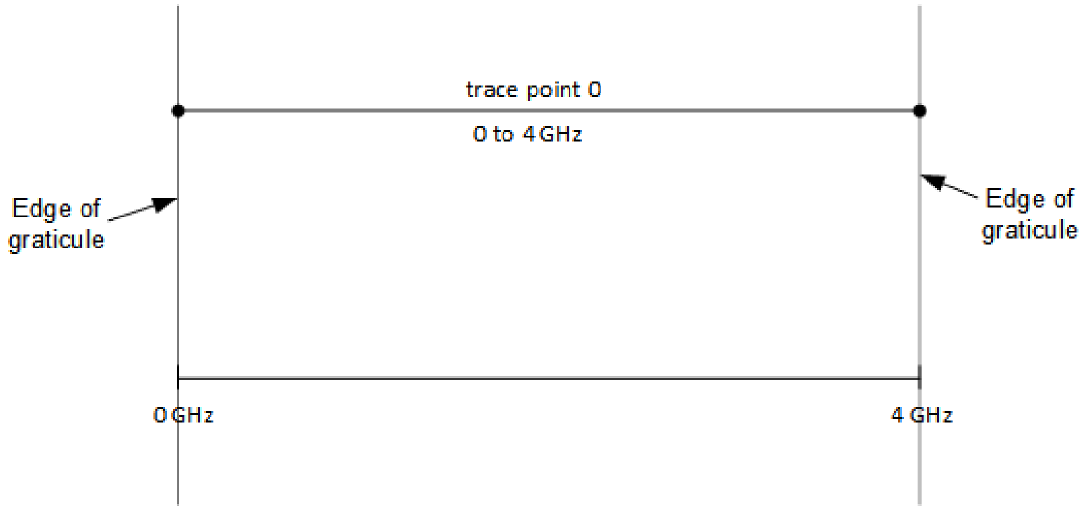
The first bucket (for measurement purposes) actually begins at start – (span/2 (sweep_points – 1)), and the last bucket extends to stop + (span/2(sweep_points – 1)). However the first bucket is drawn starting at start, so only half the bucket is drawn, and the last bucket is drawn ending at stop, so only half of the last bucket is drawn.

The limiting case for which this applies is the two-bucket trace, which looks like this:



The one-bucket trace is a special case. The one-bucket trace extends from start to stop and is drawn from start to stop as shown below.

Note that the black dots at the bucket ends are not actually drawn, but are for illustrative purposes only.


trace point 0
0 to 4 GHz
Edge of graticule
Edge of graticule
0 GHz
4 GHz

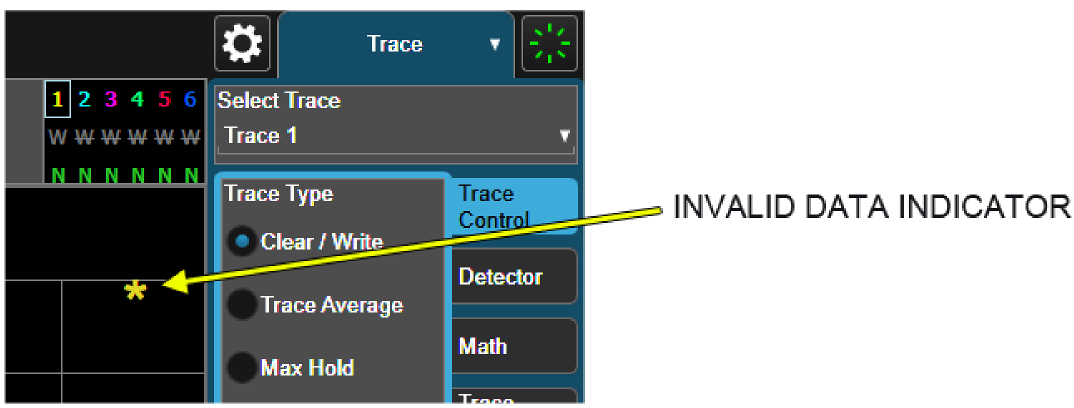
4.11 Trace

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.

A trace is a series of data points, each having an x and a y value. The x value is frequency (or time, in zero span) and the y value is amplitude. Each data point is referred to as a trace point. In any given trace, trace point 0 is the first point, and trace point (sweep_points – 1) is the last. For example, in a 1001 point trace, the first point is 0 and the last is 1000. Another term sometimes used to describe traces is bucket. A bucket is the frequency span of a trace point, equal to the point spacing. For swept analysis, the y value in each bucket is measured while the analyzer is sweeping across the bucket. How it is measured depends on which detector is selected.

When in **Single** Mode, Measurements and their Views save the trace data from the last acquisition. This is true on 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.

Invalid Data Indicator



The invalid data indicator is displayed whenever the data on the display does not match the settings of the analyzer. The most common example of this is when instrument settings have changed in the time since the data in the traces on the display was taken. This means that the screen annotation cannot be guaranteed to match the trace data. For example, if you change Center Frequency, the invalid data indicator will display until the trace has been retaken.

If any Trace is in View mode (displaying but not updating) and analyzer settings are changed, the invalid data indicator will display as long as that trace remains in View. Traces that are blanked do not turn on the invalid data indicator.

Not all analyzer settings require display of the invalid data indicator when they change; only changes that require a new acquisition will cause it to display. For example, changing the Y-Axis scale of the analyzer does not cause the invalid data indicator to display, unless the attenuation changes.

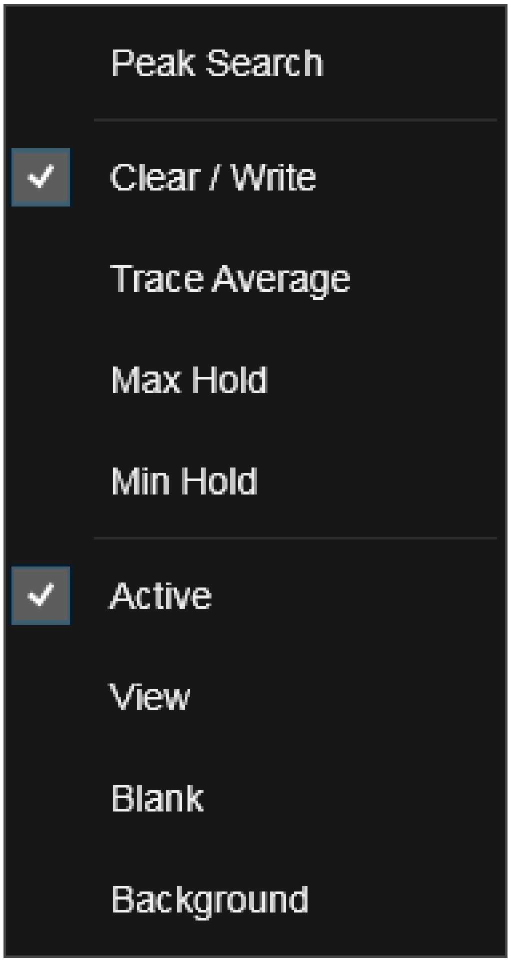
Also, the invalid data indicator is turned on:

- When the counter is turned on, until the completion of the first count
- When a trace is imported from mass storage and the trace's parameters do not match the current analyzer settings
- When a trace is sent to the analyzer from a remote interface (since there is no way to know if its settings match)

NOTE The Invalid Data Indicator has an associated status bit that can be checked at any time to see if the indicator is on.

Trace right-click menu

If you right-click on a trace (or touch and hold a trace and wait for the circle to close) you will see the Trace Right-Click Menu:



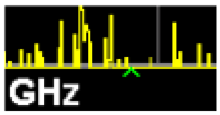
If you now tap or click on one of the items in this menu, it will perform the corresponding function. Peak Search finds the highest peak on the selected Trace. Clear/Write, Trace Average, Max Hold and Min Hold will set the Trace Type (see Trace Type). Active, View, Blank, and Background will set the View/Blank type (see View/Blank).

Trace Update Indicator

Trace updates can take one of two forms:

1. The trace is updated in a single operation that affects all of the points in the trace at once. This happens, for example, in the case of very fast (< 200 ms) sweeps, single-chunk FFT's, and the initial math operation after a math function is set for a trace.
2. The trace is updated in a series of discrete steps, with measurement data being gathered between each step. This will be the case for slow sweeps, multi-chunk FFT's, gated sweeps, etc.

In the first case, no update indicator is required. In the second case, however, 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 Annunciator Panel

The trace annunciator panel appears on the right hand side of the Meas Bar. Here is an explanation of the fields in this panel:

On the top line each trace number is shown, in the trace color. A blue box is drawn around the currently selected trace.

Below each trace number, is a letter signifying the trace type for that trace number, where

W=Clear/Write

A=Trace Average

M=Max Hold

m=Min Hold

If the letter is white it means the trace is being updated (**Update = On**); if the letter is dimmed , it means the trace is not being updated (**Update = Off**). A strikethrough indicates that the trace is blanked (**Display = Off**). Note that it is possible for a trace to be updating and blanked, which is useful if the trace is a trace math component.

The third line shows the detector type for each trace, or, if trace math is on for that trace, it shows an “f” (for “math function”). It is not always possible to have a unique detector for each trace, but the analyzer hardware provides the maximum flexibility of detector selection in order to maintain the highest accuracy. The letters used for this readout are

N=Normal

A=Average

P=peak

p=negative peak

S=Sample

Q=Quasi Peak

E=EMI Average

R=RMS Average

f=math function

If the DET letter is green it means the detector is in Auto; if it is white it means the detector has been manually selected.

So in the example above, the panel shows the following:

Trace 1: Visible, being updated, in Clear/Write, with Normal detector auto selected

Trace 2: Visible, being updated, in Clear/Write, being written to with a math function

Trace 3: Visible, not updating, data was taken in Max Hold, with the peak detector auto selected

Trace 4: Blanked, not updating, data was taken with Averaging turned on, Sample detector manually selected

Trace 5: Visible, not updating, data was taken in Min Hold with Negative Peak detector auto selected

Trace 6: Blanked, not updating, in Clear/Write, with Normal detector manually selected

Trace Annotation

When Trace Annotation (see Display menu) is On, each non-blanked trace is labeled on the trace with the detector used to take it, unless a trace math function is on for that trace, in which case it is labeled with the math function.

The detector labels are:

NORM	Normal
PEAK	Peak
SAMP	Sample
NPEAK	Negative Peak
RMS	Average detector with Power Average (RMS)
LG AVG	Average detector with Log-Pwr Average
VAVG	Average detector with Voltage Average
QPEAK	Quasi Peak
EMI AVG	EMI Average
RMS AVG	RMS Average

The trace math labels are:

PDIF	Power Difference
PSUM	Power Sum

LOFF	Log Offset
LDIF	Log Difference

4.11.1 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

4.11.2 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.

4.11.2.1 Trace Type

There are four trace Types: **Clear/Write, Trace Average, Max Hold** and **Min Hold**.

These types are described below. You may select one of these types for each trace. Re-selecting the current Trace Type initiates the same action that selecting it the first time did, even though it is already selected. For example, selecting Clear/Write while Clear/Write is already selected will nonetheless clear the trace and begin rewriting it.

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.

See:

– "Trace Mode Backwards Compatibility" on page 336
– "Trace Writing Types" on page 336
– "Clear/Write" on page 337
– "Trace Average" on page 337
– "Max Hold" on page 338
– "Min Hold" on page 338

Couplings	Selecting a trace type sets the Trace to **Active** (**Update** On, **Display** On), even if that trace type was already selected
Preset	`WRITe` After a Preset, all traces are cleared (all trace points set to mintracevalue)
State Saved	The type of each trace is saved in instrument state
Annunciation	The type for each trace is indicated in the Trace annunciator panel on the Measurement Bar

Trace Mode Backwards Compatibility

In earlier analyzers, the Trace Modes were Clear/Write, Max Hold, Min Hold, View and Blank. Averaging was global to all traces and was controlled under the BW/Avg menu.

In the X-Series, trace averaging can be done on a per-trace basis. The Trace Modes (now called Types) are Clear/Write, Trace Average, Max Hold and Min Hold. View and Blank are set separately under the View/Blank key.

While this gives the user more flexibility it also gives rise to potential backwards compatibility problems. To mitigate these, the old Trace Mode command has been retained and a new command, Trace Type, has been added. What were formerly called trace modes are now called trace types.

When the Average/Hold switch in the Mode Setup, Legacy Compatibility menu is in the “On” position, the following is true for traces in Max Hold and Min Hold:

- They pay no attention to the Average/Hold number; “Single” for Max Hold causes one sweep only, so going to Single stops after the current sweep, and going to Cont starts you going again without clearing the accumulated result
- They don’t clear the Max Hold on a Restart or Single or INIT:IMM (changing a measurement parameter like frequency or bandwidth etc. would still restart the max hold).

Trace Writing Types

Here are details about the four trace writing types:

Value	Notes
Clear/Write	In **Clear/Write** type each trace update replaces the old data in the trace with new data. Selecting Clear/Write clears the trace and initiates a new sweep
Trace Average	In **Trace Average** type the analyzer 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 Selecting **Trace Average** will clear the trace, initiate a new sweep, and restart the Average sequence
Max Hold	In **Max Hold** type the analyzer 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 Selecting **Max Hold** will clear the trace, initiate a new sweep, and restart the hold sequence
Min Hold	In **Min Hold** type the analyzer 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 Selecting **Min Hold** will clear the trace, initiate a new sweep, and restart the hold sequence

Clear/Write

In **Clear/Write** type each trace update replaces the old data in the trace with new data. Pressing the **Clear/Write** selection for the selected trace, sets the trace type to **Clear/Write** and causes the trace to be cleared, even if you are already in Clear/Write. Then a new sweep is initiated. Trigger conditions must be met before the sweep actually starts, and if in Single the sweep won't start until Restart is pressed.

Because pressing **Clear/Write** stops the current sweep and initiates a new one, **Trace Average, Max Hold** and **Min Hold** data may be interrupted in mid-sweep when **Clear/Write** is pressed, and therefore may not accurately reflect the displayed count. Therefore, when **Clear/Write** is pressed for one trace, **Trace Average, Max Hold** and **Min Hold** must restart for all traces.

When in **Clear/Write**, if a measurement-related instrument setting is changed (that is, one which requires new data to be taken, like Center Frequency or Attenuation), a new sweep is initiated but the trace is not cleared.

Trace Average

In **Trace Average** type the analyzer 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. Pressing the **Trace Average** key (for the selected trace), sets the trace type to **Trace Average** and causes the average to be restarted

Details of the count limiting behavior and the averaging calculations may be found under **Avg|Hold Number** and **Average Type** in the Meas Setup Section.

When in **Trace Average**, if a measurement-related instrument setting is changed(that is, one which requires new data to be taken, like Center Frequency or Attenuation), the average restarts and a new sweep is initiated but the trace is not cleared.

Restarting the average means:

- The average/hold count k is set to 1, so that the next time the average trace is displayed it simply represents one trace of new data
- A new sweep is initiated
- Once the new sweep starts, the trace is overwritten with current trace data as the first trace of the new average

Remember that restarting averaging also restarts **Max Hold** and **Min Hold**, as there is only one count for Trace Average and Hold.

Max Hold

In **Max Hold** type the analyzer 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. Details of the count limiting behavior may be found under **Avg|Hold Number** in the Meas Setup section.

Pressing the **Max Hold** key for the selected trace, sets the trace type to **Max Hold,** causes the trace to be cleared, and causes the **Max Hold** sequence to be (re)started, even if you are already in Max Hold.

When in **Max Hold**, if a measurement-related instrument setting is changed(that is, one which requires new data to be taken, like Center Frequency or Attenuation), the **Max Hold** sequence restarts and a new sweep is initiated but the trace is not cleared.

Restarting the **Max Hold** sequence means:

- The average/hold count k is set to 1, so that the next time the max hold trace is displayed it simply represents one trace of new data
- A new sweep is initiated.

Remember that restarting **Max Hold** also restarts averaging and **Min Hold**, as there is only one count for Trace Average and Hold.

Min Hold

In **Min Hold** type the analyzer 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. Details of the count limiting behavior may be found under **Avg|Hold Number** in the Meas Setup section.

Pressing the **Min Hold** key for the selected trace, sets the trace type to **Min Hold,** causes the trace to be cleared, and causes the **Min Hold** sequence to be (re)started, even if you are already in Min Hold.

When in **Min Hold**, if a measurement-related instrument setting is changed(that is, one which requires new data to be taken, like Center Frequency or Attenuation), the **Min Hold** sequence restarts and a new sweep is initiated but the trace is not cleared.

Restarting the **Min Hold** sequence means:

- The average/hold count k is set to 1, so that the next time the min hold trace is displayed it simply represents one trace of new data
- A new sweep is initiated

Remember that restarting **Min Hold** also restarts **Max Hold** and averaging, as there is only one count for Trace Average and Hold.

4.11.2.2 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 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

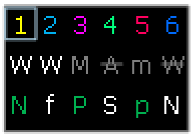
4.11.2.3 View/Blank

This key lets you set the state of the two trace values, 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 (this 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 340

– "Trace Display State On/Off" on page 340

– "More Information" on page 341

Notes	The four states of this Dropdown actually set two variables, Update and Display, to their four possible combinations: – **Active**: Update and Display both On – **View**: Update Off and Display On – **Blank**: Update Off and Display Off – **Background**: Update On, Display Off See tables below for detail on the SCPI to control these two variables.
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 puts the trace in **Active** (**Update On and Display On)**, even if that trace type was already selected. Selecting a detector for a trace puts the trace in **Active** (**Update On and Display On)**, even if that detector was already selected. Selecting a math mode 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

Couplings	Whenever you set **Update** to **On** for any trace, the **Display** is set to **On** for that trace.
Preset	1|0|0|0|0|0 (On for Trace 1; Off for 2–6)
State Saved	Saved in instrument state

Trace Display State On/Off

Couplings	Whenever you set Update to On for any trace, the Display is set to On for that trace.
Preset	1|0|0|0|0|0 (On for Trace 1; Off for 2–6)
State Saved	Saved in instrument state

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 and 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 will 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 the action of putting a trace in Display=Off and/or Update=Off does not restart the sweep and does not restart Averaging or Hold functions for any traces.

4.11.2.4 Trace Settings Table

Lets you configure the Trace system using a visual utility.

4.11.3 Detector

Lets you choose and configure detectors for the selected trace.

4.11.3.1 Detector

Selects a specific detector for the current measurement. The detector selected is then applied to the selected trace.

The instrument is in Auto detection by default, and normally Auto detection will choose the best detector for you automatically. If you choose a detector manually, this will turns Auto detection off for the selected trace.

The three detectors at the end of the Detector menu, Quasi Peak, EMI Average, and RMS Average, are referred to collectively as the “CISPR detectors” because their behaviors are specified by the CISPR 16–1–1 specification. These detectors appear only if the N6141A or W6141A application or Option EMC installed and licensed.

NOTE

The instrument can typically provide 3 different detectors simultaneously. Occasionally the instrument can only provide 2 simultaneous detectors, typically when the Average detector is selected. When one of the CISPR detectors is selected, it is only possible to have that one detector so all active traces change to that detector. It is never possible to have more than 3 simultaneous detectors.

– "More Information" on page 343
– "Detector Basics" on page 343
– "Detector Notes" on page 344
– "CISPR Detector Notes" on page 345
– "Multiple Detectors" on page 346

Remote Command	Not supported in RLC Mode
Dependencies	When Tune & Listen is on, or Demod Audio is the selected Analog Output, all active traces are forced to use the same detector CISPR detectors are grayed-out when you have manually selected FFT sweep. Conversely, if any CISPR detector is selected on an active trace, the auto rules for sweep type will never select FFT, and manual FFT selection will be grayed-out When Signal ID is on, **Detector** is grayed-out for Traces 2-6 in Image Suppress mode and for Traces 3-6 in Image Shift Mode The VBW filter is not used for the Average detector or any of the CISPR detectors (Quasi Peak, EMI Average, RMS Average), as indicated by a * after the VBW value on the graph if any of these detectors is selected for any updating trace It is never possible to have more than 3 simultaneous detectors, and sometimes fewer than three. If the instrument has to enforce this limit a message is generated, “Detector n changed due to physical constraints” where “n” is the detector number
Couplings	Selecting a detector for a trace puts **Update On and Display On** for that trace, even if that detector was already selected The auto detector rules depend upon marker type, averaging state and type, trace state writing mode, and trace active state Selecting a detector, whether by pressing the control or sending the equivalent command, turns trace math to Off for the selected/specified trace Use of the Average detector affects the VBW setting because of its effect on the VBW/RBW coupling. See the BW key description Selecting any CISPR detector on any active trace sets the EMC Standard to CISPR. If any trace with a CISPR detector becomes active, the EMC Standard is set to CISPR If the Avg Type is in Auto, and any of the CISPR detectors is selected on any active trace, the Voltage Averaging type is auto-selected
Preset	Preset returns all traces to “auto”, which results in Normal (Rosenfell) detection for all traces

State Saved	Saved in instrument state
Annunciation	The detectors currently selected are annunciated in the Trace Panel on the right side of the Meas Bar
Annotation	The four-letter mnemonic for the detector appears in the trace window next to the trace it applies to if Trace Annotation is on
Backwards Compatibility Notes	In the X-Series, the detector selected is applied to the selected trace. This differs from previous instruments, where the selected detector was applied to all traces and you could only have one detector

More Information

Value	Notes
Normal	Determines the peak of CW-like signals, and yields alternating maximums and minimums of noise-like signals. This is also referred to as Rosenfell detection
Average	Determines the average of the signal within the bucket. The averaging method depends upon Average Type selection (voltage, power or log scales) and delivers: RMS detection when Avg Type = Power Video detection when Avg Type = Log-Pwr Scalar detection when Avg Type = Voltage
Peak	Determines the highest signal within the bucket
Sample	Determines the instantaneous level of the signal at the center of the bucket
Negative Peak	Determines the minimum of the signal within the bucket
Quasi Peak	EMI – CISPR detector Only appears with the N6141 application or Option EMC installed and licensed A fast-rise, slow-fall detector used in making CISPR compliant EMI measurements, compliant with the latest CISPR 16-1-1 standard
EMI Average	EMI – CISPR detector Only appears with the N6141 application or Option EMC installed and licensed Provides a standard means to “smooth” the signal while still providing compliance to CISPR pulse response standards. It displays the average value of the amplitude envelope, rather than the average value of sample-detected amplitude, and uses an advanced algorithm to realize a lowpass filter that conforms to the latest CISPR 16-1-1standard
RMS Average	EMI – CISPR detector Not to be confused with the RMS mode of the regular Average detector, this is a special frequency-dependent EMI filter which only appears when the N6141 application or Option EMC is installed and licensed This filter conforms to the latest revision of the CISPR 16–1–1 standard

Detector Basics

To understand detectors you must understand the concept of trace buckets. For every trace point in swept and zero span analysis, there is a finite time during which the data for that point is collected. The instrument has the ability to look at all of the data collected during that time and present a single point of trace data based on the detector type. We call the interval during which the data is being collected the “bucket.” Often the term “trace point” is used to mean the same thing.

However, it is important to understand that a trace is more than a series of single points. The data is sampled rapidly enough within each “bucket” and processed so that the detector results are equivalent to those that would be achieved with a continuous time (non-sampled) system.

Detector Notes

- The VBW filter is not used for the Average detector or any of the CISPR detectors (Quasi Peak, EMI Average, RMS Average), so varying the VBW will have no effect for any traces for which this detector is selected (other than to slow down the sweep, because of the coupling to Sweep Time of VBW). If any traces for which VBW does not apply are in Update On state (traces with Average, EMI Average, RMS Average or Quasi Peak detectors selected), then an * displays after the VBW annotation on the front panel.
- Rosenfell (Normal) detection: when the signal is CW-like, it displays the peak-detected level in the interval (bucket) being displayed. If the signal is noise-like (within a bucket the signal both rose and fell), it alternates displaying the max/min values. That is, an even bucket shows the peak (maximum) within a two-bucket wide interval centered on the even bucket. And an odd bucket will show the negative peak (minimum) within a two-bucket wide interval. For example, for an even bucket the two-bucket wide interval is a combination of one-half bucket to the left of the even bucket, the even bucket itself, and one-half bucket to the right of the even bucket, so the peak found will be displayed in the correct relative location on screen. The odd buckets are similar.
- The Average Detector result depends on the Average Type. To explicitly set the averaging method, use the **Meas Setup**, **Average Type** key.
- 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.
- Peak detection is used for CW measurements and some pulsed-RF measurements. For FFT analysis, the highest amplitude across the frequency width of a bucket is displayed, even if that peak amplitude falls between samples of the spectrum computed in the FFT process.
- Sample detection is good for displaying noise or noise-like signals but is not the best choice for making amplitude measurements of CW-like signals. This is because:
- the peak response to a signal can occur between samples. So unless the Span to RBW ratio is lower than usual, then the highest sample can be well below the peak signal amplitude.
- for the high sweep rates normally used, the peak response of the RBW filters is up to –0.5 dB. This sweeping error is compensated when using the peak and normal detectors by changing the overall gain. But the gain is not changed when in the sample detector, because doing so would cause errors in the response to noise. Instead, the auto-couple rules for sweep time are modified to give slower sweeps.
- When the **Detector** choice is **Auto**, the detector selected depends on marker functions, trace functions, average type, and the trace averaging function.
- When you manually select a detector (instead of selecting **Auto**), that detector is used regardless of other instrument settings.

CISPR Detector Notes

Quasi Peak

This is a fast-rise, slow-fall detector used in making CISPR compliant EMI measurements and defined by CISPR Publication 16–1–1. Quasi-peak detection displays a weighted, sample-detected amplitude using specific, charge, discharge, and meter time constants derived from the legacy behaviors of analog detectors and meters. It is used for EMI measurements to provide a specific and consistent response to EMI-like signals.

In the past, Quasi Peak and EMI Average measurements were often made on a linear display scale (and CISPR standard operation calls for this), because those detectors only worked properly with signals on a linear (voltage) scale. The X-series instruments are capable of making Quasi Peak and EMI Average detected measurements correctly on a log scale, due to the digital IF. This latter capability means that the user can observe detected EMI levels on a log scale, allowing a large visible dynamic range. You can manually set the Average Type to Log-Power or Power, but the results will no longer be CISPR compliant.

Also in the past, EMI analysis equipment would need to perform a ranging operation to set the reference level when one of these detectors was turned on, but the X-series instruments do not - because of its digital IF, there is no need to set the reference level (range) to improve the accuracy nor to allow visibility of the detected level.

EMI Average

The EMI Average detector in Agilent’s X-Series instruments is so called to distinguish it from the Average detector, although EMI users typically refer to it simply as the “Average detector”. The intent of this detector is to provide a standard means to “smooth” the signal while still providing compliance to CISPR pulse response standards.

Unlike the regular Average detector, which averages on a bucket-by-bucket basis using either a power, log-power or voltage scale (a bucket is the same as a trace point), the EMI Average detector displays the average value, on the voltage scale, of the overall amplitude envelope, independent of the trace bucket width. It is defined for EMI measurements by the CISPR 16–1–1 standard and, in the X-series, uses a sophisticated algorithm to implement a lowpass filter that conforms to the latest CISPR standard.

Note that CISPR standard operation is to perform the envelope averaging on the voltage scale. You can manually set the Average Type to Log-Power or Power, but the results will no longer be CISPR compliant. See note under Quasi-Peak.

RMS Average

Not to be confused with the RMS mode of the regular Average detector, this is a special filter for making EMI measurements. It is a frequency dependent RMS/Averaging filter, used in making CISPR compliant EMI measurements. This filter conforms to the 2007 revision of the CISPR 16–1–1 standard. This detector does one averaging process (in the VBW hardware) on the "power" (a.k.a. RMS) scale and another process on the voltage scale using a "meter movement simulator" similar to the one used in the QPD filter.

Note that CISPR standard operation is to perform the envelope averaging on the voltage scale. You can manually set the Average Type to Log-Power or Power, but the results will no longer be CISPR compliant. See note under Quasi-Peak.

Multiple Detectors

The instrument always provides the requested detector on the specified trace. Depending on the detectors requested the instrument can provide up to three different detectors simultaneously within the constraints of its digital processing algorithms. Some detectors utilize more resources; the Quasi-Peak detector, for example, utilizes most of the digital IF's resources, and the hardware in some instruments is incapable of providing another detector when Quasi-Peak is on. If the limit of system resources is exceeded, detectors on some existing traces may be forced to change. When this happens, they change to match the detector just requested, and a message is generated: "Detector <X> changed due to physical constraints", where X might contain multiple values.

Example: User has traces 1, 2, and 3 with Peak, Average, and Negative Peak. User specifies QPD for trace 1. Traces 2 and 3 also change to QPD and we generate the message "Detector 2,3 changed due to physical constraints". Now all three traces have the QPD.

4.11.3.2 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 you select any detector explicitly, this toggles automatically to Man (manual).

Remote Command	Not supported in RLC Mode
Dependencies	The auto detector rules depend upon marker type, averaging state and type, trace state writing mode, and trace active state When operating a source in Tracking Source mode, Auto selection is the Average detector. All other detector selections are allowed, but in most cases you will want to stick with Average, which gives optimal sensitivity
Couplings	Selecting AUTO turns trace math `OFF` for the selected/specified trace
Preset	Auto (On) for all detectors
State Saved	Saved in instrument state

4.11.3.3 Detector Auto All Traces

Returns the selected set of detectors to the "preset" state, which is auto-selected.

Dependencies	When Signal ID is on, this control is grayed-out
Couplings	Sets all traces' Detector Auto to true

4.11.3.4 Detector Average Preset

Used to make a measurement of the average power and the signal envelope. This is a one-time setting of a commonly used detector set. It is quicker than making many individual changes and the detectors are free to change afterward. The effect is identical to just setting the traces' detectors individually.

Dependencies	When Signal ID is on, this control is grayed-out
Couplings	Trace 1: Set to peak detection, and Clear-Write Trace 2: Set to average detection, and Clear-Write Trace 3: Set to negative peak detection, and Clear-Write

4.11.3.5 Detector Sample Preset

Used to make a measurement that displays a power sample and the signal envelope. This is not a "mode" but a one-time setting of a commonly used detector set; it is quicker than making many individual changes but the detectors are free to change afterward, the effect is identical to just setting the traces' detectors individually.

Dependencies	When Signal ID is on, this control is grayed-out
Couplings	Trace 1: Set to peak detection, and Clear-Write Trace 2: Set to sample detection, and Clear-Write Trace 3: Set to negative peak detection, and Clear-Write

4.11.4 Math

The Math tab lets you turn on and configure trace math functions.

4.11.4.1 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 348.

See "How trace math is processed" on page 350

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`.

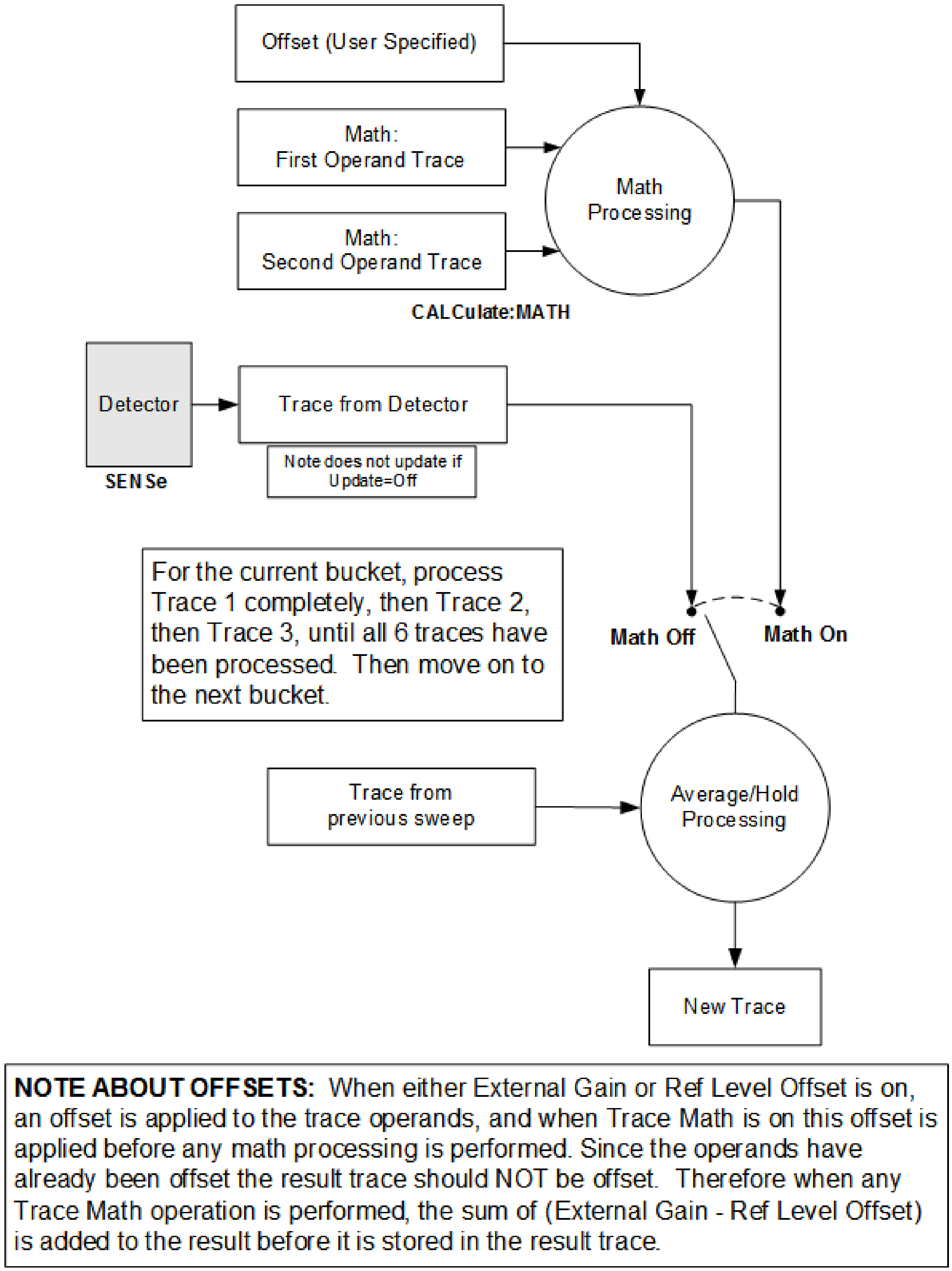
If neither of the above is true for a given point, then:

- 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).

4.11.4.2 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.

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

4.11.5 Trace Function

The Trace Function includes controls to:

- Copy and Exchange traces
- Preset or Clear all traces

4.11.5.1 From Trace

Selects the trace to be copied to or exchanged with the **To Trace** when a "Copy" on page 353 or "Exchange" on page 353 is performed

Preset	1

4.11.5.2 To Trace

Selects the trace to be copied from or exchanged with the **From Trace** when a "Copy" on page 353 or "Exchange" on page 353 is performed

Preset	2

4.11.5.3 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	Not available in RLC Mode
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	`TRACE1, TRACE2`
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 The 2-DL->2 function in ESA and PSA (which was really a trace math function) has been eliminated, because its use case was very rare.. It actually subtracted the dB-equivalent of the dBm-expressed display line, regardless of the y axis unit. For example, if DL = +21.99 dBmV, it subtracted –25.00 dB (i.e. add +25.00 dB) to trace 2. New, more useful functions are provided in the new Trace, Math menu

4.11.5.4 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	Not available in RLC Mode
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

4.11.5.5 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	Not available in RLC Mode
Dependencies	When Signal ID is on, this key is grayed-out

4.11.5.6 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 of all traces, except traces in `Min Hold`, in which case it loads `maxtracevalue`.

These actions occur even if Update=Off.

Remote Command	Not available in RLC Mode
Dependencies	When Signal ID is on, this key is grayed-out

4.11.6 Normalize

Lets you configure and execute functions to display one trace relative to a reference trace.

4.11.6.1 Normalize On/Off

Switches the Normalize function on or off. When `ON`, on each sweep, the normalized trace (Trace 3) is subtracted from Trace 1 and the result is added to the normalized reference level. This arithmetic assumes all values are in decibel units, so we are actually taking a ratio.

The steps to perform the Normalize function are:

– Store the current Trace 1 into the reference trace, which is Trace 3

– Turn on Normalize

If you try to turn on Normalize without first storing a reference trace, you will see an error.

When Normalize is `ON`, Y-Axis Unit (in the Amplitude menu) is grayed-out and forced to dBm, and Transducer Unit (in the Limit Editor) is grayed-out and forced to None.

See:

– "More Information" on page 355

– "Normalize Block Diagram" on page 357

Remote Command	`:CALCulate:NTData[:STATe] OFF | ON | 0 | 1` `:CALCulate:NTData[:STATe]?`
Example	`:CALC:NTD ON` `:CALC:NTD?`
Dependencies	If Normalize (On) is pressed before Store Ref (1→ 3), an error message is generated Normalize remains `OFF` in this case Normalize is not available (grayed-out) if any Trace Math function is on Normalize is not available if Amplitude, Scale Type is set to 'Lin"
Couplings	When Normalize is turned on, Trace 1 is placed in Clear/Write with Update = ON and Display = ON
Preset	`OFF`
State Saved	Saved in instrument state

More Information

The Normalize function is most useful for applying correction data to a trace while making a stimulus-response measurement with a tracking generator (or synchronized source). For example, connect the cables and a through line, in place of the device to be measured, between the tracking generator and the instrument input. Notice that the frequency response is not perfectly flat, showing the response of the cables, as well as the flatness of both the tracking generator and the instrument. Now press Store Ref (1→ 3), Normalize On. Notice that the displayed trace is now flat, or normalized. The position of the normalized trace can now be moved to a different position on the display by changing the normalized reference position. This may be useful if the device to be tested has positive gain, such as an amplifier. Now replace the through line with the device under test, and an accurate measurement of the gain or loss can be made.

The Normalize function can also be used to perform a scalar reflection measurement (return loss). In this case a directional coupler or bridge is used to extract the reflected signal. In the simplest reflection measurement a Short is placed at the end of the cable and the result is stored to trace 3 (as before). When Normalize is turned on, the result is the calibrated return loss in dB. For a more accurate calibration, an Open and Short can be used. To do the Open/Short calibration, the Open/Short key at the bottom of the Normalize menu is pressed. This will initiate a guided calibration procedure which captures the reference trace. This is then stored to Trace 3, as before. When Normalize is turned on the corrected return loss is displayed.

Measurement Details

First the following calculation is performed:

Trace 1 = (Trace 1D – Normalized Trace)

Where:

- Trace 1D is the measured value of trace 1, as it comes from the SENSe subsystem
- Normalized Trace is Trace 3, in which you have previously stored a reference trace
- All values are in decibel units

This Trace 1 contains the values that will be returned from a trace query, or if the marker is placed on the trace.

For example, let's say bucket 1 on Trace 1 is at 0 dBm, and bucket 1 on Trace 3 is at 10 dBm. The resultant bucket is at 0 dBm – 10 dBm = –10 dB (just like with a delta marker).

You are also given the ability to define what (dB) value to use for Ref Level, and to define where on the screen the Ref Lvl line will appear using Normalized Reference Position. This flexibility in displaying the result allows a wide range of devices, including amplifiers, to be tested using Normalize.

In the example above, bucket 1 has the value of –10 dB. Let us assume you have set Norm Ref Lvl to 5 dB. Thus bucket 1 will display 1.5 divisions below the Reference Level line (assuming 10 dB per division).

The Reference Level line is normally the top line of the graticule. If Norm Ref Position is set to 10, this is the case. If it is set to 9, it is the next line down. If it is set to 5, it is the middle line of the graticule. If set to 0 it is the bottom line.

So in the example above, if Norm Ref Position is set to 9, then bucket 1 will display 2.5 divisions below the top line of the graticule.

None of the manipulations of Norm Ref Position and Norm Ref Lvl affect the data in the trace.

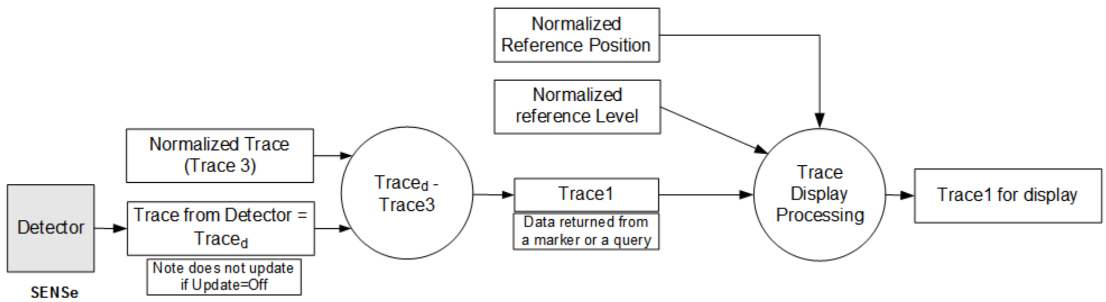
As Normalize displays a ratio between two traces (a difference, in dB) the Y-Axis Unit while in Normalize is dB in Log Amplitude and dimensionless in Linear. The Y Axis Unit chosen in the Y Axis Unit menu is unaffected by Normalize. When you leave Normalize the Y Axis Unit returns to the value set in the Y Axis Unit menu. While in Normalize, all amplitude functions, such as Marker Y and the values in other traces, should be always in dB unit, and so should the returned trace query results. In other words, both trace query result and marker Y become independent of the Y Axis Unit chosen in the Y Axis Unit menu when normalize is on.

(In Linear, the equivalent calculation is performed but it yields a dimensionless ratio, so the normalized ref level will be unitless, presetting to 1, just as in Log it presets to 0 dB. Linear normalization is not currently available in the X-Series).

Y Axis annotation is blanked while in Normalize. Any other traces on the display are plotted in dB, where the dB value used is equivalent to the dBm value of the trace. For example, if bucket 1 in trace 2 is at –40 dBm, that bucket is plotted at –40 dB. All traces use Norm Ref Lvl and Norm Ref Position for positioning on the display. When Normalize exits, the normal Ref Lvl is restored. This normal Ref Level is unaffected by Normalize.

Normalize Block Diagram

This block diagram shows how Normalize works:



4.11.6.2 Store Reference (Trace1 -> Trace3)

Copies trace 1 into trace 3. Store Ref (1→ 3) must be pressed before pressing Normalize (On). Note that this puts Trace 3 in Update=OFF (not updating) and Display=ON (visible).

Notes	There is no remote command for this function, but the trace copy command can be used for this purpose
Dependencies	If Normalize (On) is pressed before Store Ref (1→ 3), an error message is generated. Normalize remains OFF in this case

4.11.6.3 Show Reference (Trace 3)

Views or blanks the reference trace on the display. The reference trace is trace 3, so this is the same as setting Trace 3's "Display" attribute.

Notes	Trace 3 is always the reference trace by definition
State Saved	Saved in instrument state

4.11.6.4 Norm Ref Lvl

Sets the level (in dB) of the normalized reference. This is the Level of the line specified by Norm Ref Position.

Remote Command	`:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:NRLevel <rel_ampl>` `:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:NRLevel?`
Example	`:DISP:WIND:TRAC:Y:NRL .10 dB` `:DISP:WIND:TRAC:Y:NRL?`
Preset	0 dB

State Saved	Saved in instrument state
Min	–327.6 dB
Max	327.6 dB

4.11.6.5 Norm Ref Position

Sets the graticule line that represents the Norm Ref Lvl. 10 is the top line and 0 is the bottom line. The normalized reference position is indicated with a white right arrow on the left side of the display and a white left arrow on the right side of the display, just inside the graticule.

This function may be used to offset the displayed trace without affecting the instrument gain or attenuation settings. This allows the displayed trace to be moved off the top of the screen so that it may be completely seen, but without decreasing measurement accuracy.

Remote Command	`:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:NRPosition <integer>` `:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:NRPosition?`
Example	`:DISP:WIND:TRAC:Y:NRP 5` `:DISP:WIND:TRAC:Y:NRP?`
Notes	The top and bottom graticule lines correspond to 10 and 0, respectively
Preset	10
State Saved	Saved in instrument state
Min	0
Max	10

4.11.6.6 Open/Short Cal

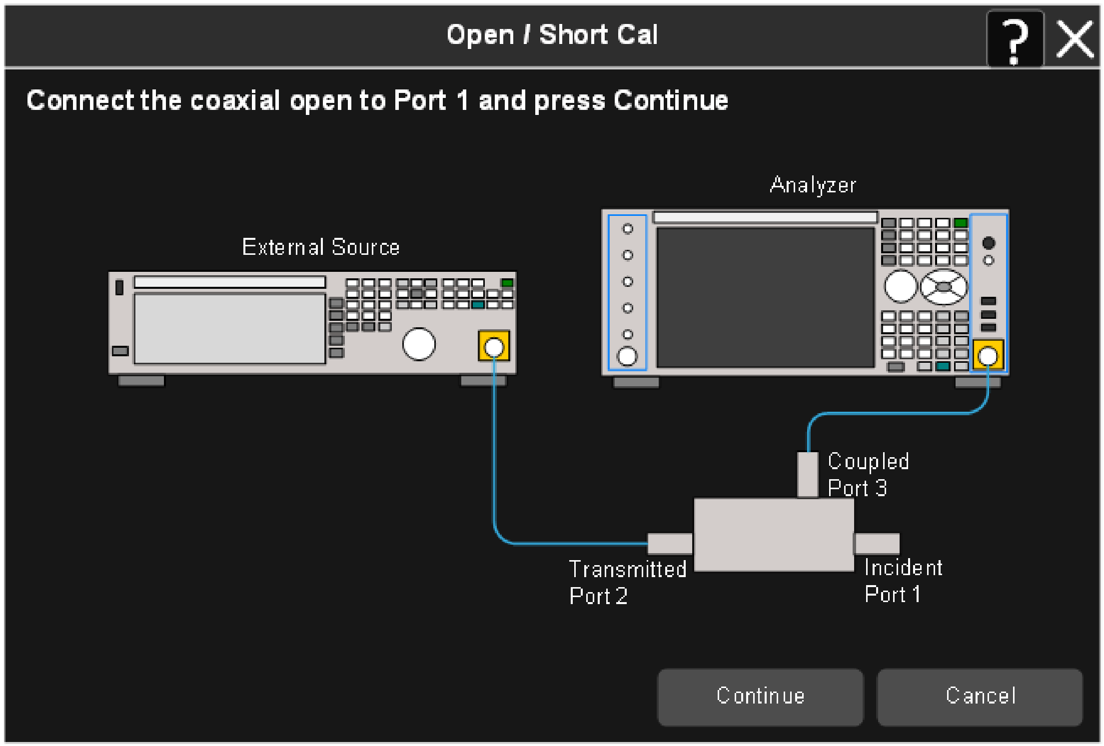
Performs a guided Open/Short Calibration, providing step-by-step instructions. This is the most accurate way to make the return loss measurement on the X-series instruments. You are directed through a 1-Port coaxial open calibration, and a 1-Port coaxial short calibration. The result can then be saved to Trace 3. It is used to perform calibrated scalar reflection measurements (return loss), using the Normalize function.

See "Open/Short Guided Cal" on page 358

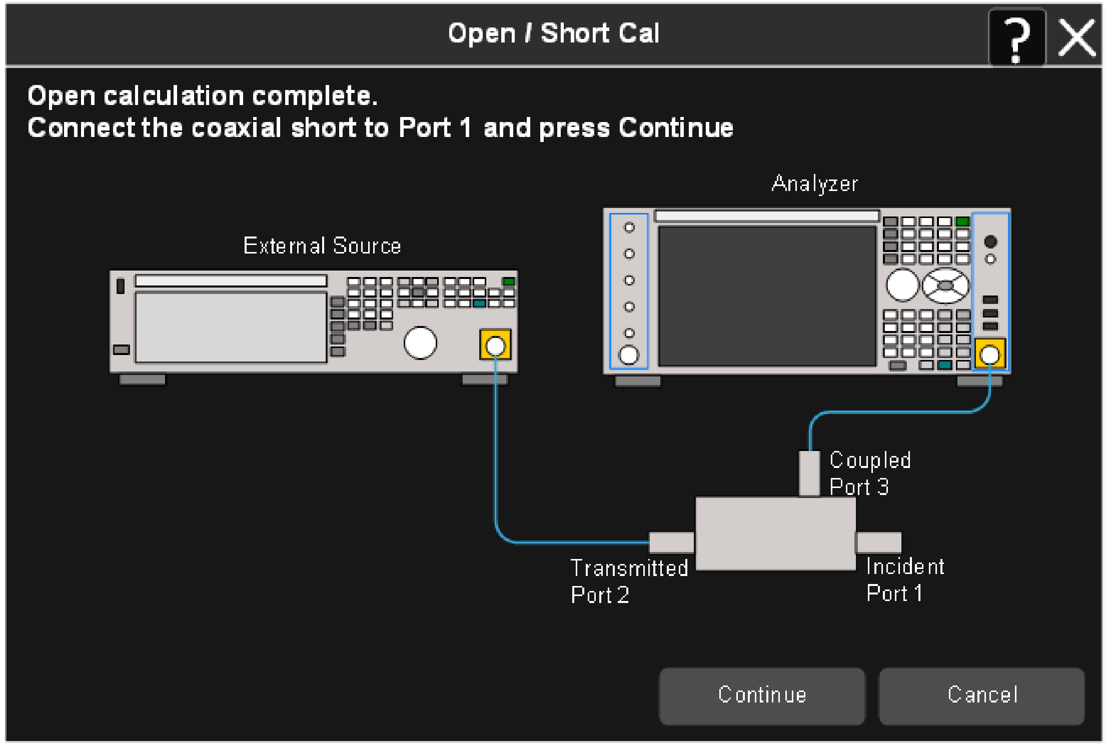
Notes	Does not auto return

Open/Short Guided Cal

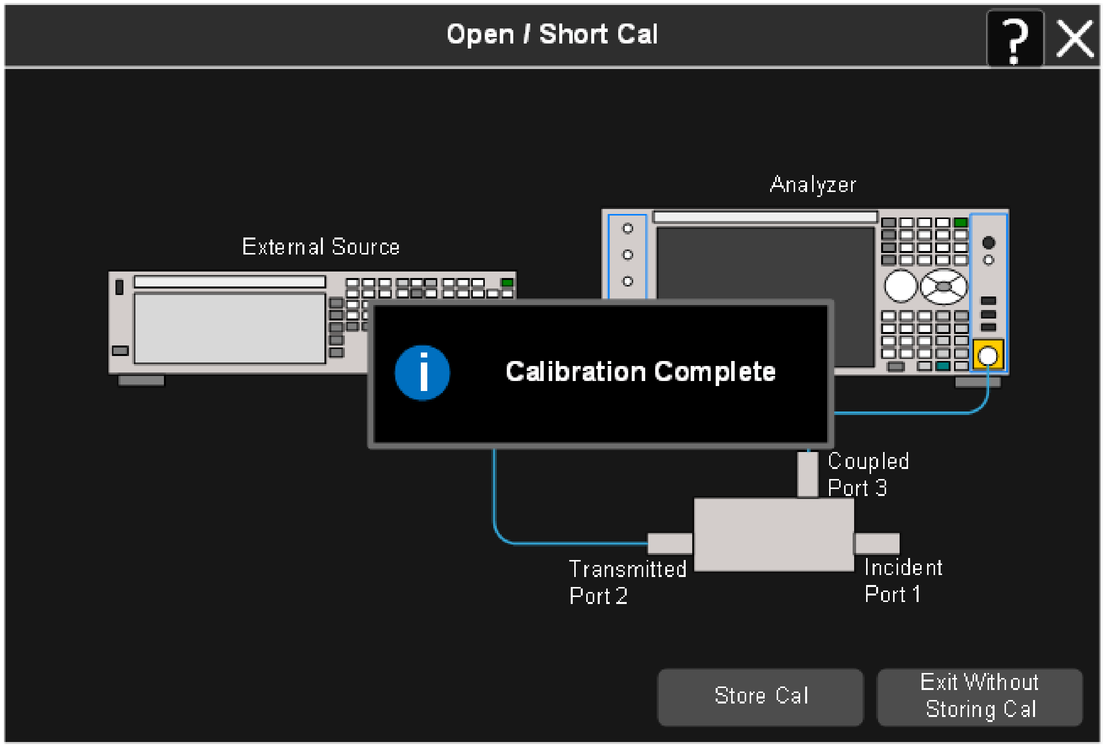
On pressing the **Open/Short Cal** control in the **Normalize** menu, the Open Calibration Formis displayed. The form shows a diagrammatic representation of how to connect the external source to the spectrum instrument to perform the calibration. When the **Continue** button is pressed, the Open calibration sweep is taken and stored in internal memory, for use later in this cal process. If the Cancel button is pressed, the Open/Short Cal is cancelled and the Normalize menu is returned.



On completion of the Open Calibration, the Short Calibration Form is displayed. This form shows a diagrammatic representation of how to connect the external source to the spectrum analyzer to perform the Short calibration. When the Continue button is pressed, the Short calibration sweep is taken and stored in internal memory, for use later in this cal process. If the Cancel button is pressed, the Open/Short Cal is cancelled and the Normalize menu is returned.



On completion of the Short Calibration, the Open and Short calibration measurements are averaged (power). The picture with prompt is taken off the screen and a menu with “Store Cal” and “Exit Without Storing Cal” is displayed. When you press “Store Cal” the resulting trace is stored to Trace 3. If the “Exit Without Storing Cal” button is pressed, the Open/Short Cal is cancelled. In either case you return to the Normalize menu.



The Open Short calibration is applied by taking the average of the Open and the Short trace. The average is a linear average point-by-point. You can further configure averaging on the traces (Open, Short, and final measurement). In this case, the value of the averaged Open and Short trace are linear averaged (by performing a point-by-point average of the two traces). Both the Open and the Short terminations should have approximately unity reflection. Taking the average gives the best estimate of a perfect reflector for a scalar return loss measurement. You should store the result in reference trace 3, for later application with the Normalize function.

5 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

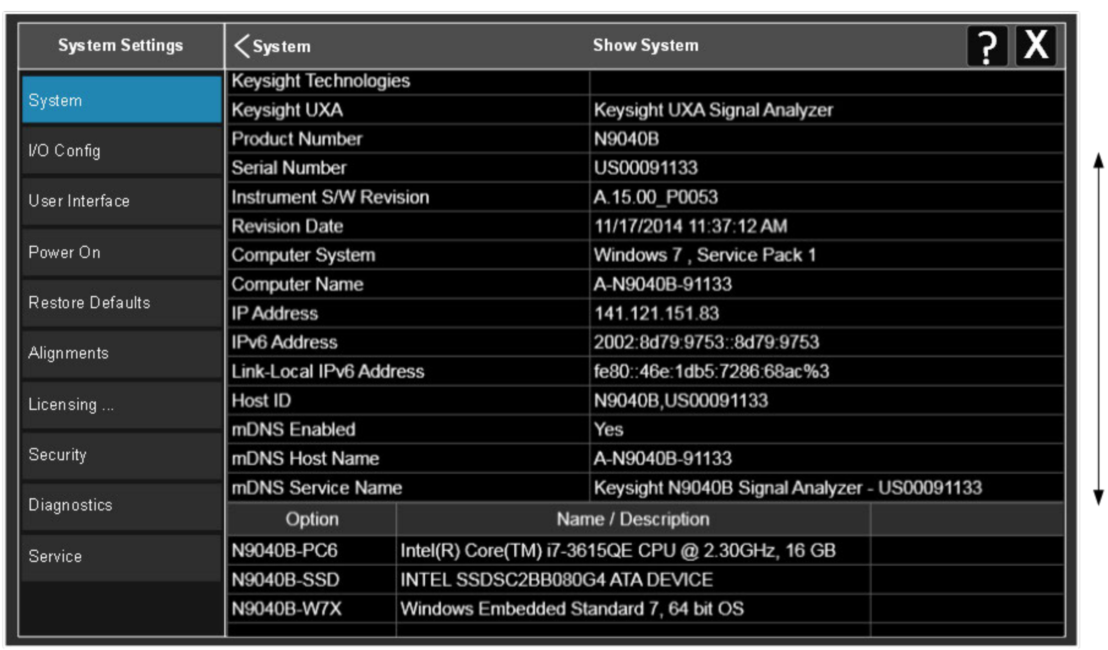
5.1 System

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`

5.1.1 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

5.1.2 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`

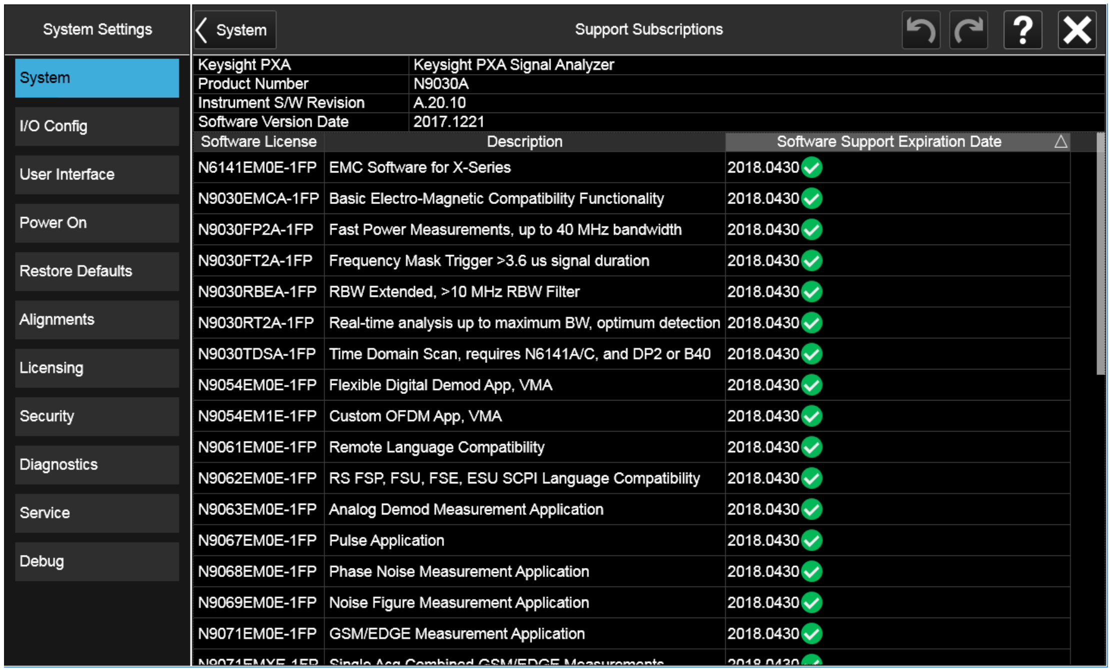
5.1.3 Show LXI

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`

5.1.4 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`

5.1.5 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`

5.1.6 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

5.1.7 Web Browser

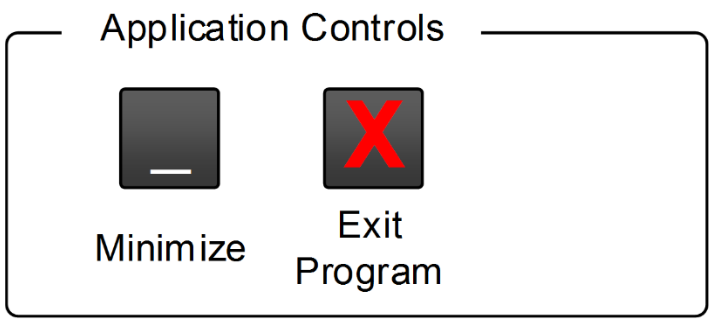
Launches the system's default **Web Browser**. Usually, the default is Microsoft Internet Explorer. A mouse and external keyboard are highly desirable for using

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.

5.1.8 Application Controls

Lets you Minimize or Exit the application.



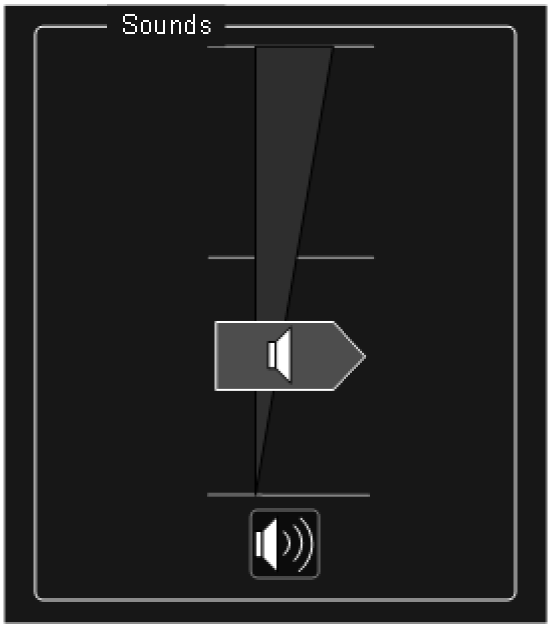
Pressing **Exit Program** displays a prompt asking if you are sure you want to close the program. If you choose **OK**, the entire analyzer application will shut down, and you will lose any unsaved trace or measurement data.

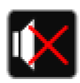
Notes	No equivalent remote command for this key

5.1.9 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

5.2 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.

5.2.1 GPIB

Activates a menu for configuring the GPIB I/O port.

Dependencies	This control is not available on the M9391A, M9393A, UXM or E7760

5.2.1.1 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

5.2.1.2 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

5.2.2 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 371
– "SCPI Socket" on page 371
– "SICL Server" on page 372
– "HiSLIP Server" on page 372

5.2.2.1 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`

5.2.2.2 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`

5.2.2.3 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`

5.2.2.4 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`

5.2.3 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

5.2.4 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.

5.2.4.1 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 374 :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.

5.2.4.2 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

5.2.5 LXI

Accesses various **LXI** configuration properties.

Dependencies	This control is not available on the M9391A or M9393A or UXM

5.2.5.1 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.

5.2.6 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.

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`

5.3.1 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)

5.3.2 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)

5.3.3 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

5.3.4 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)

5.3.5 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

5.3.6 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)

5.3.7 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)

5.3.8 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)

5.3.9 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)

5.3.10 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)

5.3.11 Screen Tabs Left/Right

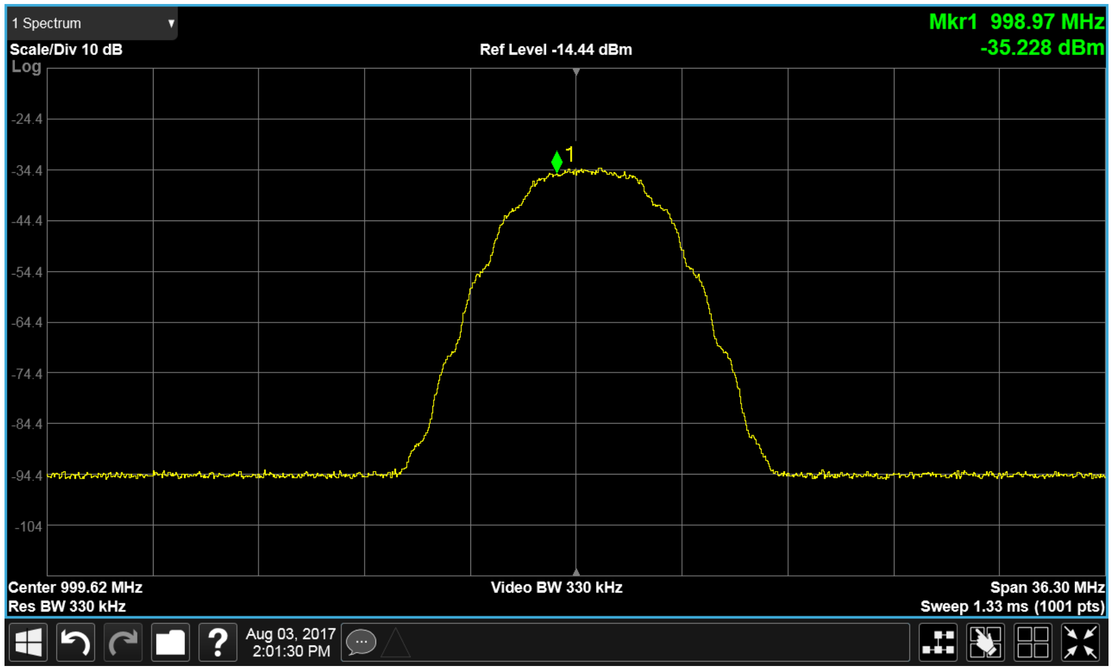
This switch, when in the RIGHt position, makes the screen tabs start on the right and build across to the left, thus minimizing the finger travel over to the screen tab when there is only one screen.

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)

5.3.12 Hide Screen Tabs in Full Screen

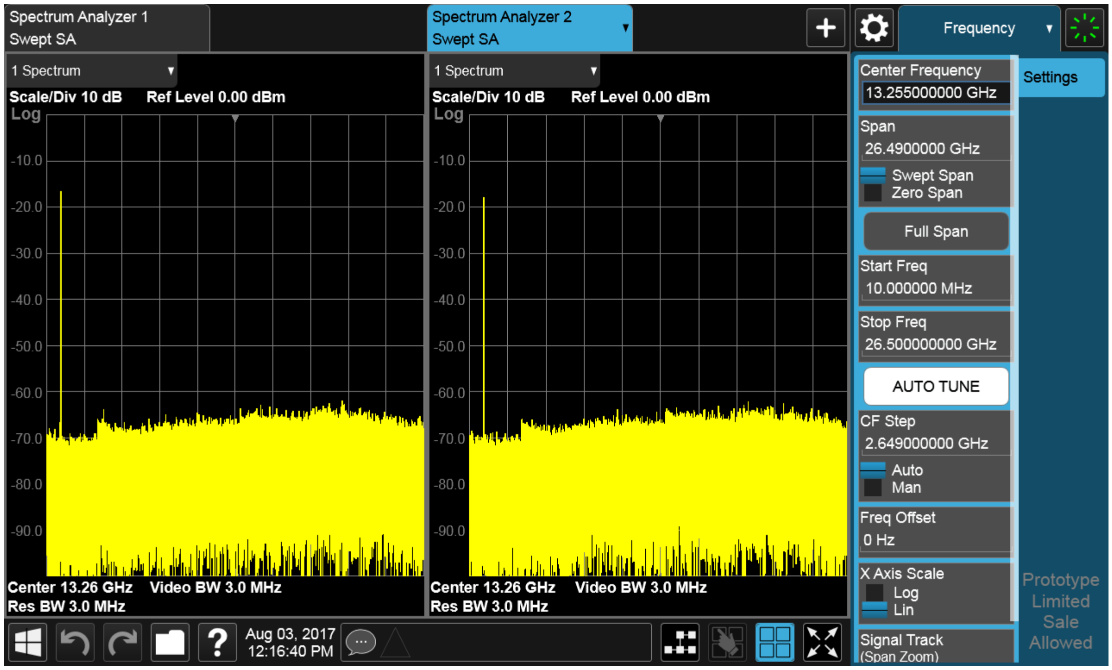
This switch, when in the ON position, causes the Screen Tabs to be hidden when in Full Screen view, thus maximizing the display area available for results. By also turning off the Meas Bar (in the **Display, Annotation** menu), you can maximize the available area for results, as shown below:



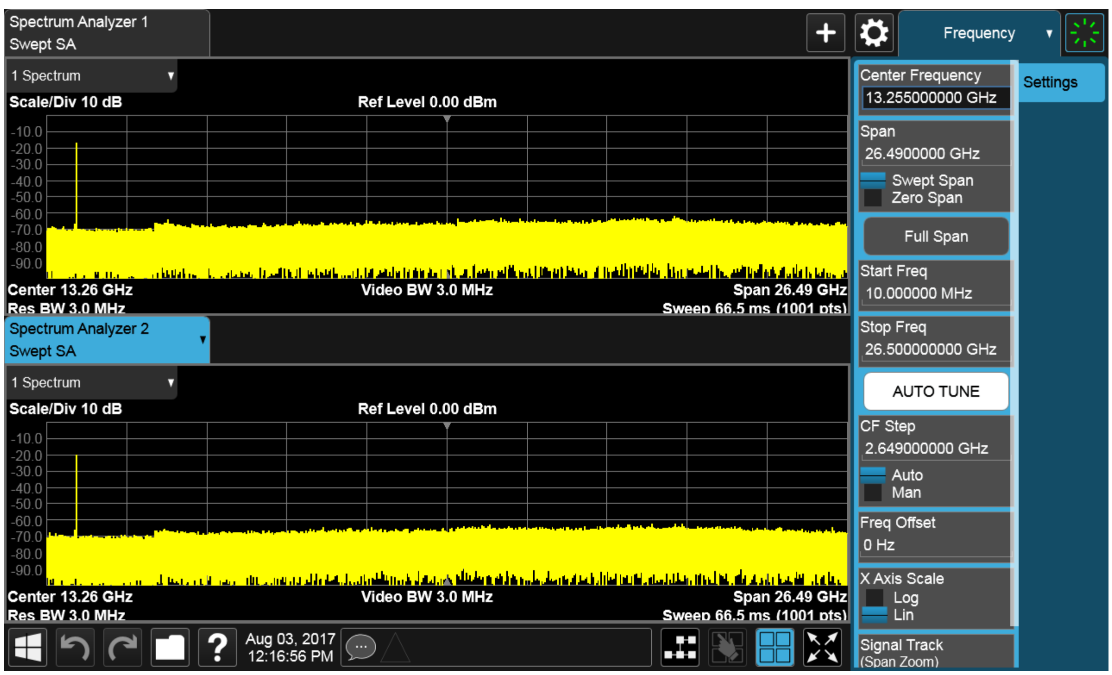
Remote Command	`:DISPlay:UINTerface:HTABs ON | OFF | 1 | 0` `:DISPlay:UINTerface:HTABs?`
Example	`:DISP:UINT:HTAB ON` Hide the tabs in full screen
Preset	This is unaffected by **Preset** but is set to `OFF` by **Restore User Interface Defaults** or **Restore System Defaults->All**
State Saved	Power On Persistent (survives shutdown and restart)

5.3.13 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**

5.3.14 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**

5.3.15 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`

5.4 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

5.4.1 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 388. 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 388, *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.

5.4.2 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

5.4.3 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.

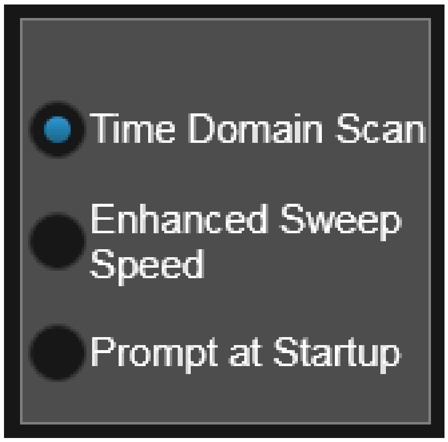
FPGA Updates When Firmware Installs

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

5.4.3.1 FPGA Load Preference

You may choose one image or the other from the radio buttons at the top of the dialog:



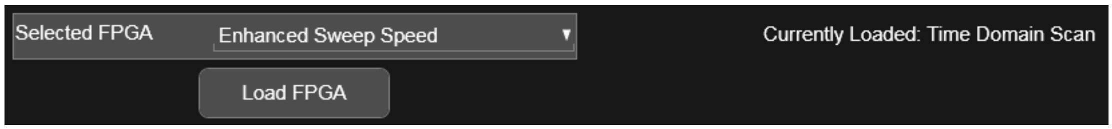
If you select the image that is already loaded, you will not be prompted again. If you select a different one, the Selected FPGA control changes to that one and you must then press the **Load FPGA** control to load the other image.

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**

5.4.3.2 Load FPGA

Depending on the "FPGA Load Preference" on page 391 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**

5.4.4 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`

5.4.5 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 394

– "Access to Configure Applications utility" on page 394

– "Virtual memory usage" on page 395

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.

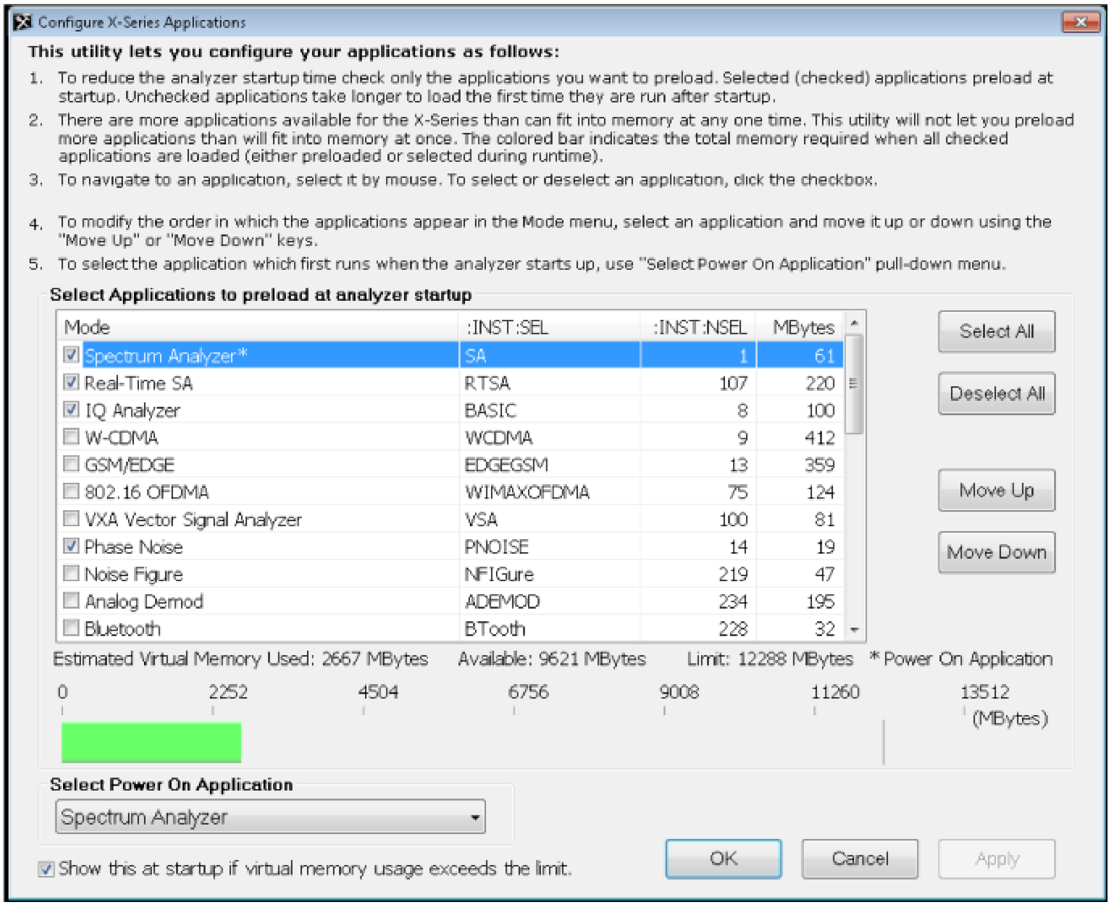
Note that there are more applications available for the X-Series than can fit into Windows Virtual Memory. By allowing you to choose which licensed applications to load at startup, the **Configure Applications** utility allows you to make optimal use of the instrument memory.

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.

5.4.6 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.

5.5 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

5.5.1 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`

5.5.2 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

5.5.3 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 122

"Onscreen Keyboard key" on page 123

"Touch On/Off Key" on page 124

"Tab key" on page 125

5.5.4 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

5.5.5 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`

5.5.6 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`

5.5.7 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`

5.6 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.

5.6.1 Auto Align

Lets you configure the automatic background alignments and the alerts from the automatic alignment system.

Dependencies	Does not appear in VXT

5.6.1.1 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 402 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.

5.6.1.2 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

5.6.1.3 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 405

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.

5.6.2 Align Now

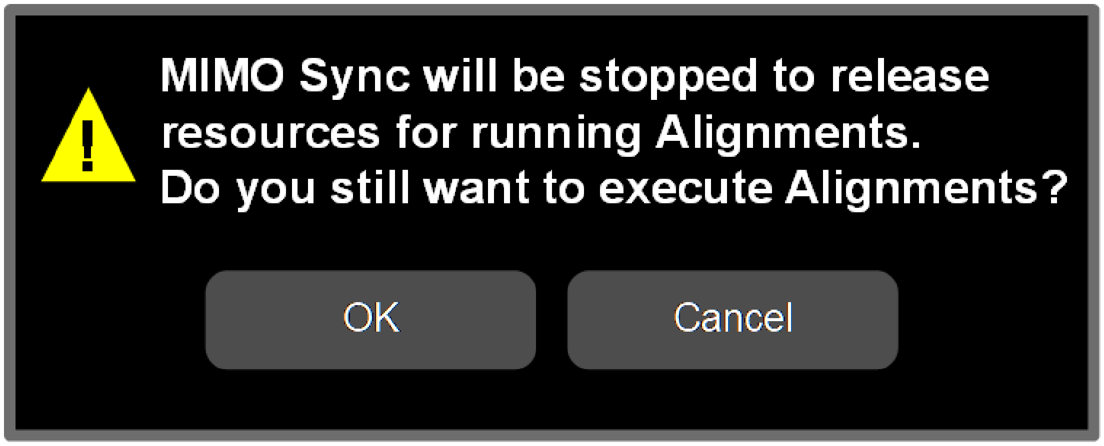
Accesses alignment processes that are immediate action operations. They perform complete operations and run until they are complete.

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).

5.6.2.1 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

5.6.2.2 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)

5.6.2.3 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)

5.6.2.4 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

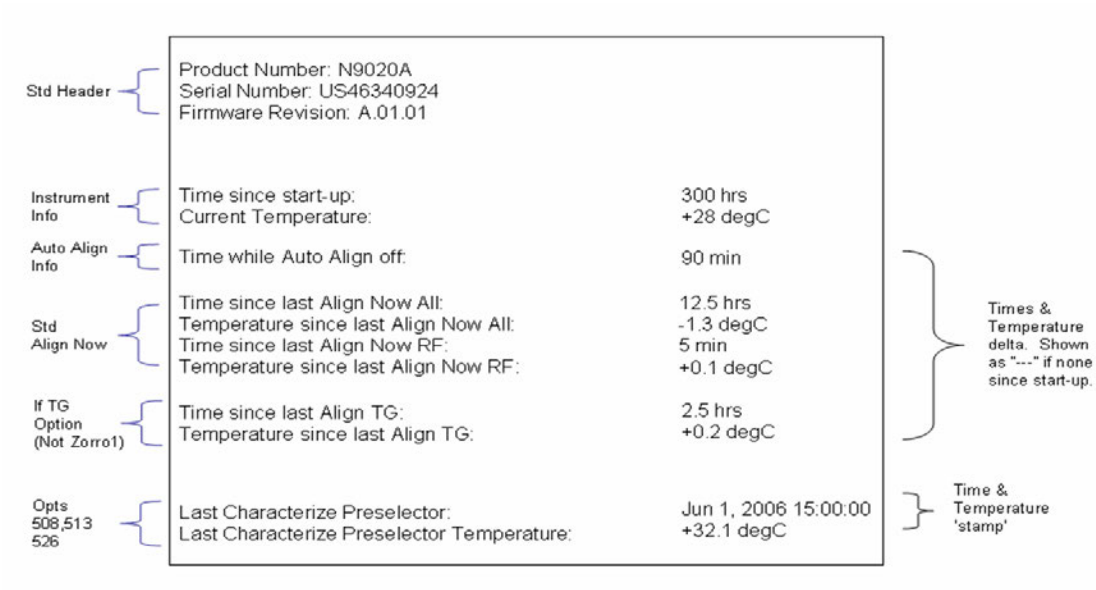
5.6.3 Show Alignment Statistics

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 which are 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 will set the Last Align RF temperature to the current temperature, and reset the Last Align RF time. A successful Align Now All or Align Now All but RF will set the Last Align Now All temperature to the current temperature, and reset the Last Align Now All time. A successful Align Now All will also reset the Last Align RF items if the RF portion of the Align Now succeeded.

Notes	The values displayed on the screen are only updated upon entry to the screen and not updated while the screen is being displayed

5.6.4 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

5.6.4.1 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.

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 a "Restore System Defaults->Align".
State Saved	No

5.6.4.2 User Value

Allows setting 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.

Notes	If the value of the timebase is changed the alignment system automatically performs an alignment or alerts that an alignment is due
Preset	This is unaffected by Preset but is set to the factory setting on a "Restore System Defaults->Align"
State Saved	No
Min	0
Max	16383

5.6.5 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

5.6.5.1 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)

5.6.5.2 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 417

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

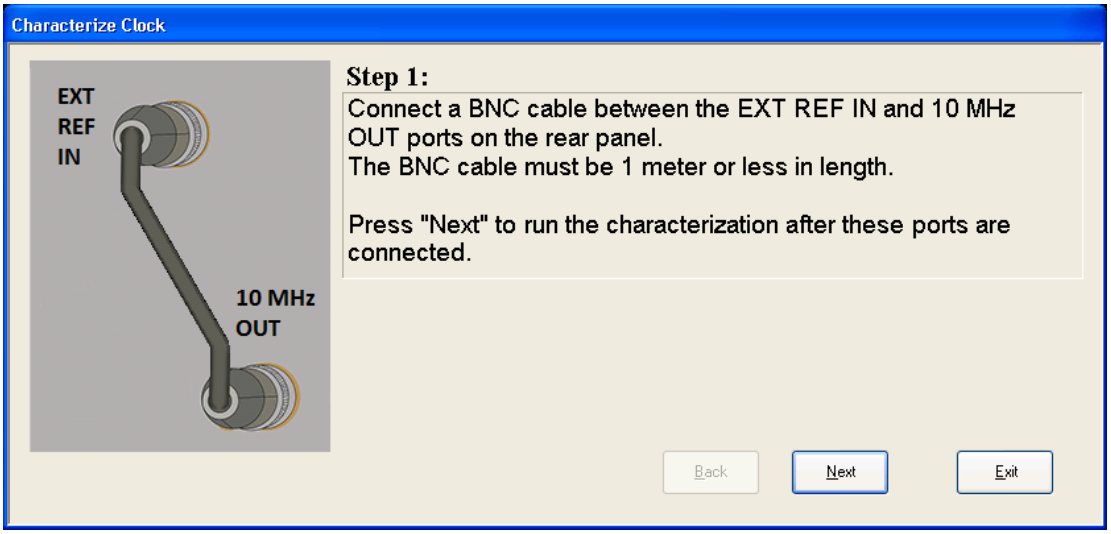
Remote Command	`:CALibration:REFerence:CLOCk:END?`
Example	`:CAL:REF:CLOC:END?`
Notes	Returns 0 if successful, or 1 if failed
Dependencies	Option DP2 or B40
Couplings	Expected to be run after sending the `:CAL:REF:CLOC?` query, and after removing the cable used in that Characterize Reference Clock step. 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

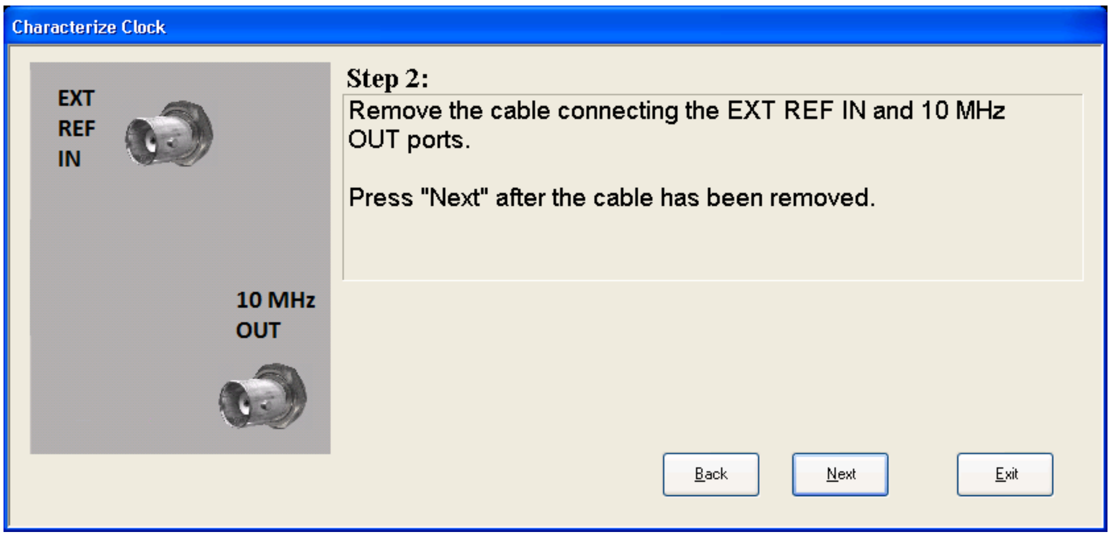
Front panel guided calibration sequence

When selecting **Characterize Reference Clock** via the front panel, the following form is displayed.

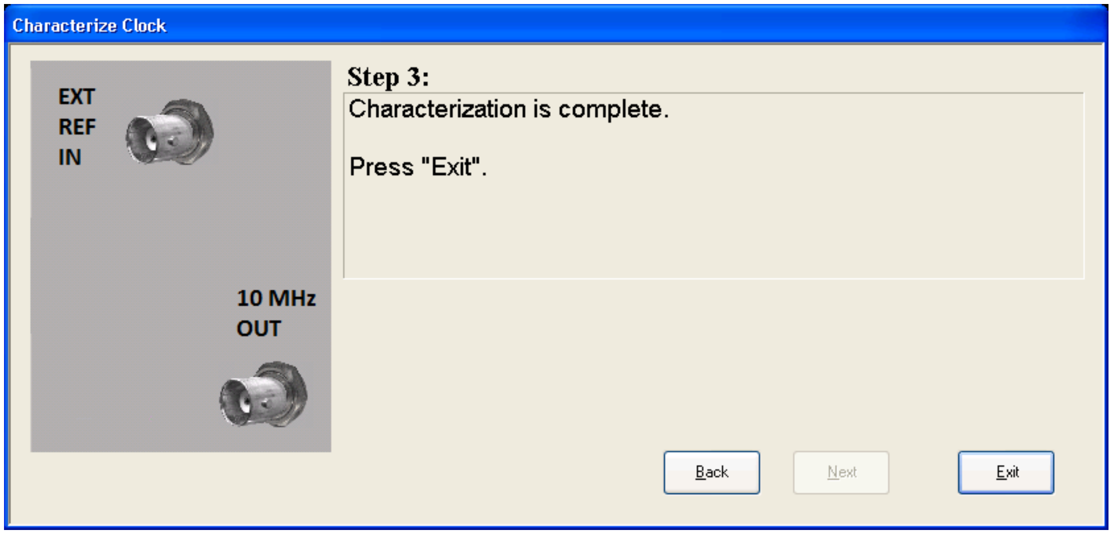
Step 1 of the guided calibration sequence:



Step 2 of the guided calibration sequence:



Step 3 of the guided calibration sequence:



5.6.5.3 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

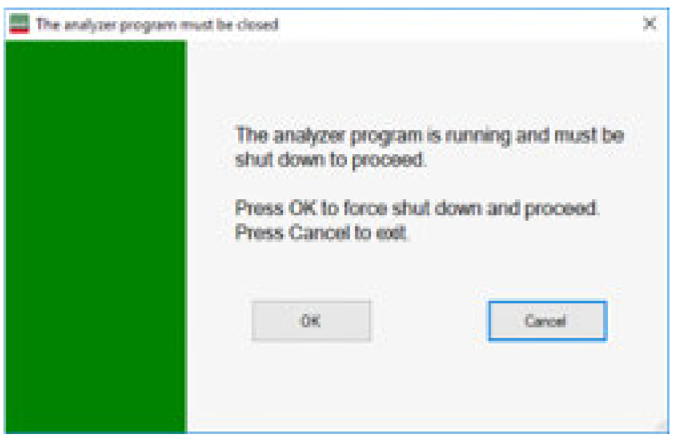
Remote Command	`:CALibration:TEMPerature:NFLoor?`
Example	`:CAL:TEMP:NFL?`
Notes	Value is the temperature of the last successful **Characterize Noise Floor** was executed Returns “” if no **Characterize Noise Floor** has ever been performed on the instrument
Dependencies	In models that do not include 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

5.6.6 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 422) 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 432) will be invoked and will prompt you to restore that backup.

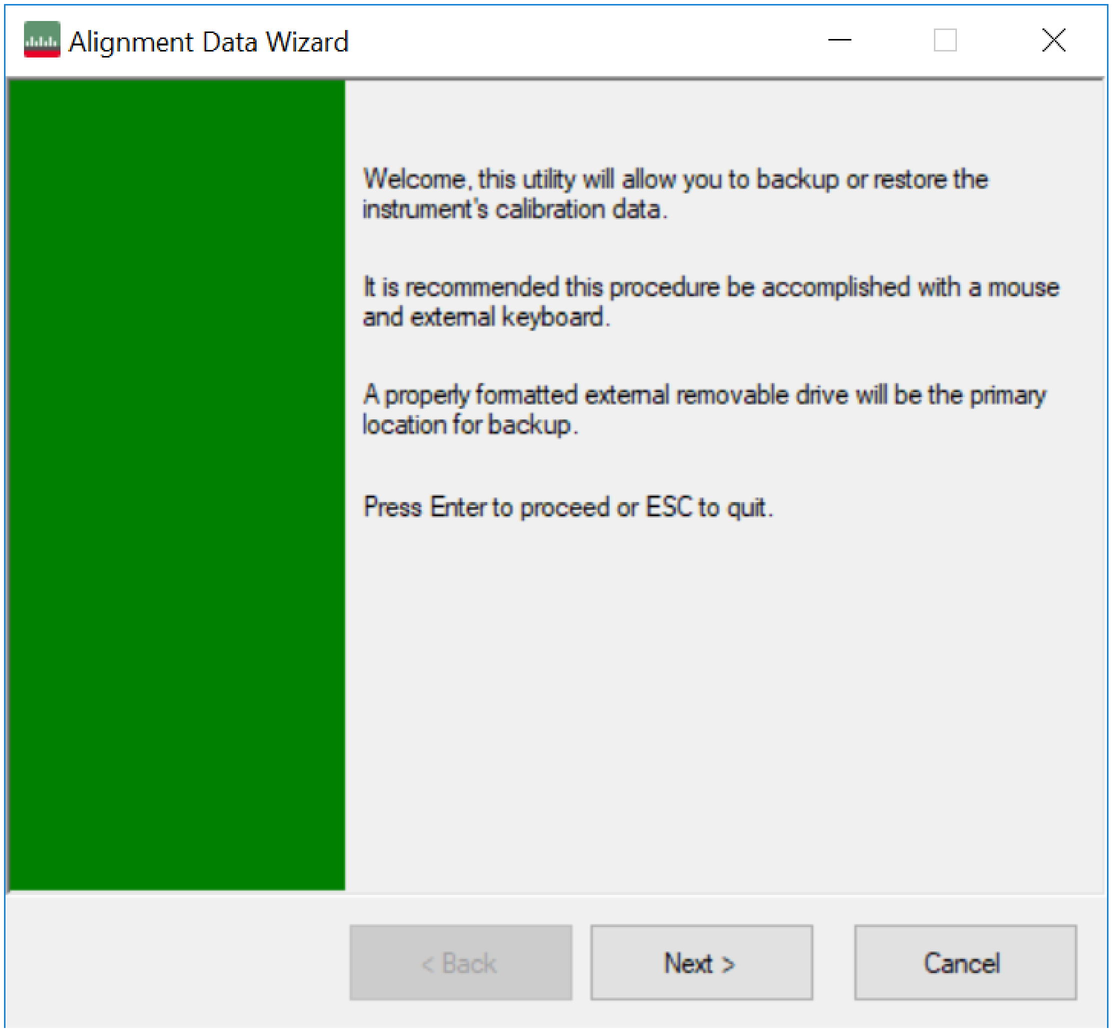
For purposes of these instructions, “alignment data” and “calibration data” are used interchangeably.

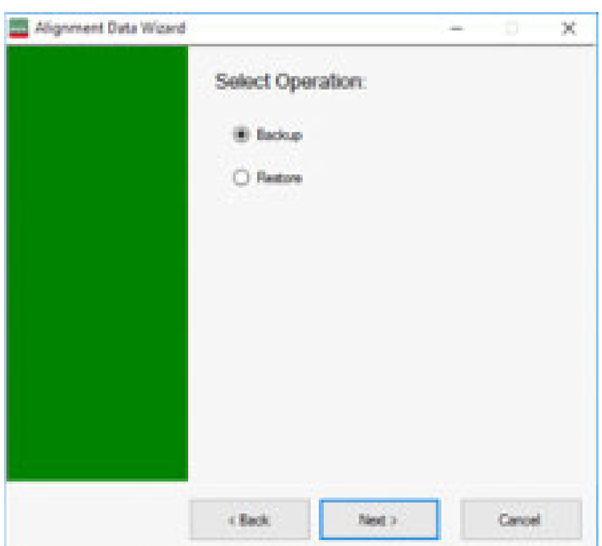
Dependencies	This menu is not available on the M9391A or M9393A or UXM

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

5.6.6.1 Alignment Data Wizard (without Flash)

Guides you through the operation of backing-up or restoring the alignment data.

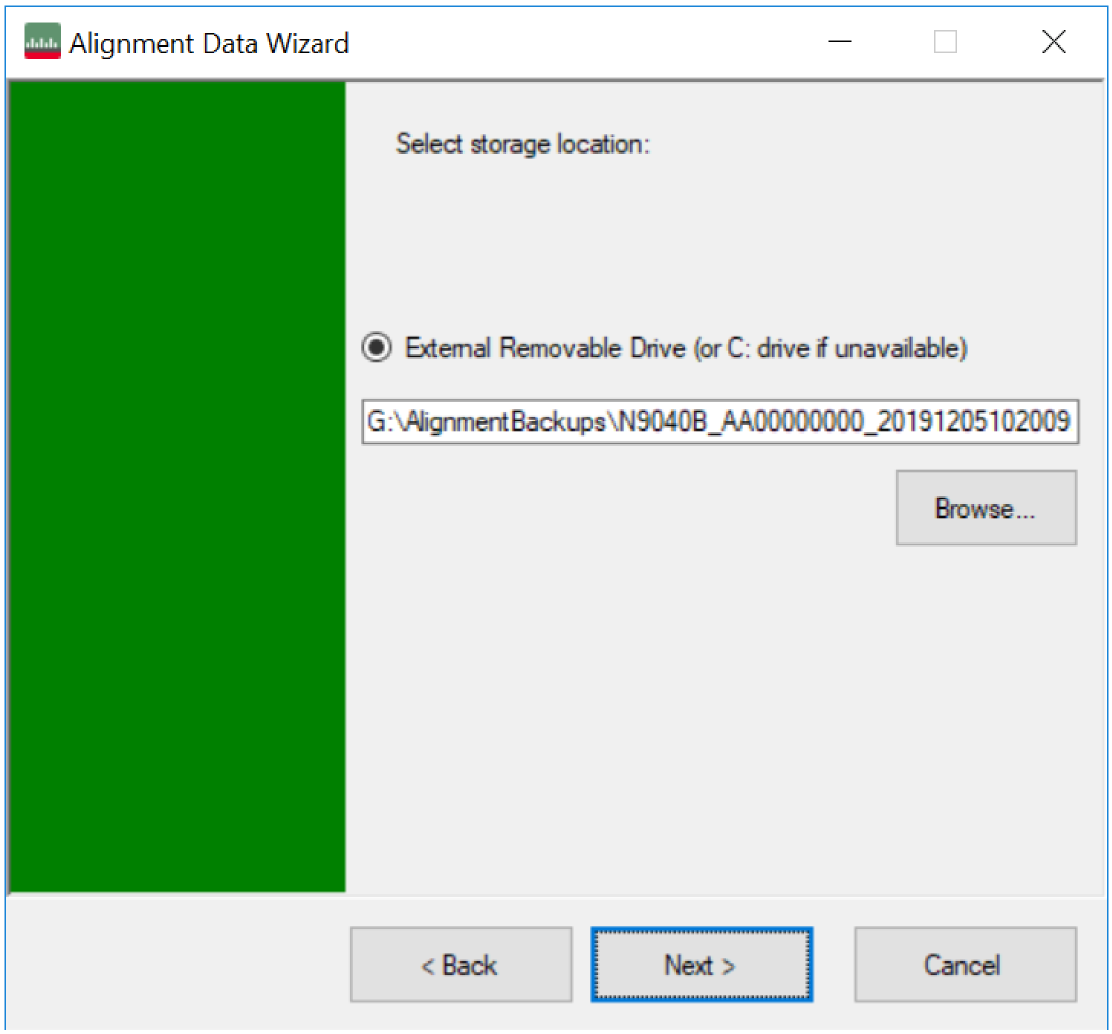

Alignment Data Wizard
Welcome, this utility will allow you to backup or restore the instrument's calibration data.
It is recommended this procedure be accomplished with a mouse and external keyboard.
A properly formatted external removable drive will be the primary location for backup.
Press Enter to 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`.

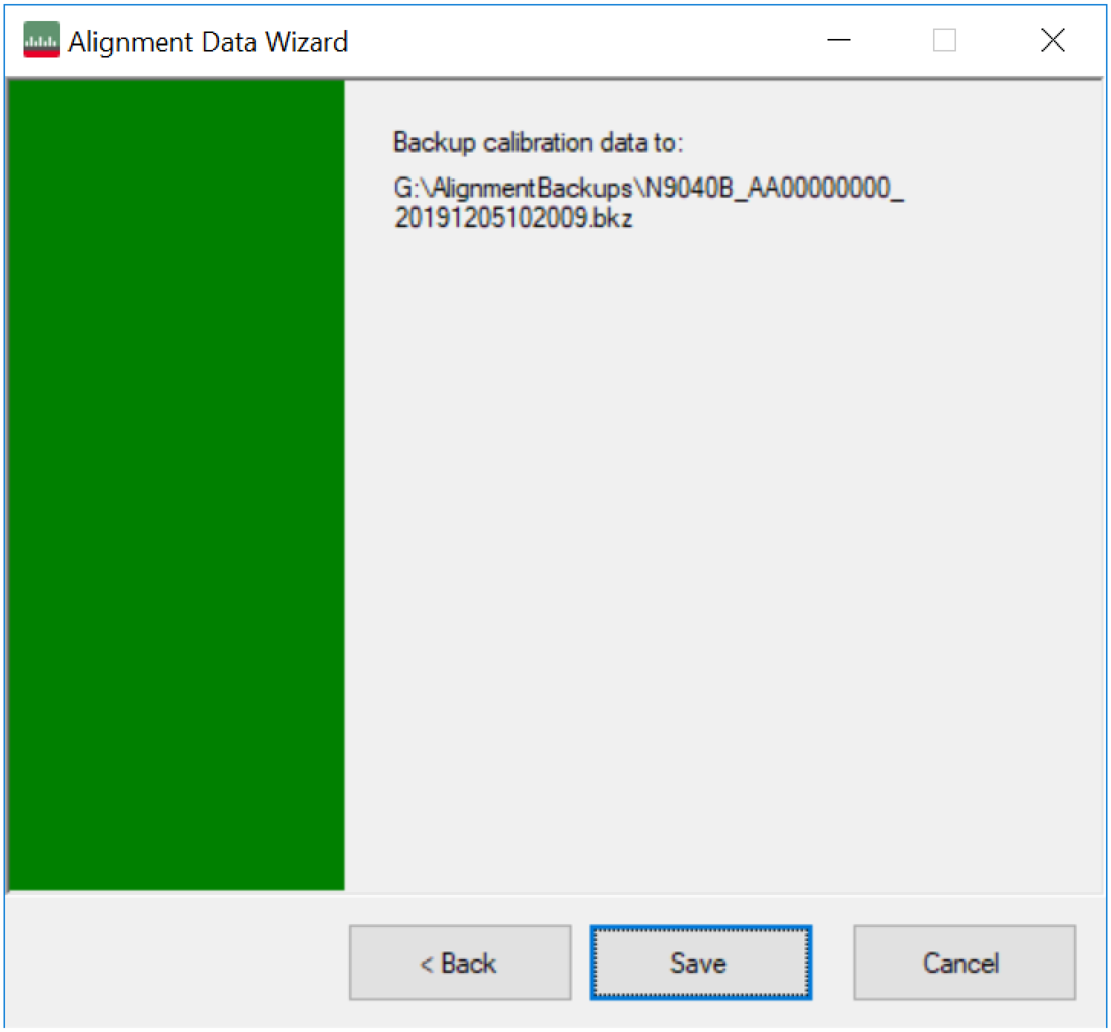
The default file extension for legacy backup files was `.bak`. The Backup and Restore operations support both the `.bak` (legacy format) and `.bkz` formats.

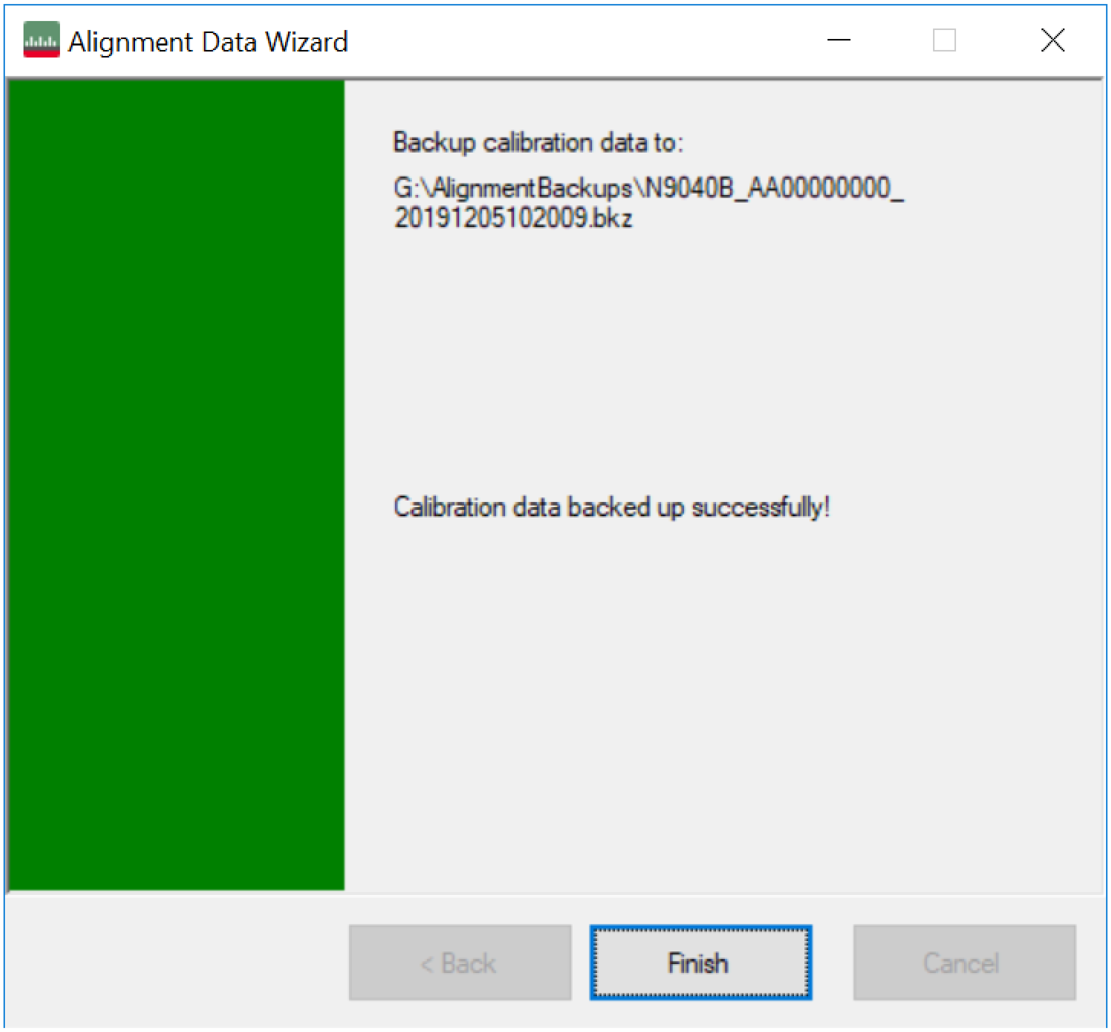


If a USB drive is present, it will be selected by default. The path defaults to the `AlignmentBackups` folder, and a filename is automatically created, in the form: `<model>_<serial number>_<date><time>.bkz`

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:

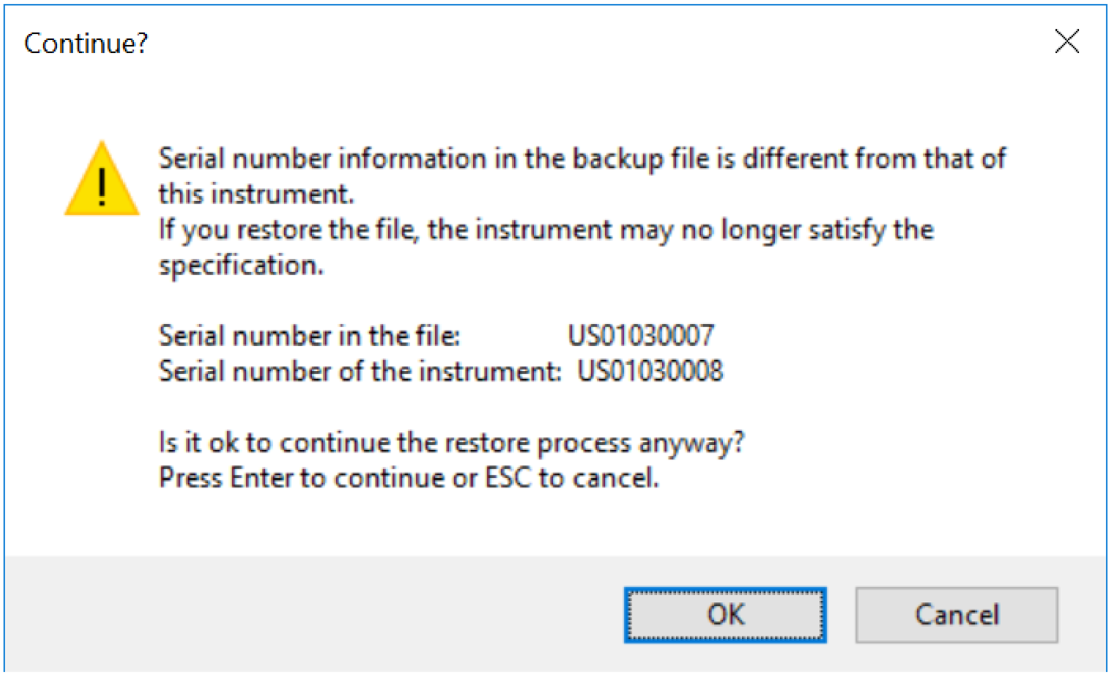
When the **Next >** button is pressed, you will be prompted to create a new folder if the chosen path does not yet exist.



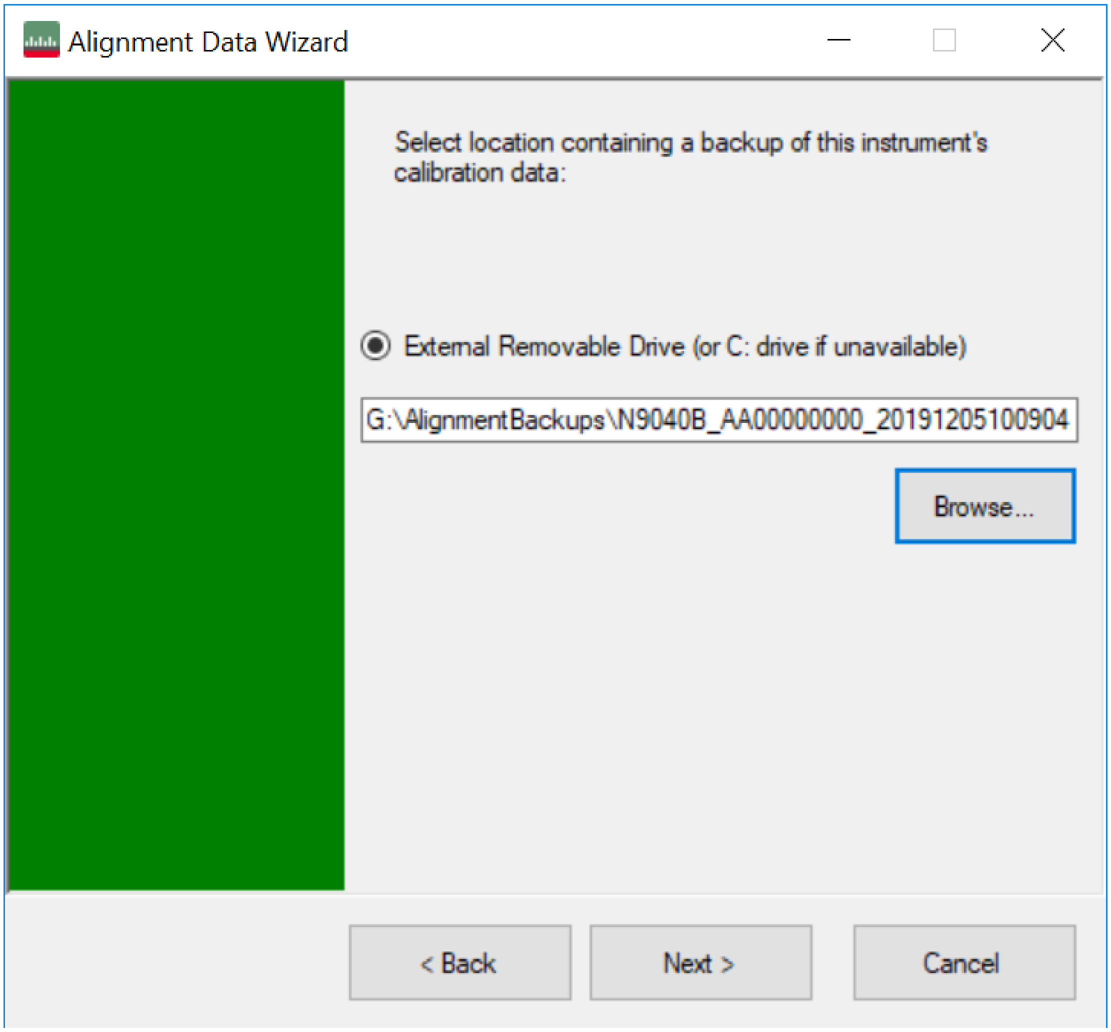


The restore operation checks the validity of the restore file using the database's built-in file validation. If the restore file is corrupt, the existing alignment data will remain in use.

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):

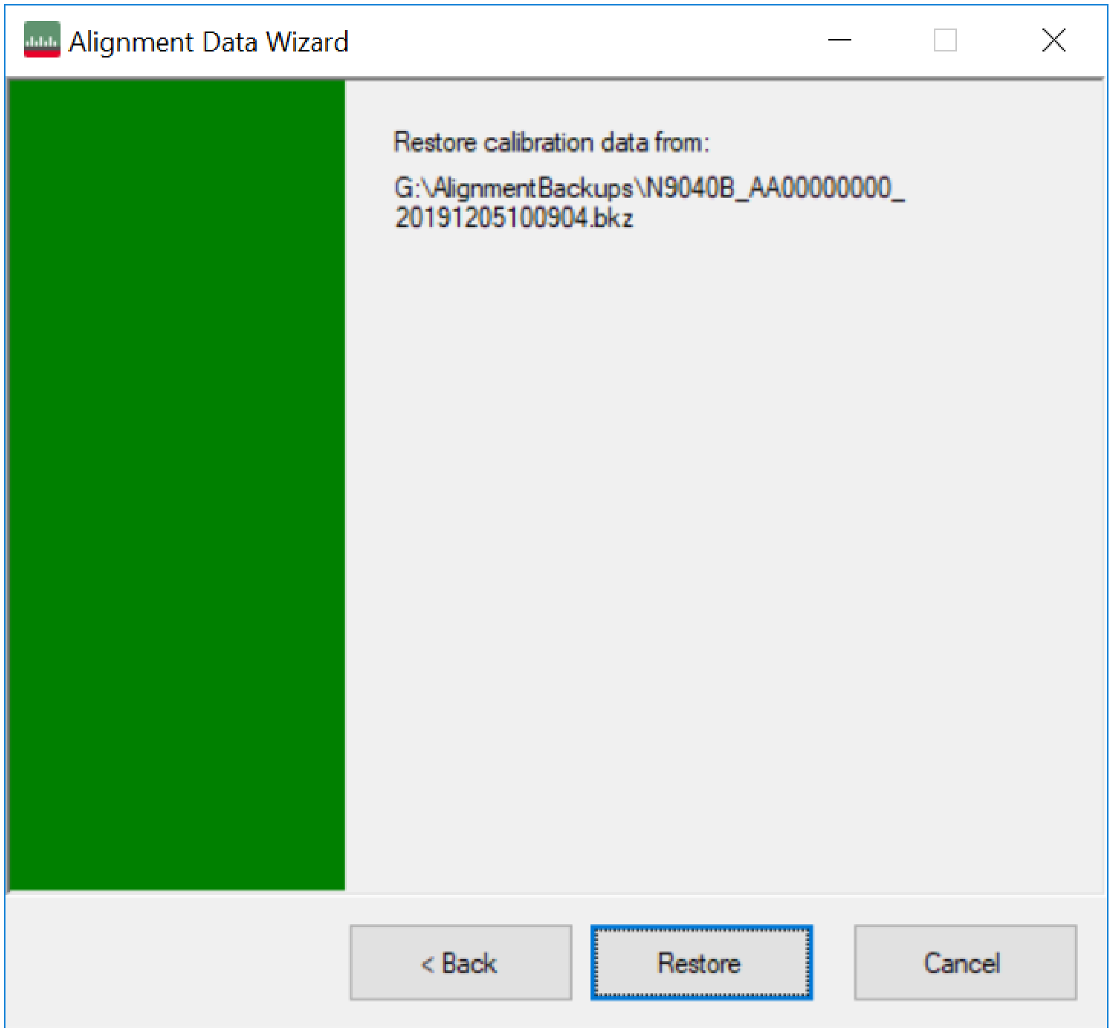


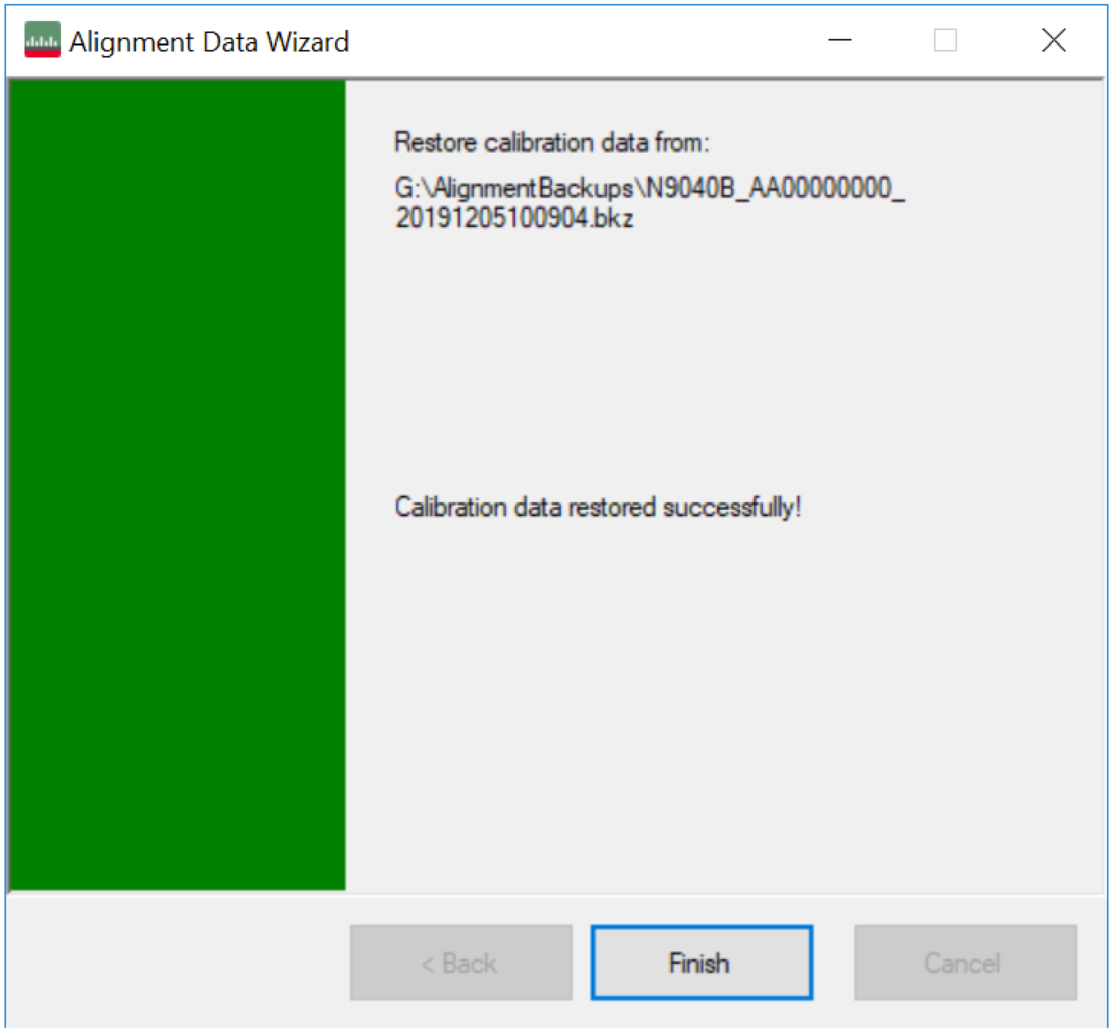
The default restore location for instruments *without* internal flash will be the first drive identified as an external drive (USB or LAN) if such is available; or, if not, the internal D: partition. The default restore file will be the most recent file that matches the default backup file name format: <model number>_<serial number>_<date>.bkz



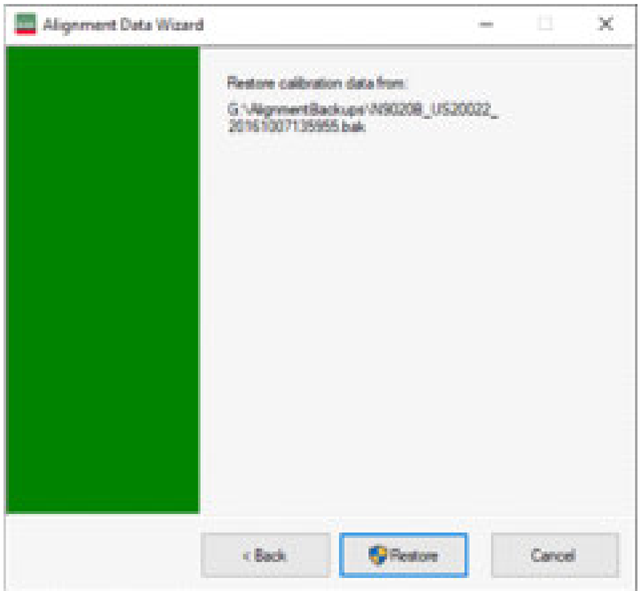
Changing the drive letter also modifies the path displayed in the box below. When this step is first loaded, the drive drop-down menu is populated with connected drives, which provide you with read access.

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).



5.6.6.2 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).

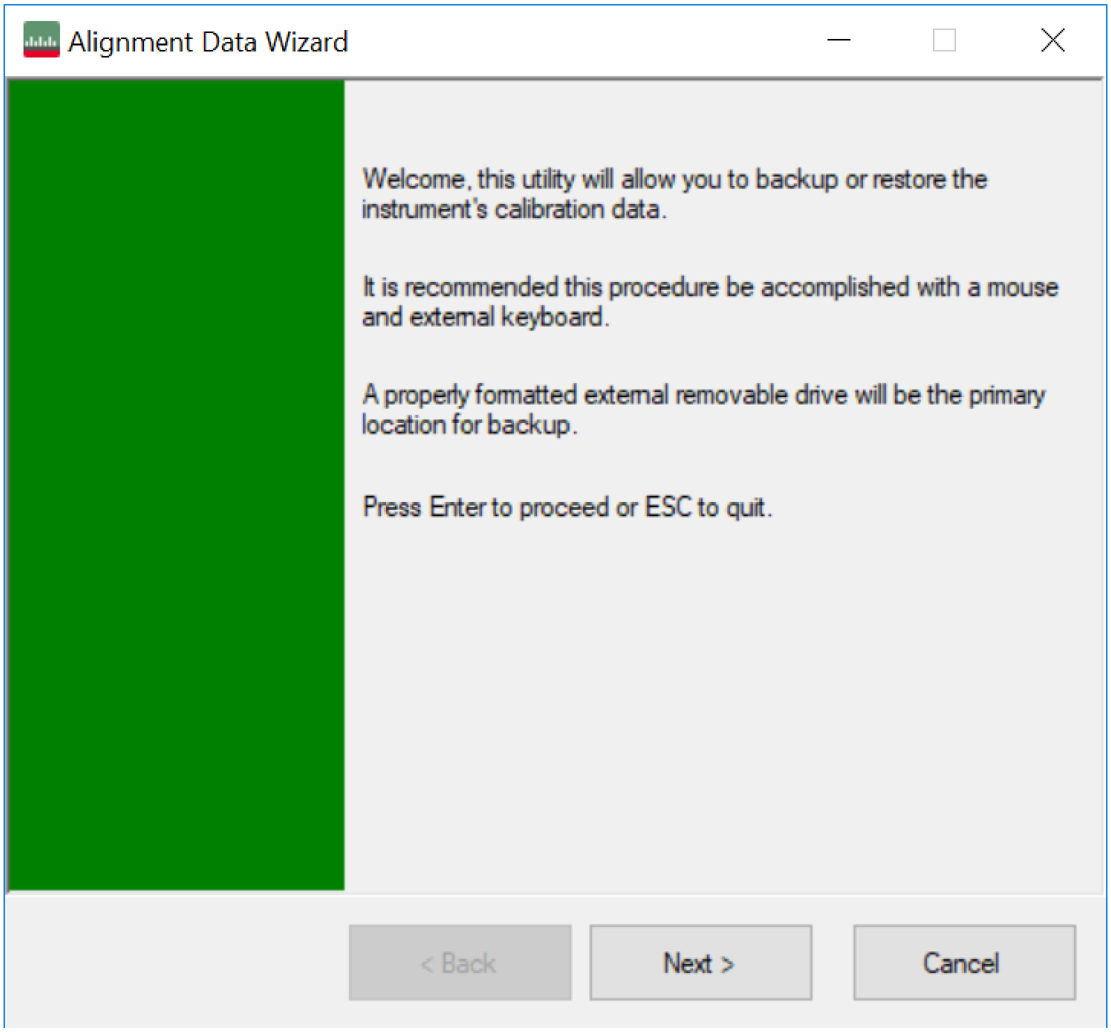
Remote Command	:CALibration:DATA:BACKup <filename>
Example	:CAL:DATA:BACK "F:\AlignDataBackup_N9020A_US00000001_2008140100.bkz"

5.6.6.3 Perform Restore (With Flash) (Remote Command Only)

Invokes an alignment data restore operation from the internal flash EEPROM.

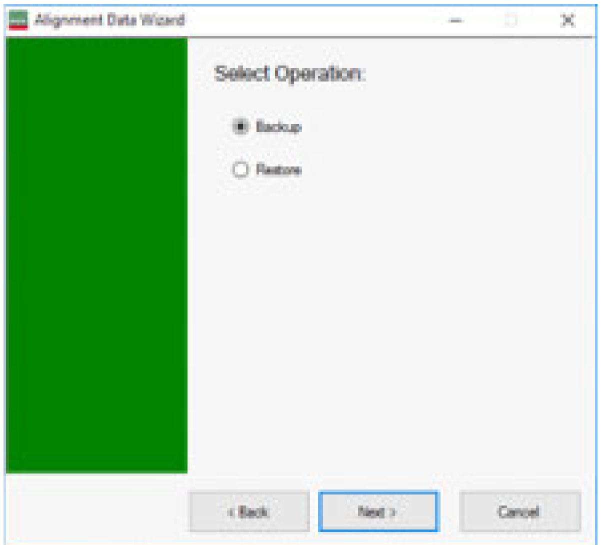
Remote Command	:CALibration:DATA:INTernal:RESTore
Example	:CAL:DATA:INT:REST

5.6.6.4 Alignment Data Wizard (with Flash)



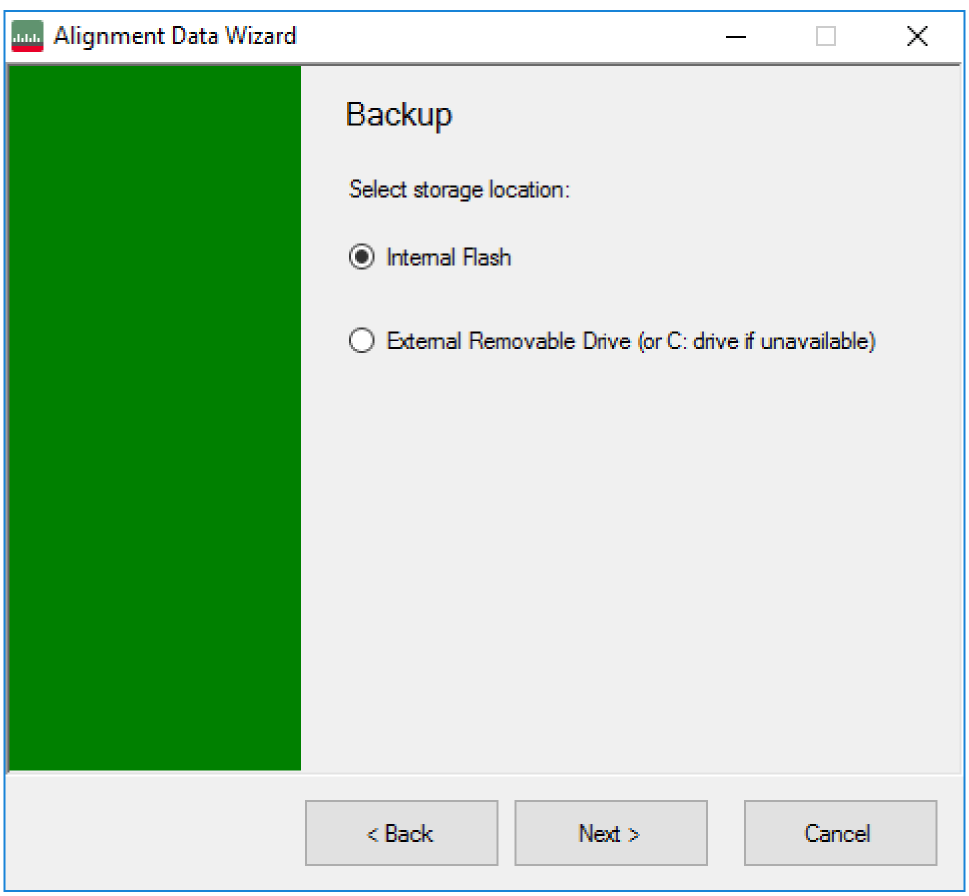
If your instrument has Processor Assembly type PC6S or PC7S (see "Show System" on page 363) the instrument has an internal flash EEPROM that can store a backup of the alignment data. In this case, the interface to the Alignment Data Wizard is enhanced to accommodate this internal storage. This section details the use of this internal flash. For details on using external storage, see the previous section ("Alignment Data Wizard (without Flash)" on page 422).

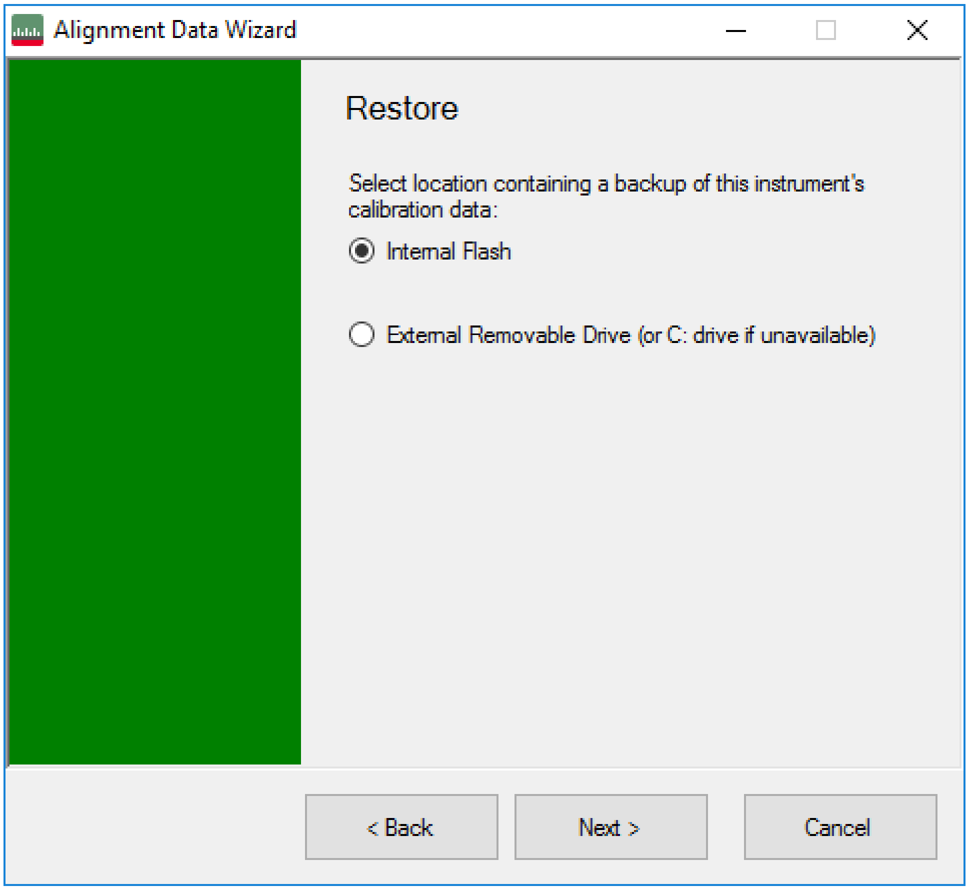
The Alignment Data Wizard guides you through the operations of backing up or restoring alignment data.



Having selected **Backup** or **Restore**, you then select the source or destination for the alignment data. As shown below, you can select either:

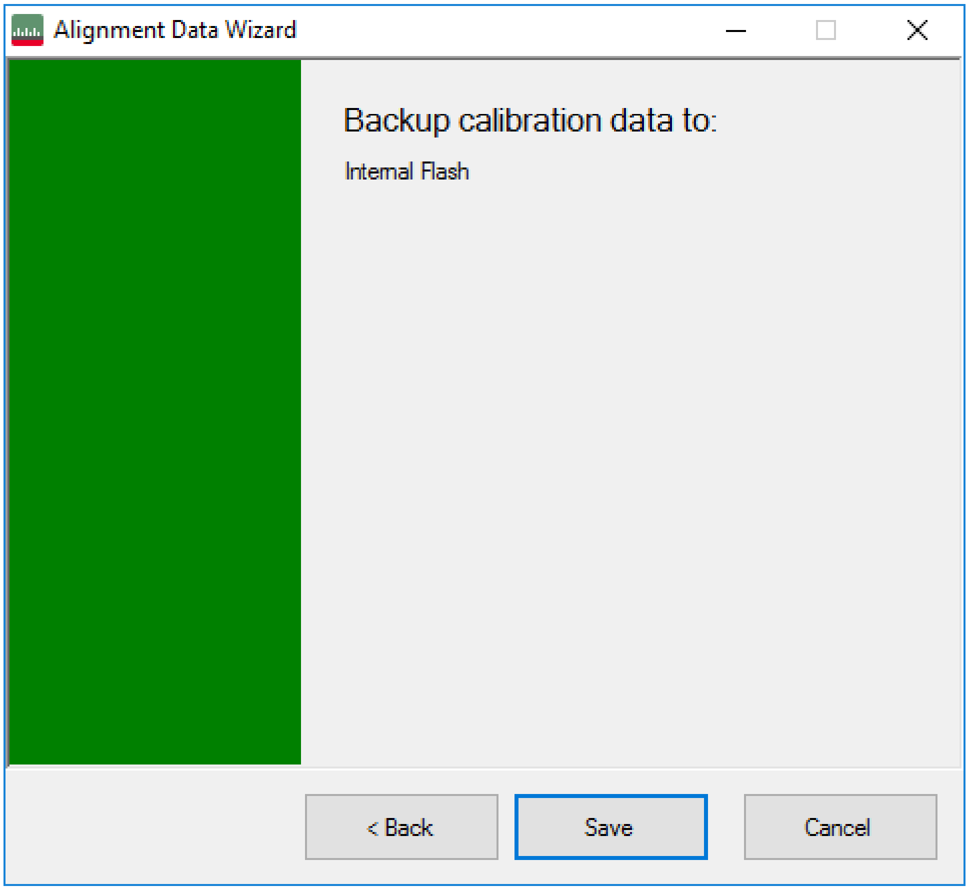
- Internal flash EEPROM, or,
- External Removable Drive (which includes the SD card described in "Backup or Restore Align Data..." on page 421)

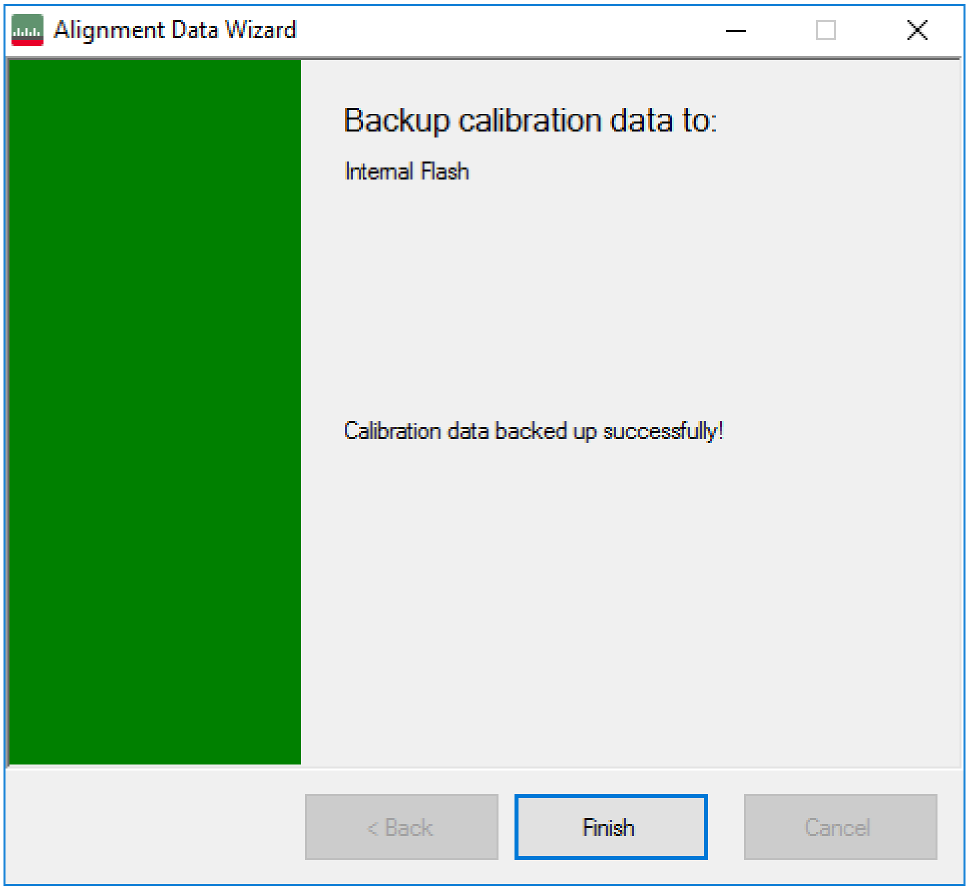




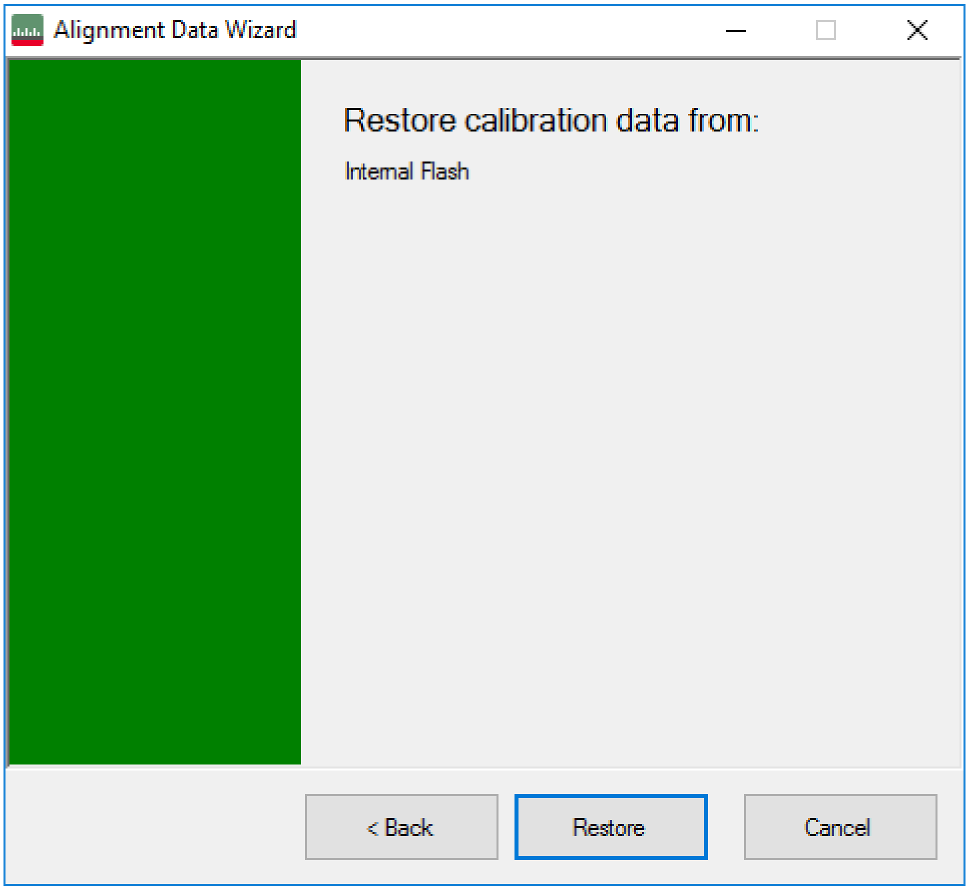
The final page of the wizard asks you to confirm the choices made in the previous pages. When the operation is complete, an indication is displayed on the same page, as below.

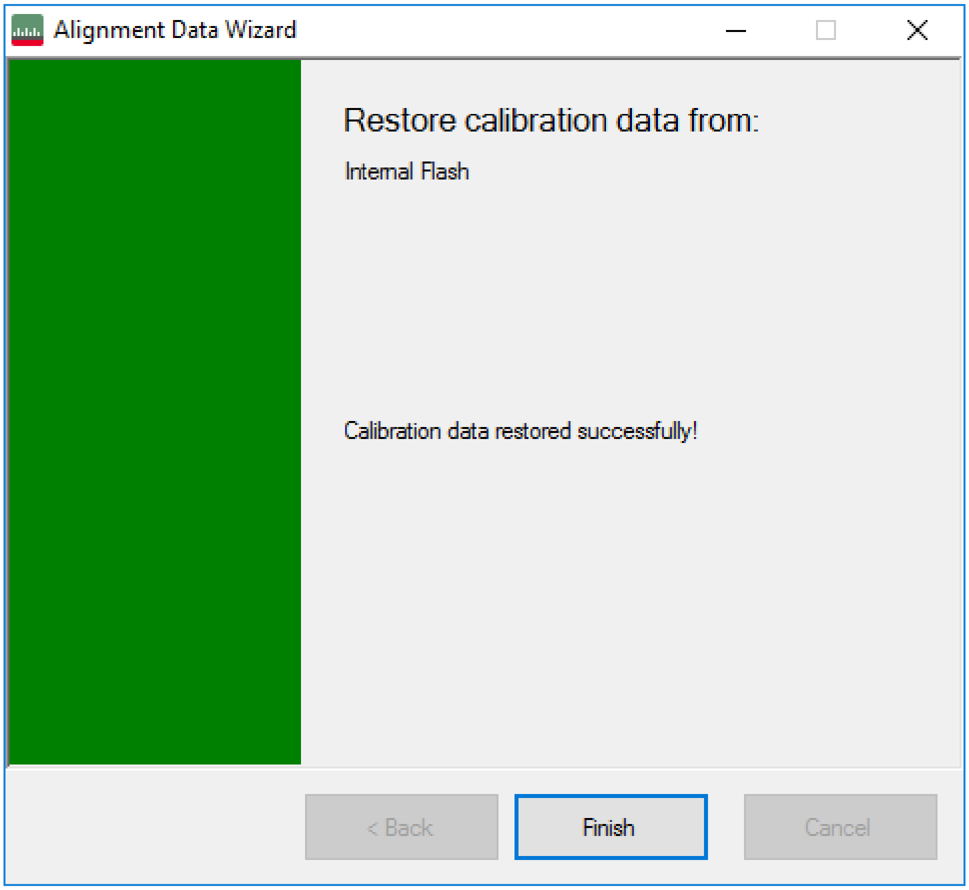
Backup:


Alignment Data Wizard
Backup calibration data to:
Internal Flash
< Back
Save
Cancel

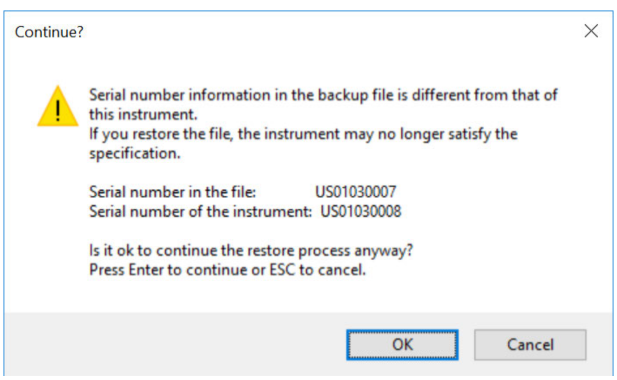

Alignment Data Wizard
Backup calibration data to:
Internal Flash
Calibration data backed up successfully!
< Back
Finish
Cancel

Restore:

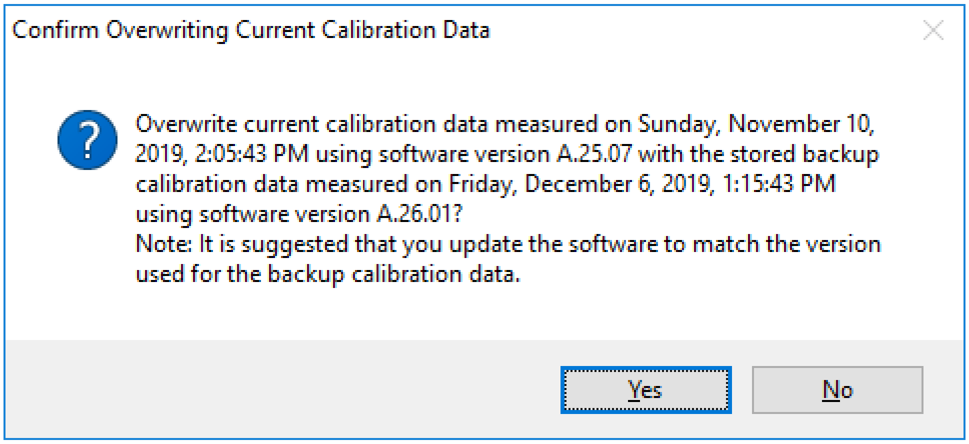

Alignment Data Wizard
Restore calibration data from:
Internal Flash
< Back
Restore
Cancel



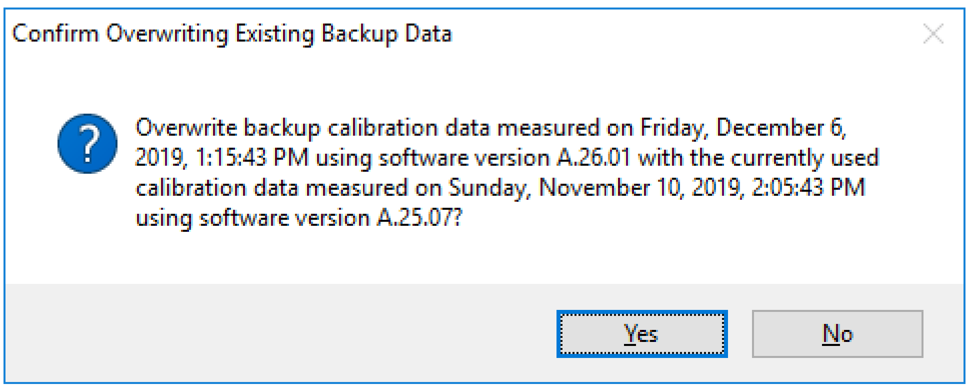
When restoring alignment data, if the serial number information in the backup file being restored is different from that of the instrument, the following message appears (the serial numbers shown are examples):



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):



5.6.6.5 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`

5.6.6.6 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`

5.6.7 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

5.7 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

5.7.1 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

5.7.2 Restore Security Defaults

Sets USB Read/Write to Enable.

NOTE This control is only available to users with Administrator privileges.

5.8 Diagnostics

Displays a slider that allows you to view Hardware Statistics.

Dependencies	This menu is not available on the M9391A or M9393A or UXM

5.8.1 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

5.8.2 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

5.8.3 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

5.8.4 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

5.9 Licensing

Accesses capabilities for configuring the licenses in your instrument.

5.9.1 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 445
– "Remove License (Remote Command Only)" on page 445
– "List Licenses (Remote Command Only)" on page 446
– "Validate License (Remote Command Only)" on page 446
– "Host ID Query (Remote Command Only)" on page 447
– "List Borrowed Licenses (Remote Command Only)" on page 447
– "Return a Borrowed License (Remote Command Only)" on page 447

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

5.9.2 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.

5.9.3 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

5.9.4 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

5.9.5 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)

5.9.6 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”

5.9.7 Host ID Query (Remote Command Only)

Returns the Host ID as a string.

Remote Command	:SYSTem:HID?

5.9.8 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

5.9.9 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”

5.10 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

5.11 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

6 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

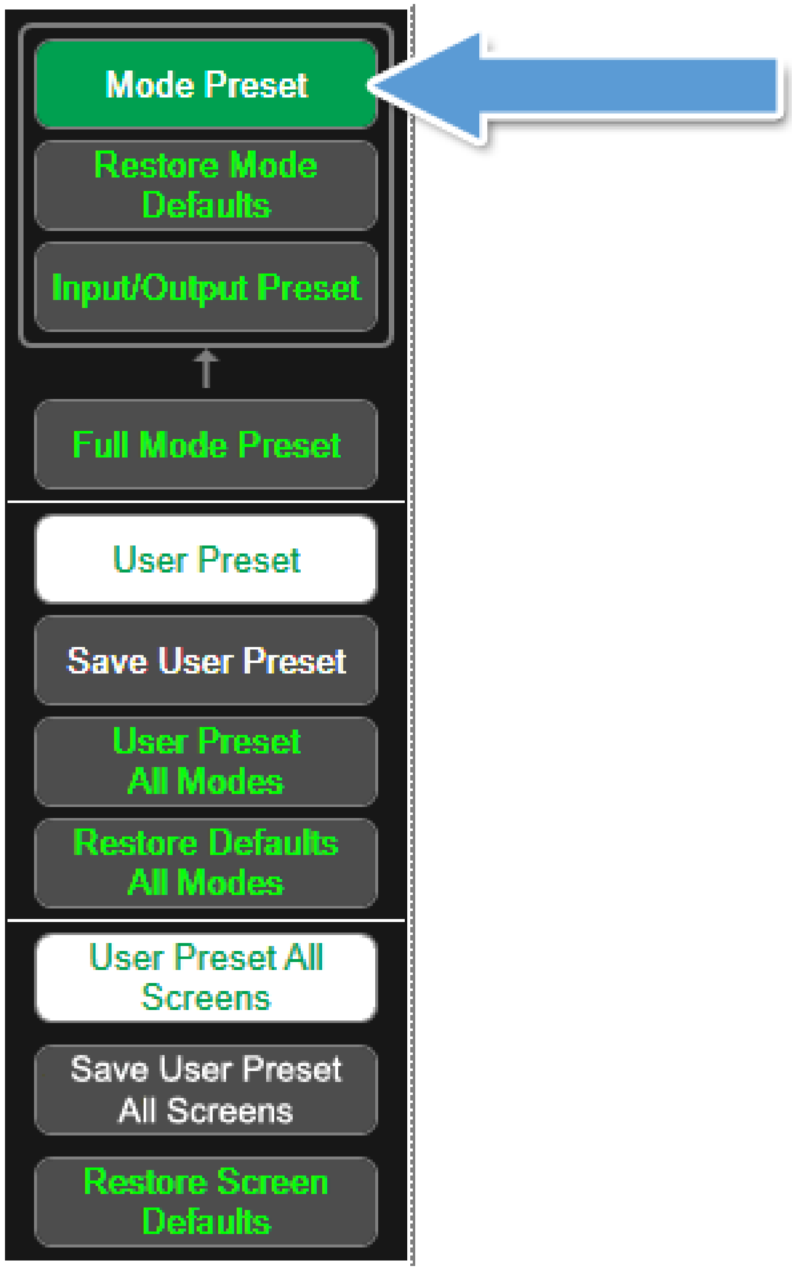
Type Of Preset	SCPI Command	Scope of Preset	Front Panel Access
		Does not preset the RF Source	System Menu, Restore Defaults
Full Mode Preset	:SYSTem:PRESet:FULL	Same as doing Mode Preset, Restore Mode Defaults and Input/Output Preset. Essentially a factory preset of the current Mode Presets the RF Source	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

6.1 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 450 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 642
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

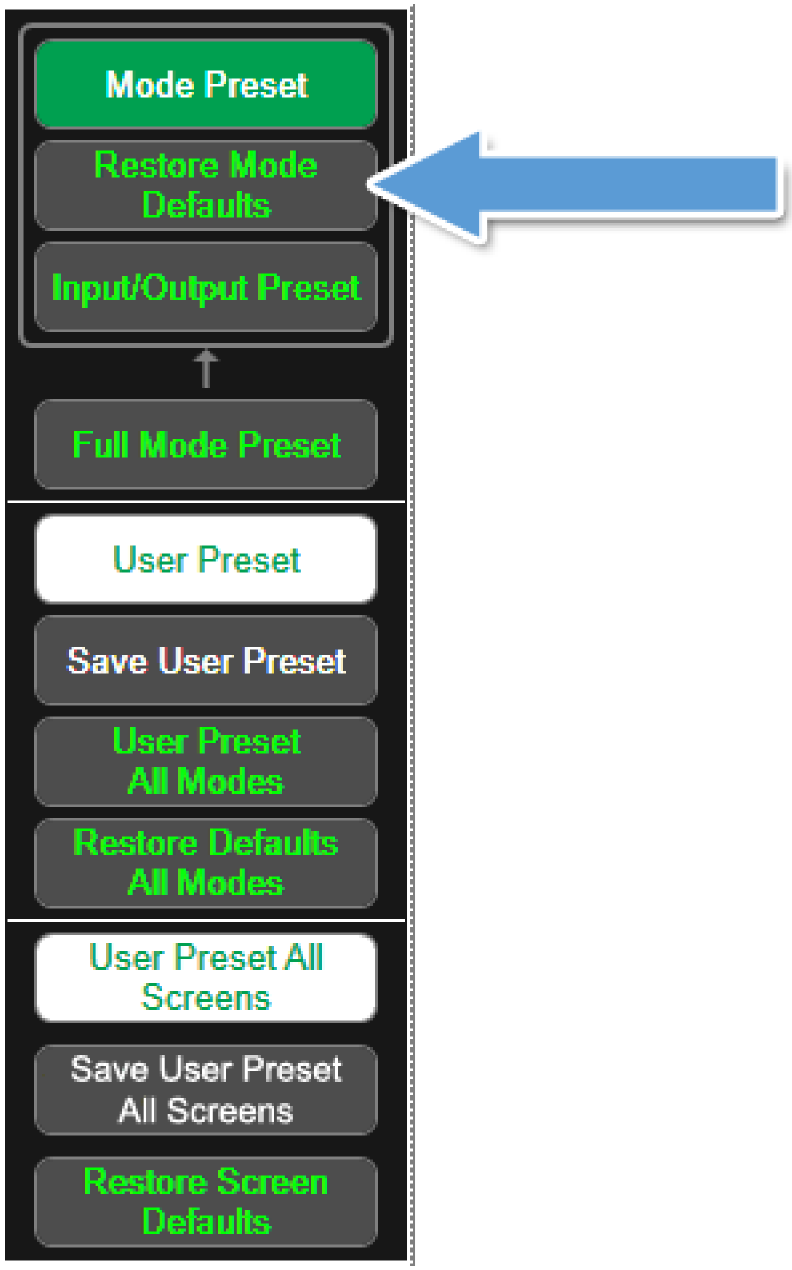
6.2 Restore Mode Defaults

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

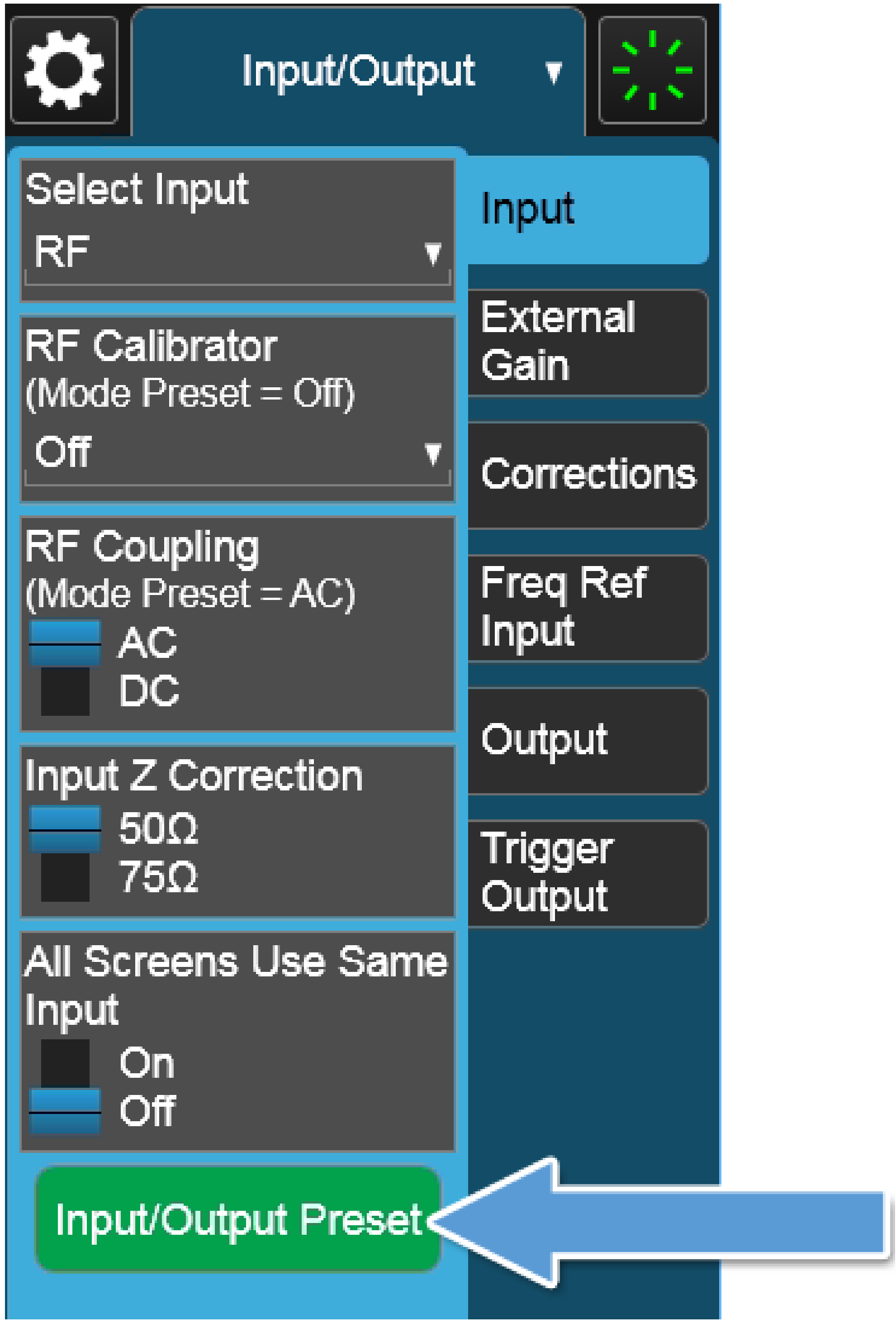
6.3 Input/Output Preset

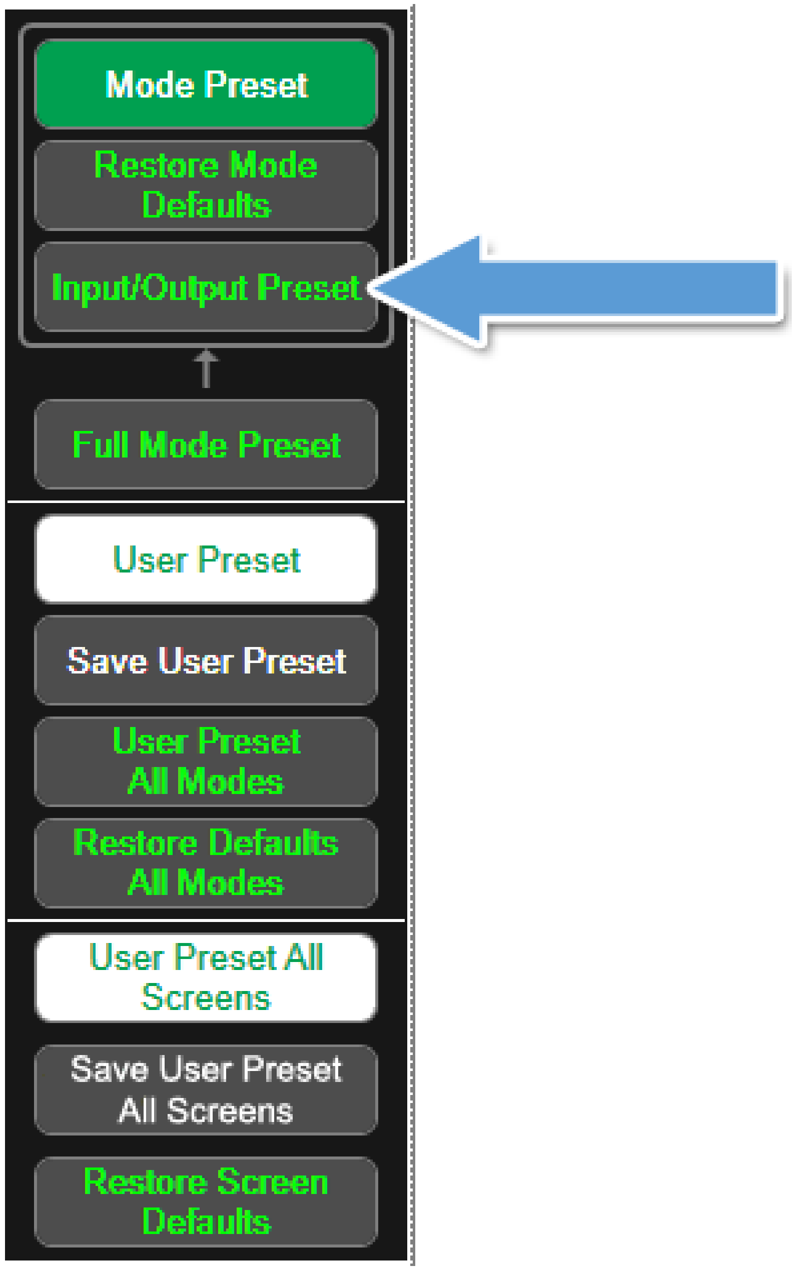
Input/Output Preset resets the group of settings and data associated with the Input/Output front-panel key to their default values. These settings are not affected by a Mode Preset because they are generally associated with connections to the instrument, and most users would not want these resetting 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
RF Calibrator
(Mode Preset = Off)
Off
RF Coupling
(Mode Preset = AC)
AC
DC
Input Z Correction
50Ω
75Ω
All Screens Use Same Input
On
Off
Input/Output Preset
Input
External Gain
Corrections
Freq Ref Input
Output
Trigger Output


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.

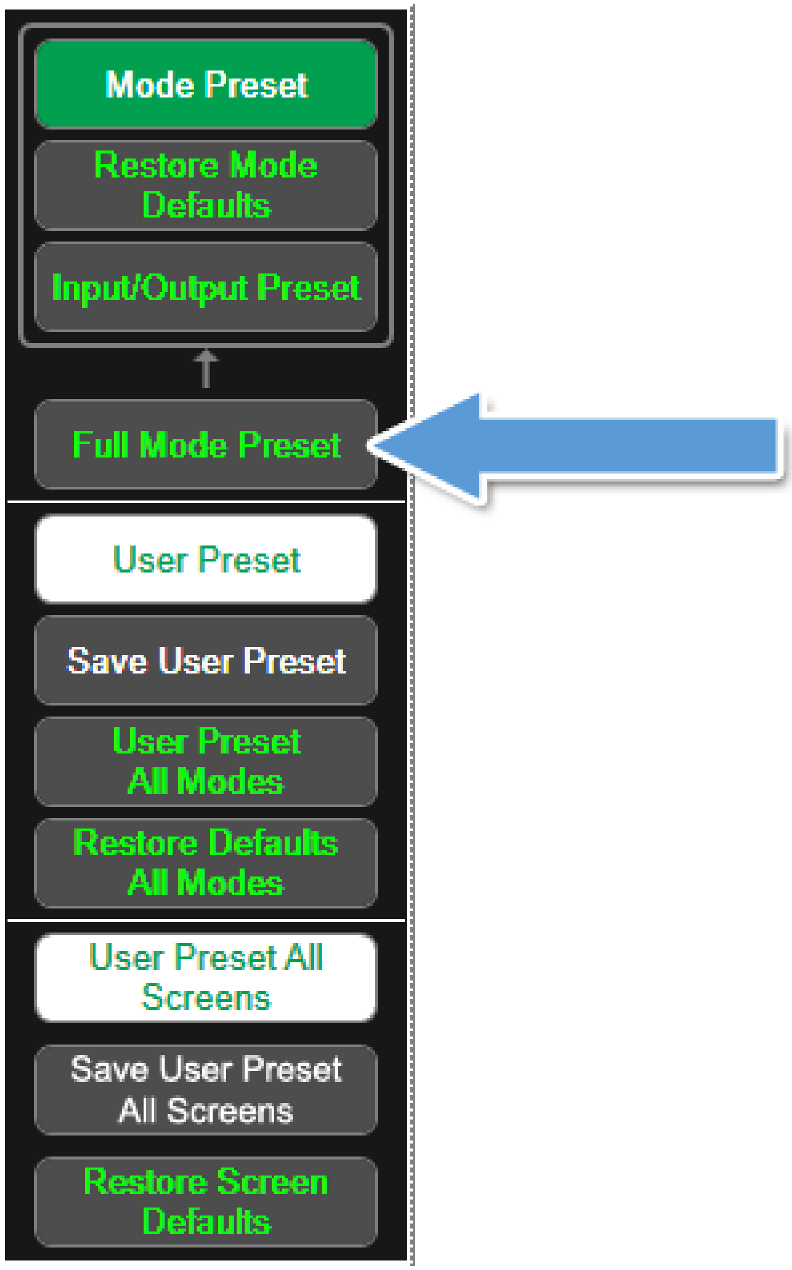
This action cannot be undone. Do you want to proceed?”

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

6.4 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?”

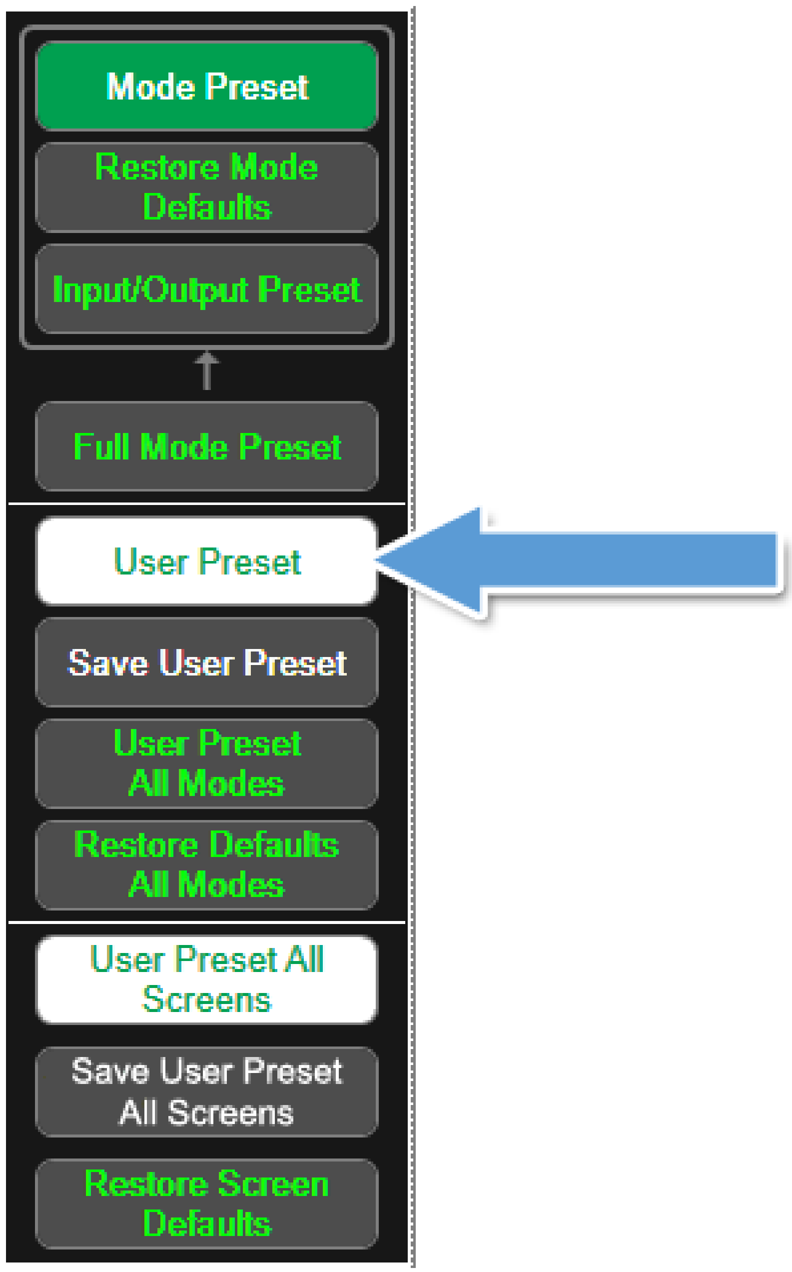
The message provides **OK** and **Cancel** buttons, to let you affirm or cancel the operation.

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

6.5 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`

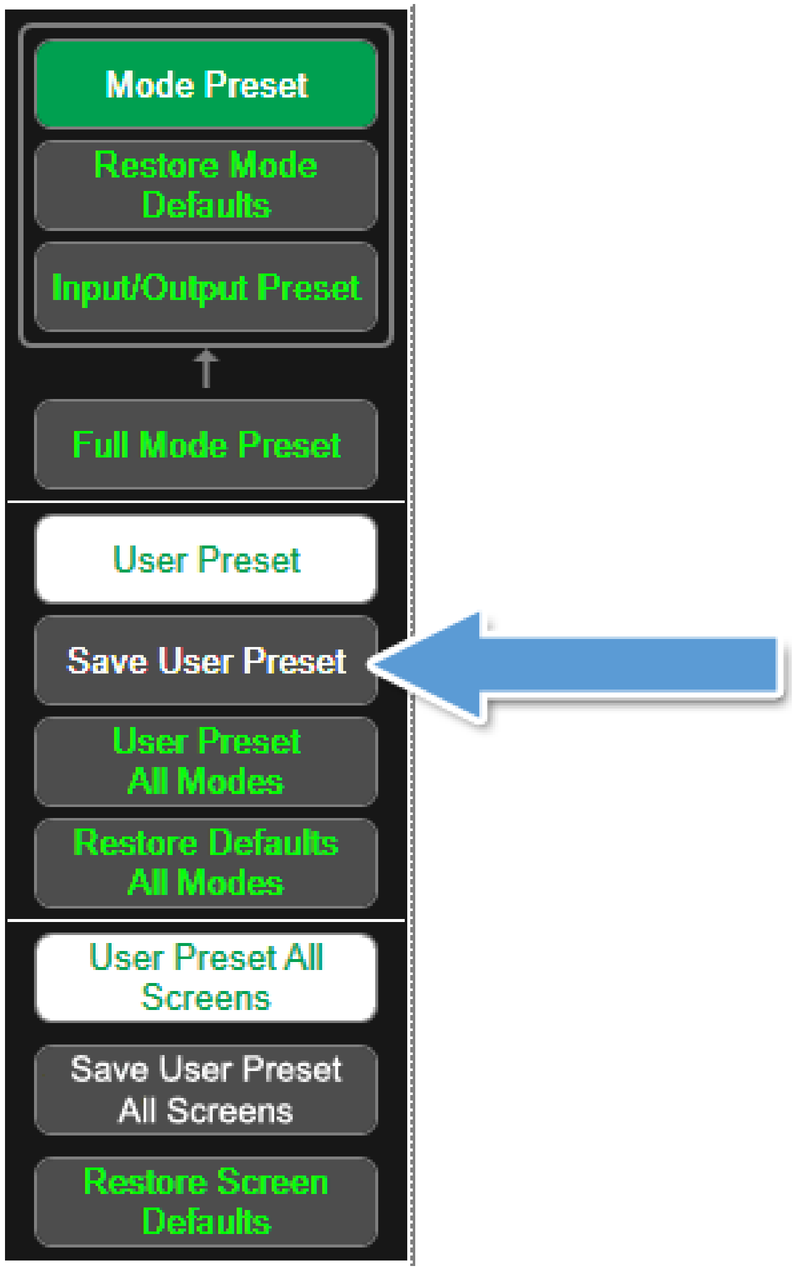
Example	`:SYST:PRES:USER:SAVE`
	Save the User Preset
	`:SYST:PRES:USER`
	Recall the User Preset

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

6.6 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.



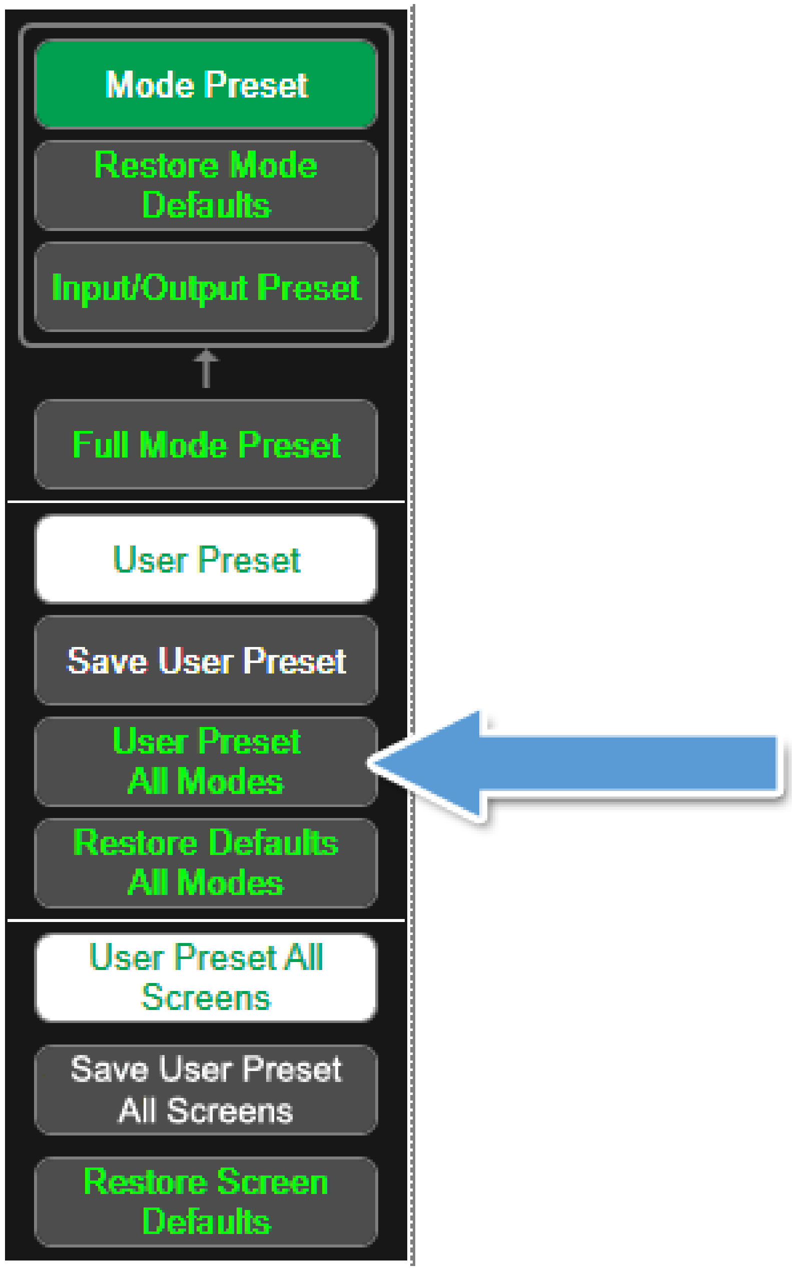
All of the Mode variables are saved, including those reset by Mode Preset and those only reset by Restore Mode Defaults, as well as all of the Input/Output variables, so when you subsequently press the **User Preset** key, the instrument returns to the exact same setup that existed when you pressed the **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

6.7 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.



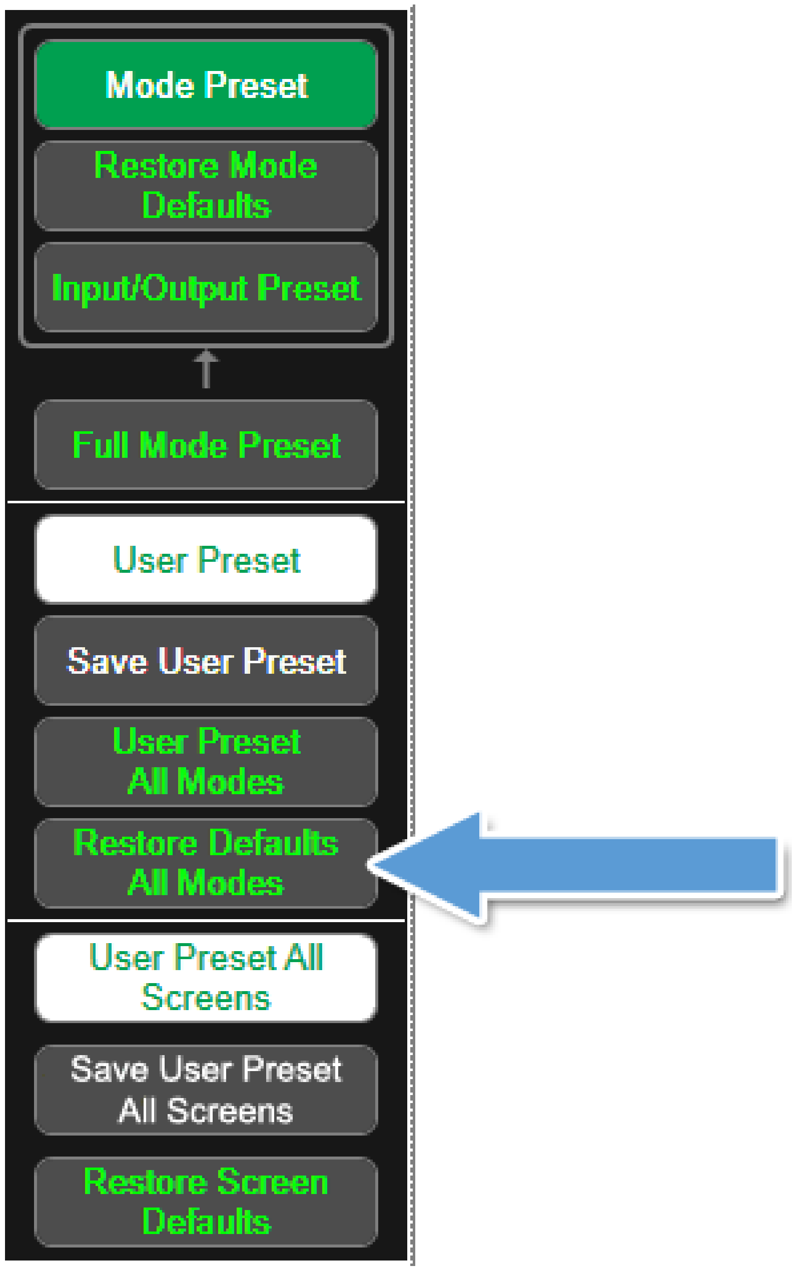
See the "User Preset" on page 467 description for more details on User Preset.

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

6.8 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.

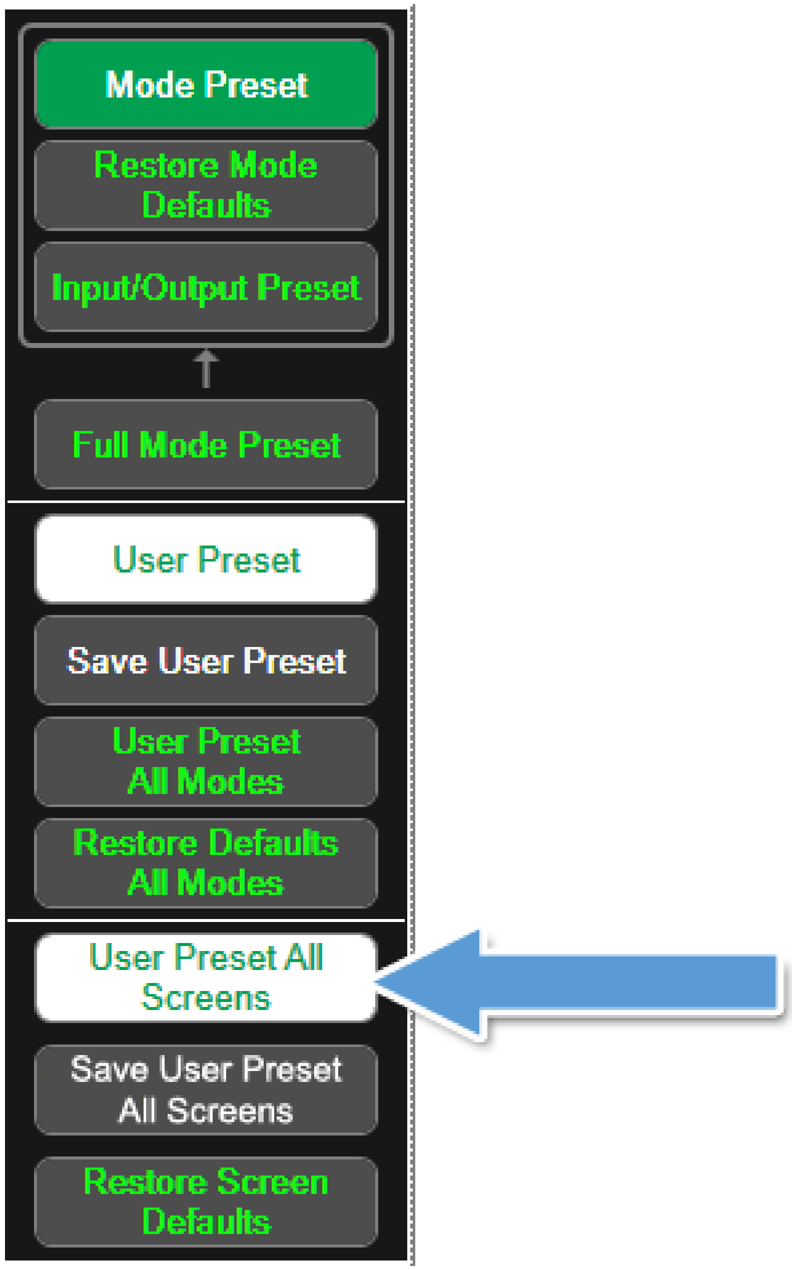
Example	`:SYST:DEF MOD`
Couplings	Causes the currently running measurement to be aborted, a mode switch to the power-on mode, and activates the default measurement for the power-on mode

6.9 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.

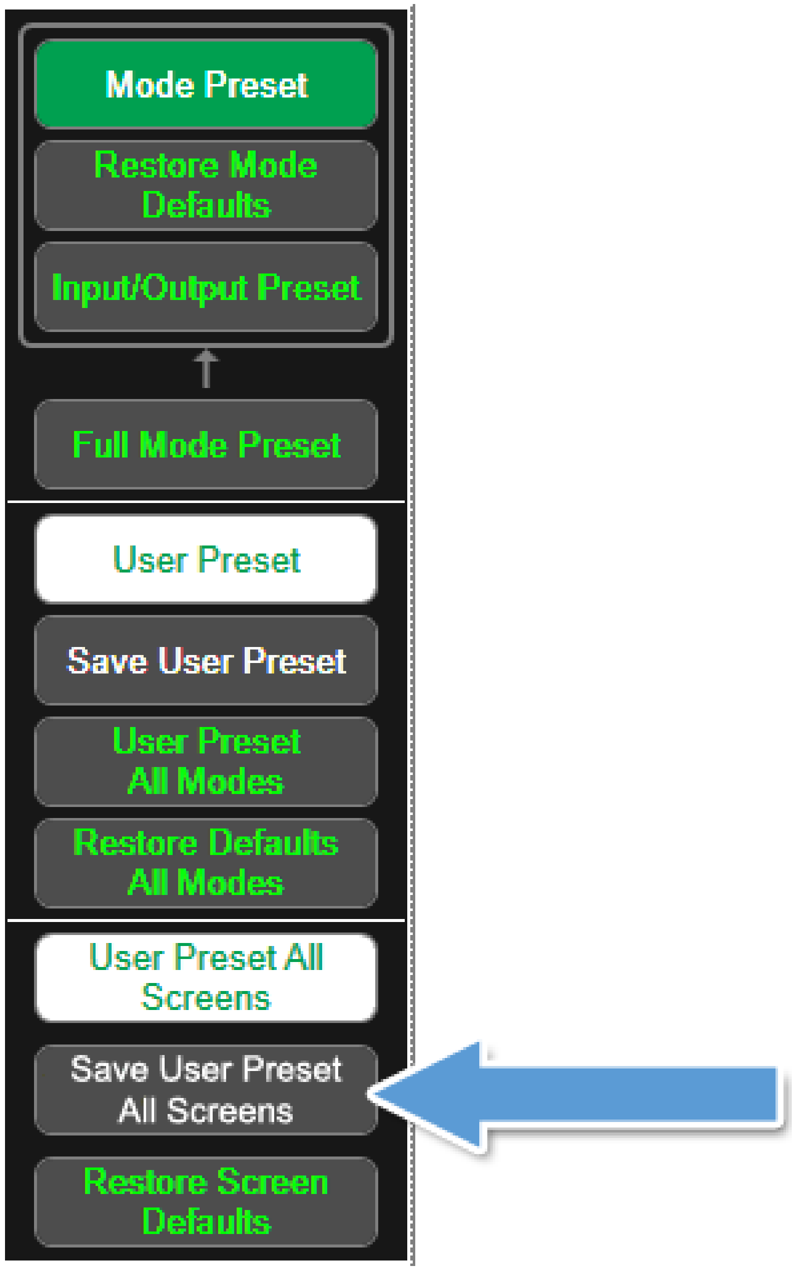


Notes	"Save User Preset All Screens" on page 477 is used to save the current screen configuration as the “user preset all screens” configuration If loading a User Preset All Screens file from a different instrument, some settings may be limited and/or coupled differently, since the capabilities of the 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

6.10 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

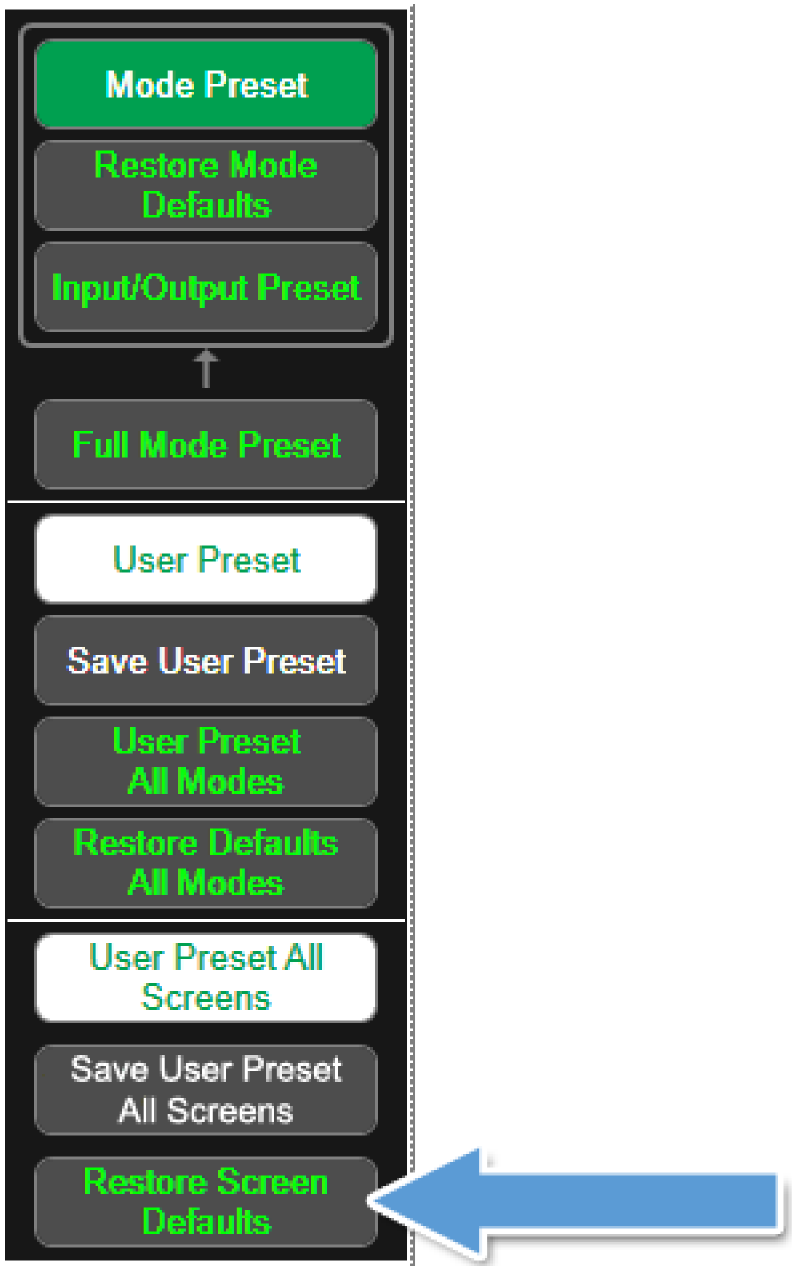
Preset All Screens key, the instrument returns to the exact Screen setup that existed when you pressed the Save User Preset All Screens control.

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

6.11 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`

7 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.

7.1 Input

The controls on this tab let you select and configure the instrument's inputs.

7.1.1 Select Input

Select Input lets you choose which signal input you want to analyze.

Command	Not available in RLC Mode
Preset	This setting is unaffected by a Preset or power cycle. It survives a Mode Preset and mode changes. It is set to RF on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved	Saved in instrument state.

RF Input

Selects the front-panel RF input port to be the analyzer signal input. If RF is already selected, pressing this control accesses the RF input setup functions.

External Mixer (requires Option EXM)

This selection allows you to choose an External Mixer through which to apply signal input to the analyzer. When chosen, the LO/IF port becomes the input to the analyzer.

External Mixing requires option EXM. External Mixer 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. See "More Information on External Mixer" on page 485.

IQ (requires Option BBA)

Selects the front-panel I/Q input ports to be the analyzer 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 50Ω 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.

Couplings

The act of connecting the U7227A USB Preamplifier to one of the analyzer’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.

More Information on External Mixer

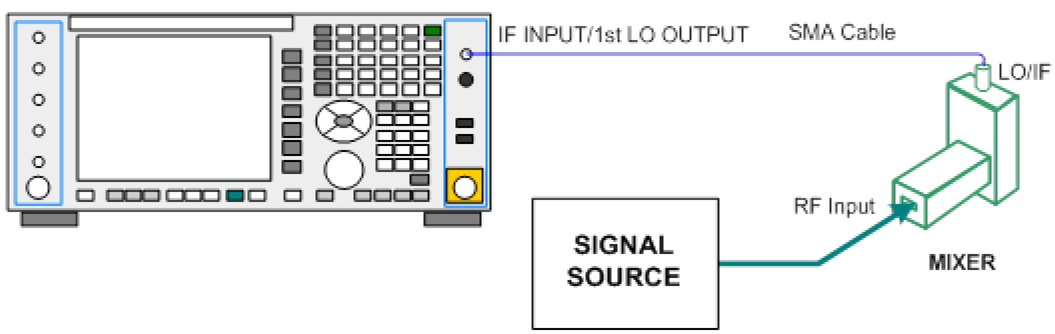
When External Mixer is selected, the Center Freq key controls the setting of the Center Freq in external mixing, which is separate from the settings of Center Freq for the RF Input or BBIQ. Each input retains its unique settings for Center Freq. A unique SCPI command is provided solely for the external 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.

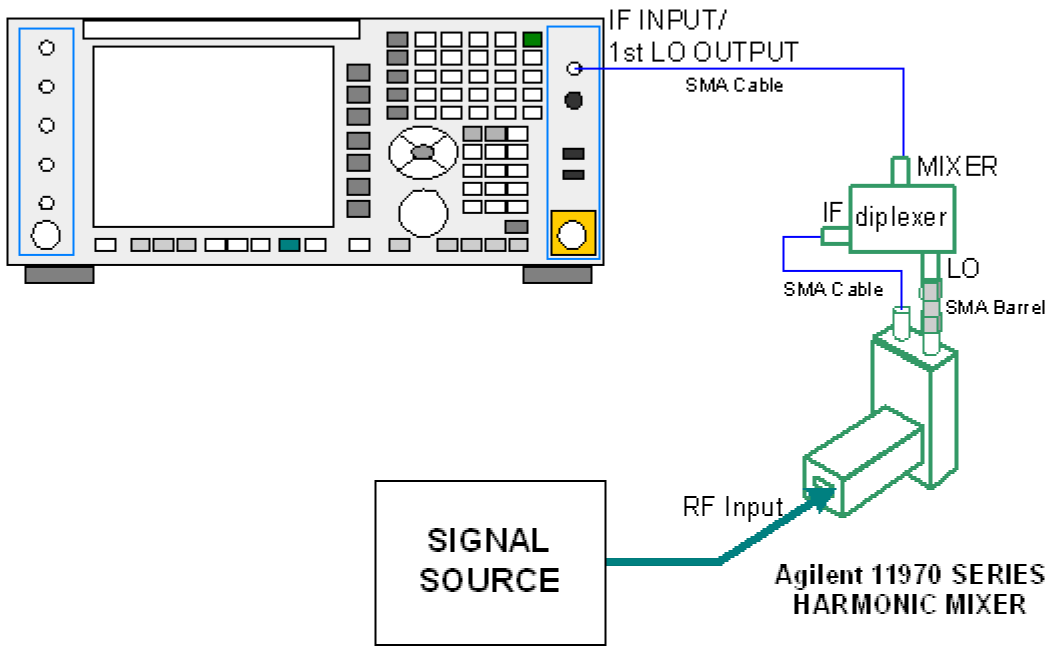
All settings under this selection, and all Frequency settings, are remembered when you go out of External Mixer, so that when External Mixer is chosen again, all the external mixer functions will retain their previous settings, with the exception of Signal ID which is set to OFF (Signal ID is also set 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 analyzer.

X-series analyzers have a combined LO Out/IF In connection, whereas earlier analyzers used separate ports for the LO Out and the IF in. Internal diplexers in the analyzer and the mixer simplify the connection for the user – only a single SMA cable is required.



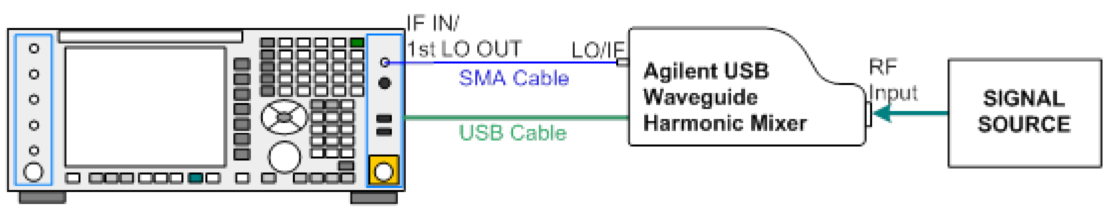
Legacy HP/Agilent and some third party mixers have separate LO In and IF out connections. This requires you to use an external diplexer to connect these mixers. A diplexer can easily be purchased for this purpose (for example, Diplexer Model # DPL.26 or # DPL.313B from OML Inc., Morgan Hill CA)

The connection diagram for such a legacy mixer is:



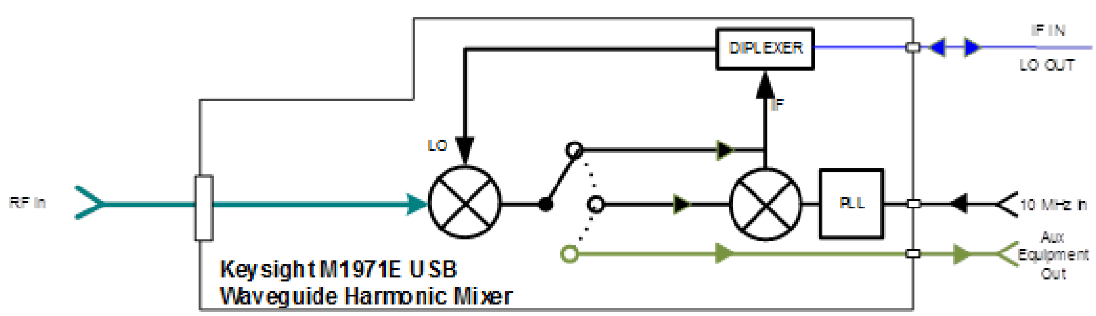
In addition, External Mixing in the X-Series supports the new Keysight M1970 series of Harmonic Mixers, which provide a USB connection for download of calibration data and additional control.

The connection diagram for one of the Keysight USB mixers is:

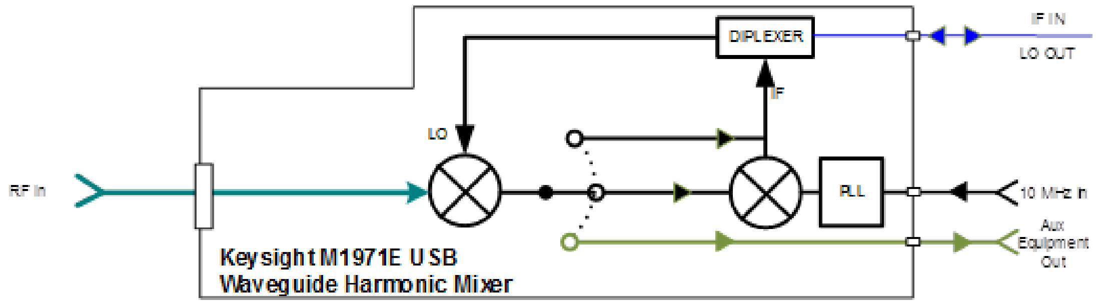


Also available in the M197x series are the M1971 series USB Mixers, which provide additional inputs and outputs for special functionality as described below. These mixers have multiple signal paths which allow them to function in three different states:

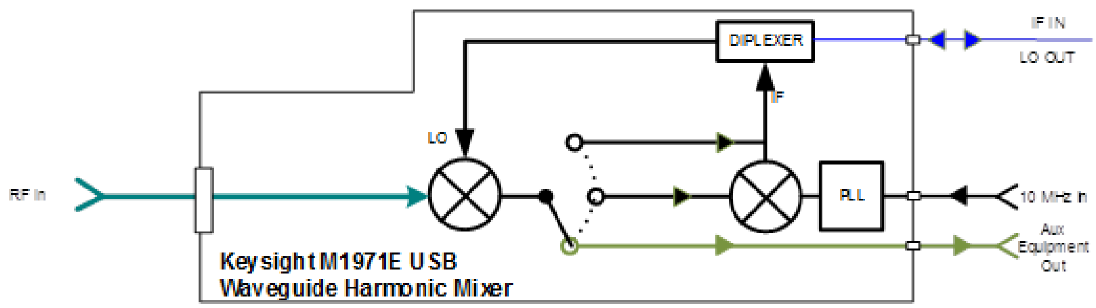
- Normal, in which it functions as a classic external mixer with a single conversion:



– 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 analyzer 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	Measurement	Sig ID (Image Suppress only)
Spectrum Analyzer	Swept SA	Y*
	TOI	Y
	Spurious Emissions	Y
	Harmonics	N
	Channel Power	Y
	Occupied BW	Y
	ACP	Y
	Spectrum Emissions Mask	Y
	CCDF	N
	Burst power	N

Mode	Measurement	Sig ID (Image Suppress only)
	List Sweep	N
Phase Noise	Monitor Spectrum	Y
	Log Plot	Y
	Spot Frequency	N
	Waveform	N
I/Q Waveform	Complex Spectrum	N
	Waveform	N

* the Swept SA measurement also supports Image Shift

7.1.2 RF Calibrator

Lets you choose a calibrator signal to look at or turns the calibrator off.

Only appears when RF Input is selected as the input.

Command	Not available in RLC Mode
Preset	OFF
State Saved	Saved in instrument state.

Dependencies

Selecting an input (RF, Ext Mix or I/Q) turns the Calibrator OFF.

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 selection will be blanked, and if the REF4800 parameter is sent, the analyzer will generate an error.

Couplings

When one of the calibrator signals is selected, the analyzer routes that signal (an internal amplitude reference) to the analyzer, 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.

7.1.3 RF Coupling

Specifies alternating current (AC) or direct current (DC) coupling at the analyzer RF input port. Selecting AC coupling switches in a blocking capacitor that blocks any DC voltage present at the analyzer input. This decreases the input frequency range of the analyzer, but prevents damage to the input circuitry of the analyzer if there is a DC voltage present at the RF input.

When operating in DC coupled mode, ensure protection of the analyzer 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).

See "More information" on page 489

Only appears when RF Input is selected as the Input.

Command	`:INPut:COUPling AC|DC` `:INPut:COUPling?`
Example	INP:COUP 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.

Dependencies

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.

More information

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
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 analyzer.

7.1.4 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 analyzer 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 or 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.

Command	Not available in RLC Mode
Preset	This is unaffected by a Preset but is set to 50 ohms on a "Restore Input/Output Defaults" or "Restore System Defaults->All".
State Saved	Saved in instrument state

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.

7.1.5 All Screens Use Same Input

- ON - the input/output state is shared between all screens. This is the default.
- OFF - independent input/output per screen.

Pressing **Input/Output Preset** affects only the current Screen.

When you clone a Screen, you also clone its Input/Output state.

Command	Not available in RLC Mode
Preset	ON (not affected by Input/Output Preset but set to ON by Restore Input/Output Defaults)

7.1.6 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 you would usually not want these to reset every time you press 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 **OK** and **Cancel** buttons, allowing you to affirm or cancel the operation.

7.2 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.

7.2.1 Ext 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 analyzer 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 the instrument Preset. The External Preamp Gain is reset by the "Restore Input/Output Defaults" or "Restore System Defaults->All functions. The External Gain is subtracted from the amplitude readout so that the displayed signal level represents the signal level at the output of the device-under-test, which is the input of the external device that is providing gain or loss.

The Swept SA Measurement 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.

The Swept SA Measurement does not support the Data Source function. The key is blanked, and if the :FEED:DATA SCPI is sent an Undefined Header error is generated.

The Swept SA Measurement supports the Corrections function. In Modes/Measurements that do not support Corrections, the control is blanked, and sending SCPI for Corrections will generate a Settings Conflict message.

The Swept SA Measurement does not support the Digital Bus function or the I/Q Cal Out function under Output Config; although the controls display, the outputs do not function in this measurement.

The Swept SA Measurement supports all of the functions under Output Config, Analog Out. If the appropriate license is present the associated keys appear, and function properly. In Modes/Measurements that do not support particular controls, they still appear, but no output will be generated if they are selected.

The reference level limits are determined in part by the External Gain/Atten, Max Mixer Level, and RF Atten.

See "More Information" on page 493.

This control is grayed out in Modes that do not support External Gain.

Command	Not available in RLC Mode
Preset	This is unaffected by Preset but is set to 0 dB on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Min/Max	–120 dB/120 dB
State Saved	Saved in instrument state.

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 analyzer over USB whenever it is connected to one of the analyzer’s USB ports.

While the USB Preamplifier is plugged into one of the analyzer’s USB ports, the analyzer 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 analyzer 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 analyzer 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.

7.2.2 MS

Sets an external gain/attenuation value for MS (Mobile Station) tests.

This selection is grayed out in modes that do not support MS.

Command	Not available in RLC Mode
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/Max	–100 dB/100 dB
State Saved	Saved in instrument state.

Dependencies

The reference level limits are determined in part by the External Gain, Max Mixer Level, RF Atten.

7.2.3 BTS

Sets an external attenuation value for BTS (Base Transceiver Station) tests.

This selection is grayed out in modes that do not support BTS

Command	Not available in RLC Mode
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/Max	–100 dB/100 dB
State Saved	Saved in instrument state.

Dependencies

The reference level limits are determined in part by the External Gain, Max Mixer Level, RF Atten.

7.3 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

7.3.1 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

7.3.2 Corrections On/Off

Turning the Selected Correction from the OFF state to the ON state 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.

Command	Not available in RLC Mode
Preset	Not affected by a Preset. Set to OFF by Restore Input/Output Defaults
State Saved	Saved in instrument state.

Dependencies

Changing this from the OFF state to the ON state automatically turns on "Apply Corrections".

Only the first correction array (Correction 1) supports Transducer units. When this array is turned on, and it contains a Transducer Unit other than “None”, the Y Axis Unit of the analyzer is forced to that Transducer Unit. All other Y Axis Unit choices are grayed out.

Note that this means that a correction file with a Transducer Unit can only be loaded into the Corrections 1 register. Consequently only for Correction 1 does the dropdown in the Recall dialog include.ant, and if an attempt is made to load a correction file into any other Correction register which DOES contain a Transducer unit, a Mass Storage error is generated.

This command will generate an “Option not available” error unless you have the proper option installed in your instrument.

Backwards Compatability

Unlike legacy analyzers, Preset does not turn Corrections off (Restore Input/Output Defaults does).

7.3.3 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
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

Correction Port	Example	Note
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

7.3.4 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.

7.3.4.1 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

7.3.4.2 Frequency

Touching a frequency value makes the touched row the current row and lets you edit the frequency.

Min	0
Max	1 THz

7.3.4.3 Amplitude

Touching an amplitude value makes the touched row the current row and lets you edit the amplitude.

Min	-1000 dB
Max	1000 dB

7.3.4.4 Go to Row

Lets you move through the table to edit the desired point.

Min	1
Max	2000

7.3.4.5 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.

7.3.4.6 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.

7.3.4.7 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"

7.3.4.8 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**.

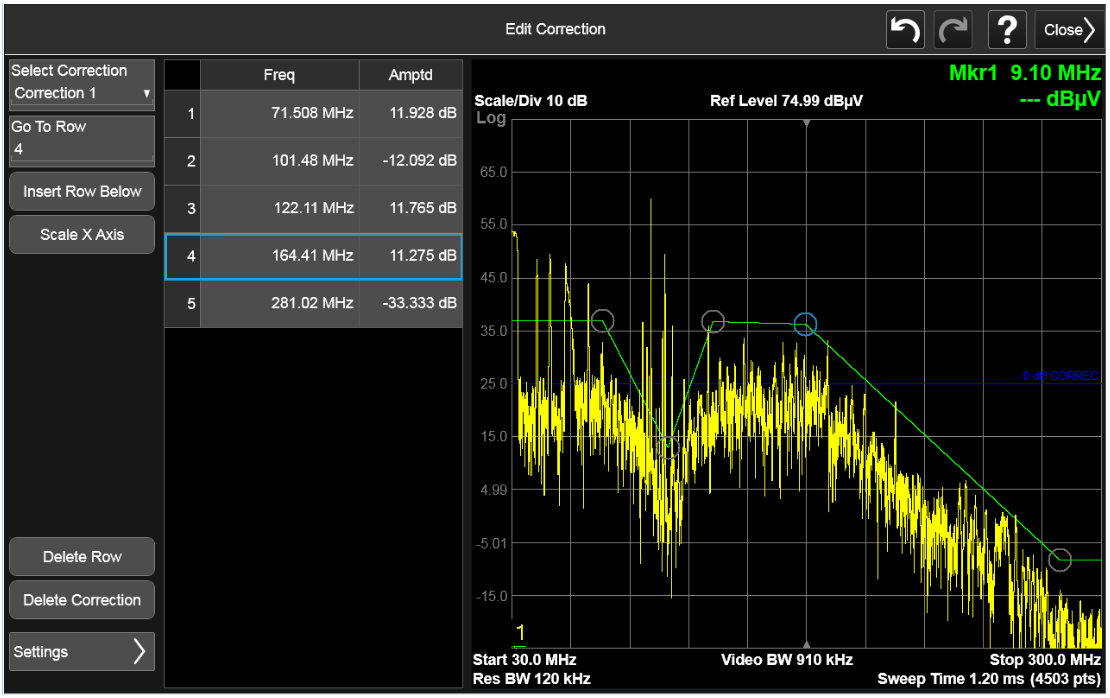
Remote Command	`[:SENSe]:CORRection:CSET[1]|2|...|16:DELete`

Example	`:CORR:CSET:DEL`
	`:CORR:CSET1:DEL`
	`:CORR:CSET4:DEL`

Notes	Pressing this key when no corrections are present is accepted without error

7.3.4.9 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.



7.3.5 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.

7.3.5.1 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

7.3.5.2 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`

7.3.5.3 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`

7.3.5.4 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

7.3.5.5 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 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
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

Correction Port	Example	Note
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

7.3.5.6 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

7.3.5.7 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

7.3.5.8 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]:CCORection:CSET:COMMent "text"` `[:SENSe]:CCORection: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

7.3.5.9 File

Shows the file from which the selected correction was loaded. If correction was loaded with a SCPI command 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

7.3.6 Apply Corrections

Applies amplitude corrections, which are marked as ON to the measured data. If this is set to OFF, then no amplitude correction sets will be used, regardless of their individual on/off settings. If set to ON, the corrections that are marked as ON (see "Corrections On/Off" on page 498) are used.

Command	Not available in RLC Mode
Preset	Not affected by Preset. Set to OFF by Restore Input/Output Defaults
Saved State	Saved in instrument state.

7.3.7 Delete All Corrections

Erases all correction values for all 4 Amplitude Correction sets.

When this control 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.

7.3.8 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.

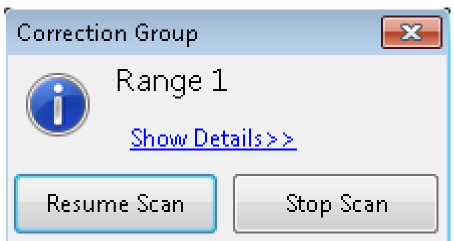
Remote Command	`[:SENSe]:CORRection:CSET:GROup[:STATe] ON | OFF | 1 | 0` `[:SENSe]:CORRection:CSET:GROup[:STATe]?`
Example	`:SENS:CORR:CSET:GRO ON`
Dependencies	Correction group is supported in EMI Receiver Mode, and in Spectrum Analyzer Mode if option EMC or EMI Receiver Mode is present. If you switch 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

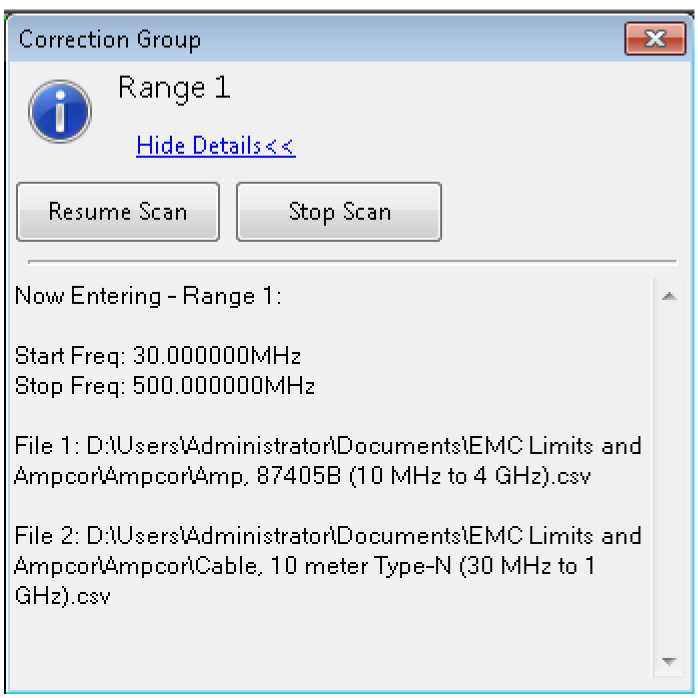
Preset	Not affected by Preset. Set to OFF by **Restore Input/Output Defaults**
State Saved	Saved in instrument state

7.3.9 Break

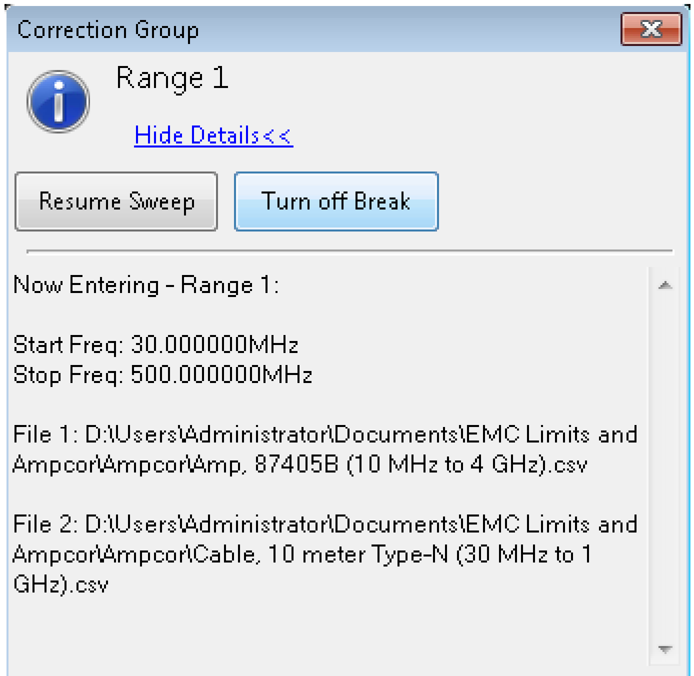
If break is turned on, the scan or sweep will be paused when it reaches the boundary of correction group ranges. At the same time, a window at the size of ~ 6.5cm x 3.5 cm is prompt at the upper right hand corner of the graticule.

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

7.3.10 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

7.3.11 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

7.3.11.1 Go to Row

Lets you move through the table to edit the desired point.

Min	1
Max	2000

7.3.11.2 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.

7.3.11.3 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.

7.3.11.4 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**

7.3.11.5 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

7.3.11.6 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

7.3.11.7 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

7.3.11.8 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

7.3.11.9 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

7.3.11.10 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

7.3.11.11 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

7.4 Freq Ref Input

This tab lets you configure the External Frequency Reference input on the rear panel.

7.4.1 Select Freq Ref Input

Specifies the frequency reference as being the internal reference at the rear panel input labeled EXT REF IN, a 1 pulse per second signal at the EXT REF IN input, external reference or sensing the presence of a signal at the EXT REF IN input.

Selection Examples

Selection	Example (N/A in RLC Mode)	Notes
Sense	:ROSC:SOUR:TYPE SENS	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 softkey), 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.
Internal	:ROSC:SOUR:TYPE INT	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	:ROSC:SOUR:TYPE INT	The external reference is used.
Pulse	:ROSC:SOUR:TYPE PULS	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 analyzer 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. See "More Information" on page 518.

More Information

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 analyzer 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 analyzer 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 analyzer’s internal frequency reference is specified. This is the only 1 pps signal that is guaranteed to function properly with the X-Series.

Command	Not available in RLC Mode
Preset	This is unaffected by a Preset but is set to SENSe on a "Restore Input/Output Defaults" or "Restore System Defaults->All".
State Saved	Saved in instrument state.

Dependencies

The PULSe parameter, and support of the 1 pps signal at the EXT REF IN input, are not available in firmware prior to A.13.00. They are also not available in some model numbers. If not available, the Pulse key will be blank, and sending the PULSe parameter via SCPI will generate an error.

Status Bits/OPC Dependencies

STATus:QUEStionable:FREQuency bit 1 set if unlocked.

7.4.2 External Ref Freq

This control sets 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 analyzer 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.

Command	Not available in RLC Mode
Preset	This is unaffected by a Mode Preset or an "Input/Output Preset" or "Restore Defaults, Input/Output" but is set to 10 MHz on a "Restore Defaults, Misc" or "Restore Defaults, All" or by pressing the "Default External Ref Freq" button.
Min/Max	1 MHz/50 MHz

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).

7.4.3 Default External Ref Freq

This control 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.**

This control is grayed out if the Ext Ref Freq is already set to the default

7.4.4 Ref Lock BW

This control lets you adjust the External Reference phase lock bandwidth. This control is available in some models of the X-Series.

The variable reference loop bandwidth allows an external reference to be used and have the analyzer close-in phase noise improved to match that of the reference. This could result in an improvement of tens of decibels. The choice of "Wide" or "Narrow" affects the phase noise at low offset frequencies, especially 4 to 400 Hz offset. When using an external reference with superior phase noise, we recommend setting the external reference phase-locked-loop bandwidth to wide (60 Hz), to take advantage of that superior performance. When using an external reference with inferior phase noise performance, we recommend setting that bandwidth to narrow (15 Hz). 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.

Command	Not available in RLC Mode
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.

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 key only appears in analyzers equipped with the required hardware.

7.5 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.

7.5.1 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 523 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

7.5.2 Digital Bus Out

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.

Command	Not available in RLC Mode
Preset	This is unaffected by a Preset but is set to Off on a "Restore Input/Output Defaults" or "Restore System Defaults -> All"
State Saved	Saved in Input/Output state

7.5.3 Wideband Digital Bus (Option RTS)

The Wideband Digital Bus control 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 measurement application, which is 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.

Requires option RTS or control is not displayed.

Command	Not available in RLC Mode
Preset	OFF (set by Restore Input/Output Defaults)
State Saved	Saved in Input/Output state.

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

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.”

7.5.4 Aux IF Out

This menu controls the signals that appear on the SMA output on the rear panel labeled “AUX IF OUT".

NOTE **The Aux IF Out functionality is only valid for RF and External Mixer inputs. When using the External Mixing path, the Aux IF Out levels (for all three Options CR3, CRP, and ALV) will be uncalibrated because the factory default Aux IF level was set to accommodate the expected IF levels for the RF path.**

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.

The control does not appear in models that do not support the Aux IF Out.

Notes on 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	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.

Command	Not available in RLC Mode
Preset	This is unaffected by a Preset but is set to OFF on a "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.

Various Aux IF Outputs

Source	Example (N/A in RLC Mode)	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 analyzer.
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	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. 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.

7.6 Trigger Output

Accesses controls that configure the **Trigger Output** settings.

7.6.1 Trig 1 Out

This control selects the type of output signal that will be output from the Trig 1 Out connector.

Command	Not available in RLC Mode
Preset	Trigger 1: Sweeping (HSWP) Trigger 2: Gate 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.

Trigger Outputs

Source	Example (N/A in RLC Mode)	Notes
Off	TRIG1:OUTP OFF TRIG2:OUTP OFF	Selects no signal to be output to the Trig 1 Out, or Trig 2 Out connector.
Sweeping (HSWP)	TRIG1:OUTP HSWP	Selects the Sweeping Trigger signal to be output to the Trig 1 Out, or Trig 2 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, or Trig 2 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, or Trig 2 Out connector
Gate Trigger	TRIG1:OUTP GTR	Selects the gate signal to be output to the Trig 1 Out, or Trig 2 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, or Trig 2 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 1 Out, or Trig 2 Out represents the

Source	Example (N/A in RLC Mode)	Notes
		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, or Trig 2 Out connector when performing swept spectrum analysis. When the polarity is positive, this output goes high during the time the analyzer 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, or Trig 2 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. Similarly, when Ext Trigger 2 is selected as the Point Trigger under Source, the Source Point Trigger key under Trig 2 Out automatically gets selected.

7.6.2 Trig 1 Out Polarity

This control sets the output to the Trig 1 Out connector to trigger on either the positive or negative polarity.

Command	Not available in RLC Mode
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.

7.6.3 Trig 2 Out

This control selects the type of output signal that will be output from the Trig 2 Out connector.

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 key 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.

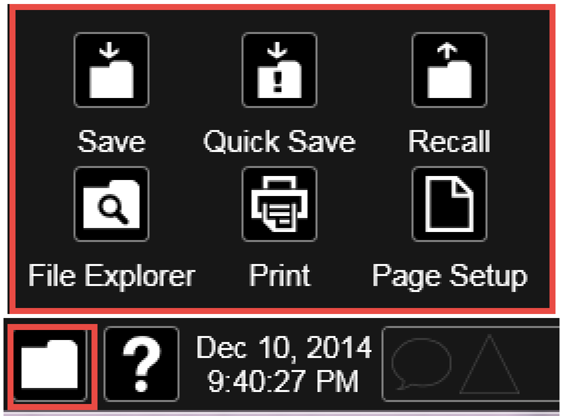
7.6.4 Trig 2 Out Polarity

This control sets the output to the Trig 2 Out connector to trigger on either the positive or negative polarity.

Preset	This is unaffected by a Preset but is set to POSitive on a "Restore Input/Output Defaults" or "Restore System Defaults->All"

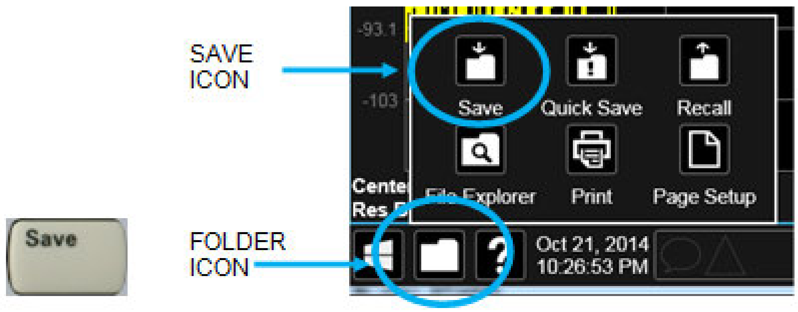
8 Save/Recall/Print

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.

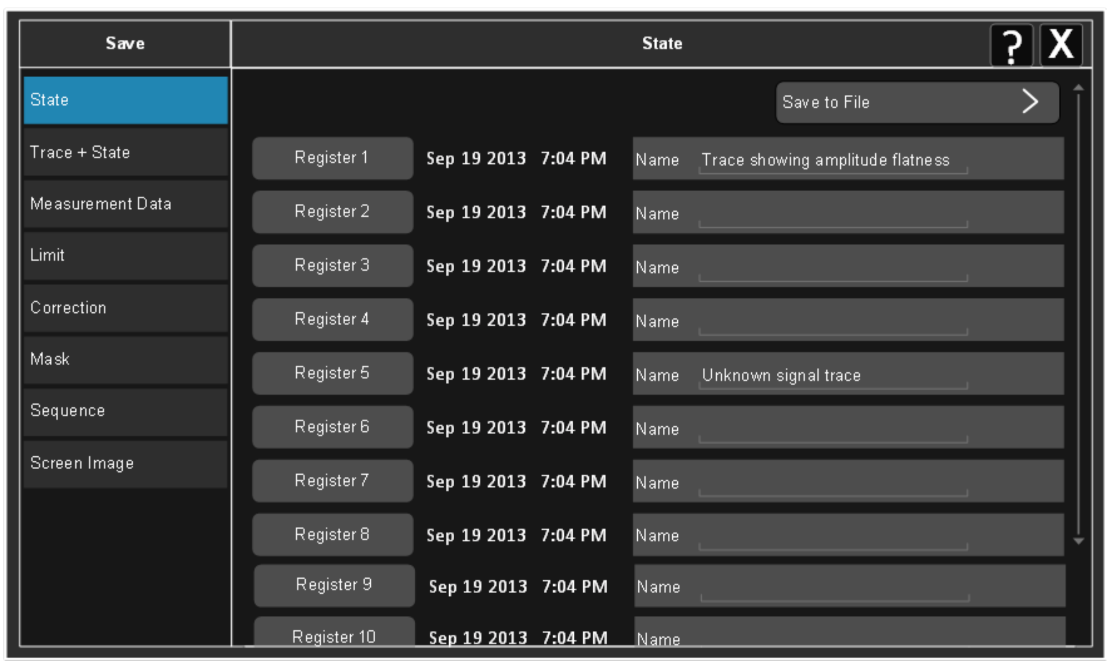


8.1 Save

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.



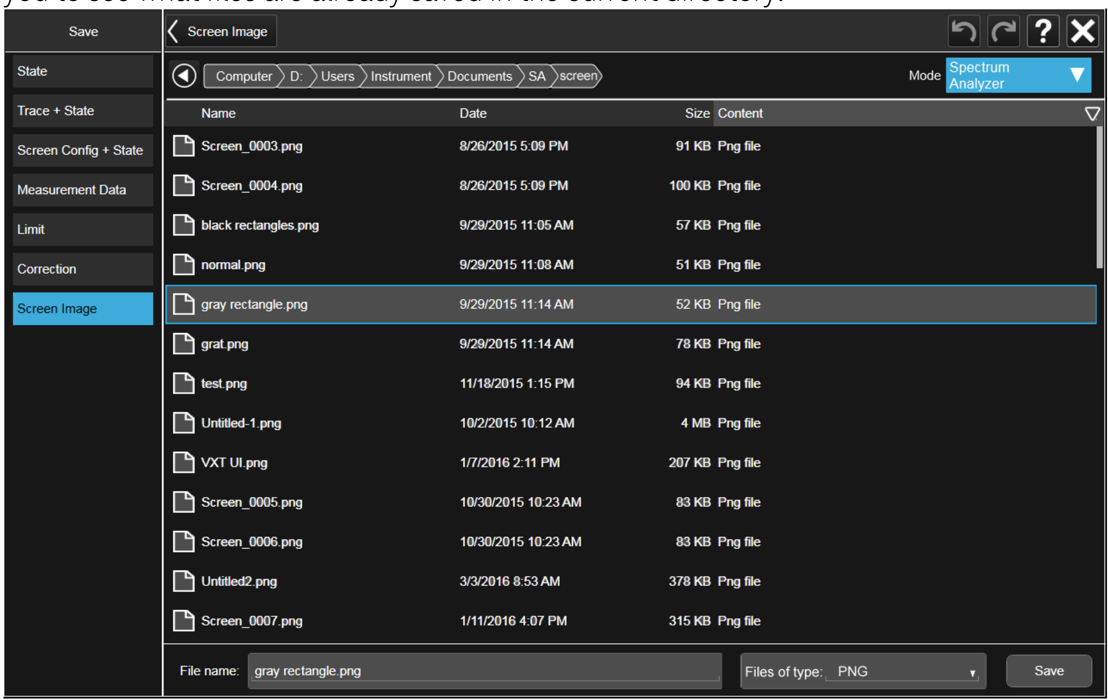
You choose the save item and then complete the save by choosing a register or file location to which to save the item.

Notes	No remote command for this key specifically, but `:MMEM:STORe` is available for specific file types Example: `:MMEM:STOR:STATe <filename>`

8.1.1 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 567 for details of the automatic file naming algorithm.

8.1.2 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

8.1.2.1 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.

IEEE 488.2 Command not available in RLC Mode

8.1.2.2 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 analyzer, it will bring its custom name along with it.

If you try to edit the name of an empty register, the analyzer will first save the state to have a file to put the name in. If you load a named state file into an analyzer with older firmware it will ignore the metadata.

Command	Not available in RLC Mode
Preset	The names are unaffected by Preset or power cycle but are set to the default label (time and date) on a “Restore System Defaults->Misc”

8.1.3 Trace + State

Save Trace+State lets you choose a register or file for saving selected traces and the state.

Trace+State files contain essentially all the information required to return the analyzer 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 analyzer 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 the `:INST:SEL` command (for example, BASIC for the IQ Analyzer).

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 540.

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.

8.1.3.1 Save From Trace

This control enables you to select 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.

8.1.3.2 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.

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.

IEEE 488.2 Command not available in RLC Mode

8.1.3.3 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).

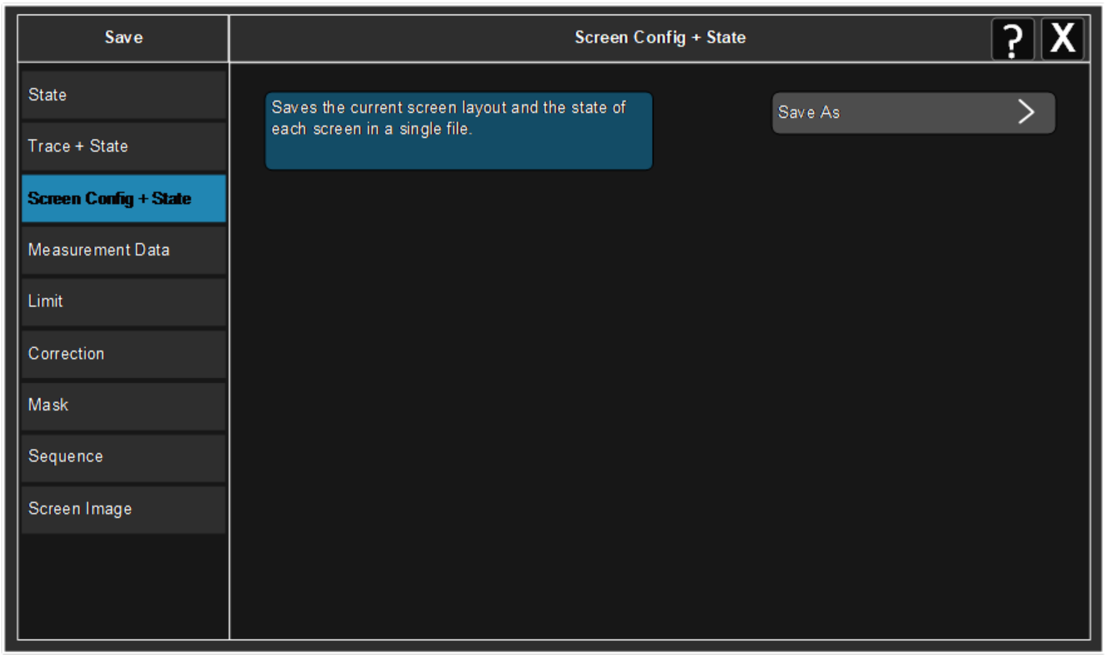
The register names are stored within the trace+state files, but they are not part of the instrument state; that is, once you have edited a register name, loading a new state will not change that register name. Another consequence of this is that the names will be persistent through a power cycle. Also, if a named state file is transferred to another analyzer, it will bring its custom name along with it.

If you try to edit the name of an empty register, the analyzer will first save the trace+state to have a file to put the name in. If you load a named state file into an analyzer with older firmware it will ignore the metadata.

Command	Not available in RLC Mode
Preset	The names are unaffected by Preset or power cycle but are set to the default label (time and date) on a “Restore System Defaults->Misc”

8.1.4 Screen Config + State

SaveScreen Config + State lets you save the complete configuration of all your screens to a file. You choose a file to which to export the data.



8.1.5 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`

8.1.5.1 Save From Trace

This control enables you to select 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

8.1.5.2 Data Type

You choose the data type to save by using the radio button selection box. The available selections are listed below.

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.

Trace

Selecting Trace allows you to export Trace files in the PC-readable .csv format.

Trace files have the extension “.csv”. The default filename is Trace_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 Trace data files is:

My Documents\<mode name>\data\traces

where <mode name> is the parameter used to select the mode with the INST:SEL command (for example, SA for the Spectrum Analyzer).

The trace file contains a “meta” data header which describes the current state of the analyzer. The metadata is detailed in Trace File Contents below.

See "More Information" on page 544.

Notes

Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade.

Dependencies

For SA measurements, traces cannot be recalled from a trace file that was saved with ALL traces selected.

Couplings

When you select which trace to save, it makes that trace the current trace, so it displays on top of all of the other traces.

More Information

Trace File Contents

A Trace Data File contains the data for one trace.

Note that when importing the data from one of these files back into the instrument, it has to run through units conversion to get it back into dBm, which is how it is stored internally.

Metadata: Trace Specific

Besides the trace data, there is metadata describing the context by which the trace was produced. Some of the metadata is trace specific:

- Trace Type
- Detector

- Trace math (function, operand1, operand2, offset, reference)

- Trace name/number

When importing a trace, the detector and/or trace math function specified in the metadata is imported with the trace, so that the annotation correctly shows the detector and/or math type that was used to generate the data

Metadata: Display Specific

There is also some display-related metadata:

- Ref Level Offset

- External Gain

- X-Axis Unit

- Y-Axis Unit

NOTE **Because the trace data in the file needs to appear in the current X-axis and Y-Axis unit, in the same way that data is output to SCPI in those units, the units need to be included in the file. Note, however, that when the display-specific settings change, this is NOT something that needs to restart the measurement or turn on the dirty marker.**

Metadata: Measurement Related

The rest of the metadata is measurement specific and reflects the state of the measurement the last time the trace was updated. These are the “measurement-related instrument settings” that are referred to in section Error! Reference source not found., the ones which, if changed, cause a measurement restart.

- Number of Points

- Sweep Time

- Start Frequency

- Stop Frequency

- Average Count (actual; not the limit for the instrument)

- Average Type

- RBW

- RBW Filter Type

- RBW Filter BW Type

- VBW
- Sweep Type (FFT vs. Swept)
- Log/Lin X Scale (sometimes called Log Sweep)
- Preamp (on/off, band)
- Trigger (source, level, slope, delay)
- Phase Noise optimization setting
- Swept IF Gain
- FFT IF Gain
- AC/DC setting (RF Coupling)
- FFT Width
- External Reference setting
- Input (which input is in use)
- RF calibrator on/off
- Attenuation

Because any inactive trace can have a value that does not match the rest of the measurement, when performing a Save the metadata for each trace is pulled from the individual trace, not from the measurement.

A revision number is also included in the trace database, to allow for future changes.

Note that the formatting of the numbers (integer, float) should be driven by the implementer, who will be most familiar with the internals, rather than by this example.

Frequency and time are stored in fundamental units so again no suffixes are needed.

The choices for the various 1 of N and binary fields are as follows:

- Average Type: Power(RMS), Voltage, LogPower(Video)
- RBW Filter Type: Flattop, EMI, Gaussian
- RBW Filter BW: 3dB, 6dB, Noise, Impulse
- Sweep Type: Swept, FFT
- PreAmp State: On, Off
- PreAmp Band: Low, Full

- Trigger Source: Free, RFBurst, Video, Line, Periodic, Ext1, Ext2, TV
- Trigger Slope: Positive, Negative
- Phase Noise Optimization: Fast, Narrow, Wide
- Swept IF Gain: Low, High
- FFT If Gain: Autorange, Low, High
- Input: RF, ExtMix, BBIQ
- RF Calibrator: 50M, 400G, Comb, Off
- Trace Type: ClearWrite, TraceAverage, MaxHold, MinHold
- Detector: Normal, Average, Peak, NegPeak, Sample
- Trace Math: Off, PowerDifference, PowerSum, LogOffset, LogDifference
- Y Axis Unit: dBm, dBmV, dBmA, W, V, A, dBuV, dBuA, dBuV/m, dBuA/m, dBuV, dBpT, dBG, dB

After the header, just before the trace data, a line with just the word DATA on it is inserted to flag the start of the trace data.

The following file example shows the first lines of a Trace 1 file with X Axis Unit = Hz and Y Axis Unit = dBuV, after importing into Excel (the second row contains the Title):

Trace	
"AS/NZS 1044; Conducted >1000 W, Motors, Average"	
A.15.00	N9040B
526 EA3 B25 P26 PFR	1
Segment	0
Number of Points	1001
Sweep Time	0.066266667
Start Frequency	18827440
Stop Frequency	24463718
Average Count	0
Average Type	Power(RMS)
RBW	51000
RBW Filter	Gaussian
RBW Filter BW	3dB
VBW	51000
Sweep Type	Swept

X Axis Scale	Lin
PreAmp State	Off
PreAmp Band	Low
Trigger Source	Video
Trigger Level	1.2
Trigger Slope	Positive
Trigger Delay	1.00E–06
Phase Noise Optimization	Fast
Swept IF Gain	Low
FFT IF Gain	Autorange
RF Coupling	AC
FFT Width	411900
Ext Ref	10000000
Input	RF
RF Calibrator	Off
Attenuation	10
Ref Level Offset	0
External Gain	0
Trace Type	ClearWrite
Detector	Normal
Trace Math	Off
Trace Math Oper1	Trace5
Trace Math Oper2	Trace6
Trace Math Offset	0
Trace Name	Trace1
X Axis Unit	Hz
Y Axis Unit	dBm
DATA	
1.6009301E+07	4.82047E+01
1.6018694E+07	4.69737E+01
1.6028087E+07	4.81207E+01
1.6037480E+07	4.72487E+01
1.6046873E+07	4.66437E+01
1.6056266E+07	4.66237E+01
1.6065659E+07	4.66967E+01

1.6075052E+07	4.77117E+01
1.6084445E+07	4.75787E+01
1.6093838E+07	4.83297E+01
1.6103231E+07	4.71327E+01
1.6112624E+07	4.78957E+01
1.6122017E+07	4.67507E+01
1.6131410E+07	4.81137E+01

Peak Table

Selecting Peak Table allows you to export Peak Table files in the PC-readable .csv format.

Peak Table files have the extension ".csv". The default filename is MeasR_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 Peak Table data files is:

My Documents\<mode name>\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) and <measurement name> is the parameter used to select the measurement with the CONF: command (for example, SAN for the Swept SA).

The Peak Table file contains a "meta" data header which describes the current state of the analyzer. The metadata is detailed below.

See "More Information" on page 549.

Notes

Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade.

Dependencies

If a save of Peak Table results is requested and the Peak Table is not on, no file is saved and a message is generated.

More Information

This section discusses the Peak Table Meas Results file format.

The Meas Results file, when opened, would show the header data (the same as for the Marker Table except that the Result Type is Peak Table) ending with a few fields of specific interest to Peak Table users:

- Peak Threshold
- Peak Threshold State (On|Off)
- Peak Excursion
- Peak Excursion State (On|Off)
- Display Line
- Peak Readout (All|AboveDL|BelowDL)
- Peak Sort (Freq|Amptd)

These fields are then followed by the data for the Peak Table itself.

Note that the label for the Frequency column changes to Time in 0 span.

Here is what the table for the above display looks like:

MeasurementResult	
Swept SA	
A.01.40_R0017	N9020A
526 B25 PFR P26 EA3	1
Result Type	Peak Table
Ref Level	0
Number of Points	1001
Sweep Time	0.066266667
Start Frequency	10000000
Stop Frequency	26500000000
Average Count	0
Average Type	LogPower(Video)
RBW	3000000
RBW Filter	Gaussian
RBW Filter BW	3dB
VBW	3000000
Sweep Type	Swept
X Axis Scale	Lin
PreAmp State	Off
PreAmp Band	Low
Trigger Source	Free
Trigger Level	1.2

Trigger Slope	Positive	
Trigger Delay	1.00E−06	
Phase Noise Optimization	Fast	
Swept If Gain	Low	
FFT If Gain	Autorange	
RF Coupling	AC	
FFT Width	411900	
Ext Ref	10000000	
Input	RF	
RF Calibrator	Off	
Attenuation	10	
Ref Level Offset	0	
External Gain	0	
X Axis Units	Hz	
Y Axis Units	dBm	
Peak Threshold	−85	
Peak Threshold State	On	
Peak Excursion	6	
Peak Excursion State	On	
Display Line	−61	
Peak Readout	AboveDL	
Peak Sort	Amptd	
DATA		
Peak	Frequency	Amplitude
1	1.0000E+06	1.86
2	1.0020E+06	−57.27
3	1.0048E+06	−58.97
4	9.8320E+05	−58.99
5	9.5120E+05	−59.58
6	9.9360E+05	−59.71
7	1.0390E+06	−59.71
8	1.0054E+06	−59.78
9	1.1086E+06	−60.05
10	9.9740E+05	−60.25
11	9.6680E+05	−60.25

12	1.0286E+06	–60.69
13	9.5500E+05	–60.74
14	9.5240E+05	–60.88
15	9.5140E+05	–60.89
16	9.5920E+05	–60.90
17		
18		
19		
20		

Marker Table

Selecting Marker Table allows you to export Marker Table files in the PC-readable .csv format.

Marker Table files have the extension “.csv”. The default filename is MeasR_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 Marker Table data files is:

My Documents\<mode name>\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) and <measurement name> is the parameter used to select the measurement with the CONF: command (for example, SAN for the Swept SA).

The Marker Table file contains a “meta” data header which describes the current state of the analyzer. The metadata is detailed below.

See "More Information" on page 552.

Notes

Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade.

Dependencies

If a save of Marker Table results is requested and the Marker Table is not on, no file is saved and a message is generated.

More Information

Marker Table File Contents

This section discusses the Marker Table Meas Results file format.

The Meas Results file, when opened, would show the following data:

Meas-ure-mentRes-ult	
Swept SA	
A.15.00	N9040-B
526 B25 PFR P26 EA3	1
Result Type	Marker Table
Ref Level	0
Number of Points	1001
Sweep Time	0.0662-66667
Start Frequency	10000-000
Stop Frequency	26500-000000
Average Count	0
Average Type	LogPo-wer (Video)
RBW	30000-00
RBW Filter	Gaus-sian
RBW Filter BW	3dB
VBW	30000-00
Sweep Type	Swept
X Axis Scale	Lin

PreAmp State	Off
PreAmp Band	Low
Trigger Source	Free
Trigger Level	1.2
Trigger Slope	Positive
Trigger Delay	1.00E–06
Phase Noise Optimization	Fast
Swept If Gain	Low
FFT If Gain	Autorange
RF Coupling	AC
FFT Width	411900
Ext Ref	10000000
Input	RF
RF Calibrator	Off
Attenuation	10
Ref Level Offset	0
External Gain	0
X Axis Units	Hz
Y Axis Units	dBm

MKR	MODE	TR-	SCL	X	Y	FUNCTION	FUNCTION	FUNCTION	FUNCTION

		C					WIDTH	VALUE	UNIT
1	Normal	1	Frequency	2.2350E+09	67.481	Off	0.0000E+00	0	None
2	Delta3	1	Frequency	0.0000E+00	–0.761	Off	0.0000E+00	0	None
3	Fixed	1	Frequency	1.3255E+10	–64.71	Off	0.0000E+00	0	None
4	Normal	2	Frequency	1.5904E+10	73.108	Off	0.0000E+00	0	None
5	Delta7	2	Frequency	2.7280E+09	30.258	Band Power	1.3250E+06	–3.969	dB
6	Normal	2	Time	5.2620E–02	70.177	Band Power	2.3840E+06	–43.15	dBm
7	Normal	3	Period	1.0680E–10	75.458	Off	0.0000E+00	0	None
8	Normal	3	Frequency	6.7120E+09	–77.33	Noise	3.3910E+06	–139.714	dBm/Hz
9	Fixed	3	Inverse Time	4.0000E+01	–30.05	Off	0.0000E+00	0	None
10	Normal	3	Frequency	1.1454E+10	75.161	Band Density	1.3250E+06	–138.973	dBm/Hz
11	Off	1	Frequency	0.0000E+00	0	Off	0.0000E+00	0	None
12	Off	1	Frequency	0.0000E+00	0	Off	0.0000E+00	0	None

Spectrogram

Selecting Spectrogram allows you to export Spectrogram files in the PC-readable .csv format.

Spectrogram files have the extension ".csv". The default filename is MeasR_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 Spectrogram data files is:

My Documents\<mode name>\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) and <measurement name> is the parameter used to select the measurement with the CONF: command (for example, SAN for the Swept SA).

The Spectrogram file contains a "meta" data header which describes the current state of the analyzer. The metadata is detailed below.

Notes

Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade.

Dependencies

If a save of Spectrogram results is requested and the Spectrogram is not on, no file is saved and a message is generated.

The Spectrogram choice only appears if option EDP is licensed.

More Information

This section discusses the Spectrogram Results file format. The Spectrogram choice only appears if option EDP is licensed.

The Spectrogram results are the same as a Trace data export, except that instead of having just one trace's data, all 300 traces appear one after the other.

Each trace has its own data mark; the data for Spectrogram Trace 0 follows the row marked DATA, the data for Spectrogram Trace 1 follows the row marked DATA1, for Spectrogram Trace 2 follows the row marked DATA2, and so on.

Each DATA row has a timestamp in the second column (as of firmware revision A.11.01). So, for example, if Trace 0 had a relative start time of 1729.523 sec, then the first DATA row would look like this:

DATA,1729.523

And if Trace 13 had a relative start time of 100.45 sec, then the fourteenth data row would look like:

DATA13,100.453

To find the absolute time for the relative timestamps of each trace, the last row before the first DATA row gives the absolute start time of the Spectrogram, in the form YYYYMMDDHHMMSS

So, for example, if the absolute start time is 13:23:45:678 on January 30, 2012, this row would look like:

Start Time,20120130132345678

NOTE **The resolution of the absolute time stored is 1 ms, which matches up with the fact that the fastest sweep time is also 1 ms. However, there is no specification for the absolute accuracy of the clock in the analyzer, nor is there any facility provided to allow the user to set this time to any particular degree of accuracy.**

Traces that have not yet been filled in the Spectrogram display are empty; there is no DATA header for them. The file ends after the last non-empty trace.

For the purpose of this example, we have set the Average/Hold Number to 10, thus we have only traces 0 thru 10. The Spectrogram was started at 02:28:08:700 pm on April 25, 2012 (that is, 700 ms after 2:28:08 pm), although the screen dump itself shows a different time, as it was taken ten minutes after the Spectrogram data. Trace 0 is showing a start time of 5.30 seconds, meaning 5.3 seconds after the Spectrogram started (trace 10 has a start time of 0, as it was the first trace taken but has now rolled up into the tenth trace slot).

The Meas Results file, when opened, shows the header data and ten traces of trace data. Below is an extract from the result file for the above display. Note the start time of 20120425142808700 showing in the last row before the first DATA row, and the relative time of 5.299231048 showing in the first DATA row:

Result Type	Spectrogram
MeasResult	
Swept SA	
A.15.00	N9040B
503 508 513 526 ALL ALV B1C B1X B25 B2X B40 BAB BBA CR3 CRP DP2 DRD EA3 EDP EMC EP1 ERC ESC ESP EXM FSA HBA K03 LFE MPB P03 P08 P13 P26 PFR RTL RTS S40 SB1 SEC SM1 UK6 YAS YAV	1
Segment	0
Number of Points	1001
Sweep Time	0.523333333
Start Frequency	5999984415
Stop Frequency	6000009415
Average Count	0

Average Type	LogPower(Video)
RBW	240
RBW Filter	Gaussian
RBW Filter BW	3dB
VBW	240
Sweep Type	Swept
X Axis Scale	Lin
PreAmp State	Off
PreAmp Band	Low
Trigger Source	Free
Trigger Level	1.2
Trigger Slope	Positive
Trigger Delay	0
Phase Noise Optimization	Wide
Swept If Gain	Low
FFT If Gain	Autorange
RF Coupling	AC
FFT Width	411900
Ext Ref	10000000
Input	RF
RF Calibrator	Off
Attenuation	14
Ref Level Offset	0
External Gain	0
Trace Type	Clearwrite
Detector	Normal
Trace Math	Off
Trace Math Oper1	Trace5
Trace Math Oper2	Trace6
Trace Math Offset	0
Trace Name	Trace1
X Axis Units	Hz
Y Axis Units	dBm
Start Time	20120425142808700
DATA	5.299231048

5999984415	-76.34749519
5999984440	-77.28097006
5999984465	-75.32317869
5999984490	-73.64417681
5999984515	-72.67154604
…	…
6000009315	-77.94423277
6000009340	-79.51829697
6000009365	-78.46108961
6000009390	-78.46108957
6000009415	-76.59570596
DATA2	4.708697055
5999984415	-80.98197882
5999984440	-80.98197879
5999984465	-75.83142132
5999984490	-74.02712079
5999984515	-73.57213005
…	…
6000009315	-75.9183103
6000009340	-79.53787488
6000009365	-78.82602191
6000009390	-78.82602188
6000009415	-76.37486709
DATA10	0
5999984415	-75.56751112
5999984440	-75.76485645
5999984465	-76.67718717
5999984490	-78.79238489
5999984515	-83.72680212
…	…
6000009315	-71.3942461
6000009340	-72.28308332
6000009365	-73.92684489
6000009390	-75.45548832
6000009415	-75.17904815

8.1.5.3 Limit

Save 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 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). So a Limit file from any measurement in the Spectrum Analyzer mode would be stored in

My Documents\SA\data\limits

Limit files have the extension ".csv". The default filename is LLine_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 analyzer, but yon can only save limits as .csv files.

- See "Limit File Contents" on page 560
- See ".csv file format" on page 561
- See ".lim file format" on page 562

Command	Not available in RLC Mode
Preset	1; not part of Preset, but is reset by Restore Mode Defaults and survives power cycles
State Saved	The selected Limit number is saved in instrument state.

Notes

Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade.

Dependencies

This key only appears if you have the proper option installed in your instrument.

More Information

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 analyzers to be loaded into the X-Series. Design of files in this format is not recommended.

Select Limit

This control enables you to select the specific Limit to be saved, e.g., Limit 1.

Preset	Not part of Preset, but is reset to LLINE1 by Restore Mode Defaults; survives shutdown

8.1.6 Correction

Allows you to export 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.

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 analyzer, but you can only save corrections as .csv files.

See "Correction Data File" on page 563.

Notes

Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade.

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.

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).

Corrections files are text files in .csv (comma separated values) form, to make them importable into Excel or other spreadsheet programs. The format for Corrections files is as follows.

8.1.6.1 Select Correction

This control enables you to select the specific Correction to be saved, e.g., Correction 1.

Preset	Not part of a Preset, but is reset to Correction 1 by Restore Input/Output Defaults. Survives a shutdown.

8.1.7 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.

8.1.8 Screen Image

Save Screen Image lets you choose a file for saving the contents of the display.

Screen Image files are PNG files with the same resolution as the data display. They contain the picture that was on the screen before going into the Save dialog. When the Screen Image key is pressed, a "thumbnail" of the captured image is displayed, as shown below, with the note “This is the image that will be saved” below it, as shown below.

The default path for State Files is:

`My Documents\<mode name>\screen`

where <mode name> is the parameter used to select the mode with the INST:SEL command (for example, SA for the Spectrum Analyzer).

Screen Image files have the 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.

8.1.8.1 Theme

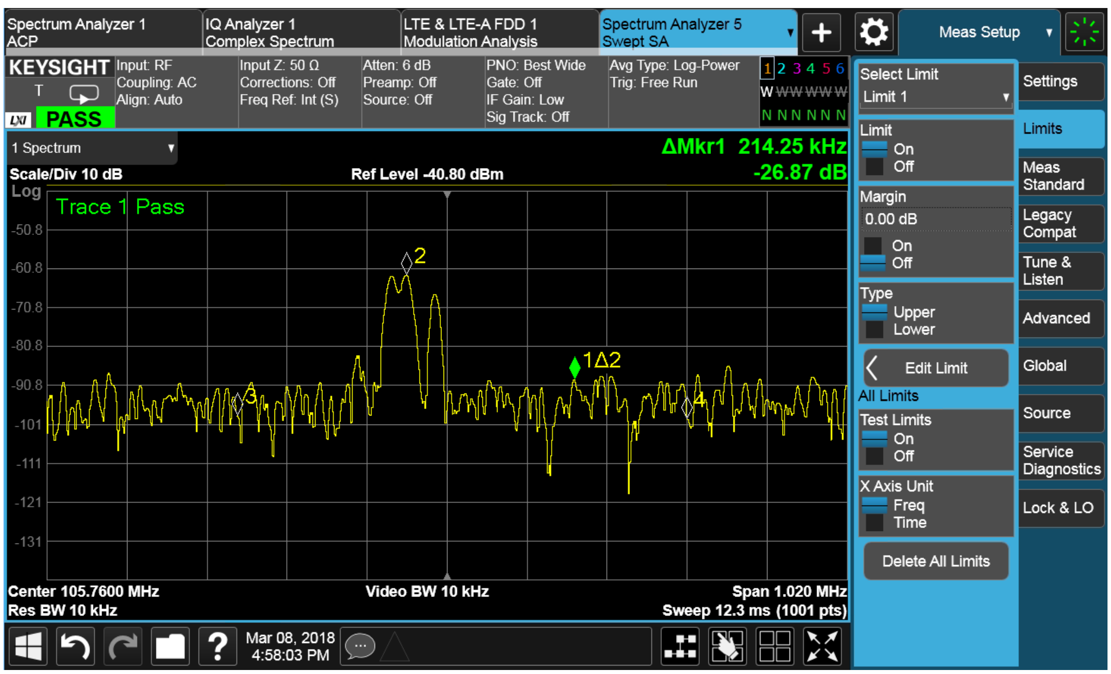
Accesses a menu of functions that enable you to choose the theme to be used when saving the screen image. It allows you to choose between themes to be used when saving the screen image.

See "More Information" on page 565 for examples of the themes.

Preset	Filled; not part of Preset, but is reset by Restore Misc Defaults or Restore System Defaults All
Backwards Compatibility Notes	In ESA and PSA we offer the choice of "Reverse Bitmap" or "Reverse Metafile" when saving screen images. This is much like the "Outline" theme available in the X-Series Touch UI. There is no monochrome theme in the X-Series Touch UI

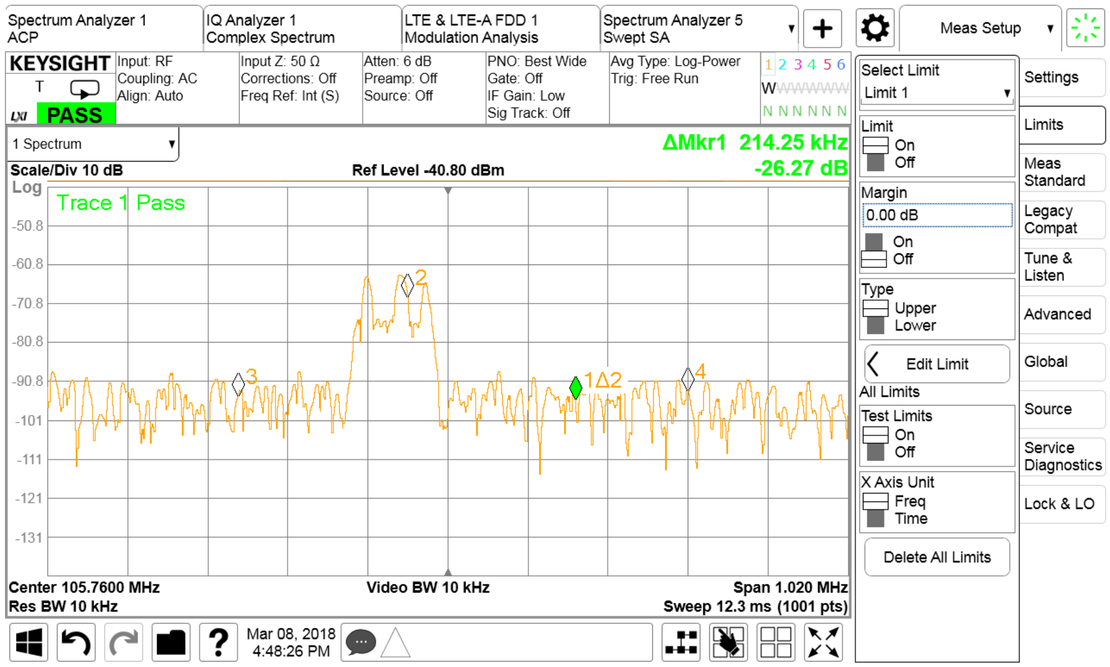
More Information

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.

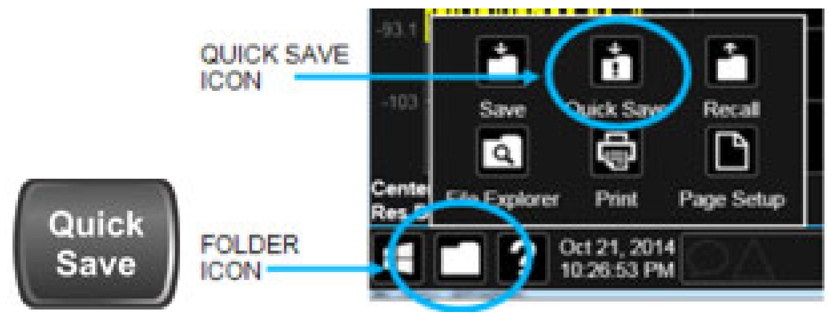
Note that some objects remain filled. In particular, the selected marker remains filled with the green marker color, in order to distinguish it from the other markers. This is important, as it is the selected marker whose readout appears in the upper right corner of the display:


Spectrum Analyzer 1
ACP
IQ Analyzer 1
Complex Spectrum
LTE & LTE-A FDD 1
Modulation Analysis
Spectrum Analyzer 5
Swept SA
Meas Setup
KEYSIGHT
PASS
Input: RF
Coupling: AC
Align: Auto
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
Atten: 6 dB
Preamp: Off
Source: Off
PNO: Best Wide
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Trig: Free Run
1 Spectrum
ΔMkr1 214.25 kHz
-26.27 dB
Scale/Div 10 dB
Ref Level -40.80 dBm
Log
Trace 1 Pass
Center 105.7600 MHz
Video BW 10 kHz
Span 1.020 MHz
Res BW 10 kHz
Sweep 12.3 ms (1001 pts)
Mar 08, 2018
4:48:26 PM
Select Limit
Limit 1
Limit
On
Off
Margin
0.00 dB
On
Off
Type
Upper
Lower
Edit Limit
All Limits
Test Limits
On
Off
X Axis Unit
Freq
Time
Delete All Limits
Settings
Limits
Meas Standard
Legacy Compat
Tune & Listen
Advanced
Global
Source
Service Diagnostics
Lock & LO

8.2 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

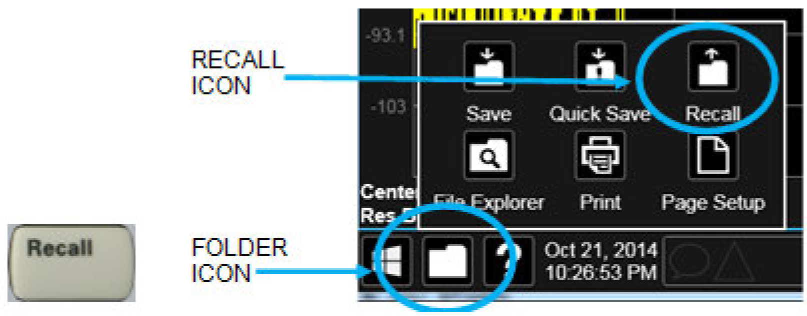
Quick Save can be operated in the Normal mode and in a special “Prompt” mode. There is a switch on the User Interface page of the System menus that lets you control this.

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

8.3 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

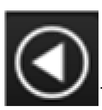
8.3.1 Recall From File / Open

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`)

8.3.2 State

Recall **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.

Notes

When you pick a file to recall, the analyzer first verifies that the file is recallable in the current instrument by checking the software version and model number of the instrument. If everything matches, a full 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) are loaded with values from the saved file. The saved measurement of the mode becomes the newly active measurement and the data relevant to the measurement (if there is any) is recalled.

If there is a mismatch between file version or model number or instrument version or model number, the recall function tries to recall as much as possible and returns a warning message. It may limit settings that differ based on model number, licensing or version number.

After recalling the state, the Recall State function does the following:

- Makes the saved measurement for the mode the active measurement.
- 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.

8.3.2.1 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.

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 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.

8.3.2.2 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.

8.3.3 Trace + State

Recall **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.

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.

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 analyzer exits the Recall menu and returns to the previous menu.

8.3.3.1 Recall To Trace

These menu selections let you choose the Trace where the recalled trace will go. 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 chosen All then it remains chosen 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" file, "To Trace" is ignored and the traces each go back to the trace from which they were saved.

8.3.3.2 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.

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.

Recall Register

Range	1-5

Save Register

8.3.3.3 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.

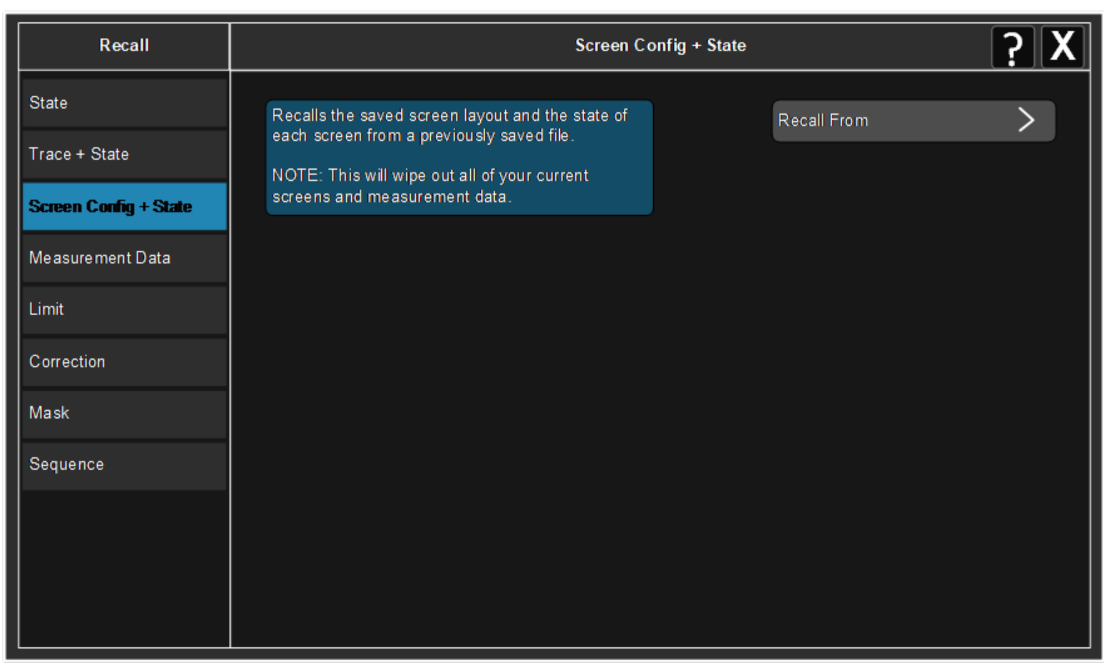
8.3.4 Screen Config + State

RecallScreen 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
```



8.3.5 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 542 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.

8.3.5.1 Recall To Trace

These menu selections let you choose the Trace where the recalled trace will go. 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 chosen All then it remains chosen 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" file, "To Trace" is ignored and the traces each go back to the trace from which they were saved.

8.3.5.2 Data Type

You choose the data type to recall by using the radio button selection box. The available data types are listed below.

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

Selecting Trace allows you to import Trace files in the PC-readable .csv format.

Trace files have the extension ".csv". The trace file contains a "meta" data header which describes the current state of the analyzer. The metadata is detailed in Trace File Contents below.

The trace file contains "meta" data which describes the state of the analyzer when the trace was exported (see Trace File Contents). If the meta data in the file does not match the current SA state, the "invalid data indicator" (*) is displayed.

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.

If any error occurs while trying to load a file manually (as opposed to during remote operation), the analyzer returns to the Import Data menu and the File Open dialog goes away.

Couplings

When a trace is imported, Trace Update is always turned OFF for that trace and Trace Display is always turned ON.

Trace File Contents

A **Trace Data File** contains the data for one trace.

Metadata: Trace Specific

Besides the trace data, there is metadata describing the context by which the trace was produced. Some of the metadata is trace specific:

- Trace Type
- Detector
- Trace math (function, operand1, operand2, offset, reference)
- Trace name/number

When importing a trace, the detector and/or trace math function specified in the metadata is imported with the trace, so that the annotation correctly shows the detector and/or math type that was used to generate the data

Metadata: Display Specific

There is also some display-related metadata:

- Ref Level Offset
- External Gain
- X-Axis Unit
- Y-Axis Unit

Metadata: Measurement Related

The rest of the metadata is measurement specific and reflects the state of the measurement the last time the trace was updated. These are the “measurement-related instrument settings” that are referred to in section Error! Reference source not found., the ones which, if changed, cause a measurement restart.

- Number of Points
- Sweep Time
- Start Frequency
- Stop Frequency
- Average Count (actual; not the limit for the instrument)
- Average Type
- RBW
- RBW Filter Type
- RBW Filter BW Type
- VBW
- Sweep Type (FFT vs. Swept)
- Log/Lin X Scale (sometimes called Log Sweep)
- Preamp (on/off, band)
- Trigger (source, level, slope, delay)
- Phase Noise optimization setting
- Swept IF Gain
- FFT IF Gain
- AC/DC setting (RF Coupling)
- FFT Width

- External Reference setting
- Input (which input is in use)
- RF calibrator on/off
- Attenuation

Because any inactive trace can have a value that does not match the rest of the measurement, when performing a Save the metadata for each trace is pulled from the individual trace, not from the measurement.

A revision number is also included in the trace database, to allow for future changes.

The choices for the various 1 of N and binary fields are as follows:

- Average Type: Power(RMS), Voltage, LogPower(Video)
- RBW Filter Type: Flattop, EMI, Gaussian
- RBW Filter BW: 3dB, 6dB, Noise, Impulse
- Sweep Type: Swept, FFT
- PreAmp State: On, Off
- PreAmp Band: Low, Full
- Trigger Source: Free, RFBurst, Video, Line, Periodic, Ext1, Ext2, TV
- Trigger Slope: Positive, Negative
- Phase Noise Optimization: Fast, Narrow, Wide
- Swept IF Gain: Low, High
- FFT If Gain: Autorange, Low, High
- Input: RF, ExtMix, BBIQ
- RF Calibrator: 50M, 400G, Comb, Off
- Trace Type: ClearWrite, TraceAverage, MaxHold, MinHold
- Detector: Normal, Average, Peak, NegPeak, Sample
- Trace Math: Off, PowerDifference, PowerSum, LogOffset, LogDifference
- Y Axis Unit: dBm, dBmV, dBmA, W, V, A, dBuV, dBuA, dBuV/m, dBuA/m, dBuV, dBpT, dBG, dB

After the header, just before the trace data, a line with just the word DATA on it is inserted to flag the start of the trace data.

The following file example shows the first lines of a Trace 1 file with X Axis Unit = Hz and Y Axis Unit = dBuV, after importing into Excel (the second row contains the Title):

Trace	
"AS/NZS 1044; Conducted >1000 W, Motors, Average"	
A.01.00	E4410A
526 EA3 B25 P26 PFR	1
Segment	0
Number of Points	1001
Sweep Time	0.066266667
Start Frequency	18827440
Stop Frequency	24463718
Average Count	0
Average Type	Power(RMS)
RBW	51000
RBW Filter	Gaussian
RBW Filter BW	3dB
VBW	51000
Sweep Type	Swept
Swept X Axis Scale	Lin
PreAmp State	Off
PreAmp Band	Low
Trigger Source	Video
Trigger Level	1.2
Trigger Slope	Positive
Trigger Delay	1.00E–06
Phase Noise Optimization	Fast
Swept IF Gain	Low
FFT IF Gain	Autorange
RF Coupling	AC
FFT Width	411900
Ext Ref	10000000
Input	RF
RF Calibrator	Off

Attenuation	10
Ref Level Offset	0
External Gain	0
Trace Type	ClearWrite
Detector	Normal
Trace Math	Off
Trace Math Oper1	Trace5
Trace Math Oper2	Trace6
Trace Math Offset	0
Trace Name	Trace1
X Axis Unit	Hz
Y Axis Unit	dBm
DATA	
1.6009301E+07	4.82047E+01
1.6018694E+07	4.69737E+01
1.6028087E+07	4.81207E+01
1.6037480E+07	4.72487E+01
1.6046873E+07	4.66437E+01
1.6056266E+07	4.66237E+01
1.6065659E+07	4.66967E+01
1.6075052E+07	4.77117E+01
1.6084445E+07	4.75787E+01
1.6093838E+07	4.83297E+01
1.6103231E+07	4.71327E+01
1.6112624E+07	4.78957E+01
1.6122017E+07	4.67507E+01
1.6131410E+07	4.81137E+01

8.3.6 Limit

Recall 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.

Limit files have the extension “.csv”.

For backwards compatibility, older limit files with the extension .lim can be read into the analyzer, 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

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. If any of these occur during manual operation, the analyzer returns to the Import Data menu and the File Open dialog goes away.

This key will only appear 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 analyzer 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.

Status Bits/OPC dependencies

Sequential - aborts the current measurement

8.3.6.1 Recall To Limit

This control enables you to select the specific Limit to be recalled, e.g., Limit 1.

Example	Not part of Preset, but is reset to LLINE1 by Restore Mode Defaults; survives shutdown

8.3.7 Correction

8.3.7.1 Amplitude Correction

Selecting **Amplitude 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 analyzer.

A set of preloaded Corrections files can be found in the directory

/My Documents/ EMC Limits and Ampcor/Ampcor

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. Only Correction 1 supports Antenna (Transducer) Units. When the Amplitude Correction is an Antenna correction and the Antenna Unit in the file is not **None**, the Y Axis Unit setting will change to match the Antenna (Transducer) Unit in the file.

Dependencies

Only the first correction array (Correction 1) supports antenna units. This means that a correction file with an Antenna Unit can only be loaded into the Corrections 1 register. Consequently only for Correction 1 does the dropdown in the Recall dialog include.ant, and if an attempt is made to load a correction file into any other Correction register which DOES contain an antenna unit, a Mass Storage error is generated.

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.

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. If any of these occur during manual operation, the analyzer returns to the Import Data menu and the File Open dialog goes away.

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 to On. This allows you to see its effect, thus confirming the load.

Select Correction

This control enables you to select the specific Correction to be recalled, e.g., Correction 1.

Preset	Not part of a Preset, but is reset to Correction 1 by Restore Input/Output Defaults. Survives a shutdown

8.3.8 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

8.3.8.1 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

8.3.9 Correction Group

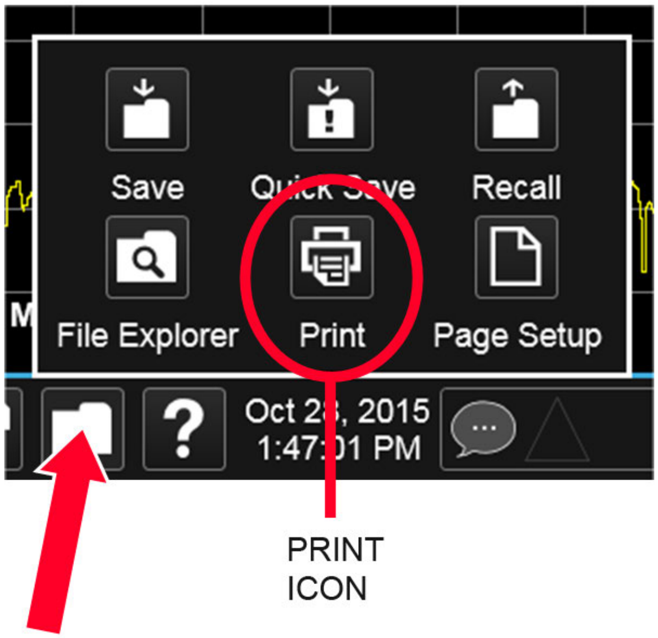
Selects the Correction Group as the data type to be imported. The next step is to press **Recall From** to open the file dialog. When recalling a correction group, the correction group settings, range table and correction files data will be loaded.

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

8.4 Print

Print is found under the File Functions icon.



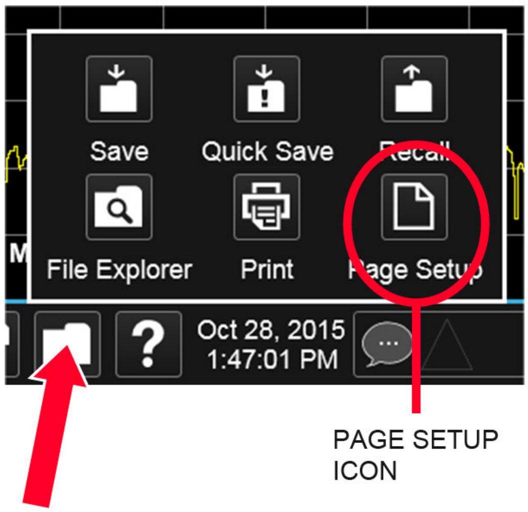
Opens a dialog for configuring printing (for example, to the printer of your choice).

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`

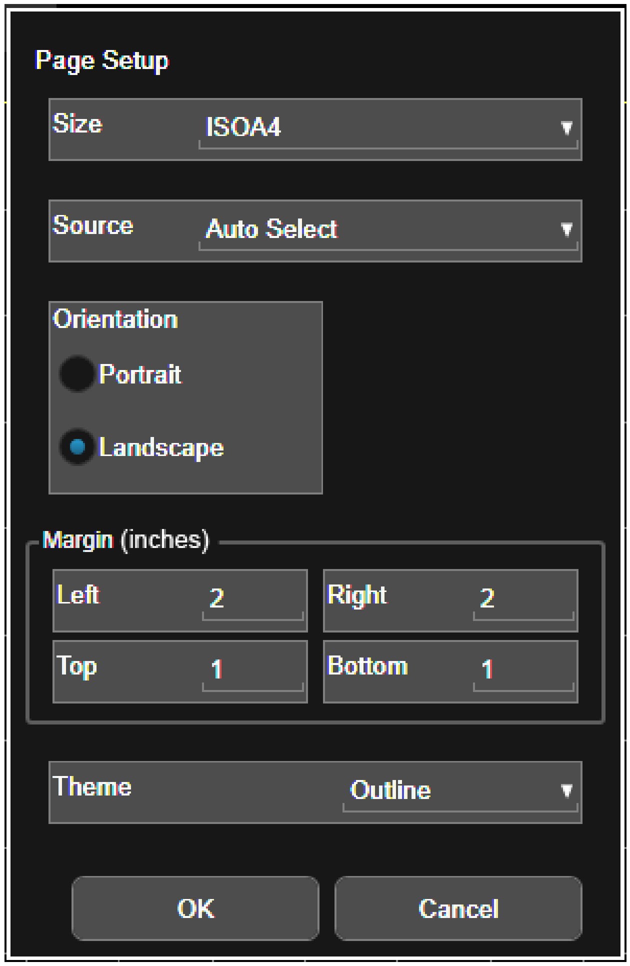
8.5 Page Setup

The **Page Setup** button is found under the File Functions icon.



Tapping the Page Setup button displays a Windows Page Setup dialog that allows you to control aspects of the pages sent to the printer during a Print operation.

You can set the paper size, the printer paper source, the page orientation and the margins. There are no SCPI commands for controlling these parameters.



Also contained in this dialog is a drop-down control that lets you select the display Theme to use when printing. The Page Setup themes are the same as those available for the Screen Image "Theme" on page 565.

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

9 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.

In general, each Measurement can have a different Trigger, and each Measurement remembers its previous-trigger setting.

9.1 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.

9.1.1 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.

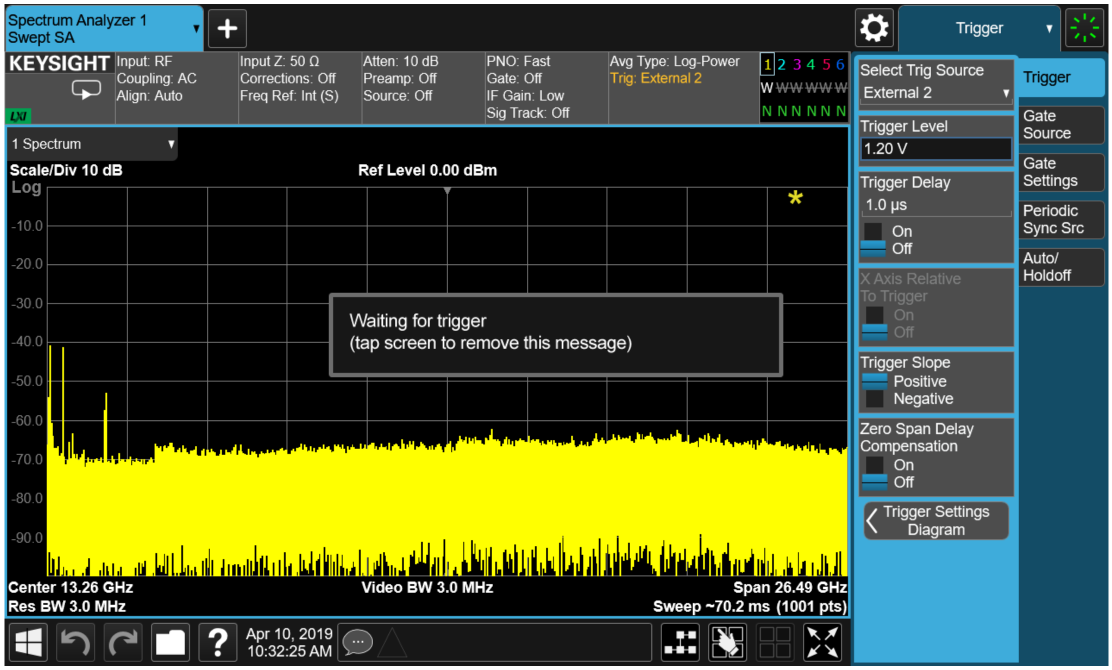
In general, each Measurement can have a different Trigger Source, and each Measurement remembers its previously-set Trigger Source. Not every Trigger Source is available for every Measurement, so the available choices for Select Trig Source may vary from Mode to Mode and Measurement to Measurement. The 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.

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 598	All Modes and measurements, except those measurements that support no triggers at all
"Video" on page 598	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	All Modes and measurements supporting Video, except Spectrum Analyzer

	mode Only supported in certain models' IF Paths
"Line" on page 599	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	RTSA and Pulse Modes only
FMT	RTSA and Pulse Modes only
"External 1/2" on page 599	All Modes and measurements
"External 3" on page 599	See "External 3 Support" on page 593
"RF Burst" on page 601	All Modes except EMI In Spectrum Analyzer, all measurements except List Sweep
"Periodic" on page 601	All Modes except EMI In Spectrum Analyzer, all measurements except List Sweep
"TV" on page 602	Spectrum Analyzer Mode only, and only in the Swept SA measurement

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

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.)

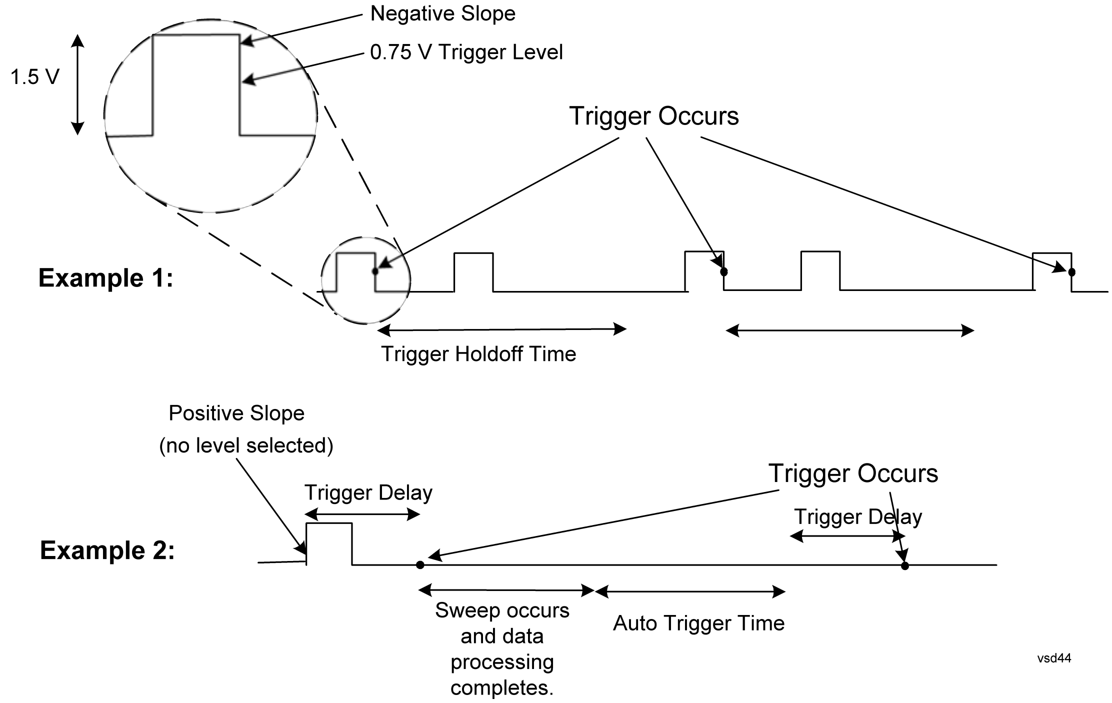
For each of the trigger sources, you may define a set of operational parameters or settings, which will be applied when that source is selected as the current trigger source. Examples of these settings are Trigger Level, Trigger Delay, and Trigger Slope. You may apply different settings for each source; 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	Not supported in RLC Mode

Dependencies	Not all 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
	`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

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
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:	LTEATDD: - BTS: EXT1 - MS: FRAM GSM/EDGE: IQM All others: IMM

Meas	Mode	Preset for RF	Preset for IQ
		RFBurst All others: IMM	
EVM	LTEAFDD, LTEATDD, SRCOMMS, 5GNR, WLAN	IMM	IMM
PVT	WLAN	RFB	IQ not supported
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	BT	RFB	IQ not supported
Adjacent Channel Power	BT	IMM	IQ not supported
LE In-band Emissions	BT	IMM	IQ not supported
EDR In-band Spurious Emissions	BT	Periodic Timer	IQ not supported
Conformance EVM	LTEAFDD, LTEATDD, MSR	IMM	IMM
Spectrum & PvT	RTSA	IMM	IQ not supported

Meas	Mode	Preset for RF	Preset for IQ
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

9.1.1.1 Free Run

Free run triggering occurs immediately after the sweep/measurement is initiated.

Annunciation	Free Run (in the Meas Bar)

Video

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 application do not support Video Trigger.

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 which 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 which support Video Trigger as an IF Envelope trigger, the units are typically in dBm.

Annunciation	Video (in the Meas Bar)

ADC Trigger

Some IF Paths in certain models (like N9042B) in IQ Measurements have an ADC trigger. ADC is like the Video trigger, but with 2 limitations due to a lack of post-processing.

First, the trigger is not limited to the current measurement's setup IF BW. The trigger sees everything in the passband, so measurements like IQA Complex Spectrum can be triggered outside of the current Digital IF BW.

The final limitation is, due to lack of post-processing, the amplitude accuracy of the ADC trigger is less than the video trigger.

If ADC trigger is available for at least one IF Path on a model, then the ADC trigger will always be seen as a trigger option in IQ Measurements. However, it will only be available (not grayed out) to select when using IF Paths that support it.

If Video Trigger is selected and measurement setup (IF Path or IF BW) is changed to a path that only supports the ADC trigger instead, then ADC trigger will be selected and *vice versa*.

Annunciation	ADC (in the Meas Bar)

Line

When Line is selected a new sweep/measurement will start 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 analyzers like the VXT.

Annunciation	LINE (in the Meas Bar)

External 1/2

When External 1 or External 2 is selected, a new sweep/measurement will start when the external trigger condition is met using the TRIGGER 1/2 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 if already selected and Point Trigger is set to External 1/2.

Annunciation	External 1/2 (in the Meas Bar)

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 593 in the section "Select Trig Source" on page 591.

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 598).

When **External 3** Trigger is selected, the **Trigger** tab displays the following Trigger Source dependent controls:

- "Trigger Delay" on page 606
- "Trigger Slope" on page 608

Additional controls are also present that are not dependent on the selected Trigger Source.

Annunciation	External 3 (in the Meas Bar)

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 606
- "Trigger Slope" on page 608

Additional controls are also present that are not dependent on the selected Trigger Source.

Annunciation	Audio Ext (in the Meas Bar)

RF Burst

When RF Burst is selected, a new sweep/measurement will start 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 analyzer automatically chooses the appropriate trigger path based on the hardware configuration and other settings of the analyzer.

Annunciation	RF Burst (in the Meas Bar)

Periodic

When Periodic is selected, the analyzer 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 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 Notes below).

If you do not have a sync source selected (it is Off), then the internal timer will not be synchronized with any external timing events.

See "More Information" on page 601

Annunciation	Periodic (in the Meas Bar)

More Information

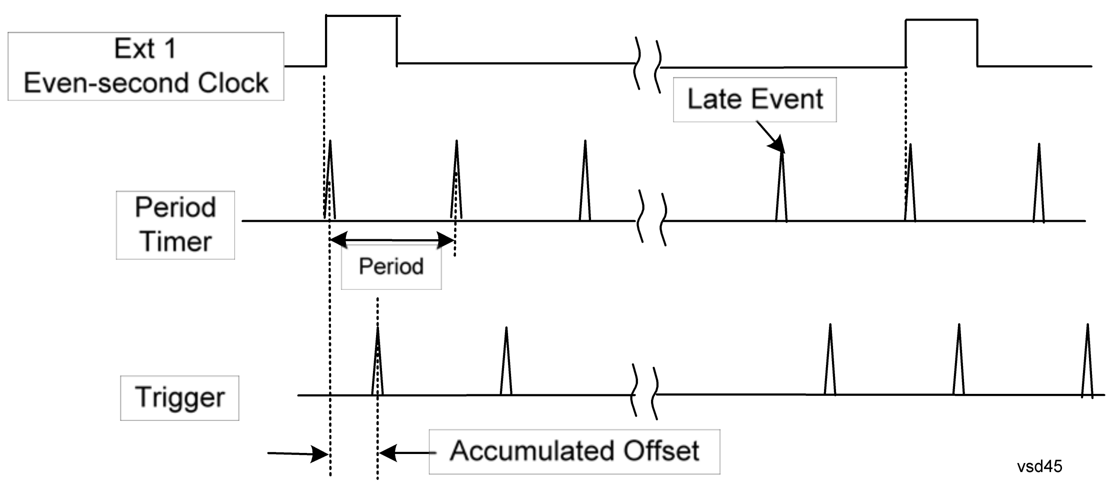
The figure below shows the action of the periodic timer trigger. Before reviewing the figure, we'll explain some uses for the periodic trigger.

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 which 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 analyzer 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 analyzer 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 analyzer, 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.)



TV

When TV Trigger is selected, a new sweep/measurement will start synchronized with the next occurrence of the synchronizing pulse of the selected TV line number.

TV Trigger is used when triggering on analog TV signals. It is only available in the Swept SA measurement.

The Trigger Tab contains the following Trigger Source dependent controls when TV Trigger is selected:

- "TV Line" on page 612
- "Field" on page 613
- "Standard" on page 613

Additional controls are also present which are not dependent on the selected Trigger Source.

See "More Information" on page 603

Annunciation	TV (in the Meas Bar)

More Information

Pressing this key, when it is not selected, selects the TV input signal as the trigger.

Pressing this key, when it is already selected, opens a menu of TV Trigger setup functions. The default active function in this menu is the TV line number on which you want to trigger.

The Frame and Field options enable you to determine how the fields of the TV picture signal will be affected by the trigger system. One complete TV image consists of one frame of 525 or 625 horizontal lines depending on the TV standard being used. Each frame is composed of two fields of interlacing lines, each consisting of 262 1/2 lines (or 312 1/2 lines). The fields are called Field One and Field Two. Field One is viewed as having 263 lines (or 313 lines) and Field Two is viewed as having 262 lines (or 312 lines).

For the 525 line NTSC video standard, we refer to TV lines as follows (these are the Field Modes):

- Entire Frame, lines 1 to 525
- Field One, lines 1 to 263
- Field Two, lines 1 to 262 (note that this really refers to "actual" lines 264 to 525)

For the 625 line PAL and SECAM video standards, we refer to TV lines as follows:

- Entire Frame, lines 1 to 625
- Field One, lines 1 to 313
- Field Two, lines 314 to 625

As the Field is changed, the appropriate value for Line is chosen to keep triggering on the same line as before, or if this is not possible, the corresponding line in the new Field. For example, suppose line 264 is selected while in the NTSC-M standard and the Entire Frame mode. This is the first line in Field Two. If Field Two is then selected, the Line number changes to Line 1, the same actual line in the TV signal. If Field One is then selected, the line number stays at 1, but now we are triggering in the first line in Field One. The only exception to this is if we are on the last line of Field One and change to Field Two. In this case, we go to the last line in Field Two.

9.1.1.2 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	Min	Max	Preset	Resolution	Step Key Incr.	Knob Incr.
Video	-170 dBm	+30 dBm	-25 dBm	.01 dB	Scale/Div (Log), 1 dB (Lin)	Step/10, but never < 0.1 dB
Level	-170 dBm	+30 dBm	-25 dBm	.01 dB	Scale/Div (Log), 1 dB (Lin)	Step/10, but never < 0.1 dB
External 1|2	-5 V VXT models M9410A/11 A: 0 V	5 V VXT models M9410A/11 A: 2.5 V	1.2 V	10 mV	0.5 V	0.1 V
I/Q Mag	-200 dBm	100 dBm	-25	.1 dB	Scale/Div	Step/10,

Source	Min	Max	Preset	Resolution	Step Key Incr.	Knob Incr.
			dBm		(Log), 1 dB (Lin)	but never < 0.1 dB
I (Demod)	-1 V	1 V	0.25 V	4 significant digits	Scale/Div	Step/100, but never < 1 µV
Q (Demod)	-1 V	1 V	0.25 V	4 significant digits	Scale/Div	Step/100, but never < 1 µV
Input I	-1 V	1 V	0.25 V	4 significant digits	Scale/Div	Step/100, but never < 1 µV
Input Q	-1 V	1 V	0.25 V	4 significant digits	Scale/Div	Step/100, but never < 1 µV
Aux Chan I/Q Mag	-200 dBm	100 dBm	-25 dBm	.1 dB	Scale/Div (Log), 1 dB (Lin)	Step/10, but never < 0.1 dB
Internal	-5 V VXT models M9410A/11 A: 0 V	5 V VXT models M9410A/11 A: 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 might often 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.

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

9.1.1.3 Trigger Delay

Controls a time delay that the analyzer 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.

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 user increases the Acq Time, it will increase this MaxValue
State Saved	Saved in instrument state
Annotation	Trig Delay (in the Measurement Bar)

Trigger Delay Parameters

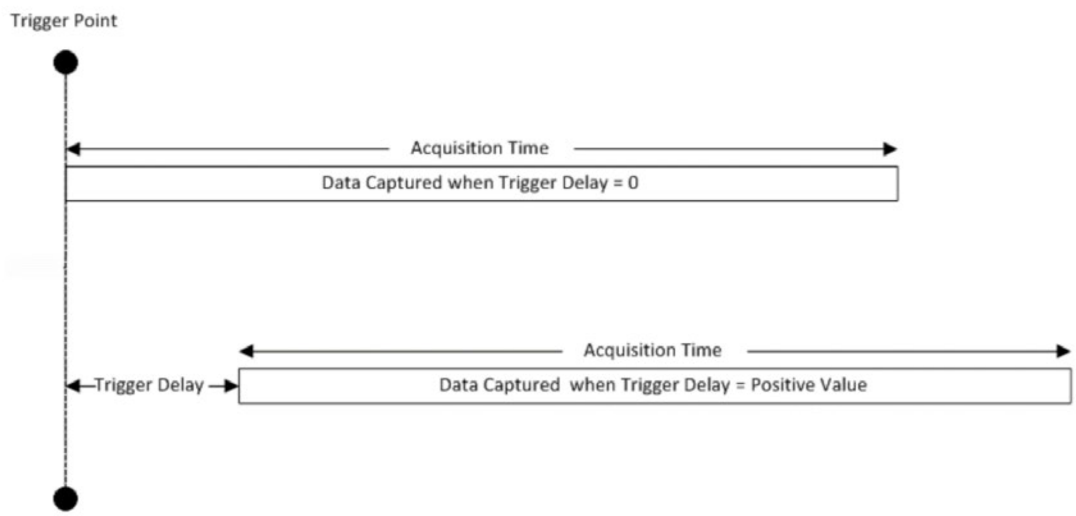
Note: in Swept SA, when transitioning from Zero Span to Swept spans, the trigger delay is clipped to -150 ms if it had been longer in Zero Span.

Source	Preset	Min	Max	Resolution
Video	Off, 1 us	-150 ms (-10s in Swept SA Zero Span)	+500 ms	100 ns
Level	Off, 30 ms	0 ms	70 sec (but dependent on Acq Time like FMT)	Multiple of Acq Time (as is FMT)
FMT	Off, 30 ms	0 ms	70 sec (but dependent on Acq Time like FMT)	Multiple of Acq Time (as is FMT)
External 1|2	Off, 1 us	-150 ms (-10s in Swept SA Zero Span)	+500 ms	100 ns
Line	Off, 1 us	-150 ms	+500 ms	100 ns

Source	Preset	Min	Max	Resolution
		(-10s in Swept SA Zero Span)		
RF Burst	Off, 1 us	-150 ms (-10s in Swept SA Zero Span)	+500 ms	100 ns
Periodic Timer	Off, 1 us	-150 ms (-10s in Swept SA Zero Span)	+500 ms	100 ns
I/Q Mag	Off, 1 us	-2.5 s	+10 s	10 ns
I (Demod)	Off, 1 us	-2.5 s	+10 s	10 ns
Q (Demod)	Off, 1 us	-2.5 s	+10 s	10 ns
Input I	Off, 1 us	-2.5 s	+10 s	10 ns
Input Q	Off, 1 us	-2.5 s	+10 s	10 ns
Aux Chan I/Q Mag	Off, 1 us	-2.5 s	+10 s	10 ns
PXI	Off, 1 us	-150 ms	+500 ms	100 ns
Internal	Off, 1 us	-150 ms	+500 ms	100 ns
Prot Channel Detection	Off, 1 ms	-10 ms	+10 ms	100 ns
Prot Frame Aligned	Off, 1 ms	-10 ms	+10 ms	100 ns
Prot Event	Off, 1 ms	-10 ms	+10 ms	100 ns

More Information

Here is the diagram for Frequency Mask Trigger (FMT) Trigger Delay:



9.1.1.4 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.

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

Note that, when transitioning from Zero Span to Swept spans, the trigger delay is clipped to -150 ms if it had been longer in Zero Span.

9.1.1.5 Trigger Level Absolute/Relative

This control selects between Absolute and Relative Burst Triggering.

Dependencies	Only appears when RF Burst is selected as the Trigger Source
Preset	`ABSolute`
State Saved	Saved in instrument state

9.1.1.6 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	Not supported in RLC Mode
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

9.1.1.7 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	Not supported in RLC Mode
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

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.

9.1.1.8 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	Not supported in RLC Mode
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

9.1.1.9 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 serves to delay the timing of the trigger event.

Remote Command	Not supported in RLC Mode
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 606
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

9.1.1.10 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	Not supported in RLC Mode
Dependencies	Only appears when Periodic Timer is selected as the Trigger or Gate Source

9.1.1.11 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.

Dependencies	Only appears when Periodic Timer is selected as the Trigger or Gate Source
Preset	OFF
State Saved	Saved in instrument state

9.1.1.12 TV Line

Selects the **TV Line** number on which to trigger. Line number range is dependent on the settings of the Standard and "Field" on page 613 menus 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	Not supported in RLC Mode
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

9.1.1.13 Field

Selects the **Field** on which to trigger:

Entire Frame	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	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	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	Not supported in RLC Mode
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`

9.1.1.14 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, if line 600 is selected in Entire Frame mode in PAL-N, then NTSC-M is selected, the line number is clipped to 525.

If line 313 is selected in Field 1 mode in PAL-N, then 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	Not supported in RLC Mode
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

9.1.1.15 Trigger Center Frequency

Sets the center frequency to be used by the auxiliary receiver for the Auxiliary Channel I/Q Magnitude trigger.

Remote Command	Not supported in RLC Mode
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

9.1.1.16 X Axis Relative to Trigger

For triggers that support Trigger Delay it is beneficial that in time-domain displays (like Zero Span), X-axis values should be referenced to the Trigger point, that is, the zero value on the X Axis should be wherever the trigger point appears on the X Axis (including to the left or right of the X Axis). For negative trigger delays this means the zero point can actually appear on the X Axis.

Traditionally the zero point is at the left edge of the X Axis, and this behavior is retained for backwards compatibility, but if you turn on **X Axis Relative to Trigger**, the zero point moves to the trigger point and all X Axis values change to be relative to the trigger point.

When the **X Axis Relative to Trigger** switch is On, the trigger point on the X-axis will be marked with a vertical line and an annotation of “TRIG”. Additionally, when the switch is On, values which are tied to the X-axis, such as trace data and markers, will have their X values adjusted to be referenced to the trigger point.

This switch only appears in the Swept SA measurement. It is grayed-out and Off unless in Zero Span.

Notes	Although shown in all Trigger menus that have Trig Delay, the function is global to all of them and has the same value in all
Dependencies	Grayed-out unless in Zero Span. When grayed out, shows as Off
Preset	Off
State Saved	Saved in instrument state

9.1.1.17 Zero Span Delay Compensation

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 **Zero Span Delay Comp On/Off** to enable or disable zero span delay compensation.

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
Dependencies	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

9.1.1.18 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	Not supported in RLC Mode

Preset	0
State Saved	Saved in instrument state
Range	[0,7]

9.1.1.19 Reset Sync Monitor

Allows you to reset the status of Synchronization for Periodic trigger

Remote Command	Not supported in RLC Mode
Notes	This control works together with status bit 10 “Periodic Trigger Synchronized” in Condition Errors – Signal Integrity Message “Periodic Trigger, Waiting for Sync Source” is displayed after pressing this control, and the status bit will be cleared Message “Periodic Trigger Synchronized” is displayed 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

9.1.1.20 Trigger Optimization

Sets the trigger behavior for various desired operation conditions.

Remote Command	Not supported in RLC Mode
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

Available Trigger optimization types:

Trigger Optimization	Notes
Normal	No optimization
Minimum Jitter	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,

Trigger Optimization	Notes
	the jitter will be reduced to 1ns This setting apples to all the Trigger Sources

9.1.1.21 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.

9.2 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

9.2.1 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

Remote Command	Not supported in RLC Mode
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
Preset	GSM/EDGE: FRAM MSR: EXT1 LTEATDD, 5G NR: – Direction is Downlink: EXT1 – Direction is Uplink: FRAM All Others: EXT1

9.3 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.

9.3.1 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 Method.

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	Not supported in RLC Mode
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

9.3.2 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	Not supported in RLC Mode
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 627 – 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.

9.3.3 Gate Delay

Controls the length of time from the time the gate condition goes True until the gate is turned on.

Remote Command	Not supported in RLC Mode
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

9.3.4 Gate Length

Controls the length of time that the gate is on after it opens.

Remote Command	Not supported in RLC Mode
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

9.3.5 Gate Method

Lets you choose one of the three different types of gating. Not all types of gating are available for all measurements.

For control option details, see "LO" on page 624, "Video" on page 625 or "FFT" on page 625

Remote Command	Not supported in RLC Mode
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.

9.3.6 Control Edge/Level

Sets the method of controlling the gating function from the gating signal.

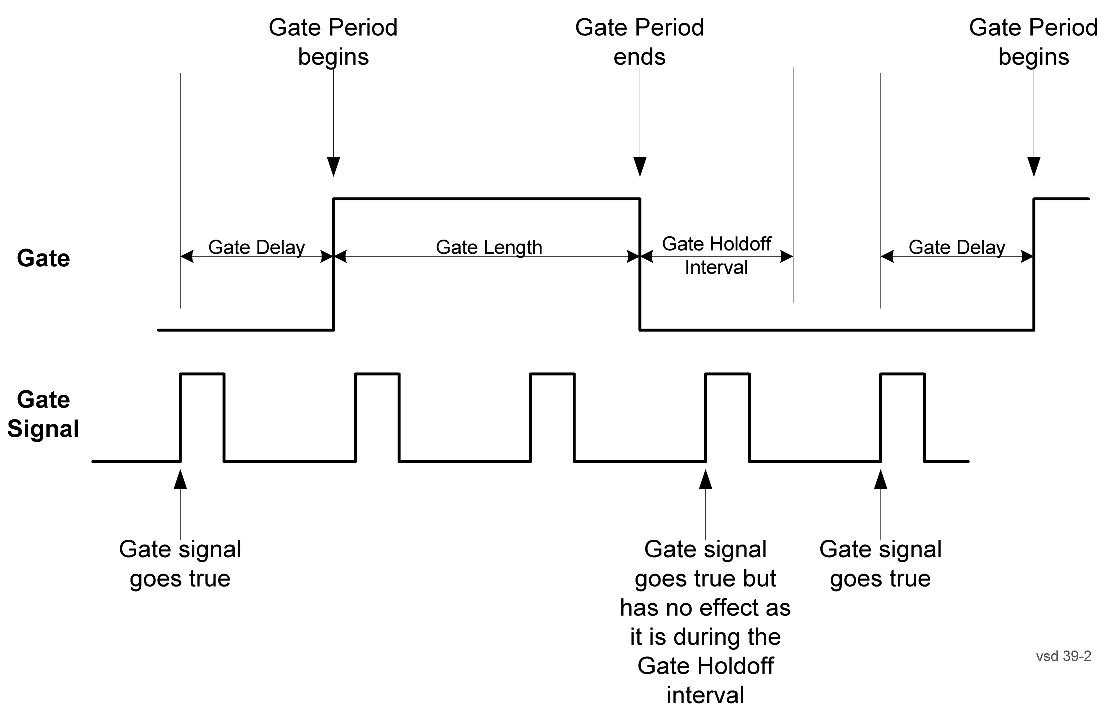
`EDGE`	The gate opens (after the Delay) on the selected edge (for example, positive) of the gate signal and closes on the alternate edge (for example, negative)
`LEVel`	The gate opens (after the Delay) when the gate signal has achieved a certain level and stays open as long as that level is maintained

Remote Command	Not supported in RLC Mode
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

9.3.7 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	Not supported in RLC Mode
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

9.3.8 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	Not supported in RLC Mode
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

9.3.9 Gate View Start Time

Controls the time at the left edge of the Gate View.

Remote Command	Not supported in RLC Mode
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

9.3.10 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.

You can 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 629

Remote Command	Not supported in RLC Mode
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 If Gate Delay Compensation is not supported at all within a particular mode, the control is not displayed

	Note that, for modular products such as EXM and VXT, this function is not supported. In those products the control is not displayed
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.

9.4 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.

9.4.1 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	Not supported in RLC Mode
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
Preset	`OFF` GSM/EDGE, LTE, LTETDD, 5G NR: `RFBurst`
State Saved	Saved in instrument state

9.5 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.

9.5.1 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	Not supported in RLC Mode
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
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

9.5.2 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	Not supported in RLC Mode
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

9.5.3 Holdoff Type

Sets the Trigger **Holdoff Type**.

NOTE Holdoff Type is not supported by all measurements. If the current measurement does not support it, this control does not appear and the Holdoff Type is Normal.

Trigger Holdoff Type options:

`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	Not supported in RLC Mode
Preset	All modes but GSM/EDGE: `NORMal` GSM/EDGE, Bluetooth: `BELow`
State Saved	Saved in instrument state

10 Programming the Instrument

This section provides information about the instrument's programming interface. You can operate the instrument remotely using SCPI or legacy languages.

10.1 List of Supported SCPI Commands

When the N9061C application has been selected, the instrument supports only a subset of SCPI commands.

The SCPI commands available while using the N9061C application are listed below. (Non-SCPI commands for legacy analyzers are *not* listed here; see instead "List of Legacy Analyzer Commands" on page 645.)

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.

You can use the index table below to navigate to the section for commands starting with a specific letter.

* A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

*

```
*IDN?
*RST
*TRG
*WAI
```

I

```
ID?
INPut:COUPling
INPut:COUPling
INPut:COUPling
INPut:COUPling?
INSTrument:DEFault
INSTrument:NSELect
INSTrument:NSELect
INSTrument:NSELect?
INSTrument[:SELect]
INSTrument[:SELect]
INSTrument[:SELect]?
```

O

```
OUTPut:ANALog
OUTPut:ANALog?
OUTPut:ANALog:AUTO
OUTPut:ANALog:AUTO?
OUTPut:ANALog:SVIDeo
```

OUTPut:ANALog:SVIDeo?

S

[:SENSe]:RLC:ATTenuation:OFFSet
[:SENSe]:RLC:ATTenuation:STATe
[:SENSe]:RLC:BANDwidth:LIMit
[:SENSe]:RLC:SWEep:TIME:AUTO:RULes
[:SENSe]:RLC:SWEep:TIME:LIMit
[:SENSe]:RLC:SWEep:TYPE:AUTO:RULes
[:SENSe]:SWEep:TYPE
[:SENSe]:SWEep:TYPE?
[:SENSe]:SWEep:TYPE:AUTO
[:SENSe]:SWEep:TYPE:AUTO?
[:SENSe]:SWEep:TYPE:AUTO:RULes
[:SENSe]:SWEep:TYPE:AUTO:RULes?
[:SENSe]:SWEep:TYPE:AUTO:RULes:AUTO[:STATe]
[:SENSe]:SWEep:TYPE:AUTO:RULes:AUTO[:STATe]?
SOURce:NOISe[:STATe]
SOURce:NOISe[:STATe]?
SOURce:NOISe:TYPE
SOURce:NOISe:TYPE?
SYSTem:LANGuage
SYSTem:LANGuage?
SYSTem:OPTions?

10.2 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.

10.2.1 *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 407.

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 407

10.2.2 *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

10.2.3 *ESE - Standard Event Status Enable

Sets the desired bits in the Event Enable Register of the "Standard Event Status Register" on page 959, 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

10.2.4 *ESR? - Standard Event Status Register Query

Queries and clears the "Standard Event Status Register" on page 959. (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)

10.2.5 *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

10.2.6 *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)

10.2.7 *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?`

10.2.8 *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

10.2.9 *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`

10.2.10 *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

10.2.11 *SRE - Service Request Enable

This command enables the desired bits of the "Service Request Enable Register" on page 958.

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)

10.2.12 *STB? - Status Byte Query

Returns the value of the "Status Byte Register" on page 955 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)

10.2.13 *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`

10.2.14 *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

10.2.15 *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.

10.3 List of Legacy Analyzer Commands

The following table ("Alphanumeric List of all Legacy Commands with RLC Mode Support" on page 645) lists all legacy analyzer programming commands (that is, commands for 8566A/B, 8568A/B, and the 8560 Series), and indicates which are supported by RLC Mode.

For more detailed information about each supported command, click on the link in the "More Information" column of the table to go to the relevant section in the "Legacy Command Descriptions" on page 679

(SCPI commands supported by RLC Mode are **not** listed here; see instead "List of Supported SCPI Commands" on page 635.)

Key to Table Columns "8566", "8568", and "8560 Series"

The entries in these columns have the following significance:

Entry	Significance
N/A	This command is not available in this legacy instrument.
No	This command is available in this legacy instrument, but is not supported by RLC Mode. This situation may occur due to architectural differences between legacy and X-Series instruments, which make support of the command either unnecessary or technically unfeasible.
Yes	This command is available in this legacy instrument, and is supported by RLC Mode.
Ext	This is an "extension" command. It is supported by RLC Mode when emulating this legacy instrument, but does not appear in the native command set of the legacy instrument.

Alphanumeric List of all Legacy Commands with RLC Mode Support

Command	Description	8566	8568	8560 Series	More Information
A1	Clear-writes trace A	Yes	Yes	Yes	"A1 (Clear Write for Trace A)" on page 681
A2	Max Holds trace A	Yes	Yes	Yes	"A2 (Maximum Hold for Trace A)" on page 682
A3	View trace A	Yes	Yes	Yes	"A3 (View Mode for Trace A)" on page 683
A4	Blanks trace A	Yes	Yes	Yes	"A4 (Blank Trace A)" on page 684
ABORT	Interrupt operation of all	N/A	N/A	No	

Command	Description	8566	8568	8560 Series	More Information
	user-defined functions				
ABS	Absolute	No	No	No	
ACP	Performs the adjacent channel power measurement	N/A	N/A	N/A	
ACPACCL	Accelerate adjacent channel power measurement	N/A	N/A	No	Not required in RLC Mode, because ACP measurement is faster than in legacy analyzers
ACPALPHA	Adjacent channel power alpha weighting	N/A	N/A	Yes	"ACPALPHA (Adjacent Channel Power Alpha Weighting)" on page 685
ACPALTCH	Adjacent channel power alternate channels	N/A	N/A	Yes	"ACPALTCH (Adjacent Channel Power Alternate Channels)" on page 686
ACPBRPER	Adjacent channel power burst period	N/A	N/A	Yes	"ACPBRPER (Adjacent Channel Power Burst Period)" on page 687
ACPBRWID	Adjacent channel power burst width	N/A	N/A	Yes	"ACPBRWID (Adjacent Channel Power Burst Width)" on page 688
ACPBW	Specifies channel bandwidth for ACP measurement	N/A	N/A	Yes	"ACPBW (Adjacent Channel Power Bandwidth)" on page 689
ACPCOMPUTE	Compute adjacent channel power	N/A	N/A	Yes	"ACPCOMPUTE (Adjacent Channel Power Compute)" on page 690
ACPCONTM	Performs ACP measurement in continuous sweep	N/A	N/A	N/A	
ACPE	Adjacent channel power extended	N/A	N/A	N/A	
ACPERR	ACP measurement error query	N/A	N/A	N/A	
ACPFRQWT	Adjacent channel power frequency weighting	N/A	N/A	Yes	"ACPFRQWT (Adjacent Channel Power Frequency Weighting)" on page 691
ACPGR	Adjacent channel power graph on or off	N/A	N/A	N/A	
ACPGRAPH	Compute adjacent channel power	N/A	N/A	No	

Command	Description	8566	8568	8560 Series	More Information
	graph				
ACPLOWER	Lower adjacent channel power	N/A	N/A	Yes	"ACPLOWER (Lower Adjacent Channel Power)" on page 692
ACPMAX	Maximum adjacent channel power	N/A	N/A	Yes	"ACPMAX (Maximum Adjacent Channel Power)" on page 693
ACPMEAS	Measure adjacent channel power	N/A	N/A	Yes	"ACPMEAS (Measure Adjacent Channel Power)" on page 693
ACPMETHOD	Adjacent channel power measurement method	N/A	N/A	No	
ACPMK	Adjacent channel power marker on or off	N/A	N/A	N/A	
ACPMSTATE	Adjacent channel power measurement state	N/A	N/A	Yes	"ACPMSTATE (Adjacent Channel Power Measurement State)" on page 694
ACPPAR	ACP manual or auto	N/A	N/A	N/A	
ACPPWRTX	Total power transmitted	N/A	N/A	Yes	"ACPPWRTX (Adjacent Channel Power Total Power Transmitted)" on page 696
ACPRSLTS	Adjacent channel power measurement results	N/A	N/A	Yes	"ACPRSLTS (Adjacent Channel Power Measurement Results)" on page 697
ACPSNGLM	Performs ACP measurement in single sweep	N/A	N/A	N/A	
ACPSP	Channel spacing	N/A	N/A	Yes	"ACPSP (Adjacent Channel Power Channel Spacing)" on page 698
ACPT	Adjacent channel power T weighting	N/A	N/A	Yes	"ACPT (Adjacent Channel Power T Weighting)" on page 699
ACPUPPER	Upper adjacent channel power	N/A	N/A	Yes	"ACPUPPER (Upper Adjacent Channel Power)" on page 700
ACTDEF	Give user-defined function active	N/A	N/A	N/A	

Command	Description	8566	8568	8560 Series	More Information
	status				
ACTVF	Active function	N/A	N/A	N/A	
ACTVFUNC	Creates a user defined active function	N/A	N/A	No	
ADD	Add	No	No	No	
ADJALL	LO & IF adjustment	N/A	N/A	Yes	"ADJALL (LO and IF Adjustments)" on page 701
ADJCRT	Adjust CRT alignment	N/A	N/A	No	
ADJIF	Adjust IF	N/A	N/A	Yes	"ADJIF" on page 702
AMB	Trace A - trace B -> trace A	Yes	Yes	Yes	"AMB (A minus B into A)" on page 702
AMBPL	Trace A - trace B + Display Line -> trace A	Yes	Yes	Yes	"AMBPL (A minus B plus Display Line into A)" on page 703
AMPCOR	Applies amplitude correction at specified frequencies	N/A	N/A	Yes	"AMPCOR" on page 704
AMPCORCFGC-NT	Retrieves count of AMPCOR settings	N/A	N/A	Ext	"AMPCORCFGCNT" on page 705
AMPCORCLEA-R	Clears current AMPCOR setting	N/A	N/A	Ext	"AMPCORCLEAR" on page 706
AMPCORDATA	Amplitude correction data	N/A	N/A	Yes	"AMPCORDATA" on page 706
AMPCORRCL	Amplitude correction recall	N/A	N/A	Yes	"AMPCORRCL" on page 707
AMPCORRESET	Deletes all AMPCOR settings	N/A	N/A	Ext	"AMPCORRESET" on page 708
AMPCORSAVE	Save amplitude correction data	N/A	N/A	Yes	"AMPCORSAVE" on page 708
AMPCORSIZE	Amplitude correction data array size	N/A	N/A	Yes	"AMPCORSIZE" on page 709
AMPLEN	Amplitude correction length	N/A	N/A	N/A	
ANLGPLUS	Turns on or off the Analog+ display mode	N/A	N/A	N/A	
ANNOT	Display	Yes	Yes	Yes	"ANNOT (Annotation)" on

Command	Description	8566	8568	8560 Series	More Information
	Annotation				page 709
APB	Trace A + trace B -> trace A	Yes	Yes	Yes	"APB (Trace A Plus Trace B to A)" on page 710
ARRAYDEF	Defines an array	N/A	N/A	No	
AT	Input Attenuation	Yes	Yes	Yes	"AT (Input Attenuation)" on page 711
AUNITS	Amplitude Units	Yes	Yes	Yes	"AUNITS (Absolute Amplitude Units)" on page 712
AUTO	Auto couple	N/A	N/A	N/A	
AUTOCPL	Auto couple	N/A	N/A	Yes	"AUTOCPL (Auto Coupled)" on page 714
AUTOEXEC	Turns on or off the function defined with AUTOFUNC	N/A	N/A	No	
AUTOFUNC	Defines a function for automatic execution	N/A	N/A	No	
AUTOSAVE	Automatically saves trace	N/A	N/A	No	
AVG	Average	No	No	No	
AXB	Exchange Traces A & B	Yes	Yes	Yes	"AXB (Exchange Trace A and Trace B)" on page 715
B1	Clear-writes trace B	Yes	Yes	Yes	"B1 (Clear Write for Trace B)" on page 716
B2	Max Holds trace B	Yes	Yes	Yes	"B2 (Maximum Hold for Trace B)" on page 717
B3	View trace B	Yes	Yes	Yes	"B3 (View Mode for Trace B)" on page 718
B4	Blanks trace B	Yes	Yes	Yes	"B4 (Blank Trace B)" on page 719
BAUDRATE	Baud rate of spectrum analyzer	N/A	N/A	N/A	
BIT	Return or receive state of bit	N/A	N/A	N/A	
BITF	Bit flag	N/A	N/A	N/A	
BL	Trace B - Display line -> trace B	Yes	Yes	N/A	"BL (Trace B minus Display Line to Trace B)" on page 720
BLANK	Blanks specified trace	Yes	Yes	Yes	"BLANK (Blank Trace)" on page 721
BML	Trace B - Display line -> trace B	Yes	Yes	Yes	"BML (Trace B Minus Display Line)" on page 722

Command	Description	8566	8568	8560 Series	More Information
BRD	Bus Read	No	No	N/A	
BTC	Transfer trace B to C	Yes	Yes	N/A	"BTC (Transfer Trace B to Trace C)" on page 723
BWR	Bus Write	No	No	N/A	
BXC	Exchange Traces B & C	Yes	Yes	N/A	"BXC (Exchange Trace B and Trace C)" on page 724
C1	Turns off A - B	Yes	Yes	Yes	"C1 (Set A Minus B Mode Off)" on page 725
C2	A - B -> A	Yes	Yes	Yes	"C2 (A Minus B Into A)" on page 726
CA	Couples Attenuation	Yes	Yes	Yes	"CA (Couple Attenuation)" on page 727
CAL	Calibrate	N/A	N/A	N/A	
CARDLOAD	Copies data from memory card to module memory	N/A	N/A	No	
CARDSTORE	Copies data to memory card	N/A	N/A	No	
CARROFF	Carrier off power	N/A	N/A	Yes	"CARROFF (Carrier Off Power)" on page 728
CARRON	Carrier on power	N/A	N/A	Yes	"CARRON (Carrier On Power)" on page 729
CAT	Catalog	N/A	N/A	N/A	
CATALOG	Catalog	N/A	N/A	No	
CF	Center Frequency	Yes	Yes	Yes	"CF (Center Frequency)" on page 730
CHANNEL	Channel selection	N/A	N/A	Yes	"CHANNEL (Channel Selection)" on page 731
CHANPWR	Channel power	N/A	N/A	Yes	"CHANPWR (Channel Power)" on page 732
CHP	Performs the channel power measurement	N/A	N/A	N/A	
CHPGR	Channel power graph on or off	N/A	N/A	N/A	
CHPWRBW	Channel power bandwidth	N/A	N/A	Yes	"CHPWRBW (Channel Power Bandwidth)" on page 733
CLRAVG	Reset avg. counter to 1	Yes	Yes	N/A	"CLRAVG (Clear Average)" on page 734
CLRBOX	Clears a rectangular area	N/A	N/A	N/A	

Command	Description	8566	8568	8560 Series	More Information
	on the analyzer display				
CLRDSP	Clear display	N/A	N/A	No	
CLRSCHED	Clears autosave & autoexec schedule buffer	N/A	N/A	No	
CLRW	Clear-writes specified trace	Yes	Yes	Yes	"CLRW (Clear Write)" on page 734
CLS	Clear status byte	N/A	N/A	N/A	
CMDERRQ	Command error query	N/A	N/A	N/A	
CNF	Confidence test	N/A	N/A	N/A	
CNTLA	Auxiliary interface control line A	N/A	N/A	No	
CNTLB	Auxiliary interface control line B	N/A	N/A	No	
CNTLC	Auxiliary interface control line C	N/A	N/A	No	
CNTLD	Auxiliary interface control line D	N/A	N/A	No	
CNTLI	Auxiliary interface control line input	N/A	N/A	No	
CNVLOSS	Selects ref level offset to calibrate amplitude display	N/A	N/A	Yes	"CNVLOSS (Conversion Loss Compensation)" on page 736
COMB	Turns the comb generator on or off	N/A	N/A	N/A	
COMPRESS	Compress	No	No	N/A	
CONCAT	Concat	No	No	N/A	
CONTS	Continuous sweep mode	Yes	Yes	Yes	"CONTS (Continuous Sweep)" on page 737
CORREK	Correction factors on	N/A	N/A	N/A	
COUPLE	Selects AC or DC coupling	N/A	N/A	Yes	"COUPLE (Input Coupling)" on page 738
CR	Couples Resolution BW	Yes	Yes	Yes	"CR (Couple Resolution Bandwidth)" on page 739
CRTHPOS	Horizontal position of CRT display	N/A	N/A	N/A	
CRTVPOS	Vertical position of CRT display	N/A	N/A	N/A	

Command	Description	8566	8568	8560 Series	More Information
CS	Couples Step Size	Yes	Yes	N/A	"CS (Couple Frequency Step Size)" on page 740
CT	Couples Sweep Time	Yes	Yes	N/A	"CT (Couple Sweep Time)" on page 741
CTA	Converts display units to dBm	No	No	N/A	
CTM	Converts dBm to display units	No	No	N/A	
CTRLHPIB	Allows SA to control HP-IB	N/A	N/A	No	
CV	Couples Video Bandwidth	Yes	Yes	N/A	"CV (Couple Video Bandwidth)" on page 742
D1	Sets display to normal size	No	No	N/A	
D2	Sets display to full CRT size	No	No	N/A	
D3	Sets display to expanded size	No	No	N/A	
DA	Display Memory Address	Yes	Yes	N/A	"DA (Display Address)" on page 743
DATEMODE	Set the date display format	N/A	N/A	No	
DD	Display write binary	No	No	N/A	
DELMKBW	Occupied power bandwidth within delta marker	N/A	N/A	Yes	"DELMKBW (Occupied Power Bandwidth Within Delta Marker)" on page 744
DEMOD	Turns the demodulator on or off	N/A	N/A	No	
DEMODAGC	Demodulation automatic gain control	N/A	N/A	No	
DEMODT	Demodulation time	N/A	N/A	No	
DET	Detection Mode	Yes	Yes	Yes	"DET (Detection Mode)" on page 745
DISPOSE	Frees Memory	No	No	No	
DIV	Divide	No	No	No	
DL	Display Line Level	Yes	Yes	Yes	"DL (Display Line)" on page 746

Command	Description	8566	8568	8560 Series	More Information
DLE	Turns the display line on/off	Yes	Yes	N/A	"DLE (Display Line Enable)" on page 747
DLYSWP	Delay sweep	N/A	N/A	Yes	"DLYSWP (Delay Sweep)" on page 748
DN	Reduces the active function by applicable step size	N/A	N/A	N/A	
DONE	Synchronizing function	Yes	Yes	Yes	"DONE (Done)" on page 749
DOTDENS	Sets the dot density value in Analog+ display mode	N/A	N/A	N/A	
DR	Display Memory Address Read	Yes	Yes	N/A	"DR (Display Read)" on page 750
DRAWBOX	Draws a rectangular box on analyzer display	N/A	N/A	N/A	
DSPLY	Display	No	No	No	
DT	Define Terminator	No	No	N/A	
DW	Display Memory Address Write	No	No	N/A	
E1	Active marker to maximum signal	Yes	Yes	Yes	"E1 (Peak Marker)" on page 750
E2	Active marker to center frequency	Yes	Yes	Yes	"E2 (Marker to Center Frequency)" on page 751
E3	Active marker frequency to CF step size	Yes	Yes	Yes	"E3 (Delta Marker Step Size)" on page 752
E4	Active marker to reference level	Yes	Yes	Yes	"E4 (Marker to Reference Level)" on page 753
EDITDONE	Indicates limit line editing is complete	N/A	N/A	Yes	"EDITDONE (Edit Done)" on page 754
EDITLIML	Allows current limit line to be edited	N/A	N/A	No	"EDITLIML (Edit Limit Line)" on page 755
EE	Enable entry	No	No	N/A	
EK	Enable knob	No	No	N/A	
ELSE	Conditional Programming	No	No	No	

Command	Description	8566	8568	8560 Series	More Information
	(If...then...else...endif)				
EM	Erase trace C memory	No	No	No	
ENDIF	Conditional Programming (If...then...else...endif)	No	No	N/A	
ENTER	Enter from HP-IB	No	No	No	
EP	Enter parameter function	N/A	N/A	N/A	
ERASE	User memory & registers erased	N/A	No	N/A	
ERR	Queries the error queue	Yes	Yes	Yes	"ERR (Error)" on page 756
ET	Elapsed time	N/A	N/A	Yes	"ET (Elapsed Time)" on page 758
EX	Exchanges trace A & B	Yes	Yes	Yes	"EX (Exchange Trace A and Trace B)" on page 759
EXP	Exponential	No	No	No	
EXTMXR	Presets external mixing mode	No	N/A	No	
FA	Start frequency	Yes	Yes	Yes	"FA (Start Frequency)" on page 760
FB	Stop frequency	Yes	Yes	Yes	"FB (Stop Frequency)" on page 761
FDIAG	Frequency diagnostics	N/A	N/A	No	
FDSP	Frequency display off	N/A	N/A	Yes	"FDSP (Frequency Display Off)" on page 762
FFT	Fast fourier transform	No	No	No	
FFTAUTO	Marker to Auto FFT	N/A	N/A	N/A	
FFTCLIP	FFT signal clipped	N/A	N/A	N/A	
FFTCONTS	FFT continuous sweep	N/A	N/A	N/A	
FFTKNL	Fast fourier transform kernel	No	No	N/A	
FFTMKR	FFT markers	N/A	N/A	N/A	
FFTMM	FFT marker to midscreen	N/A	N/A	N/A	

Command	Description	8566	8568	8560 Series	More Information
FFTMS	FFT marker to FFT stop frequency	N/A	N/A	N/A	
FFTOFF	FFT off	N/A	N/A	N/A	
FFTPCTAM	FFT percent amplitude modulation	N/A	N/A	N/A	
FFTPCTAMR	FFT percent amplitude modulation readout	N/A	N/A	N/A	
FFTSNGLS	FFT single sweep	N/A	N/A	N/A	
FFTSTAT	FFT status	N/A	N/A	N/A	
FFTSTOP	FFT stop frequency	N/A	N/A	N/A	
FMGAIN	FM gain	N/A	N/A	N/A	
FOFFSET	Frequency offset	Yes	Yes	Yes	"FOFFSET (Frequency Offset)" on page 763
FORMAT	Erase & format the selected memory device	N/A	N/A	No	
FPKA	Fast preselector peak	Yes	N/A	N/A	"FPKA (Fast Preselector Peak)" on page 764
FREF	Frequency reference	N/A	N/A	Yes	"FREF (Frequency Reference)" on page 765
FS	Full frequency span	Yes	Yes	Yes	"FS (Full Span)" on page 766
FULBAND	Set start/stop freq for ext mixing bands	N/A	N/A	Yes	"FULBAND" on page 768
FUNCDEF	Function definition	No	No	No	
GATE	Turn time-gating on or off	N/A	N/A	Yes	"GATE (Gate)" on page 769
GATECTL	Gate control	N/A	N/A	Yes	"GATECTL (Gate Control)" on page 770
GC	Gate preset	N/A	N/A	N/A	
GD	Gate delay	N/A	N/A	Yes	"GD (Gate Delay)" on page 771
GDRVCLPAR	Clear pulse parameters	N/A	N/A	N/A	
GDRVGDEL	Gate Delay for the frequency window	N/A	N/A	N/A	

Command	Description	8566	8568	8560 Series	More Information
GDRVGLEN	Gate length for frequency & time windows	N/A	N/A	N/A	
GDRVGT	Turns gate in frequency window on or off	N/A	N/A	N/A	
GDRVGTIM	Gate trigger to marker position for time window	N/A	N/A	N/A	
GDRVPRI	Pulse repetition interval	N/A	N/A	N/A	
GDRVPWID	Pulse width	N/A	N/A	N/A	
GDRVRBW	Couple resolution bandwidth to pulse width	N/A	N/A	N/A	
GDRVREFE	Enter reference edge	N/A	N/A	N/A	
GDRVST	Couple sweep time to pulse repetition interval	N/A	N/A	N/A	
GDRVSWAP	Update the time or frequency window	N/A	N/A	N/A	
GDRVSWDE	Delay sweep for time window	N/A	N/A	N/A	
GDRVSWP	Sweep time for the time window	N/A	N/A	N/A	
GDRVUTIL	Turns the gate utility on or off	N/A	N/A	N/A	
GDRVVBW	Couple video bandwidth to the gate length	N/A	N/A	N/A	
GETPLOT	Get plot	N/A	N/A	N/A	
GETPRNT	Get print	N/A	N/A	N/A	
GL	Gate length	N/A	N/A	Yes	"GL (Gate Length)" on page 772
GP	Sets the polarity (positive/negative) of the gate trigger	N/A	N/A	Yes	"GP (Gate Polarity)" on page 773
GR	Plot GPIB input as Graphs	No	No	N/A	
GRAT	Graticule on/off	Yes	Yes	Yes	"GRAT (Graticule)" on page 774

Command	Description	8566	8568	8560 Series	More Information
HAVE	Checks for options installed	N/A	N/A	N/A	
HD	Holds data entry	Yes	Yes	Yes	"HD (Hold Data Entry)" on page 775
HN	Harmonic number	N/A	N/A	N/A	
HNLOCK	Harmonic lock	N/A	N/A	Yes	"HNLOCK (Harmonic Lock)" on page 776
HNUNLK	Harmonic band unlock	No	N/A	No	
I1	Sets the RF coupling to AC	N/A	Yes	N/A	"I1 (Set RF Coupling to DC)" on page 777
I2	Sets the RF coupling to DC	N/A	Yes	N/A	"I2 (Set RF Coupling to AC)" on page 779
IB	Input to trace B memory	No	No	N/A	
ID	Instrument identification	Yes	Yes	Yes	"ID (Identify)" on page 780
IDCF	Identified signal to center frequency	N/A	N/A	No	
IDFREQ	Identified signal frequency	N/A	N/A	No	
IDSTAT	Signal identifier status	No	N/A	N/A	
IF	Conditional Programming (If...then...else...endif)	No	No	No	
IFTKNL	16 bit discrete fourier transform	No	No	N/A	
INT	Integer	No	No	No	
INZ	Input impedance	N/A	N/A	N/A	
IP	Instrument preset	Yes	Yes	Yes	"IP (Instrument Preset)" on page 781
KEYCLR	Clear user defined keys	N/A	N/A	No	
KEYCMD	Define function & label of softkey	N/A	N/A	N/A	
KEYDEF	Assign function to soft key	No	No	No	
KEYENH	Key enhance	N/A	N/A	N/A	
KEYEXC	Executes specified soft key	No	No	N/A	

Command	Description	8566	8568	8560 Series	More Information
KEYLBL	Relabels softkey without changing its function	N/A	N/A	N/A	
KS,	Mixer level	Yes	Yes	N/A	"KS, (Mixer Level)" on page 782
KS=	HP8566: Selects factory preselector setting HP8568: Marker counter frequency resolution	Yes	Yes	N/A	"KS= (8566A/B: Automatic Preselector Tracking, 8568A/B: Marker Counter Resolution)" on page 783
KS(	Locks the save registers	Yes	Yes	N/A	"KS((Lock Registers)" on page 784
KS)	Unlocks the save registers	Yes	Yes	N/A	"KS) (Unlock Registers)" on page 785
KS>	Specifies preamp gain for signal input 2	N/A	No	N/A	
KS<	Specifies preamp gain for signal input 1	N/A	No	N/A	
KS|	Display memory address write	No	No	N/A	
KS#	Turns off YTX self-heating correction	No	N/A	N/A	
KS/	Allows preselector to be peaked manually	No	N/A	N/A	
KS39	Writes display memory address in fast binary	No	No	N/A	
KS43	Sets SRQ 102 when frequency limit exceeded	No	No	N/A	
KS91	Returns the amplitude error	No	No	N/A	
KS92	Specifies value DL, TH, active mkr in display units	No	No	N/A	
KS94	Returns code for harmonic number in binary	No	No	N/A	
KS123	Returns up to	No	No	N/A	

Command	Description	8566	8568	8560 Series	More Information
	1001 words display memory				
KS125	Writes up to 1001 display memory words	No	No	N/A	
KS126	Returns every Nth value of a trace	No	No	N/A	
KS127	Sets analyzer to accept binary display write	No	No	N/A	
KSA	Sets amplitude units to dBm	Yes	Yes	N/A	"KSA (Amplitude in dBm)" on page 785
KSa	Selects normal detection	Yes	Yes	N/A	"KSa (Normal Detection)" on page 786
KSB	Sets amplitude units to dBmV	Yes	Yes	N/A	"KSB (Amplitude in dBmV)" on page 787
KSb	Selects positive peak detection	Yes	Yes	N/A	"KSb (Positive Peak Detection)" on page 787
KSC	Sets amplitude units to dBuV	Yes	Yes	N/A	"KSC (Amplitude in dBμV)" on page 788
KSc	Trace A + trace B -> trace A	Yes	Yes	N/A	"KSc (A Plus B to A)" on page 788
KSD	Sets amplitude units to V	Yes	Yes	N/A	"KSD (Amplitude in Volts)" on page 789
KSd	Selects negative peak detection	Yes	Yes	N/A	"KSd (Negative Peak Detection)" on page 789
KSE	Sets the analyzer title mode	Yes	Yes	N/A	"KSE (Title Mode)" on page 790
KSe	Selects sample detection	Yes	Yes	N/A	"KSe (Sample Detection)" on page 791
KSF	HP8566: Shifts the YTO HP8568: Measures the Sweep Time	No	No	N/A	
KSf	Recover last instrument state at power on	No	No	N/A	
KSG	Turns on video averaging	Yes	Yes	N/A	"KSG (Video Averaging On)" on page 791
KSg	Turns off the display	Yes	Yes	N/A	"KSg (Display Off)" on page 792
KSH	Turns off video averaging	Yes	Yes	N/A	"KSH (Video Averaging Off)" on page 793

Command	Description	8566	8568	8560 Series	More Information
KSh	Turns on the display	Yes	Yes	N/A	"KSh (Display On)" on page 793
KSI	Allows the reference level to be extended	Yes	Yes	N/A	"KSI (Extend Reference Level)" on page 794
KSi	Exchanges traces B & C	Yes	Yes	N/A	"KSi (Exchange Trace B and Trace C)" on page 795
KSJ	Manual control of DACs	No	No	N/A	
KSj	Views trace C	Yes	Yes	N/A	"KSj (View Trace C)" on page 795
KSK	HP8566: Active Mkr to next highest peak HP8568: Counts pilot IF at marker	Yes	No	N/A	"KSK (Marker to Next Peak)" on page 796
KSk	Blanks trace C	Yes	Yes	N/A	"KSk (Blank Trace C)" on page 797
KSL	Turns off marker noise function	Yes	Yes	N/A	"KSL (Marker Noise Off)" on page 797
KSl	Moves trace B into trace C	Yes	Yes	N/A	"KSl (Transfer Trace B to Trace C)" on page 798
KSM	Turns on marker noise function	Yes	Yes	N/A	"KSM (Marker Noise On)" on page 799
KSm	Turns off the graticule	Yes	Yes	N/A	"KSm (Graticule Off)" on page 799
KSN	Marker minimum value detected	Yes	No	N/A	"KSN (Marker Minimum)" on page 800
KSn	Turns on the graticule	Yes	Yes	N/A	"KSn (Graticule On)" on page 800
KSO	Marker span	Yes	Yes	N/A	"KSO (Marker Span)" on page 801
KSo	Turns off the annotation	Yes	Yes	N/A	"KSo (Annotation Off)" on page 802
KSP	GPIB address	Yes	Yes	N/A	"KSP (GPIB Address)" on page 802
KSp	Turns on the annotation	Yes	Yes	N/A	"KSp (Annotation On)" on page 803
KSQ	Unlocks frequency band	No	No	N/A	
KSq	Decouples IF gain and input attenuation	No	No	N/A	

Command	Description	8566	8568	8560 Series	More Information
KSR	Turns on service diagnostics	No	No	N/A	
KSr	Sets service request 102	No	No	N/A	
KSS	HP8566: Fast GPIB operation HP8568: Determine second LO frequency	No	No	N/A	
KST	HP8566: Fast preset HP8568: Shifts second LO down	Yes	No	N/A	"KST (Fast Preset)" on page 803
KSt	HP8566: Locks frequency band HP8568: Continues sweep from marker	No	No	N/A	
KSU	HP8566: External mixer preset HP8568: Shift second LO up	No	No	N/A	
KSu	Stops the sweep at the active marker	No	No	N/A	
KSV	Frequency offset	Yes	Yes	N/A	"KSV (Frequency Offset)" on page 804
KSv	HP8566: External mixer frequency identifier HP8568: Inhibits phase lock	No	No	N/A	
KSW	Amplitude error correction routine	No	No	N/A	
KSw	Displays amplitude error correction routine	No	No	N/A	
KSX	Amplitude correction factors on	No	No	N/A	
KSx	Sets trigger mode to external	Yes	Yes	N/A	"KSx (External Trigger)" on page 805
KSY	Amplitude correction factors off	No	No	N/A	

Command	Description	8566	8568	8560 Series	More Information
KSy	Sets trigger mode to video	Yes	Yes	N/A	"KSy (Video Trigger)" on page 805
KSZ	Reference level offset	Yes	Yes	N/A	"KSZ (Reference Level Offset)" on page 806
KSz	Sets the display storage address	No	No	N/A	
L0	Turns off the display line	Yes	Yes	Yes	"L0 (Display Line Off)" on page 807
LB	Writes text label	No	No	No	
LCLVAR	Defines a local variable for use	N/A	N/A	No	
LF	Preset 0-2.5GHz	Yes	N/A	N/A	"LF (Low Frequency Preset)" on page 808
LG	Selects log scale	Yes	Yes	Yes	"LG (Logarithmic Scale)" on page 808
LIMD	Delta amplitude value for limit line segment	N/A	N/A	Yes	
LIMF	Frequency value for limit-line segment	N/A	N/A	Yes	"LIMF (Limit Line Frequency Value)" on page 809
LIMIDEL	Erase contents of limit line table	N/A	N/A	N/A	
LIMIDISP	Controls when the limit line(s) are displayed	N/A	N/A	N/A	
LIMIFAIL	Limit line fail	N/A	N/A	Yes	"LIMIFAIL (Limits Failed)" on page 810
LIMIFT	Select frequency or time limit line	N/A	N/A	N/A	
LIMIHI	Upper limit	N/A	N/A	N/A	
LIMILINE	Limit line	N/A	N/A	N/A	
LIMILO	Lower limit	N/A	N/A	N/A	
LIMIMIRROR	Mirror limit line	N/A	N/A	N/A	
LIMIMODE	Limit line entry mode	N/A	N/A	N/A	
LIMIPURGE	Disposes of current limit line, not limit line table	N/A	N/A	Yes	"LIMIPURGE (Delete Current Limit Line)" on page 811
LIMIRCL	Load stored limit line into limit line table	N/A	N/A	Yes	"LIMIRCL (Recall Limit Line)" on page 812

Command	Description	8566	8568	8560 Series	More Information
LIMIREL	Determine whether limit line values absolute/relative	N/A	N/A	Yes	"LIMIREL (Relative Limit Lines)" on page 813
LIMISAV	Save contents of limit line table for recall	N/A	N/A	Yes	"LIMISAV (Save Limit Line)" on page 813
LIMISEG	Define slope & offset of limit line segments	N/A	N/A	N/A	
LIMISEGT	Enter limit line segment for sweep time	N/A	N/A	N/A	
LIMITST	Compare active trace data to limit line parameters	N/A	N/A	Yes	"LIMITST (Activate Limit Line Test Function)" on page 816
LIML	Amplitude value for limit line segment in lower limit line	N/A	N/A	Yes	"LIML (Lower-Limit Amplitude)" on page 814
LIMM	Middle amplitude value for limit-line segment	N/A	N/A	Yes	
LIMTFL	Specifies a flat limit-line segment	N/A	N/A	Yes	"LIMTFL (Flat Limit Line)" on page 815
LIMTSL	Specifies a sloped limit-line segment	N/A	N/A	Yes	"LIMTSL (Slope Limit Line)" on page 817
LIMU	Amplitude value for limit line segment in upper limit line	N/A	N/A	Yes	"LIMU (Upper-Limit Amplitude)" on page 817
LINFILL	Line fill	N/A	N/A	N/A	
LL	Provides lower left recorder output voltage at rear	No	No	N/A	
LN	Selects linear scale	Yes	Yes	Yes	"LN (Linear Scale)" on page 818
LOAD	Load article/file into internal memory	N/A	N/A	N/A	
LOG	Log	No	No	No	
LOLIMOFF	LO Limit Off	No	No	N/A	
LSPAN	Last span	N/A	N/A	N/A	
M1	Turns off all	Yes	Yes	N/A	"M1 (Marker Off)" on page

Command	Description	8566	8568	8560 Series	More Information
	markers				819
M2	Marker Normal	Yes	Yes	N/A	"M2 (Marker Normal)" on page 820
M3	Marker Delta	Yes	Yes	N/A	"M3 (Delta Marker)" on page 821
M4	Marker zoom	Yes	Yes	N/A	"M4 (Marker Zoom)" on page 823
MA	Returns the amplitude of active marker	Yes	Yes	Yes	"MA (Marker Amplitude Output)" on page 824
MBIAS	Mixer bias	No	No	N/A	
MBRD	Processor memory block read	No	No	N/A	
MBWR	Processor memory block write	No	No	N/A	
MC0	Turns off the marker frequency counter	N/A	Yes	N/A	"MC0 (Marker Frequency Counte r Off)" on page 825
MC1	Turns on the marker frequency counter	N/A	Yes	N/A	"MC1 (Marker Frequency Counte r On)" on page 825
MDS	Measurement data size	Yes	Yes	N/A	"MDS (Measurement Data Size)" on page 826
MDU	Measurement data units	Yes	Yes	N/A	"MDU (Measurement Data Units)" on page 827
MEAN	Returns mean value of trace in display units	Yes	Yes	Yes	"MEAN (Trace Mean)" on page 827
MEANPWR	Mean power measurement	N/A	N/A	Yes	"MEANPWR (Mean Power measurement)" on page 828
MEANTH	Trace mean above threshold	N/A	N/A	N/A	
MEAS	Measurement status	Yes	Yes	Yes	"MEAS (Meas)" on page 829
MEASOFF	Measurement off	No	No	N/A	
MEASURE	Measure mode	N/A	N/A	N/A	
MEM	Returns amount of memory available	No	No	No	
MENU	Menu	N/A	N/A	No	

Command	Description	8566	8568	8560 Series	More Information
MERGE	Merge two traces	No	No	N/A	
MF	Returns frequency of the active marker	Yes	Yes	Yes	"MF (Marker Frequency Output)" on page 830
MIN	Minimum	No	No	No	
MINH	Min Hold	N/A	N/A	Yes	"MINH (Minimum Hold)" on page 831
MINPOS	Returns the minimum position in the trace	Yes	Yes	N/A	"MINPOS (Minimum X Position)" on page 832
MIRROR	Mirror image of the trace	No	No	N/A	
MKA	Amplitude of the active marker	Yes	Yes	Yes	"MKA (Marker Amplitude)" on page 833
MKACT	Specifies the active marker	Yes	Yes	N/A	"MKACT (Activate Marker)" on page 834
MKACTV	Marker as the active function	N/A	N/A	N/A	
MKBW	Marker bandwidth	N/A	N/A	Yes	"MKBW (Marker Bandwidth)" on page 835
MKCF	Moves the active marker to center frequency	Yes	Yes	Yes	"MKCF (Marker to Center Frequency)" on page 836
MKCHEDGE	Marker to channel edge	N/A	N/A	No	
MKCONT	Continues sweeping from the marker after stop	No	No	N/A	
MKD	Delta marker	Yes	Yes	Yes	"MKD (Marker Delta)" on page 837
MKDELCHBW	Delta markers to channel power bandwidth	N/A	N/A	No	
MKDLMODE	Marker delta display line mode	N/A	N/A	N/A	
MKDR	Reciprocal of marker delta	N/A	N/A	No	
MKF	Specifies the frequency of the active marker	Yes	Yes	Yes	"MKF (Marker Frequency)" on page 838
MKFC	Turns the marker frequency counter on or off	N/A	Yes	Yes	"MKFC (Marker Counter)" on page 839

Command	Description	8566	8568	8560 Series	More Information
MKFCR	Specifies the marker frequency counter resolution	N/A	Yes	Yes	"MKFCR (Marker Counter Resolution)" on page 840
MKMCF	Marker mean to center frequency	N/A	N/A	No	
MKMIN	Moves active marker to minimum signal detected	Yes	Yes	Yes	"MKMIN (Marker Minimum)" on page 842
MKN	Normal marker	Yes	Yes	Yes	"MKN (Marker Normal)" on page 843
MKNOISE	Marker noise function	Yes	Yes	Yes	"MKNOISE (Marker Noise)" on page 844
MKOFF	Turns all markers or the active marker off	Yes	Yes	Yes	"MKOFF (Marker Off)" on page 845
MKP	Specifies the horizontal position of the marker	Yes	Yes	N/A	"MKP (Marker Position)" on page 846
MKPAUSE	Pauses the sweep at the active marker	No	No	N/A	
MKPK	Marker peak	Yes	Yes	Yes	"MKPK (Marker Peak)" on page 846
MKPT	Marker peak threshold	N/A	N/A	Yes	"MKPT (Marker Threshold)" on page 847
MKPX	Marker peak excursion	Yes	Yes	Yes	"MKPX (Marker Peak Excursion)" on page 848
MKREAD	Specifies marker readout mode	Yes	Yes	N/A	"MKREAD (Marker Readout)" on page 849
MKRL	Moves the active marker to reference level	Yes	Yes	Yes	"MKRL (Marker to Reference Level)" on page 851
MKSP	Marker span	Yes	Yes	Yes	"MKSP (Marker Span)" on page 852
MKSS	Marker step size	Yes	Yes	Yes	"MKSS (Marker to Step Size)" on page 853
MKSTOP	Stops the sweep at the active marker	No	No	N/A	
MKT	Position marker in units of time	N/A	N/A	Yes	"MKT (Marker Time)" on page 854

Command	Description	8566	8568	8560 Series	More Information
MKTBL	Marker table	N/A	N/A	N/A	
MKTRACE	Marker trace	Yes	Yes	N/A	"MKTRACE (Marker Trace)" on page 855
MKTRACK	Turns the marker signal track on or off	Yes	Yes	Yes	"MKTRACK (Marker Track)" on page 856
MKTYPE	Specifies the type of active marker to be used	Yes	Yes	N/A	"MKTYPE (Marker Type)" on page 857
ML	Mixer Level	Yes	Yes	Yes	"ML (Mixer Level)" on page 858
MOD	Modulo	No	No	No	
MODRCLT	Recalls trace from module memory	N/A	N/A	No	
MODSAVT	Saves trace in module memory	N/A	N/A	No	
MOV	Move	No	No	No	
MPY	Multiply	No	No	No	
MRD	Memory Read	No	No	N/A	
MRDB	Memory read byte	No	No	N/A	
MSDEV	Specifies mass storage device	N/A	N/A	No	
MSI	Mass storage interface	N/A	N/A	N/A	
MT0	Turns off marker signal track	Yes	Yes	N/A	"MT0 (Marker Track Off)" on page 859
MT1	Turns on marker signal track	Yes	Yes	N/A	"MT1 (Marker Track On)" on page 860
MWR	Memory Write	No	No	N/A	
MWRB	Memory write byte	No	No	N/A	
MXM	Maximum	No	No	No	
MXMH	Max Hold	Yes	Yes	Yes	"MXMH (Maximum Hold)" on page 861
MXRMODE	Mixer mode	N/A	N/A	Yes	"MXRMODE (Mixer Mode)" on page 862
NDB	Number of dB	N/A	N/A	N/A	
NDBPNT	Turns the N dB points function on or off	N/A	N/A	N/A	
NDBPNTR	N dB points bandwidth	N/A	N/A	N/A	

Command	Description	8566	8568	8560 Series	More Information
NORMLIZE	Normalize trace data	N/A	N/A	Yes	"NORMLIZE (Normalize Trace Data)" on page 863
NRL	Normalized reference level	N/A	N/A	Yes	"NRL (Normalized Reference Level)" on page 864
NRPOS	Normalized reference position	N/A	N/A	Yes	"NRPOS (Normalized Reference Position)" on page 865
NSTART	Start harmonic	No	N/A	N/A	
NSTOP	Stop harmonic	No	N/A	N/A	
O1	Output format	Yes	Yes	N/A	"O1 (Format - Display Units)" on page 866
O2	Output format	Yes	Yes	N/A	"O2 (Format - Two 8-Bit Bytes)" on page 866
O3	Output format	Yes	Yes	N/A	"O3 (Format - Real Amplitude Units)" on page 867
O4	Output format	Yes	Yes	N/A	"O4 (Format - One 8-Bit Byte)" on page 867
OA	Returns the active function value	Yes	Yes	N/A	"OA or ? (Query Active Function)" on page 868
OBW	Occupied bandwidth	N/A	N/A	N/A	
OBWBW	Bandwidth measured by occupied bandwidth	N/A	N/A	N/A	
OBWFERR	Occupied bandwidth transmit frequency error	N/A	N/A	N/A	
OBWLOWER	Relative lower frequency limit of occupied bandwidth	N/A	N/A	N/A	
OBWPCT	Occupied bandwidth percent	N/A	N/A	N/A	
OBWPWR	Total power in the occupied bandwidth	N/A	N/A	N/A	
OBWUPPER	Relative upper frequency limit of	N/A	N/A	N/A	

Command	Description	8566	8568	8560 Series	More Information
	occupied bandwidth				
OCCUP	Percent occupied power bandwidth	N/A	N/A	Yes	"OCCUP (Percent Occupied Power Bandwidth)" on page 868
OL	Output learn string	Yes	Yes	N/A	"OL (Output Learn String)" on page 869
ONCYCLE	On cycle	N/A	N/A	N/A	
ONDELAY	On delay	N/A	N/A	N/A	
ONEOS	On end of sweep	No	No	No	
ONMKR	On marker pause	N/A	N/A	N/A	
ONMKRU	On marker update	N/A	N/A	N/A	
ONPWRUP	On power up	N/A	N/A	N/A	
ONSRQ	On service request	N/A	N/A	N/A	
ONSWP	On sweep	No	No	N/A	
ONTIME	On time	N/A	N/A	N/A	
OP	Output parameters	No	No	No	
OR	Set position of origin	N/A	N/A	No	
OT	Output trace annotations	Yes	Yes	N/A	"OT (Output Trace Annotations)" on page 871
OUTPUT	Output - sending data to the GPIB from function	No	No	No	
PA	Plot absolute	No	No	No	
PARSTAT	Parallel status	N/A	N/A	N/A	
PCTAM	Turns the percent AM measurement on or off	N/A	N/A	N/A	
PCTAMR	Percent AM response	N/A	N/A	N/A	
PD	Pen down	No	No	No	
PDA	Probability distribution amplitude	No	No	No	
PDF	Probability distribution frequency	No	No	No	
PEAKS	Sorts the signal peaks by	Yes	Yes	Yes	"PEAKS (Peaks)" on page 873

Command	Description	8566	8568	8560 Series	More Information
	amplitude/frequency				
PKDLMODE	Peak table delta display line mode	N/A	N/A	N/A	
PKPOS	Peak position	N/A	Yes	N/A	"PKPOS (Peak Position)" on page 874
PKRES	Peak result	N/A	N/A	N/A	
PKSORT	Selects how to sort signal peaks listed in peak table	N/A	N/A	N/A	
PKTBL	Turns the peak table on or off	N/A	N/A	N/A	
PKZMOK	Peak zoom okay	N/A	N/A	N/A	
PKZOOM	Peak zoom	N/A	N/A	N/A	
PLOT	Prints the screen	Yes	Yes	Yes	"PLOT (Plot)" on page 874
PLOTORG	Display origins	N/A	N/A	No	
PLOTSRC	Plot source	N/A	N/A	No	
PLTPRT	Plot port	N/A	N/A	N/A	
POWERON	Power on state	N/A	N/A	N/A	
PP	Peaks the preselector	Yes	N/A	Yes	"PP (Preselector Peak)" on page 875
PR	Plot relative	No	No	No	
PREAMPG	External preamplifier gain	N/A	N/A	N/A	
PREFX	Change user memory entries file prefix	N/A	N/A	N/A	
PRINT	Print	N/A	N/A	Yes	"PRINT (Print)" on page 876
PRNPRT	Print port	N/A	N/A	N/A	
PRNTADRS	Print address	N/A	N/A	N/A	
PS	Skip page	No	No	N/A	
PSDAC	Preselector DAC number	N/A	N/A	No	
PSTATE	Protect state	N/A	N/A	No	
PU	Pen up	No	No	No	
PURGE	Purge file	N/A	N/A	N/A	
PWRBW	Power bandwidth	Yes	Yes	Yes	"PWRBW (Power Bandwidth)" on page 877

Command	Description	8566	8568	8560 Series	More Information
PWRUPTIME	Power up time	N/A	N/A	N/A	
Q0	Sets detector to EMI Peak detection	N/A	Yes	N/A	"Q0 (Set Detector to EMI Peak Detection)" on page 878
Q1	Sets detector to Quasi Peak detection	N/A	Yes	N/A	"Q1 (Set Detector to Quasi Peak Detection)" on page 878
R1	Resets service request 140	Yes	Yes	N/A	"R1 (Illegal Command SRQ)" on page 879
R2	Allows service request 140 & 104	Yes	Yes	N/A	"R2 (End-of-Sweep SRQ)" on page 880
R3	Allows service request 140 & 110	Yes	Yes	N/A	"R3 (Hardware Broken SRQ)" on page 880
R4	Allows service request 140 & 102	Yes	Yes	N/A	"R4 (Units-Key-Pressed SRQ)" on page 881
RB	Resolution bandwidth	Yes	Yes	Yes	"RB (Resolution Bandwidth)" on page 881
RBR	Resolution bandwidth/Span ratio	N/A	N/A	Yes	"RBR (Resolution Bandwidth to Span Ratio)" on page 883
RC	Recalls state register	Yes	Yes	Yes	"RC (Recall State)" on page 884
RCLOSCAL	Recall open/short average	N/A	N/A	No	
RCLS	Recall state	Yes	Yes	Yes	"RCLS (Recall State)" on page 885
RCLT	Recall trace	N/A	N/A	Yes	"RCLT (Recall Trace)" on page 886
RCLTHRU	Recall internal thru-reference trace into trace B	N/A	N/A	No	
RELHPIB	Release control of GPIB	N/A	N/A	No	
REPEAT	Conditional Programming (Repeat ... Until ...)	No	No	No	
RESETRL	Reset reference level	N/A	N/A	N/A	
RETURN	Return to user defined function origination point	N/A	N/A	No	
REV	Returns the revision string to the controller	Yes	Yes	Yes	"REV (Revision)" on page 887

Command	Description	8566	8568	8560 Series	More Information
RL	Reference level	Yes	Yes	Yes	"RL (Reference Level)" on page 888
RLCAL	Reference level calibration	N/A	N/A	No	
RLPOS	Reference level position	N/A	N/A	N/A	
RMS	Root mean square	Yes	Yes	N/A	"RMS (Root Mean Square Value)" on page 889
ROFFSET	Reference level offset	Yes	Yes	Yes	"ROFFSET (Reference Level Offset)" on page 890
RQS	SRQ mask	Yes	Yes	Yes	"RQS (Request Service Conditions)" on page 891
S1	Continuous sweep mode	Yes	Yes	N/A	"S1 (Continuous Sweep)" on page 893
S2	Single sweep mode	Yes	Yes	N/A	"S2 (Single Sweep)" on page 894
SADD	Adds a limit line segment	N/A	N/A	Yes	"SADD (Add Limit Line Segment)" on page 894
SAVEMENU	Save menu	N/A	N/A	N/A	
SAVES	Saves analyzer state to specified register	Yes	Yes	Yes	"SAVES (Save State)" on page 895
SAVET	Save trace	N/A	N/A	No	
SAVRCLF	Save or recall flag	N/A	N/A	N/A	
SAVRCLN	Save or recall number	N/A	N/A	N/A	
SAVRCLW	Save or recall data	N/A	N/A	N/A	
SDEL	Deletes a limit line segment	N/A	N/A	Yes	"SDEL (Delete Limit Line Segment)" on page 896
SDON	Indicates limit line segment is done	N/A	N/A	Yes	"SDON (Terminate SEDI Command)" on page 896
SEDI	Edits limit line segment	N/A	N/A	Yes	"SEDI (Edit Limit Line Segment)" on page 897
SEGDEL	Delete specified segment from limit line tables	N/A	N/A	N/A	
SENTER	Segment entry for frequency limit lines	N/A	N/A	No	
SENTERT	Segment entry for sweep time limit	N/A	N/A	N/A	

Command	Description	8566	8568	8560 Series	More Information
	lines				
SER	Serial number	N/A	N/A	Yes	"SER (Serial Number)" on page 898
SETDATE	Set the date of spectrum analyzer	N/A	N/A	Yes	"SETDATE (Set Date)" on page 899
SETTIME	Set the time of spectrum analyzer	N/A	N/A	Yes	"SETTIME (Set Time)" on page 900
SHOWMENU	Shows menu	N/A	N/A	No	
SIGDEL	Signal amplitude delta	No	N/A	N/A	
SIGID	External mixing frequency bands signal identifier	No	N/A	No	
SKYCLR	Clears user softkey	N/A	N/A	No	
SKYDEF	Defines user softkey	N/A	N/A	No	
SMOOTH	Smooths given trace over specified number points	Yes	Yes	N/A	"SMOOTH (Smooth Trace)" on page 900
SNGLS	Single sweep mode	Yes	Yes	Yes	"SNGLS (Single Sweep)" on page 901
SP	Frequency Span	Yes	Yes	Yes	"SP (Frequency Span)" on page 902
SPEAKER	Turns the internal speaker on or off	N/A	N/A	N/A	
SPZOOM	Span Zoom	N/A	N/A	N/A	
SQLCH	Sets the squelch threshold	N/A	N/A	N/A	
SQR	Square root	No	No	No	
SQUELCH	Adjusts squelch level	N/A	N/A	No	
SRCALC	Selects internal or external level control	N/A	N/A	No	
SRCAT	Attenuate source output level	N/A	N/A	N/A	
SRCCRSTK	Coarse tracking adjust	N/A	N/A	No	
SRCFINTK	Fine tracking adjust	N/A	N/A	No	

Command	Description	8566	8568	8560 Series	More Information
SRCNORM	Source normalization	N/A	N/A	N/A	
SRCPOFS	Offset source power level	N/A	N/A	No	
SRCPSTP	Select source power step size	N/A	N/A	No	
SRCPSWP	Select sweep range of source output	N/A	N/A	No	
SRCPWR	Select source power level	N/A	N/A	No	
SRCTK	Adjust tracking of source output with SA sweep	N/A	N/A	N/A	
SRCTKPK	Auto adjust tracking of source output with SA sweep	N/A	N/A	No	
SRQ	Service request	Yes	Yes	Yes	"SRQ (Service Request)" on page 904
SS	Frequency Step Size	Yes	Yes	Yes	"SS (Center Frequency Step Size)" on page 905
ST	Sweep Time	Yes	Yes	Yes	"ST (Sweep Time)" on page 906
STB	Status byte query	N/A	N/A	Yes	"STB (Status Byte Query)" on page 908
STDEV	Standard deviation of trace amplitude	Yes	Yes	N/A	"STDEV (Standard Deviation of Trace Amplitudes)" on page 909
STOR	Store file	N/A	N/A	N/A	
STOREOPEN	Save current instrument state	N/A	N/A	No	
STORESHORT	Store short	N/A	N/A	No	
STORETHRU	Store thru-calibration trace in trace B	N/A	N/A	No	
SUB	Subtract	No	No	No	
SUM	Sum of trace element amplitudes in display units	No	No	Yes	"SUM (Sum)" on page 909
SUMSQR	Squares trace element	No	No	No	

Command	Description	8566	8568	8560 Series	More Information
	amplitudes & returns sum				
SV	Saves state	Yes	Yes	N/A	"SV (Save State)" on page 910
SW	Skip to next control instruction	No	No	N/A	
SWPCPL	Sweep couple	N/A	N/A	Yes	"SWPCPL (Sweep Couple)" on page 911
SWPOUT	Sweep output	N/A	N/A	No	
SYNCMODE	Synchronize mode	N/A	N/A	N/A	
T0	Turns the threshold level off	Yes	Yes	N/A	"T0 (Turn Off Threshold Level)" on page 912
T1	Sets the trigger mode to free run	Yes	Yes	N/A	"T1 (Free Run Trigger)" on page 913
T2	Sets the trigger mode to line	Yes	Yes	N/A	"T2 (Line Trigger)" on page 914
T3	Sets the trigger mode to external	Yes	Yes	N/A	"T3 (External Trigger)" on page 915
T4	Sets the trigger mode to video	Yes	Yes	N/A	"T4 (Video Trigger)" on page 916
T7	Sets the trigger mode to level	N/A	N/A	N/A	
T8	Sets the trigger mode to edge	N/A	N/A	N/A	
TA	Returns trace A amplitude values to controller	Yes	Yes	N/A	"TA (Trace A)" on page 917
TB	Returns trace B amplitude values to controller	Yes	Yes	N/A	"TB (Trace B)" on page 918
TDF	Trace data format	Yes	Yes	Yes	"TDF (Trace Data Format)" on page 919
TEXT	Writes text on the analyzer screen	No	No	No	
TH	Threshold	Yes	Yes	Yes	"TH (Threshold)" on page 920
THE	Turns the threshold on or off	Yes	Yes	N/A	"THE (Threshold Enable)" on page 921
THEN	Conditional Programming (If...then...else...endif)	No	No	No	
TIMEDATE	Allows setting of	N/A	N/A	Yes	"TIMEDATE (Time Date)"

Command	Description	8566	8568	8560 Series	More Information
	time & date for analyzer				on page 922
TIMEDSP	Enables display of time & data on analyzer display	N/A	N/A	N/A	
TITLE	Title entry	N/A	N/A	Yes	"TITLE (Title)" on page 923
TM	Trigger Mode	Yes	Yes	Yes	"TM (Trigger Mode)" on page 924
TOI	Third order intermodulation measurement	N/A	N/A	N/A	
TOIR	Third order intermodulation response	N/A	N/A	N/A	
TRA	Returns trace A amplitude values to controller	Yes	Yes	Yes	"TRA (Trace Data Input and Output)" on page 925
TRB	Returns trace B amplitude values to controller	Yes	Yes	Yes	"TRB (Trace Data Input and Output)" on page 926
TRC	Returns trace C amplitude values to controller	Yes	Yes	N/A	"TRC (Trace Data Input and Output)" on page 926
TRCMEM	Trace C memory	N/A	N/A	N/A	
TRDEF	Trace define	No	No	No	
TRDSP	Trace display	Yes	Yes	N/A	"TRDSP (Trace Display)" on page 927
TRGRPH	Trace graph display	No	No	N/A	
TRIGPOL	Trigger polarity	N/A	N/A	Yes	"TRIGPOL (Trigger Polarity)" on page 928
TRMATH	Executes specified trace math at end of sweep	No	No	N/A	
TRPRST	Sets trace operations to their preset values	No	No	N/A	
TRSTAT	Returns current trace states to controller	Yes	Yes	N/A	"TRSTAT (Trace State)" on page 928
TS	Takes a sweep	Yes	Yes	Yes	"TS (Take Sweep)" on page 929
TVLINE	Selects which	N/A	N/A	N/A	

Command	Description	8566	8568	8560 Series	More Information
	horizontal line of video to trigger on				
TVLSFRM	Selects the type of video frame to trigger on	N/A	N/A	N/A	
TVSTND	TV standard	N/A	N/A	N/A	
TVSYNC	Selects polarity of video modulation to trigger on	N/A	N/A	N/A	
TWNDOW	Formats trace information for FFT.	N/A	N/A	No	
UNTIL	Conditional Programming (Repeat...Until...)	No	No	No	
UP	Increases active function value by applicable step	N/A	N/A	N/A	
UR	Upper right x-y recorder output voltage at rear	No	No	N/A	
USERREV	Modifies response to query "REV (Revision)" on page 887	Ext	Ext	Ext	"USERREV" on page 930
USTATE	Configures user defined states	No	No	N/A	
VARDEF	Variable definition	No	No	No	
VARIANCE	Returns the amplitude variance of specified trace	No	No	No	
VAVG	Turns video averaging on or off	Yes	Yes	Yes	"VAVG (Video Average)" on page 931
VB	Video Bandwidth	Yes	Yes	Yes	"VB (Video Bandwidth)" on page 933
VBO	Video Bandwidth Coupling Offset	Yes	Yes	N/A	"VBO (Video Bandwidth Coupling Offset)" on page 935
VBR	Video Bandwidth Ratio	N/A	N/A	Yes	"VBR (Video Bandwidth to Resolution Bandwidth Ratio)" on page 936
VIEW	Stores and views the specified trace	Yes	Yes	Yes	"VIEW (View Trace)" on page 937

Command	Description	8566	8568	8560 Series	More Information
VTL	Video trigger level	N/A	N/A	Yes	"VTL (Video Trigger Level)" on page 938
WAIT	Suspend program operation for specified time	N/A	N/A	N/A	
WINNEXT	Next window	N/A	N/A	N/A	
WINOFF	Turns off the window display mode	N/A	N/A	N/A	
WINON	Turns on the window display mode	N/A	N/A	N/A	
WINZOOM	Window zoom	N/A	N/A	N/A	
XCH	Exchanges the two specified traces.	Yes	Yes	N/A	"XCH (Exchange)" on page 939
ZMKCNTR	Zone marker at center frequency	N/A	N/A	N/A	
ZMKPKNL	Zone marker for next peak left	N/A	N/A	N/A	
ZMKPKNR	Zone marker for next peak right	N/A	N/A	N/A	
ZMKSPAN	Zone marker span	N/A	N/A	N/A	

10.4 Legacy Command Descriptions

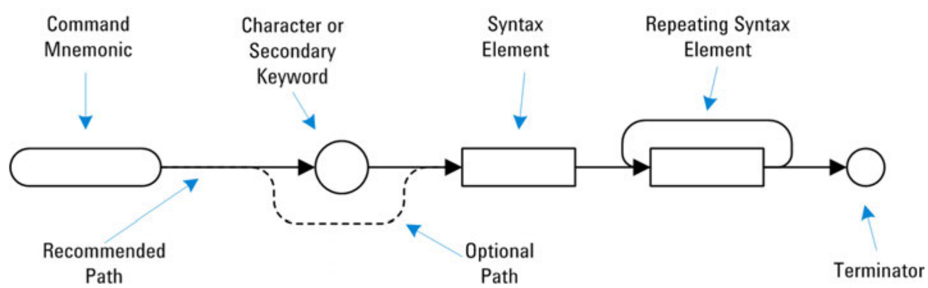
This chapter describes all the supported 8560 Series, 8566A/B and 8568A/B commands, and gives brief details of their syntax and operation. The commands are sorted alphabetically. For more detailed information about these commands, see the User's Guides for the 8566A/B, 8568A/B, and 8560 Series.

For a summary of all commands, see "List of Legacy Analyzer Commands" on page 645.

For explanations of the entries in this chapter, see: "Command Syntax" on page 679 and "Command Description Notes" on page 681

10.4.1 Command Syntax

Command syntax is represented pictorially.



- Ovals enclose command mnemonics. The command mnemonic must be entered as shown, with the exception that the case can be upper or lower.
- Uppercase is recommended for entering all commands unless otherwise noted.
- Circles and ovals surround secondary keywords or special numbers and characters. The characters in circles and ovals are considered reserved words and must be entered as shown with the exception that the case can be upper or lower.
- Rectangles contain the description of a syntax element defined in the table below.
- A loop above a syntax element indicates that the syntax element can be repeated.
- Solid lines represent the recommended path.
- Dotted lines indicate an optional path for bypassing secondary keywords or using alternate units.
- Arrows and curved intersections indicate command path direction.

– Semicolons are the recommended command terminators. Using semicolons makes programs easier to read, prevents command misinterpretation, and is recommended by IEEE-728-1982 (Recommended Practice for code and Format Conventions for IEEE Standard 488).

– Syntax Elements are shown in the syntax diagrams as elements within rectangles. In the syntax diagrams, characters and secondary keywords are shown within circles or ovals.

Syntax Elements

Syntax Component	Definition/Range
Analyzer command	Any command in this chapter, with required parameters and terminators.
Character	SP a b c d e f g h i j k l m n o p q r s t u v w x y z databyte.
Character & EOI	8-bit byte containing only character data and followed by end-or-identify (EOI) condition, where the EOI control line on GPIB is asserted to indicate the end of the transmission. END signifies the EOI condition.
Character string	A list of characters.
Data byte	8-bit byte containing numeric or character data.
Data byte & EOI	8-bit byte containing numeric or character data followed by end-or-identify (EOI) condition, where the EOI control line on GPIB is asserted to indicate the end of the transmission. END signifies the EOI condition.
Delimiter	| \ @ ^ $ % ; ! Matching characters that mark the beginning and end of a character string, or a list of commands. Choose delimiting characters that are not used within the string they delimit.
Digit	0 1 2 3 4 5 6 7 8 9
lsb length	Represents the least significant byte of a two-byte word that describes the number of bytes returned or transmitted. See msb length.
msb length	Represents the most significant byte of a two-byte word that describes the number of bytes returned or transmitted. See lsb length.
Number	Expressed as integer, decimal, or in exponential (E) form. Integer Number Range: –32,768 through +32,767 General formatting restrictions: – Real Number Range: ± 1.797693134862315 x 10^{308}, including 0 – Up to 15 significant figures allowed – Numbers may be as small as ± 2.225073858507202 x 10^{-308}
Output termination	Line feed (LF) and end-or-identify (EOI) condition. ASCII code 10 (line feed) is sent via GPIB and the end-or-identify control line on GPIB sets to indicate the end of the transmission.
Units	Represent standard scientific units: Frequency Units: GZ, GHZ, MZ, MHZ, KZ, KHZ, HZ Amplitude Units: DB, DBMV, DM, DBM, DBUV, V, MV, UV, W, MW, UW

Syntax Component	Definition/Range
	Time Units: SC, S, MS, US

10.4.2 Command Description Notes

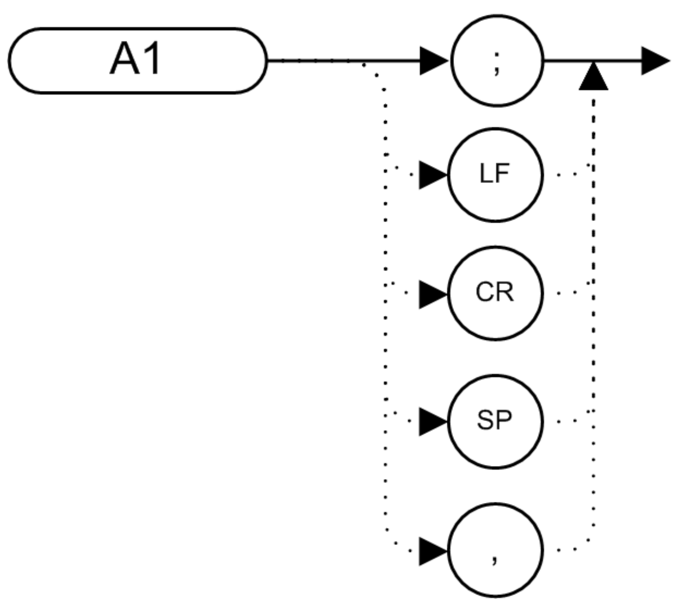
All supported commands are listed here, with descriptions and cross-references to similar commands.

The information here does not provide a comprehensive guide to all 8566A/B, 8568A/B, 8560 Series commands. It gives brief descriptions of the supported commands, and highlights important functional or behavioral differences that you should be aware of when transferring existing 8566A/B, 8568A/B, 8560 Series code to your X-Series instrument. For a complete description of the commands, refer to the 8566A/B, 8568A/B, 8560 Series Operating and Programming Manual.

To avoid confusion between numbers and letters, all commands that incorporate numbers have the number spelled out and placed in square brackets after the command. For example, the command `I1` is shown as ‘I1 [one]’ - that is, the capital letter ‘I’ followed by the number ‘1’, and then the word ‘one’ in square brackets. The word in brackets does not form part of the command.

10.4.3 A1 (Clear Write for Trace A)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

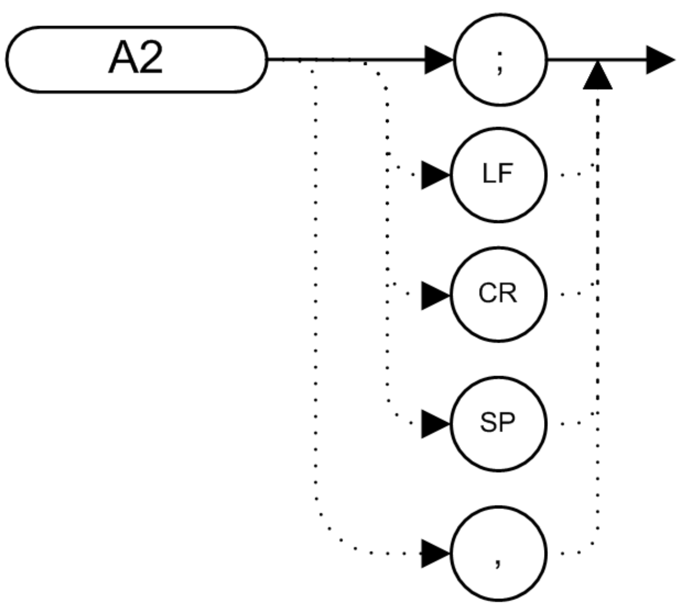
Description

Sets Trace A to clear write, which means that it continuously displays any signal present at the instrument input. This command initially clears Trace A, setting all elements to zero.

Format	A1
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of command A1 are identical to the command "CLRW (Clear Write)" on page 734

10.4.4 A2 (Maximum Hold for Trace A)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

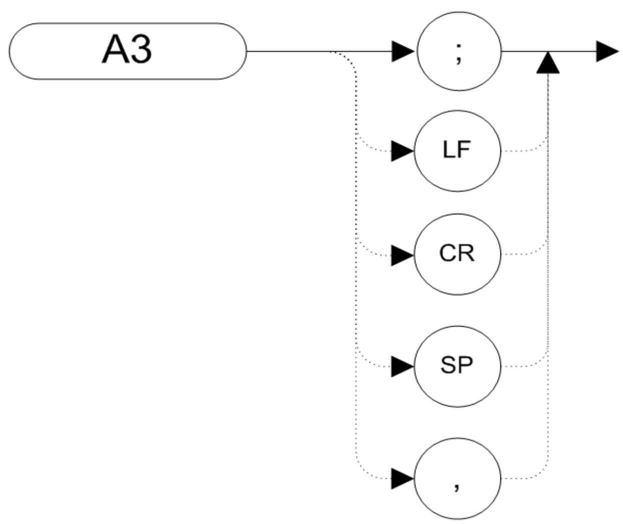
Description

Updates each trace element with the maximum level detected during the period that the trace has been active.

Format	A2
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of A2 are identical to MXMH TRA; see "MXMH (Maximum Hold)" on page 861

10.4.5 A3 (View Mode for Trace A)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

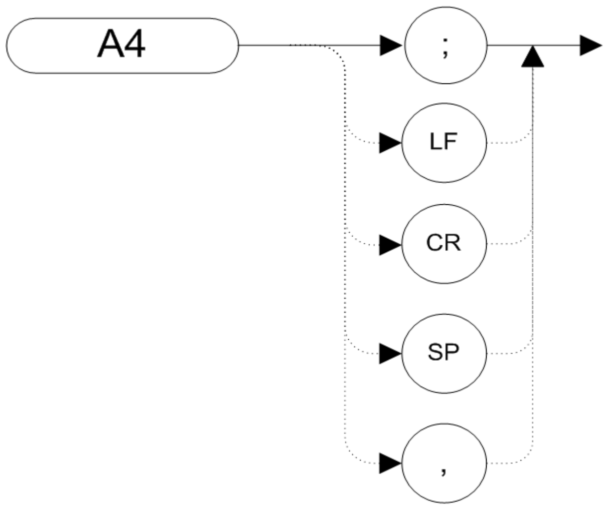
Displays Trace A and then stops the sweep if no other traces are active. Trace A does not get updated with new data.

Format	A3

Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of A3 are identical to VIEW TRA; see "VIEW (View Trace)" on page 937

10.4.6 A4 (Blank Trace A)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

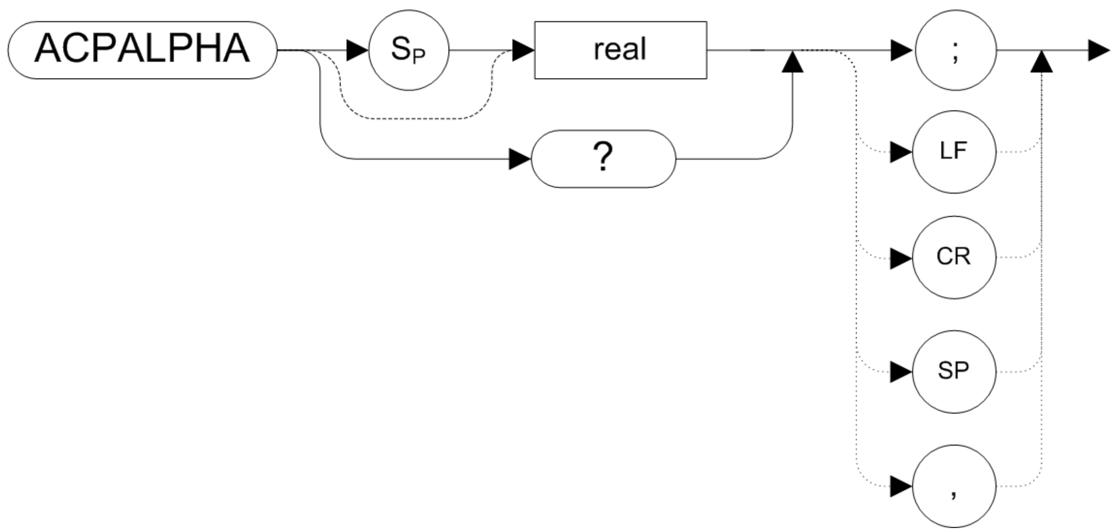
Description

Blanks Trace A and stops the sweep if no other traces are active. Trace A is not updated.

Format	A4
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of A4 are identical to BLANK TRA; see "BLANK (Blank Trace)" on page 721

10.4.7 ACPALPHA (Adjacent Channel Power Alpha Weighting)

Syntax



Legacy Products

8560 series

Description

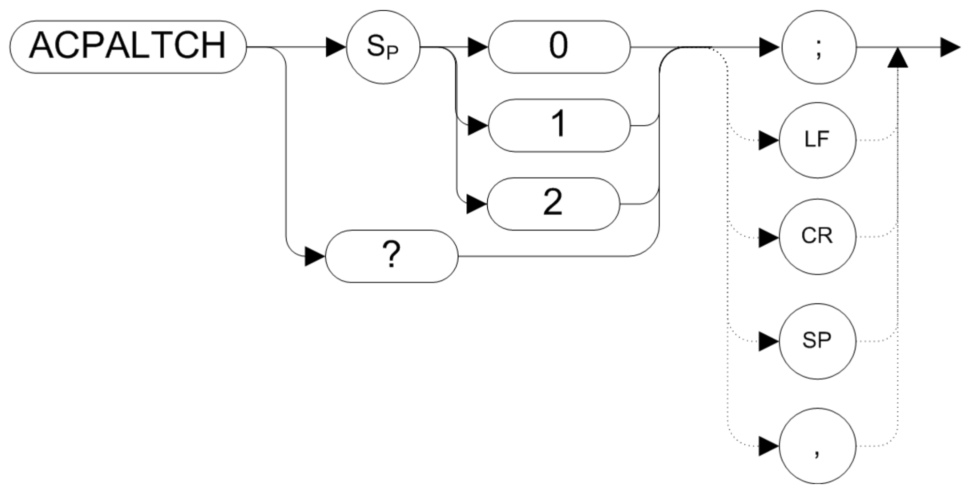
Sets the alpha weighting for ACP measurements.

Format	`ACPALPHA <real>`
	Valid Range from 0 to 1
	`ACPALPHA?`

Query Data Type	<real> (Valid Range from 0 to 1)
SCPI Equivalent Commands	None
Preset	Default – 0.35 Not affected by preset or Power Cycle

10.4.8 ACPALTCH (Adjacent Channel Power Alternate Channels)

Syntax



Legacy Products

8560 series

Description

Sets the number of alternate channels to be measured by an adjacent channel power measurement to either 0, 1, or 2. The number of alternate channels is used with "ACPRSLTS (Adjacent Channel Power Measurement Results)" on page 697.

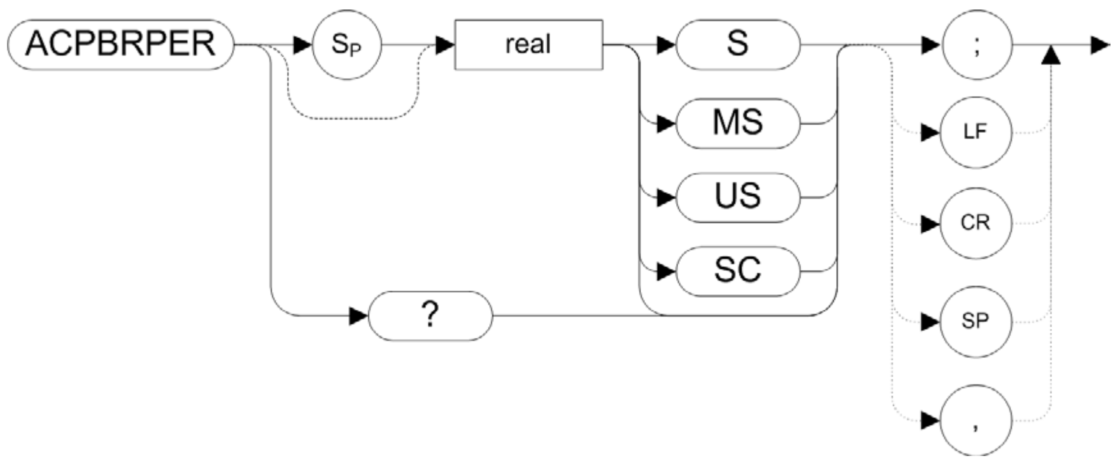
Specifying parameter value 0 makes the measurement with the adjacent channel pair, but no alternate channels. Specifying 1 selects the first alternate channel pair, which is centered at ±2 times the channel spacing away from the center frequency of the main channel. Specifying 2 selects the second alternate pair, which is at ±3 times the channel spacing.

Format	`ACPALTCH <integer>`
	Valid Range: 0, 1, 2
	`ACPALTCH?`

Query Data Type	<integer> (Valid Range: 0, 1, 2)
SCPI Equivalent Commands	None
Preset	Default: 0 Not affected by preset or Power Cycle

10.4.9 ACPBRPER (Adjacent Channel Power Burst Period)

Syntax



Legacy Products

8560 series

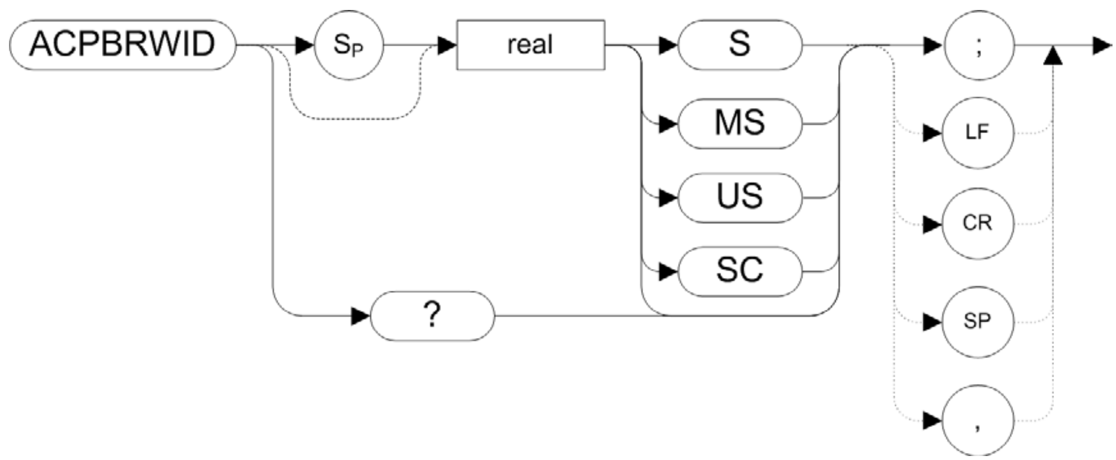
Description

Sets the cycle time (period) of the burst RF signal. The cycle time is needed to set the sweep times when using the peak, two bandwidth, burst power, and gated methods for adjacent channel power measurements.

Format	`ACPBRPER <real>`
	in time unit
	`ACPBRPER?`
Query Data Type	<real>
SCPI Equivalent Commands	None
Preset	Default: 0
	Not affected by preset or Power Cycle
Notes	RLC Mode supports the ACP measurement using the ANALOG method only and therefore, although you can set `ACPBRPER`, it has no effect

10.4.10 ACPBRWID (Adjacent Channel Power Burst Width)

Syntax



Legacy Products

8560 series

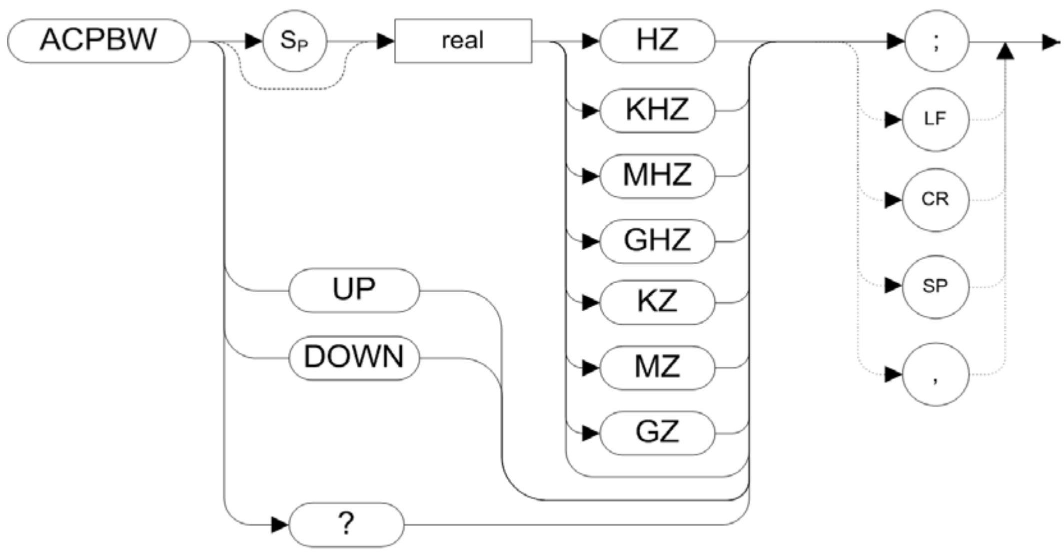
Description

Sets the on-time (pulse width) of the burst RF signal. The pulse width is needed to set the gating times when using the gated method for adjacent channel power measurements.

Format	Range: 5 µs to 9.5 seconds
Query Data Type	<real> (in time units)
SCPI Equivalent Commands	None
Preset	Default: 0 Not affected by preset or Power Cycle
Notes	RLC Mode supports the ACP measurement using the ANALOG method only and therefore, although you can set `ACPBRWID`, it has no effect

10.4.11 ACPBW (Adjacent Channel Power Bandwidth)

Syntax



Legacy Products

8560 series

Description

Sets the bandwidth of the channels as an active function for "ACPMEAS (Measure Adjacent Channel Power)" on page 693 and "ACPCOMPUTE (Adjacent Channel Power Compute)" on page 690.

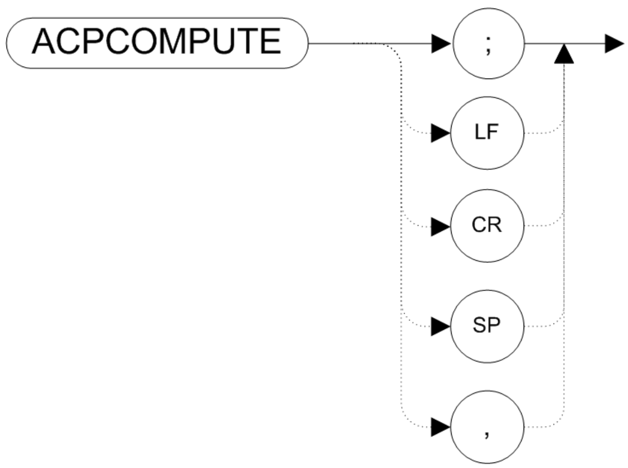
Format	`ACPBW <frequency>`
	with frequency unit
	`ACPBW?`
	Range:
	– <frequency>: 200 Hz to the double of max frequency range
	– UP: original value x 1.1
	– DN: original value x 0.9

Query Data Type	Frequency in Hz
SCPI Equivalent Commands	None

Preset	Default: 8.5 kHz Not affected by preset or Power Cycle
Couplings	Channel spacing does not couple with channel bandwidth

10.4.12 ACPCOMPUTE (Adjacent Channel Power Compute)

Syntax



Legacy Products

8560 series

Description

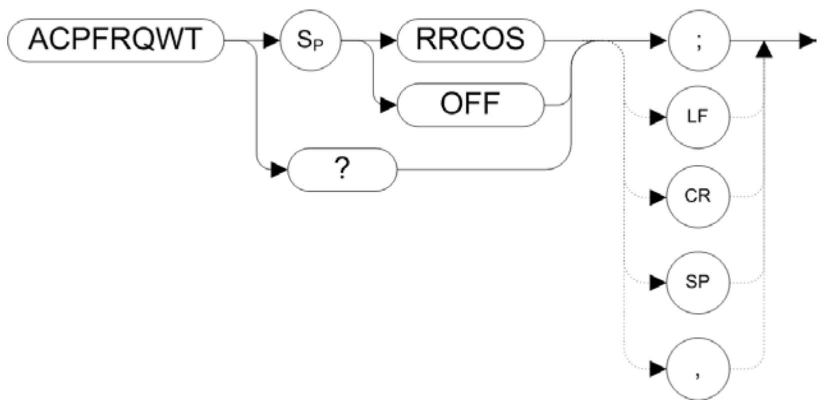
Calculates the ACP of a transmitter based on data on the display. This function does not make a new measurement before computing. The measurement must have been made with ANALOG or PEAK method selected so the appropriate data is available for the calculation.

This function is useful for recalculating ACP results on the same trace with different parameter settings.

Format	`ACPCOMPUTE`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	RLC Mode supports the ACP measurement using the ANALOG method only

10.4.13 ACPFRQWT (Adjacent Channel Power Frequency Weighting)

Syntax



Legacy Products

8560 series

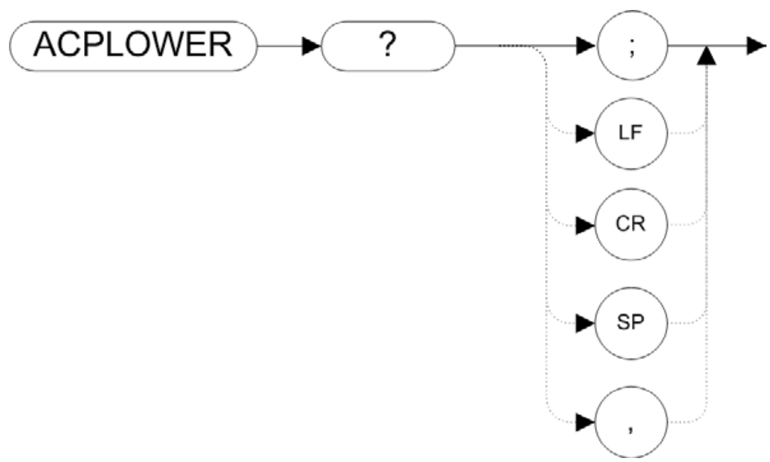
Description

This command is used to control the frequency weighting when making an Adjacent Channel Power measurement. Weighting is not used in the measurement if `OFF` has been selected. Root-raised-cosine weighting is selected with the `RRCOS` option.

Format	`ACPFRQWT RRCOS|OFF` `ACPFRQWT?`
Query Data Type	`RRCOS|OFF`
SCPI Equivalent Commands	None
Preset	Default: `OFF` Not affected by preset or Power Cycle
Notes	RLC Mode supports the ACP measurement using the ANALOG method only

10.4.14 ACPLOWER (Lower Adjacent Channel Power)

Syntax



Legacy Products

8560 series

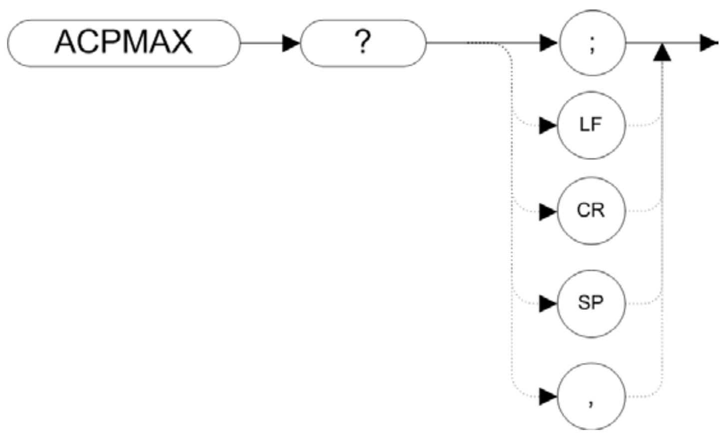
Description

Returns the power ratio result of the Adjacent Channel Power measurement for the lower frequency channel.

Format	`ACPLOWER?`
Query Data Type	The power ratio result in dB
SCPI Equivalent Commands	None
Notes	Supports the ACP measurement using the ANALOG method only

10.4.15 ACPMAX (Maximum Adjacent Channel Power)

Syntax



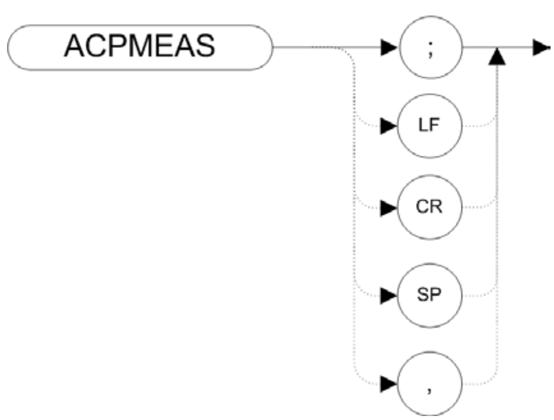
Description

Returns the maximum adjacent channel power of the adjacent channel power measurement.

Format	`ACPMAX?`
Query Data Type	The maximum adjacent channel power in dB
SCPI Equivalent Commands	None
Notes	Supports the ACP measurement using the ANALOG method only

10.4.16 ACPMEAS (Measure Adjacent Channel Power)

Syntax



Legacy Products

8560 series

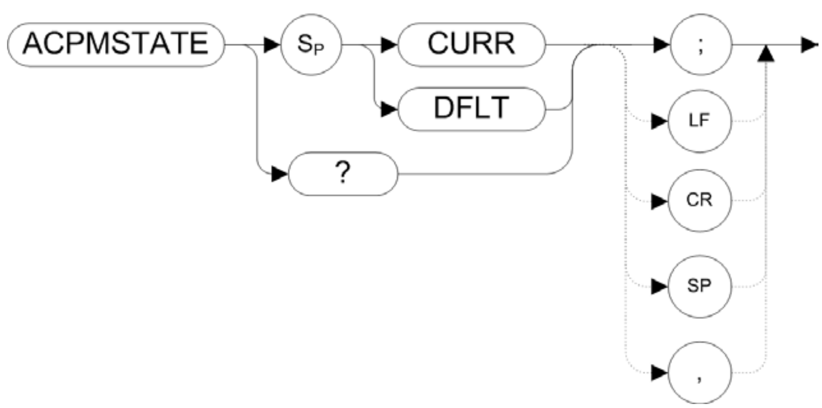
Description

Makes a measurement and calculates the adjacent channel power (ACP) of a transmitter. The measurement determines the leakage power that is in the channels adjacent to the carrier. The result is the ratio of the leakage power in the channel adjacent to the total power transmitted by the transmitter.

Format	ACPMEAS
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	Supports the ACP measurement using the ANALOG method only

10.4.17 ACPMSTATE (Adjacent Channel Power Measurement State)

Syntax



Legacy Products

8560 series

Description

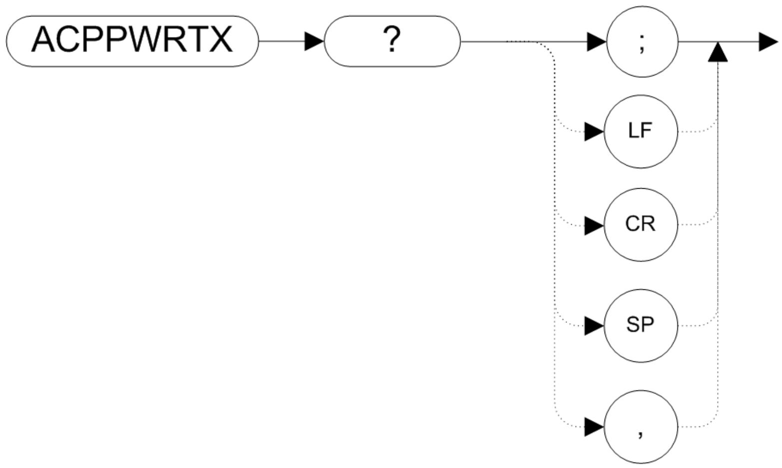
Sets the parameters of the measurement state to either the default state (determined by the setup) or the current state. The state parameters that could change between the default state and a current state include:

- Resolution bandwidth
- Video bandwidth
- Span
- Sweep time
- Detector mode
- Gating parameters
- Trigger parameters
- Video averaging

Format	`ACPMSTATE CURR|DFLT` `ACPMSTATE?`
Query Data Type	`CURR|DFLT`
SCPI Equivalent Commands	None
Preset	Default: `DFLT` Not affected by preset or Power Cycle
Couplings	Changes the following parameters: – Resolution bandwidth – Video bandwidth – Span – Sweep time – Detector mode – Gating parameters – Trigger parameters – Video averaging
Notes	Supports the ACP measurement using the ANALOG method only

10.4.18 ACPPWRTX (Adjacent Channel Power Total Power Transmitted)

Syntax



Legacy Products

8560 series

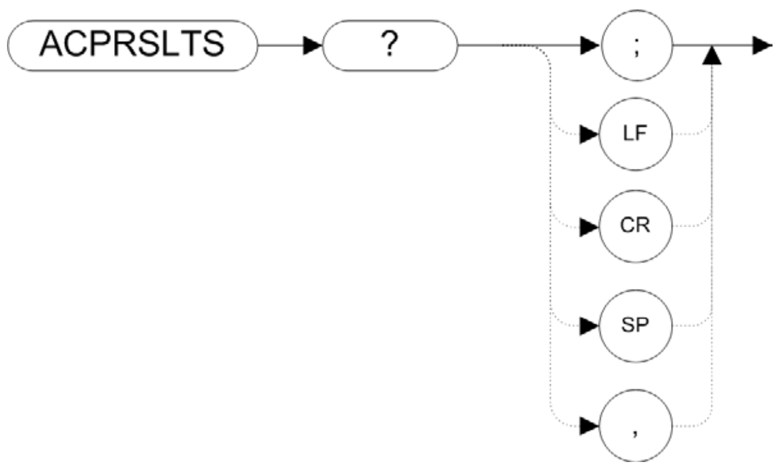
Description

Returns the result of the total power transmitted calculation of the adjacent channel power measurement.

Format	`ACPPWRTX?`
Query Data Type	A variable that contains the total transmit band carrier power Unit is determined by command "AUNITS (Absolute Amplitude Units)" on page 712
SCPI Equivalent Commands	None
Notes	The measurement must be made with the analog or burst power method selected, but the application supports the ACP measurement using the ANALOG method only

10.4.19 ACPRSLTS (Adjacent Channel Power Measurement Results)

Syntax



Legacy Products

8560 series

Description

Returns an array of power data resulting from an ACP measurement of an RF signal. The number of alternate channel pairs selected by the command "ACPALTCH (Adjacent Channel Power Alternate Channels)" on page 686 determines the size of the array.

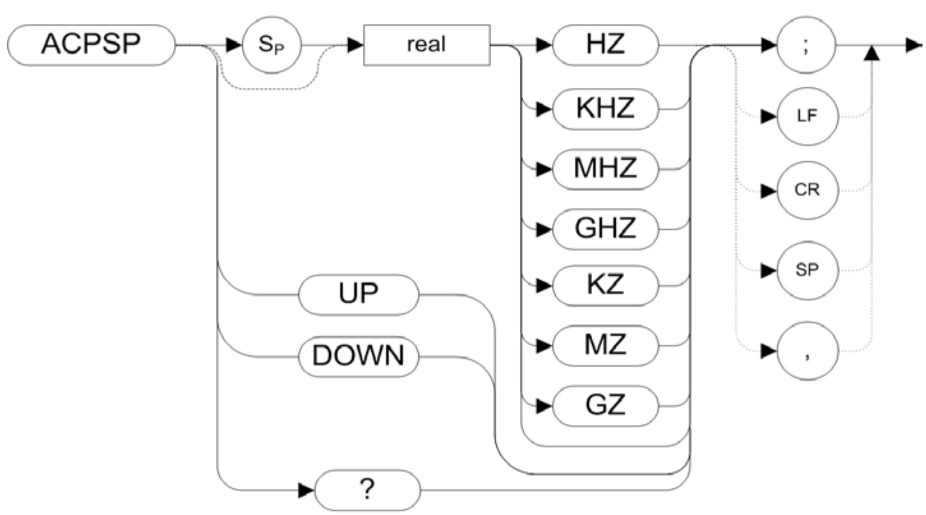
Format	`ACPRSLTS?`
Query Data Type	(Analog Method) Number of Results per Set: 2. See "Query Data Type Details" on page 698 below. Results (in order of output): – ACP ratio (lower channel) – ACP ratio (upper channel)
SCPI Equivalent Commands	None
Notes	RLC Mode supports the ACP measurement using the ANALOG method only

10.4.20 Query Data Type Details

Alternate Channels	Channels used for Calculation	Number of Values Returned
0	– Main channel – Lower adjacent channel – Upper adjacent channel	1 set
1	Above channels plus: – First alternate lower channel – First alternate upper channel	2 sets
2	Above channels plus: – Second alternate lower channel – Second alternate upper channel	3 sets

10.4.21 ACPSP (Adjacent Channel Power Channel Spacing)

Syntax



Legacy Products

8560 series

Description

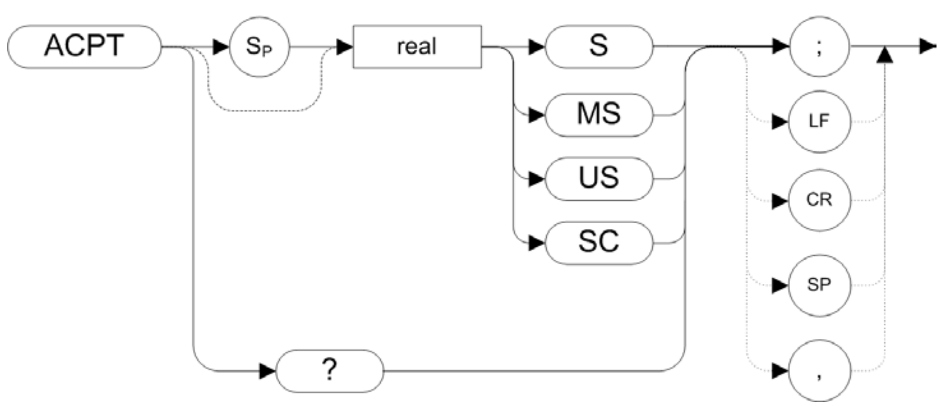
Sets the channel spacing for "ACPMEAS (Measure Adjacent Channel Power)" on page 693 and "ACPCOMPUTE (Adjacent Channel Power Compute)" on page 690.

Format	`ACP <real>`
	with frequency units
	`ACP?`
	Range:
	– <real>: Minimum: 100 Hz. Maximum: 25 GHz
	– UP: original value x 1.1
	– DN: original value x 0.9

Query Data Type	<real> in Hz
SCPI Equivalent Commands	None
Preset	Default: 12.5 kHz Not affected by preset or Power Cycle
Couplings	Channel spacing does not couple with channel bandwidth
Notes	Supports the ACP measurement using the ANALOG method only

10.4.22 ACPT (Adjacent Channel Power T Weighting)

Syntax



Legacy Products

8560 series

Description

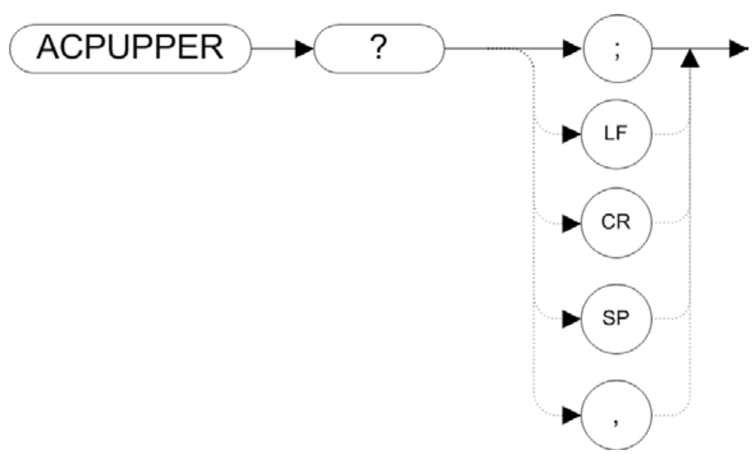
This command is used to set the T used in weighting for an adjacent channel power measurement.

Format	`ACPT <real>`
	in time units
	`ACPT?`
	Range: 1 μs to 1 s

Query Data Type	Real number in sec
SCPI Equivalent Commands	None
Preset	Default: 341 μs Not affected by preset or Power Cycle
Notes	Supports the ACP measurement using the ANALOG method only

10.4.23 ACPUPPER (Upper Adjacent Channel Power)

Syntax



Legacy Products

8560 series

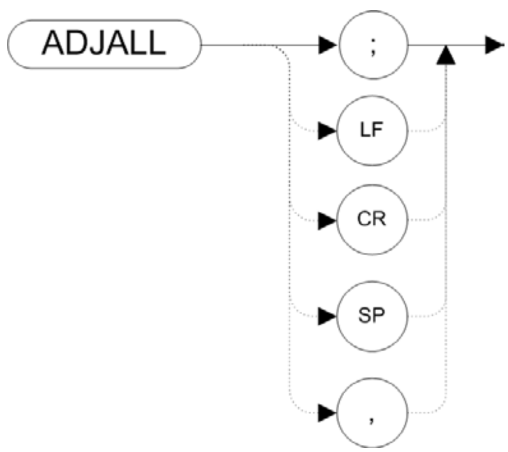
Description

Returns the power ratio result of the adjacent channel power measurement for the upper frequency channel.

Format	`ACPUPPER?`
Query Data Type	The power ratio result in dB
SCPI Equivalent Commands	None
Notes	Supports the ACP measurement using the ANALOG method only

10.4.24 ADJALL (LO and IF Adjustments)

Syntax



Legacy Products

8560 series

Description

Activates the RF local oscillator (LO) and intermediate frequency (IF) alignment routines. These are the same routines that occur when the instrument is switched on. They are also the same routines that are performed when you press **System**, **Alignments**, **Align Now**, **All**.

Commands following `ADJALL` are not executed until after the instrument has finished the alignment routines.

Format	`ADJALL;`
Query Data Type	N/A
SCPI Equivalent Commands	`:CALibration[:ALL]`

10.4.25 ADJIF

Legacy Products

8560 series

Description

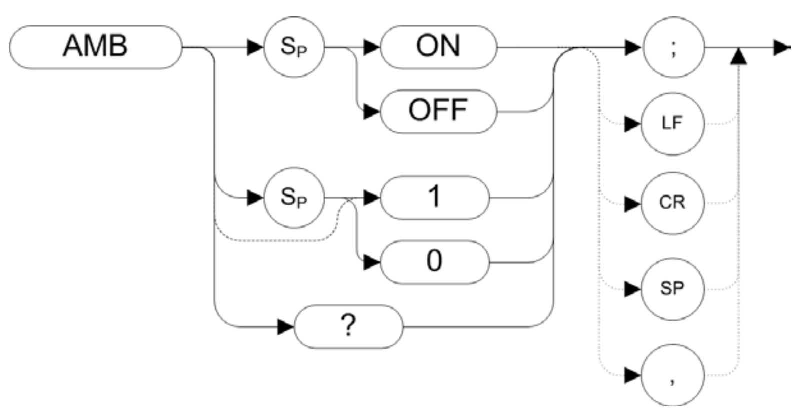
Turns the automatic IF adjustment on or off. This function is normally `ON`

Executing the IF alignment routine is seldom necessary, because the IF is continuously adjusting. When IF adjustment is not active, an “A” appears on the left side of the display

Format	`ADJIF 0|1|OFF|ON|FULL|CURR` `ADJIF?`
SCPI Equivalent Commands	None
Preset	`ON`

10.4.26 AMB (A minus B into A)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Subtracts the points in Trace B from the corresponding points in Trace A, and sends the results to Trace A. Thus, `AMB` can restore the original trace after "APB (Trace A Plus Trace B to A)" on page 710 or "KSc (A Plus B to A)" on page 788 have been executed.

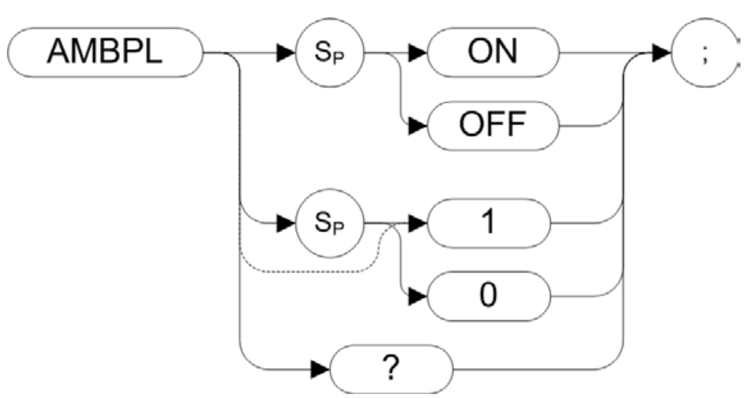
The query `AMB?` returns different responses depending on the language being used:

- The 8560 Series languages return either a `1` or a `0` to indicate the On or Off status
- The 8566, 8568 Series languages all return either `ON` or `OFF`

Format	`AMB 0|1|OFF|ON` `AMB?`
Query Data Type	1 or 0, indicating `ON` or `OFF` state respectively
SCPI Equivalent Commands	None
Preset	`OFF`
Couplings	Sets Trace B to View mode and turns "AMBPL (A minus B plus Display Line into A)" on page 703 (Normalize) `OFF`. All trace math is mutually exclusive, so turning one on turns the other off and vice versa. Similarly, when `AMB` is on and you change Trace B to Clearwrite or Maxhold, it turns `AMB` off
Notes	The functions of `AMB` are identical to "C2 (A Minus B Into A)" on page 726

10.4.27 AMBPL (A minus B plus Display Line into A)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

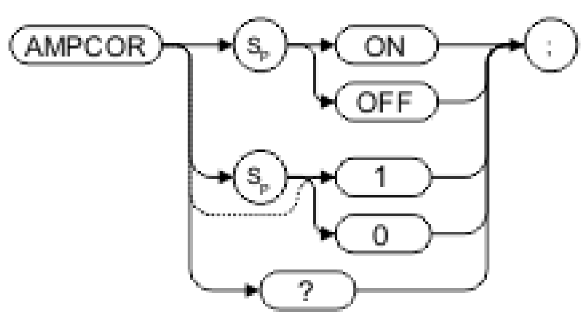
Does a point-by-point subtraction of Trace B from Trace A, and then adds the display line point values to the difference. The results are sent to Trace A.

The query `AMBPL?` returns different responses depending on the language being used.

Format	`AMBPL (0|1|OFF|ON)` `AMBPL?`
Query Data Type	8560: 1 or 0, indicating ON or OFF state respectively 8566A/B, 8568A/B: ON or OFF
SCPI Equivalent Commands	None
Preset	`OFF`
Couplings	`AMBPL` sets Trace B to View mode and turns `AMB` (Normalize) `OFF`. All trace math is mutually exclusive, so turning one on turns the other off and vice versa. Similarly, when `AMBPL` is on and you change Trace B to Clearwrite or Maxhold, it turns `AMBPL` off

10.4.28 AMPCOR

Syntax



Legacy Products

8560 series

Description

`AMPCOR` turns the amplitude correction function on and off. The `AMPCOR` function is used to compensate for frequency-dependent amplitude variations.

When `AMPCOR` is `ON`, the current correction values are added to all measurement results.

Turning `AMPCOR OFF` does not erase the current frequency-amplitude correction factors.

Performing an instrument preset ("IP (Instrument Preset)" on page 781), or turning off the instrument, turns off `AMPCOR`.

Format	`AMPCOR (0|1|OFF|ON)` `AMPCOR?`
Query Data Type	1 or 0, indicating ON or OFF state respectively
SCPI Equivalent Commands	None
Preset	`OFF`
Couplings	See "AMPCORDATA" on page 706 for details of how to set the correction data

10.4.29 AMPCORCFGCNT

Syntax

`AMPCORRCFGCNT?`

Legacy Products

8560 series

Description

Retrieves the count of all AMPCOR settings, *not* including the one currently in use. See "AMPCOR" on page 704.

This is an RLC Mode "extension" query, which is not defined in the command set of any legacy instrument.

Format	`AMPCORRCFGCNT?`
Query Data Type	<int>
SCPI Equivalent Commands	None

10.4.30 AMPCORCLEAR

Syntax

`AMPCORCLEAR`

Legacy Products

8560 series

Description

Clears the current setting of "AMPCOR" on page 704.

This is an RLC Mode "extension" command, which is not defined in the command set of any legacy instrument.

Format	`AMPCORCLEAR`
Query Data Type	N/A
SCPI Equivalent Commands	None

10.4.31 AMPCORDATA

Syntax

`AMPCORDATA`

Legacy Products

8560 series

Description

`AMPCORDATA` allows you to enter or query the frequency-amplitude correction points that are used to normalize the spectrum analyzer measurement. Up to 200 pairs of frequency-amplitude correction points can be entered.

Whenever "AMPCOR" on page 704 is on, the correction values are added to all measurement results. Setting `AMPCOR` off, performing an "IP (Instrument Preset)" on page 781, or turning off the spectrum analyzer turns off the amplitude correction.

Turning `AMPCOR` off does not erase the current frequency-amplitude correction factors.

The values of the correction points are applied across the active measurement range. Between points, the correction values are interpolated. When measuring at frequencies outside the first and last correction points, these values are used as the correction value. If you do not want any amplitude correction outside of the first and last correction points, set the amplitude correction to 0 at the frequencies that are outside of the first and last correction values.

If any of the trace data is above or below the graticule, `AMPCOR` may not properly correct it. The spectrum analyzer amplitude accuracy is not specified above or below the graticule. Whenever `AMPCOR` applies a correction such that data outside the graticule is moved to within the graticule, an error (error number 921 or 922) is generated. In order to avoid these errors, make sure that the trace data that is being corrected is within the graticule before the correction is applied.

Format	`AMPCORDATA <freq>, <ampl>, …` `AMPCORDATA?`
Query Data Type	<freq>, <ampl>, … in Hz for <freq> and dB
SCPI Equivalent Commands	None
Preset	Instrument Preset turns off amplitude correction

10.4.32 AMPCORRCL

Syntax

`AMPCORRCL`

Legacy Products

8560 series

Description

`AMPCORRCL` recalls a set of correction points from one of five possible registers. The corrections must have been previously saved with "AMPCORSAVE" on page 708.

Format	`AMPCORRCL <int>`
Query Data Type	N/A
SCPI Equivalent Commands	None

10.4.33 AMPCORRESET

Syntax

`AMPCORRESET`

Legacy Products

8560 series

Description

Deletes all settings of "AMPCOR" on page 704.

This is an RLC Mode "extension" command, which is not defined in the command set of any legacy instrument.

Format	`AMPCORRESET`
Query Data Type	N/A
SCPI Equivalent Commands	None

10.4.34 AMPCORSAVE

Syntax

`AMPCORSAVE`

Legacy Products

8560 series

Description

`AMPCORSAVE` saves the current correction points in one of five possible registers. The correction points can be recalled with "AMPCORRCL" on page 707.

Format	`AMPCORSAVE <int>`
Query Data Type	N/A
SCPI Equivalent Commands	None

10.4.35 AMPCORSIZE

Syntax

`AMPCORSIZE`

Legacy Products

8560 series

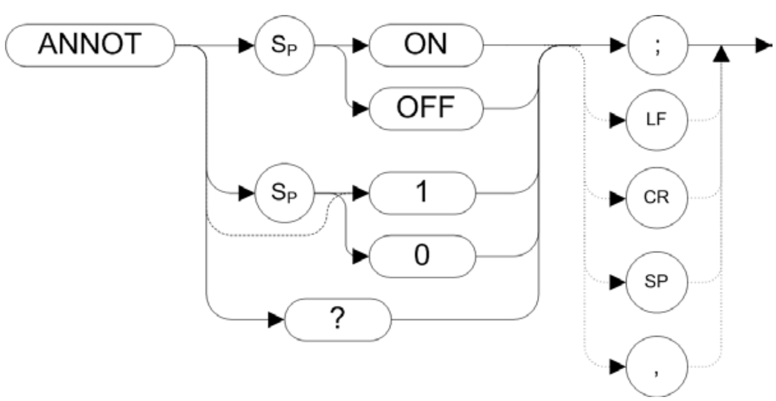
Description

`AMPCORSIZE` returns the number of frequency-amplitude correction points in the current correction table.

Format	`AMPCORSIZE?`
Query Data Type	<int>
SCPI Equivalent Commands	None
Couplings	See "AMPCORDATA" on page 706 for details of how to set the correction data

10.4.36 ANNOT (Annotation)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

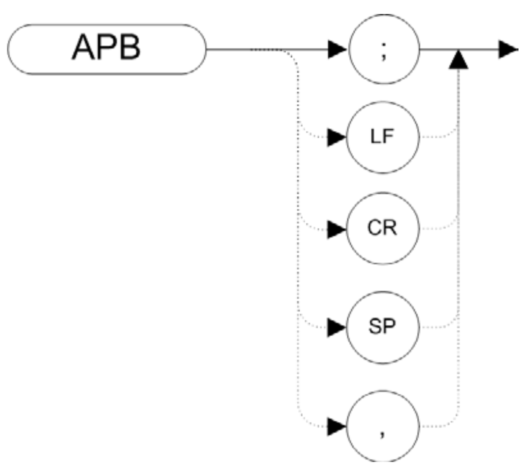
Description

Turns on or off all annotation on the instrument display. Control labels are not affected by this command and remain displayed.

Format	`ANNOT (0|1|ON|OFF)`
Query Data Type	1 or 0, indicating ON or OFF state respectively
SCPI Equivalent Commands	`DISPlay:ANNotation:SCReen[:STATe] OFF|ON|0|1` `DISPlay::ANNotation:SCReen[:STATe]?`
Preset	`ON`
Couplings	Following `FDSP`, `ANNOT` does nothing until instrument preset
Notes	The functions of `ANNOT` are identical to "KSo (Annotation Off)" on page 802 and "KSp (Annotation On)" on page 803 The two alternative commands, `KSo` and `KSp`, are only valid when the remote language is either HP8566A, HP8566B, HP8568A, or HP8568B

10.4.37 APB (Trace A Plus Trace B to A)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

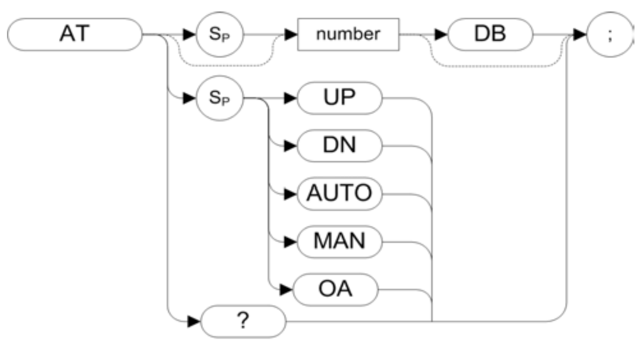
Description

Does a point-by-point addition of Trace A and Trace B, and sends the results to Trace A. Thus, APB can restore the original trace after an "AMB (A minus B into A)" on page 702 or a "C2 (A Minus B Into A)" on page 726 command has been executed.

Format	APB
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of APB are identical to "KSc (A Plus B to A)" on page 788 The alternative command, KSc, is only valid when the remote language is either HP8566A, HP8566B, HP8568A, or HP8568B

10.4.38 AT (Input Attenuation)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Specifies the RF input attenuation.

Although the attenuation level in the X-series instruments can be specified using absolute values, you can never set attenuation below 10 dB using the DN parameter. This is a safety feature to prevent inadvertent setting of attenuation to a level that could damage the instrument.

Signal levels above +30 dBm will damage the instrument.

Format	`AT <number> DB`
	<number>: any real number or integer. If the value you enter is not a valid value for the instrument you are using, it switches automatically to the closest valid setting
	Default unit: dB
	Range: 0 to 70 dB specified absolutely, and 10 to 70 dB in 10 dB steps
	If 8564E/EC or 8565E/EC is selected, the range is limited to 0 to 60 dB
	`AT OA|DN|UP|AUTO|MAN`
	AUTO|MAN available for 8560 Series only
	`AT?`
	Step Increment: 10 dB

Query Data Type	<real> in dB

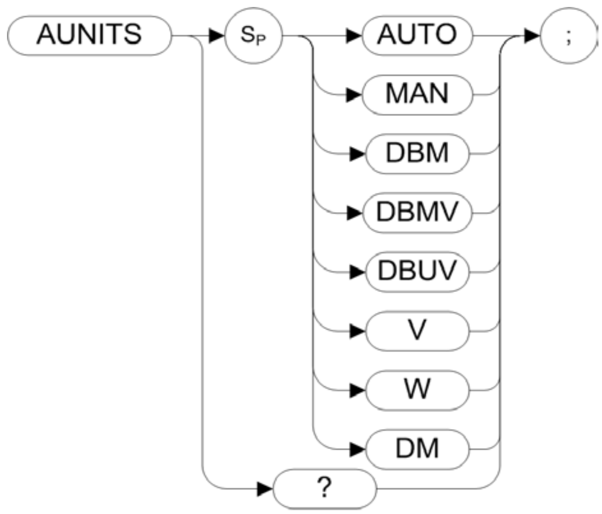
SCPI Equivalent Commands	`[:SENSE]:POWer[:RF]:ATTenuation:STEP[:INCRement] 10dB`
	on mode entry or preset
	`[:SENSE]:POWer[:RF]:ATTenuation:AUTO (OFF|ON|0|1)`

Preset	10 dB
Notes	In PXA/MXA, the auto attenuation range is 6-70 dB. In EXA, it is 6-60 dB You cannot step down below 10 dB. To set levels below 10 dB, you must specify the attenuation absolutely. For example, to set attenuation to 0 dB, you must use `AT 0DB`

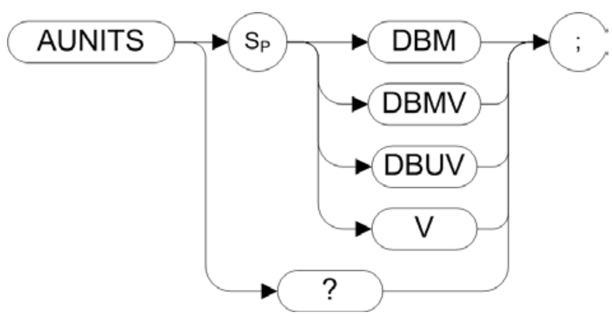
10.4.39 AUNITS (Absolute Amplitude Units)

Syntax

8560 series



8566A/B, 8568A/B



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Specifies the amplitude readout units for the reference level, the marker, and the display line.

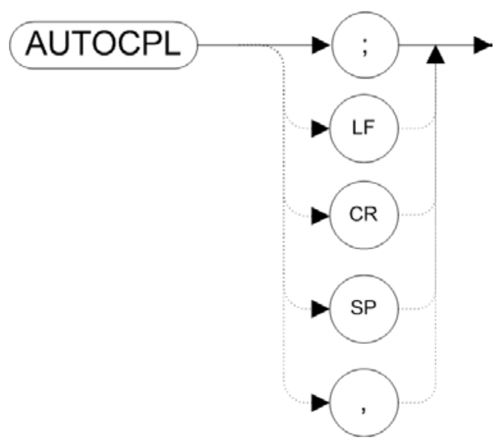
If your selected remote language is any of the 8560 Series analyzers, and if the `AUNITS` setting is `AUTO`, then a change from log scale (LG) to linear scale (LN) automatically changes the `AUNITS` setting. For all other settings, no change to `AUNITS` occurs, even when the scale is changed.

Format	`AUNITS AUTO|MAN|DBM|DBMV|DBUV|V|W|DM` `AUNITS?`
Query Data Type	`DBM|DBMV|DBUV|V`
SCPI Equivalent Commands	`:UNIT:POWer DBM|DBMV|DBUV|V|W` `:UNIT:POWer?`

Preset	DBM
Notes	The functions of AUNITS are identical to "KSA (Amplitude in dBm)" on page 785, "KSB (Amplitude in dBmV)" on page 787, "KSC (Amplitude in dBµV)" on page 788, and "KSD (Amplitude in Volts)" on page 789 The four alternative commands, KSA, KSB, KSC, and KSD are only valid when the remote language is HP8566A/B or HP8568A/B

10.4.40 AUTOCPL (Auto Coupled)

Syntax



Legacy Products

8560 series

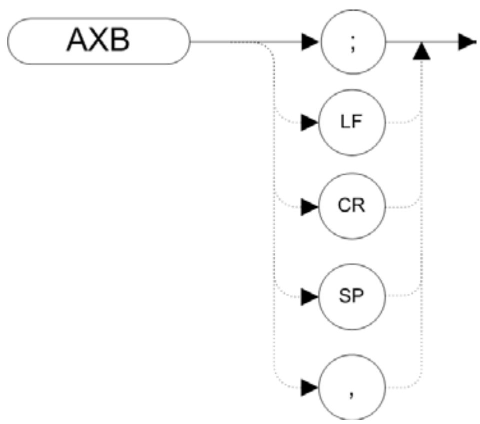
Description

Sets video bandwidth, resolution bandwidth, input attenuation, sweep time and center frequency step-size to coupled mode.

Format	AUTOCPL
Query Data Type	N/A
SCPI Equivalent Commands	:COUPle ALL

10.4.41 AXB (Exchange Trace A and Trace B)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

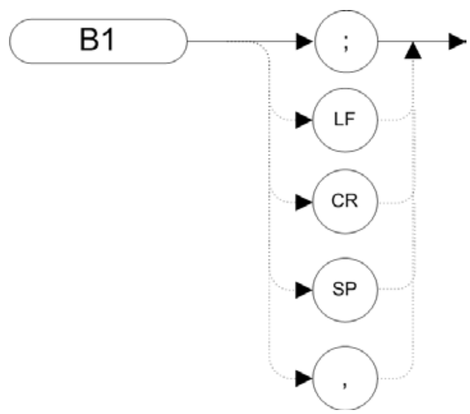
Description

Exchanges Trace A and Trace B, point by point.

Format	AXB
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of AXB are identical to "EX (Exchange Trace A and Trace B)" on page 759 and to the XCH TRA,TRB form of "XCH (Exchange)" on page 939

10.4.42 B1 (Clear Write for Trace B)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

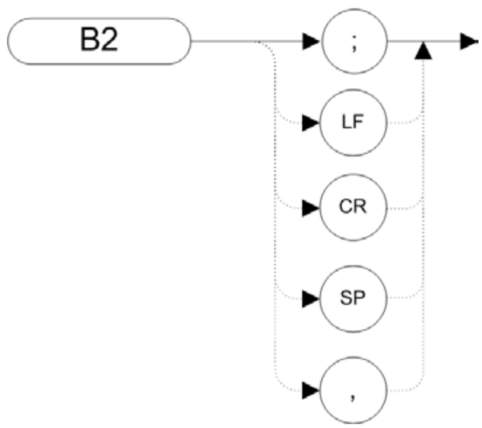
Description

Sets Trace B to clear write. That is, it continuously displays any signal present at the instrument input. The `B1` command initially clears Trace B, setting all elements to zero. The sweep trigger then signals the start of the sweep, and Trace B is continually updated as the sweep progresses. Subsequent sweeps send new amplitude information to the display addresses.

Format	`B1`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of `B1` are identical to the `CLRW TRB` form of "CLRW (Clear Write)" on page 734

10.4.43 B2 (Maximum Hold for Trace B)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

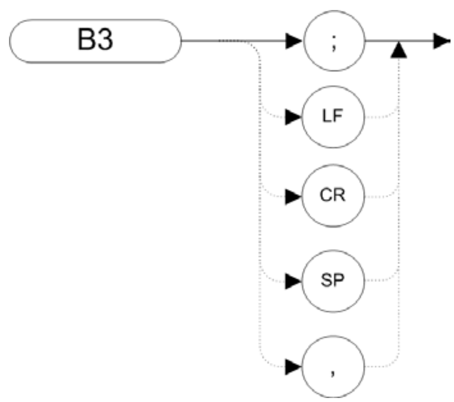
Description

Updates each trace element with the maximum level detected while the trace is active.

Format	`B2`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of `B2` are identical to the `MXMH TRB` form of "MXMH (Maximum Hold)" on page 861

10.4.44 B3 (View Mode for Trace B)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

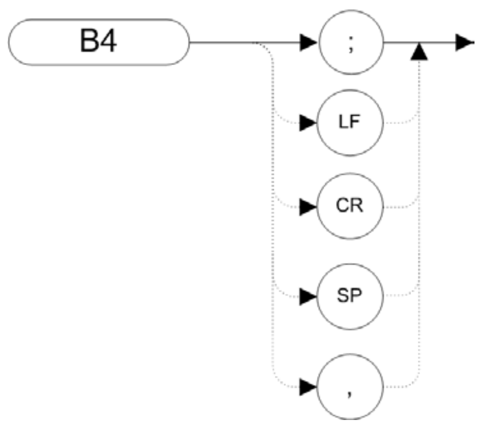
Description

Displays Trace B and then stops the sweep if no other traces are active. Trace B does not get updated.

Format	`B3`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of `B3` are identical to the `VIEW TRB` form of "VIEW (View Trace)" on page 937

10.4.45 B4 (Blank Trace B)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

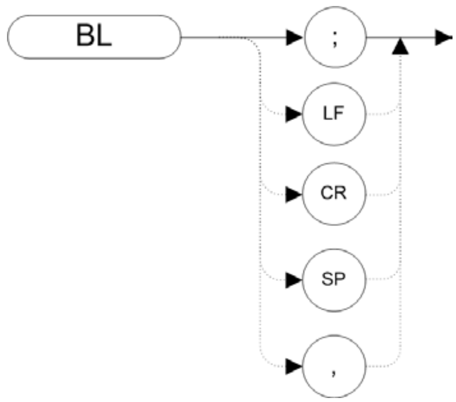
Description

Blanks Trace B and stops the sweep if no other traces are active. Trace B is not updated.

Format	`B4`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of `B4` are identical to the `BLANK TRB` form of "BLANK (Blank Trace)" on page 721

10.4.46 BL (Trace B minus Display Line to Trace B)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

Subtracts the display line from Trace B and sends the results to Trace B.

The command `BL` is calculated differently depending on the language being used; for the 8560 Series the calculation is performed in units of dBm.

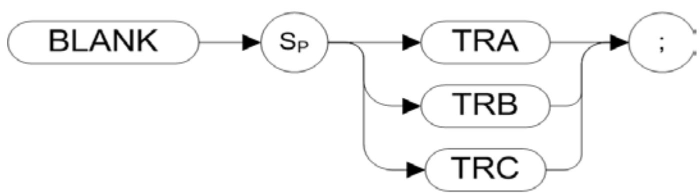
8560 Series	The calculation is performed in units of dBm
8566A/B	The calculation is performed in display units
8568A/B	

Format	`BL`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of `BL` are identical to "BML (Trace B Minus Display Line)" on page 722

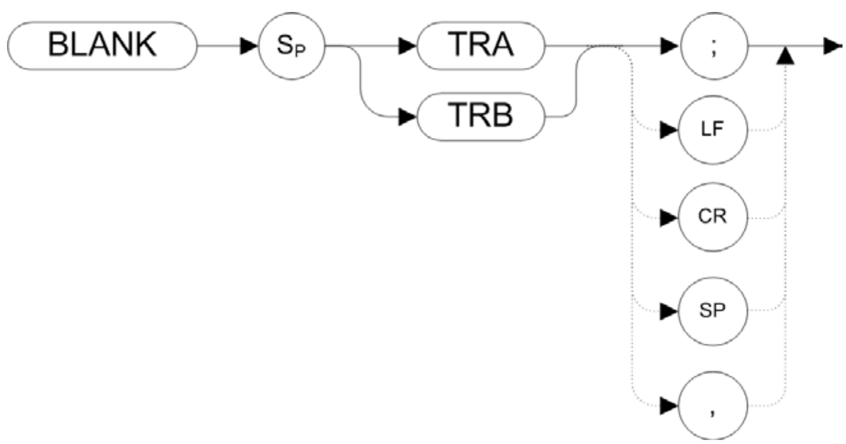
10.4.47 BLANK (Blank Trace)

Syntax

8560 Series:



8566A/B, 8568A/B:



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Blanks Trace 1 or trace 2 and stops taking new data into the specified trace. `TRA` corresponds to Trace 1, `TRB` corresponds to Trace 2, and so on.

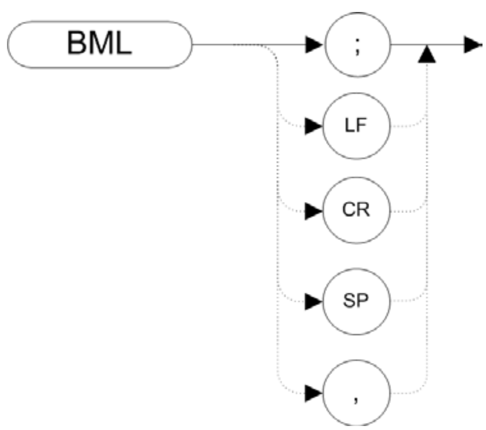
Format	8566A/B, 8568A/B:
	`BLANK TRA|TRB|TRC`
	8560 Series:
	`BLANK TRA|TRB`

Query Data Type	N/A
SCPI Equivalent Commands	`:TRACe[1|2|3|4|5|6]:UPDate[:STATe] OFF`

	`:TRACe[1|2|3|4|5|6]:DISPlay[:STATe] OFF`
	See "View/Blank" on page 339
Preset	TRB, TRC Blank
Notes	The functions of `BLANK` are identical to "A4 (Blank Trace A)" on page 684, "B4 (Blank Trace B)" on page 719, KSJ, and "KSk (Blank Trace C)" on page 797

10.4.48 BML (Trace B Minus Display Line)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Subtracts the display line from trace B (point by point), and sends the difference to trace B. Trace B corresponds to Trace 2.

The command `BML` is calculated differently depending on the language being used:

– For the 8560 Series the calculation uses units of dBm

– For the 8566A/B, 8568A/B, the calculation uses display units

Format	`BML`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of `BML` are identical to "BL (Trace B minus Display

Line to Trace B)" on page 720

10.4.49 BTC (Transfer Trace B to Trace C)

Syntax

Legacy Products

8566A/B, 8568A/B

Description

Transfers Trace B data to Trace C

Trace C cannot be an active trace. This means that the data in Trace C cannot be updated as the instrument sweeps. To ensure that the current settings of the instrument are reflected in the data transferred from Trace B to Trace C, you must follow the four step process below.

1. Select single sweep mode (S2 or SNGLS command)
2. Select the desired instrument settings
3. Take one complete sweep
4. Transfer the data

Format	`BTC`
Query Data Type	N/A
SCPI Equivalent Commands	Note that the following SCPI command is not supported in RLC Mode: `:TRACe:COPY TRACE2, TRACE3` see "Copy" on page 353
Notes	The functions of `BTC` are identical to the command "KSl (Transfer Trace B to Trace C)" on page 798

10.4.50 BXC (Exchange Trace B and Trace C)

Syntax

Legacy Products

8566A/B, 8568A/B

Description

Exchanges Trace B data with Trace C data.

Trace C must not be an active trace. This means that the data in Trace C cannot be updated as the instrument sweeps. To ensure that the current settings of the instrument are reflected in the data exchanged between Trace B and Trace C, you must follow the four step process below.

1. Select single sweep mode (`S2` or `SNGLS` command)
2. Select the desired instrument settings
3. Take one complete sweep
4. Exchange the data

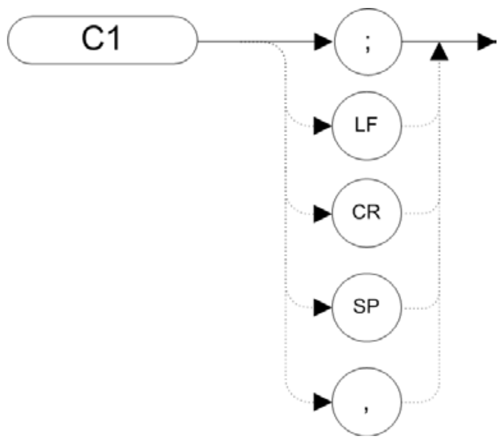
Format	`BXC`
Query Data Type	N/A

SCPI Equivalent Commands	`TRACe3:TYPe?`
	`TRACe3:UPDate?`
	`TRACe3:DISPlay?`
	`TRACe2:TYPe?`
	`TRACe2:UPDate?`
	`TRACe2:DISPlay?`
	`TRACe:EXCHange TRACE2, TRACE3`
	See "View/Blank" on page 339

Couplings	Trace Update is set to Off and Trace Display is set to On
Notes	The functions of `BXC` are identical to "KSi (Exchange Trace B and Trace C)" on page 795 and to the `XCH TRB,TRC` form of "XCH (Exchange)" on page 939

10.4.51 C1 (Set A Minus B Mode Off)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

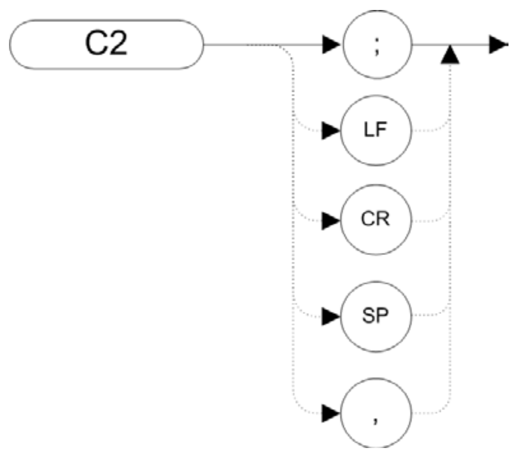
Description

Turns the A Minus B mode off. That is, it switches off the functionality that was switched on by the command "C2 (A Minus B Into A)" on page 726 or by the `AMB ON` form of the command "AMB (A minus B into A)" on page 702.

Format	`C1`
Query Data Type	N/A
SCPI Equivalent Commands	Note that the following SCPI command is not supported in RLC Mode: `:CALCulate:MATH TRACE4, OFF` See "Math Function" on page 347
Notes	The functions of `C1` are identical to the `AMB OFF` form of "AMB (A minus B into A)" on page 702

10.4.52 C2 (A Minus B Into A)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

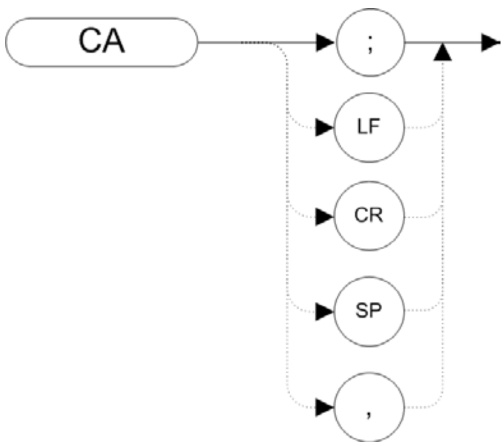
Description

Subtracts the points in Trace B from the corresponding points in Trace A, and sends the results to Trace A. Thus, if your input signal remains unchanged, C2 can restore the original trace after "APB (Trace A Plus Trace B to A)" on page 710 or "KSc (A Plus B to A)" on page 788 command has been executed.

Format	C2
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of C2 are identical to the AMB ON form of "AMB (A minus B into A)" on page 702

10.4.53 CA (Couple Attenuation)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

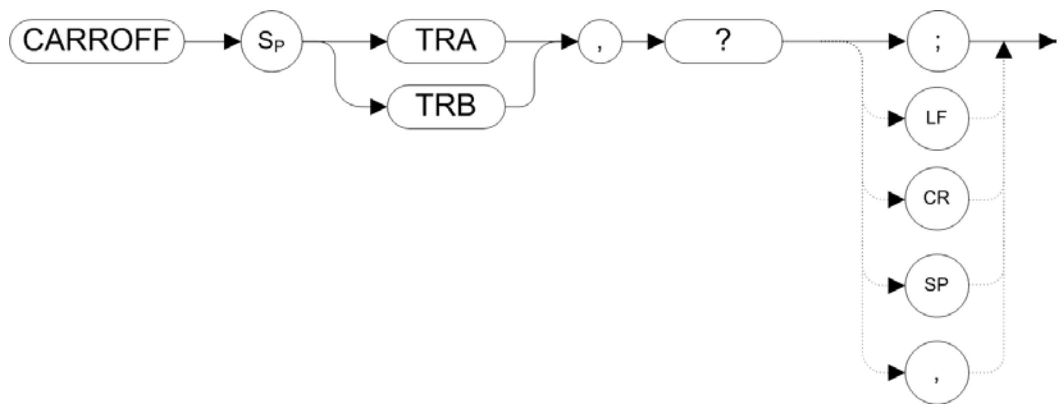
During normal operation, the instrument's input attenuation is coupled to the reference level. This coupling keeps the mixer input at a level such that a continuous wave signal displayed at the reference level is at or below –10 dBm (or the value specified in the `ML` command.)

The `CA` command sets the threshold to –10 dBm, or to the value specified by "ML (Mixer Level)" on page 858 or "KS, (Mixer Level)" on page 782. The counterpart to `CA` is "AT (Input Attenuation)" on page 711, which allows levels less than the threshold value at the mixer input.

Format	`CA`
Query Data Type	N/A
SCPI Equivalent Commands	`[:SENse]:POWer[:RF]:ATTenuation:AUTO ON`

10.4.54 CARROFF (Carrier Off Power)

Syntax



Legacy Products

8560 series

Description

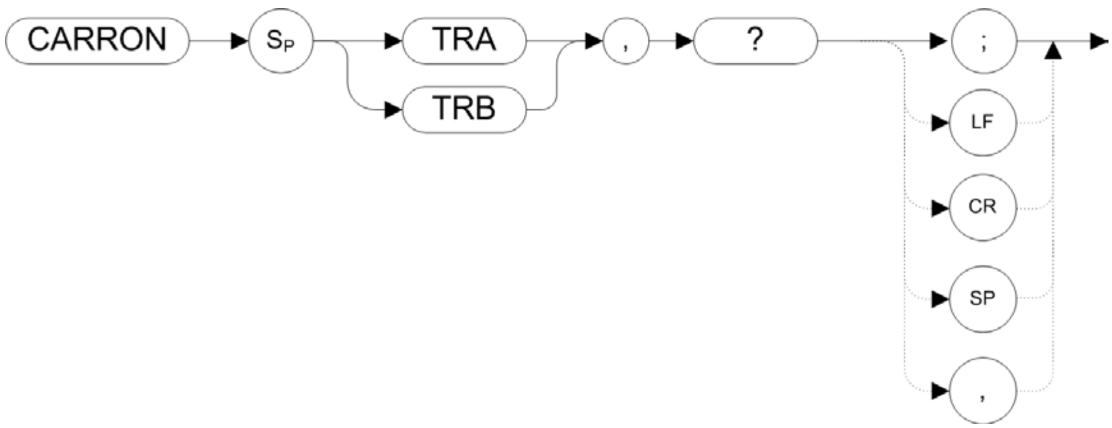
Measures the average and peak power of the carrier during the portion of time when the power is off (when it is not within 20 dB of its peak level). The powers are combined to provide a calculation of the leakage power.

The measurement must be in zero span for the measurement to run.

Format	`CARROFF TRA|TRB,?`
Query Data Type	<ampl> in dBm
SCPI Equivalent Commands	None

10.4.55 CARRON (Carrier On Power)

Syntax



Legacy Products

8560 series

Description

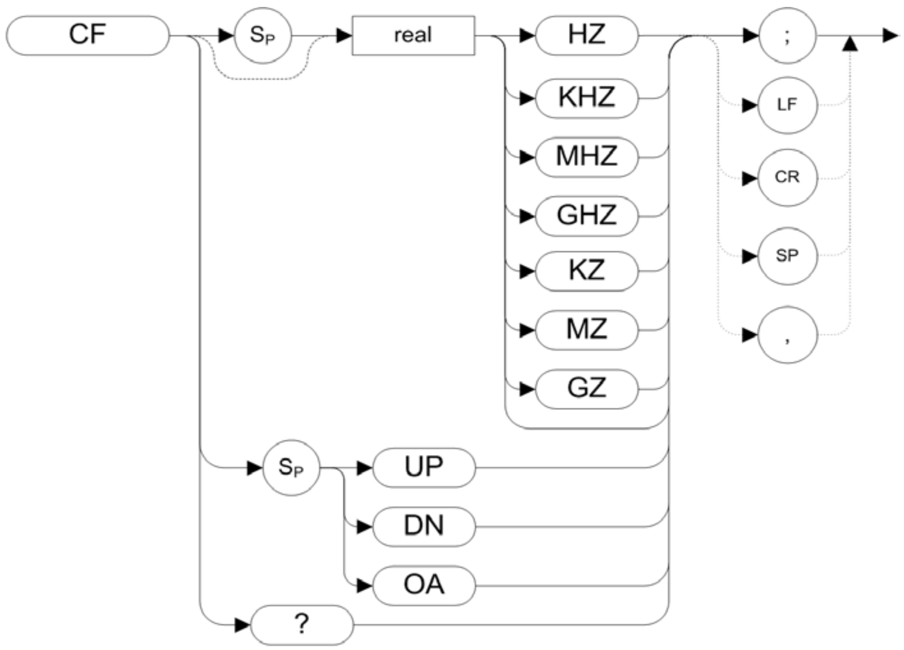
Measures the average power of the carrier during the portion of time when it is on and within 20 dB of its peak level.

The measurement needs to be in zero span for the measurement to run.

Format	`CARRON TRA|TRB,?`
Query Data Type	<ampl> in dBm
SCPI Equivalent Commands	None

10.4.56 CF (Center Frequency)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Specifies the value of the center frequency.

The step size depends on whether the frequency has been coupled to the span width using the command "CS (Couple Frequency Step Size)" on page 740

– When coupled, the step size is 10% of the span, or one major graticule division

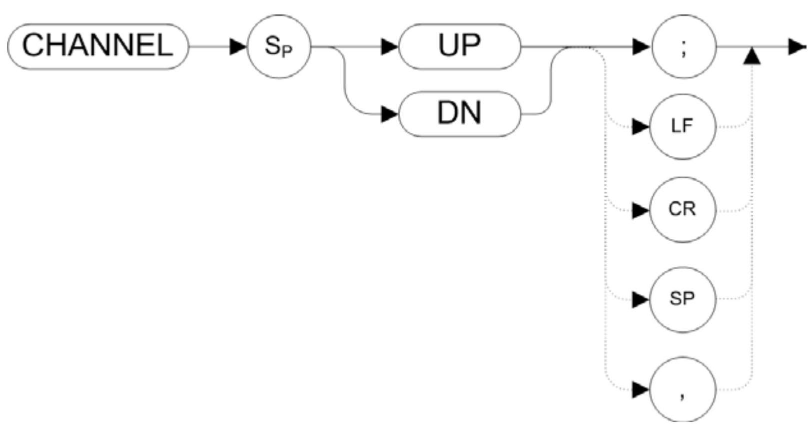
– When uncoupled, the step size is determined by the command "SS (Center Frequency Step Size)" on page 905

Format	`CF <real>HZ|KHZ|MHZ|GHZ|KZ|MZ|GZ` Range: Frequency range of the instrument Default unit is HZ

	`CF UP`
	`CF DN`
	Step size: see Description above
	`CF OA`
	`CF?`
Query Data Type	<freq> in Hz ASCII “0” if 0, otherwise scientific notation with precision to 1 Hz
SCPI Equivalent Commands	`[:SENSe]:FREQuency:CENTer <freq>` `[:SENSe]:FREQuency:CENTer?`
Notes	Although the instrument allows entry of frequencies not in the specified frequency range, using frequencies outside the frequency span of the instrument is not recommended and is not warranted to meet specifications

10.4.57 CHANNEL (Channel Selection)

Syntax



Legacy Products

8560 series

Description

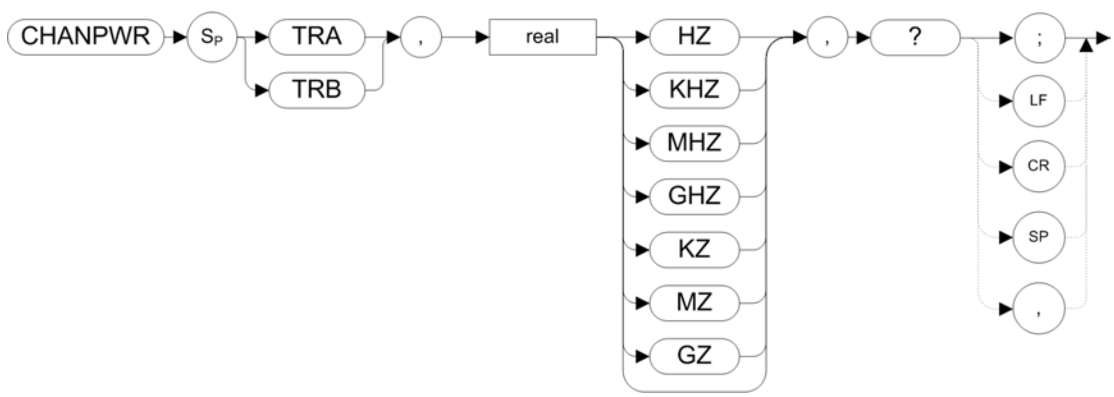
Increments or decrements the instrument center frequency by one channel spacing.

The channel spacing value is set using the command "ACPSP (Adjacent Channel Power Channel Spacing)" on page 698.

Format	`CHANNEL UP|DN`
Query Data Type	N/A
SCPI Equivalent Commands	`[:SENSe]:FREQuency:CENTer <freq>` `[:SENSe]:FREQuency:CENTer?`

10.4.58 CHANPWR (Channel Power)

Syntax



Legacy Products

8560 series

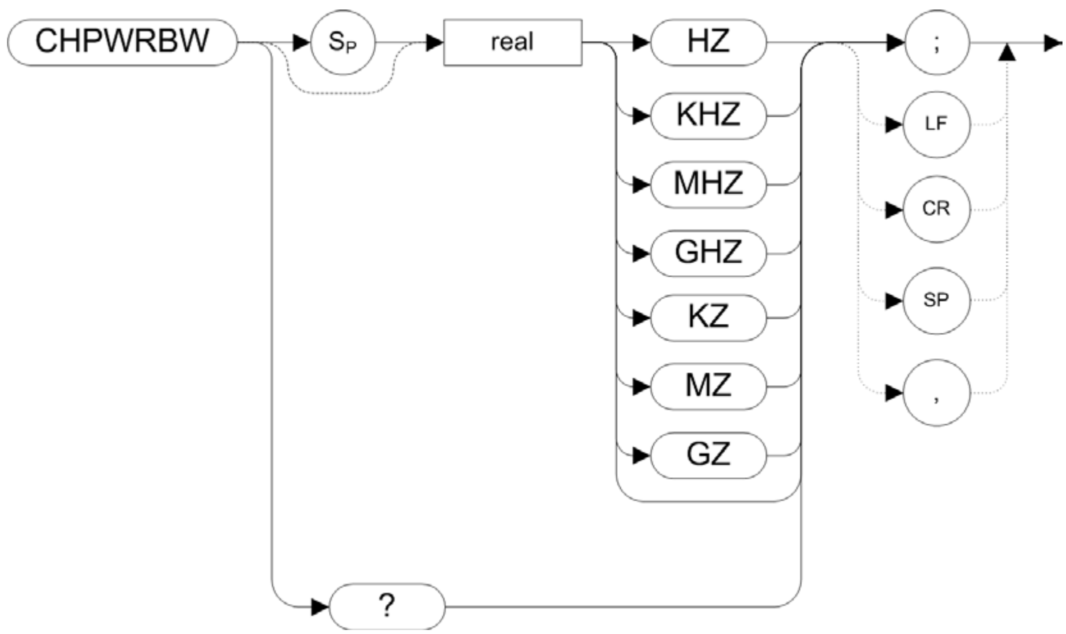
Description

Measures the power within the specified channel bandwidth.

Format	CHANPWR TRA|TRB, <frequency> with frequency unit,?
Query Data Type	<amplitude> in dBm (without explicit units).
SCPI Equivalent Commands	None

10.4.59 CHPWRBW (Channel Power Bandwidth)

Syntax



Legacy Products

8560 series

Description

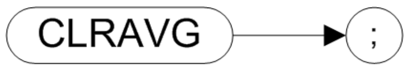
Queries or sets the current value of the channel power bandwidth. Channel power can be measured with "CHANPWR (Channel Power)" on page 732.

Format	`CHPWRBW <frequency>`
	with frequency unit
	`CHPWRBW?`

Query Data Type	<frequency>, 2 digits to the right of the decimal place
SCPI Equivalent Commands	None
Preset	3 GHz

10.4.60 CLRAVG (Clear Average)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

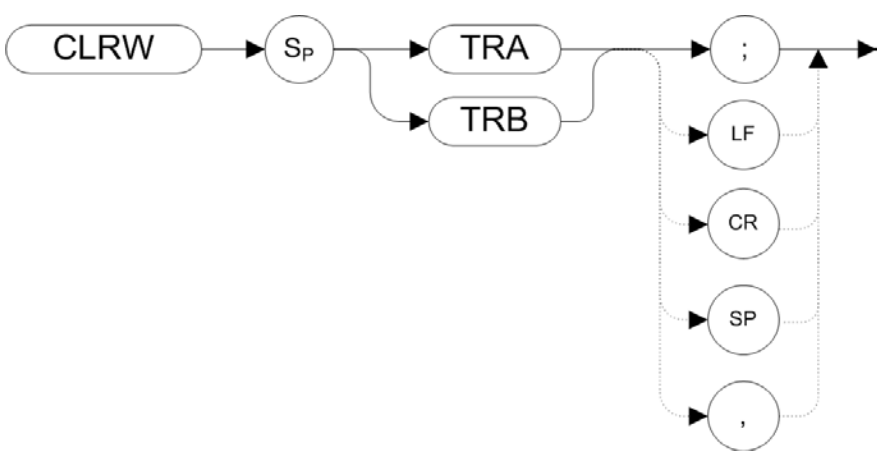
Restarts the VAVG command by resetting the number of averaged sweeps to one. The video averaging routine resets the number of sweeps, but does not stop video averaging. Use VAVG OFF to stop video averaging.

Format	CLRAVG
Query Data Type	N/A
SCPI Equivalent Commands	[:SENSe]:AVERage:CLEar

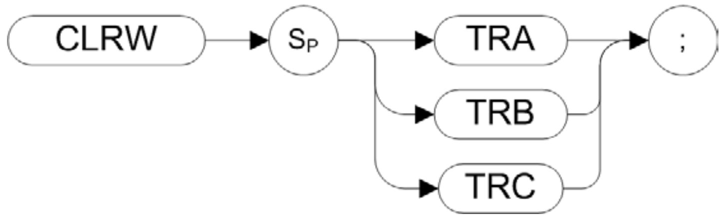
10.4.61 CLRW (Clear Write)

Syntax

8560 series



8566A/B, 8568A/B



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Clears the specified trace and enables trace data acquisition. The `CLRW` command places the indicated trace in clear-write mode. Data acquisition begins at the next sweep. (See the command "TS (Take Sweep)" on page 929 for more information about data acquisition.)

TRA corresponds to Trace 1 and TRB corresponds to Trace 2.

In the 8560 series, 8566A/B, and 8568A/B analyzers, the trace settings are controlled by the trace mode parameters, `CLRW`, `VIEW`, `BLANK`, `MINH` and `MAXH` and the averaging settings by `VAVG`. In the X-series the same settings are controlled by the Trace/Detector and View/Blank parameters.

The following table describes the parameters set in the X-series instrument when the legacy commands for trace mode and averaging are sent.

Legacy Products command mapping to X-series for trace/detector settings

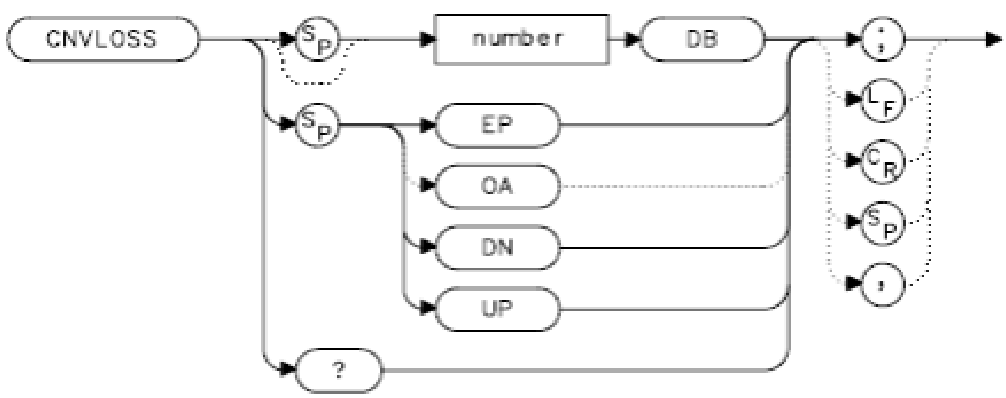
Legacy Products			X-series		
Trace Commands	**Averaging (VAVG)**	**Detector (DET)**	**Trace/Detector Trace Type**	**View/Blank**	**Detector**
CLRW	Off	Normal	ClearWrite	On	Last set
CLRW	On	Sample	Trace Average	On	Sample
MXMH	Off	Peak	Max Hold	On	Peak
MXMH	On	Sample	Trace Average	On	Peak
MINH	Off	NegPeak	Min Hold	On	NegPeak
MINH	On	Sample	Trace Average	On	NegPeak
VIEW	Off	Normal	No change	View	No change
VIEW	On	Sample	Trace Average	View	Sample
BLANK	Off	Normal	No change	Blank	No change
BLANK	On	Sample	Trace Average	Blank	Sample

For example, if an 8560 series analyzer receives `CLRW`, and averaging is set to ON, then the analyzer's detector is automatically set to Sample. In the same circumstances, this application sets the X-series instrument trace type to Trace Average, View/Blank to On, and the Detector to Sample.

Format	`CLRW TRA|TRB`
Query Data Type	N/A
SCPI Equivalent Commands	`:TRACe1|2|3|4|5|6:TYPE WRITe` see "Trace Type" on page 335
Preset	`TRA` after a preset, only trace A is set to clearwrite
Notes	The functions of `CLRW` are identical to the command "A1 (Clear Write for Trace A)" on page 681 and "B1 (Clear Write for Trace B)" on page 716.

10.4.62 CNVLOSS (Conversion Loss Compensation)

Syntax



Legacy Products

8560 series

Description

`CNVLOSS` compensates for losses outside the instrument when in external mixer mode (such as losses within external mixers or connector cables).

`CNVLOSS` specifies the mean conversion loss for the current harmonic band. In a full frequency band (such as Band K), the mean conversion loss is defined as the minimum loss plus the maximum loss for that band divided by two. Adjusting for conversion loss allows the system to remain calibrated (that is, the displayed amplitude values have the conversion loss incorporated into them).

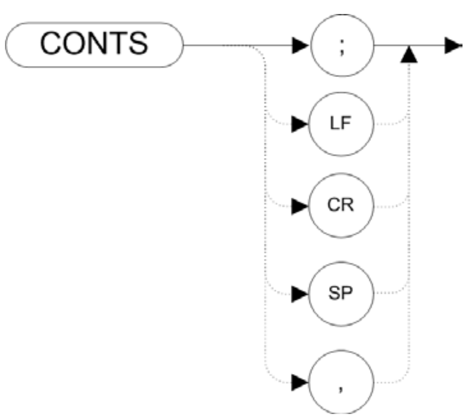
The default value for any band is 30 dB.

The instrument must be in external-mixer mode in order for this command to have any effect. When in internal-mixer mode, querying CNVLOSS returns zero.

Format	CNVLOSS <num>DB Range: 15 to 60 dB CNVLOSS DN|UP Step: 0.1 dB CNVLOSS OA CNVLOSS?
Query Data Type	Value in dB
SCPI Equivalent Commands	None
Preset	Factory default: 30 dB Power on persistence
Couplings	Command is effective only when "MXRMODE (Mixer Mode)" on page 862 is EXT

10.4.63 CONTS (Continuous Sweep)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

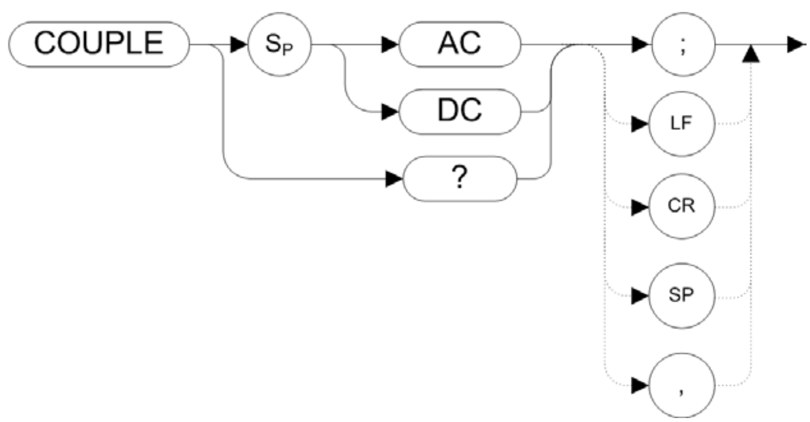
Description

Sets the instrument to continuous sweep mode. In the continuous sweep mode, the instrument takes its next sweep as soon as possible after the current sweep (as long as the trigger conditions are met). A sweep may temporarily be interrupted by data entries made over the remote interface or from the front panel.

Format	`CONTS`
Query Data Type	N/A
Preset	`CONTS`
SCPI Equivalent Commands	Note that the following SCPI command is not supported in RLC Mode: `:INITiate:CONTinuous 1` see "Sweep/Measure" on page 317
Notes	The functions of `CONTS` are identical to "S1 (Continuous Sweep)" on page 893

10.4.64 COUPLE (Input Coupling)

Syntax



Legacy Products

8560 series

Description

Selects AC or DC coupling.

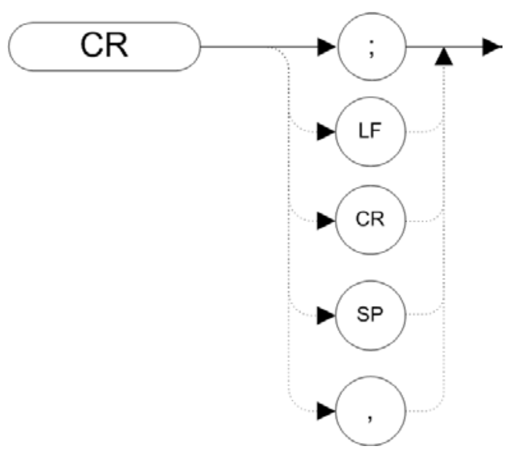
Format	COUPLE AC|DC COUPLE?
Query Data Type	AC|DC

SCPI Equivalent Commands	`:INPut:COUPling AC|DC`
	`:INPut:COUPling?`
	(See "RF Coupling" on page 488)

Preset	AC (when possible)
Notes	When using the X-series instruments, you must use DC coupling to see calibrated frequencies of less than 20 MHz. Signals of less than 20 MHz are not calibrated when using AC coupling on these instruments.

10.4.65 CR (Couple Resolution Bandwidth)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Couples the resolution bandwidth to the span.

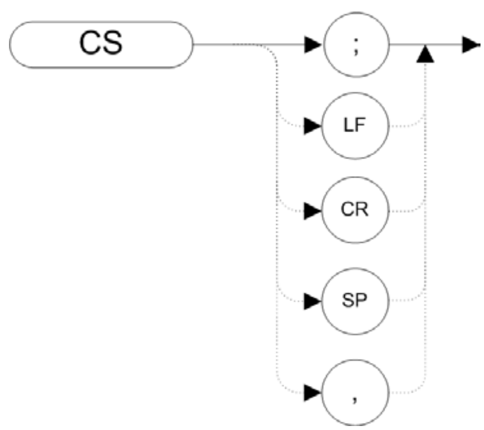
The counterpart to the `CR` command is the command "RB (Resolution Bandwidth)" on page 881 which breaks the coupling. Use the `CR` command to re-establish coupling after executing an `RB` command.

Format	`CR`

Query Data Type	N/A
SCPI Equivalent Commands	[:SENse]:BANDwidth[:RESolution]:AUTO ON
Preset	ON
Notes	CR uses the legacy instrument settings for resolution bandwidth only if "Limit RBW/VBW" on page 241 is set to ON

10.4.66 CS (Couple Frequency Step Size)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

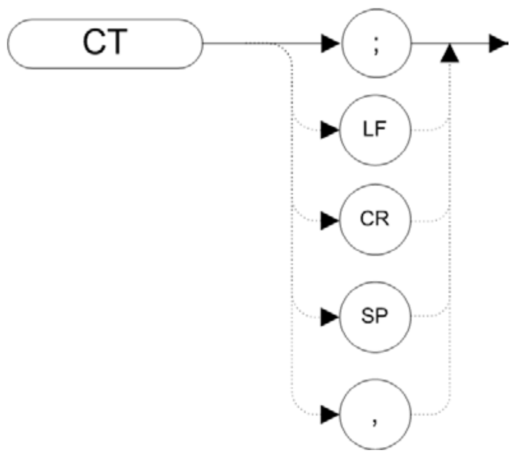
Couples the center frequency step size to the span width, so that the step size equals 10% of the span width, or one major graticule division.

The counterpart to CS is "SS (Center Frequency Step Size)" on page 905 which breaks the coupling. Use CS to re-establish coupling after an SS command has been executed.

Format	CS
Query Data Type	N/A
SCPI Equivalent Commands	[:SENse]:FREQuency:CENTer:STEP:AUTO ON
Preset	ON

10.4.67 CT (Couple Sweep Time)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

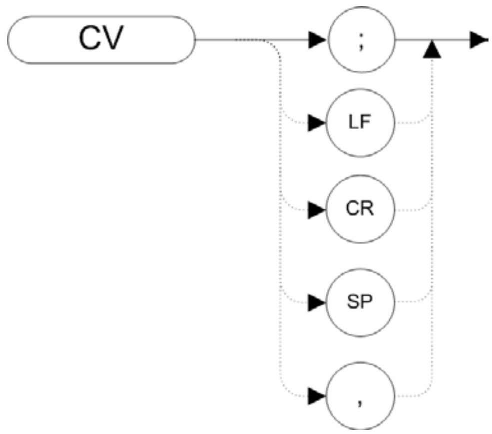
Couples the sweep time to the span, resolution bandwidth and video bandwidth.

The counterpart to the `CT` command is "ST (Sweep Time)" on page 906 which breaks the coupling. Use the `CT` command to re-establish coupling after an `ST` command has been executed.

Format	`CT`
Query Data Type	N/A
SCPI Equivalent Commands	`:SWEep:TIME:AUTO ON`
Preset	ON

10.4.68 CV (Couple Video Bandwidth)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

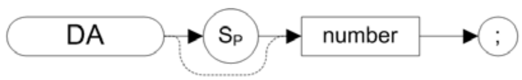
Couples the video bandwidth to the resolution bandwidth.

The counterpart to the `CV` command is "VB (Video Bandwidth)" on page 933, which breaks the coupling. Use the `CV` command to re-establish coupling after executing a `VB` command.

Format	`CV`
Query Data Type	N/A
SCPI Equivalent Commands	`[:SENse]:BANDwidth:VIDeo:AUTO ON`
Preset	`ON`
Notes	`CV` uses the legacy signal analyzer settings for video bandwidth only if "Limit RBW/VBW" on page 241 is set to ON

10.4.69 DA (Display Address)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

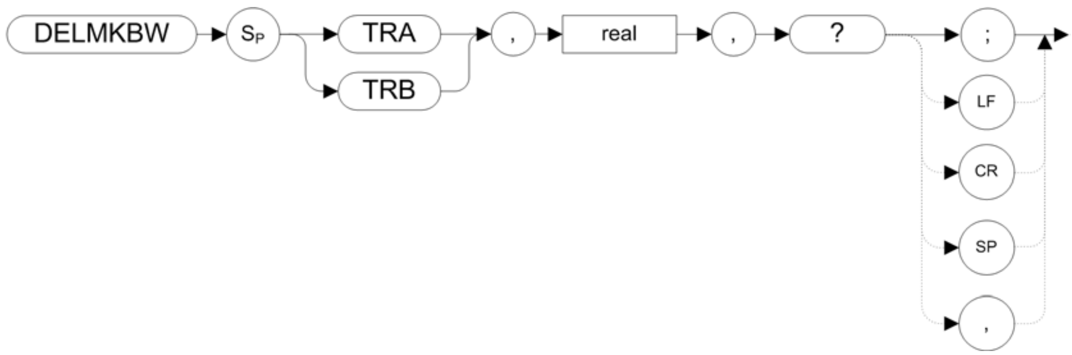
Returns the contents of the given display address to the controller.

Format	`DA 1`
	sets TRA
	`DA 1025`
	sets TRB
	`DA 3073`
	sets TRC

Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	This command only supports the use of `DA 1`, `DA 1025`, and `DA 3073`; these display addresses contain the trace data, and are equivalent to using"TRA (Trace Data Input and Output)" on page 925, "TRB (Trace Data Input and Output)" on page 926, "TRC (Trace Data Input and Output)" on page 926, "TA (Trace A)" on page 917 and "TB (Trace B)" on page 918

10.4.70 DELMKBW (Occupied Power Bandwidth Within Delta Marker)

Syntax



Legacy Products

8560 series

Description

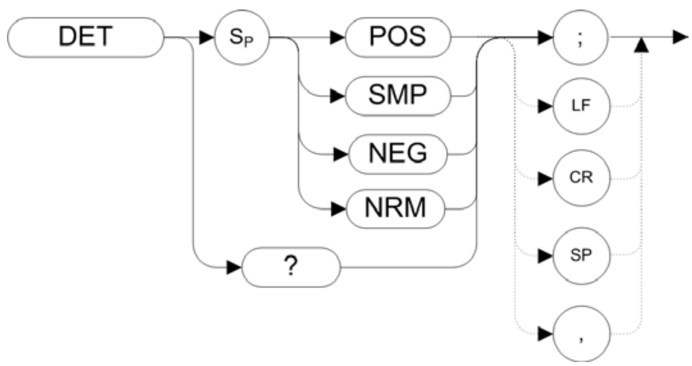
Calculates the OBW with respect to the power between the displayed delta markers. The power between the displayed markers is then used as the reference, rather than using the total power in the frequency span as is done in the command "PWRBW (Power Bandwidth)" on page 877.

If the `DELMKBW` command is used when no marker is active, a delta marker is activated at the center frequency, and the returned bandwidth is 0. If the active marker is a normal marker when the `DELMKBW` command is used, the marker type is changed to delta, and the returned bandwidth is 0.

Format	`DELMKBW TRA|TRB,<real>,?`
Query Data Type	<frequency> in Hz
SCPI Equivalent Commands	None

10.4.71 DET (Detection Mode)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Selects the type of instrument detection (`NEGative` peak, `NoRMal`, `POSitive` peak, or `SaMPle`).

NEG	Enables negative peak detection
NRM	Enables the 'rosenfell' detection algorithm that selectively chooses between positive and negative values
POS	Enables positive-peak detection, which displays the maximum video signal detected over a number of instantaneous samples for a particular frequency
SMP	Enables sample detection, which uses the instantaneous video signal value. Video averaging and noise-level markers, when activated, activate sample detection automatically

Format	`DET NEG|NRM|POS|SMP`
	For option descriptions, see table above
	`DET?`

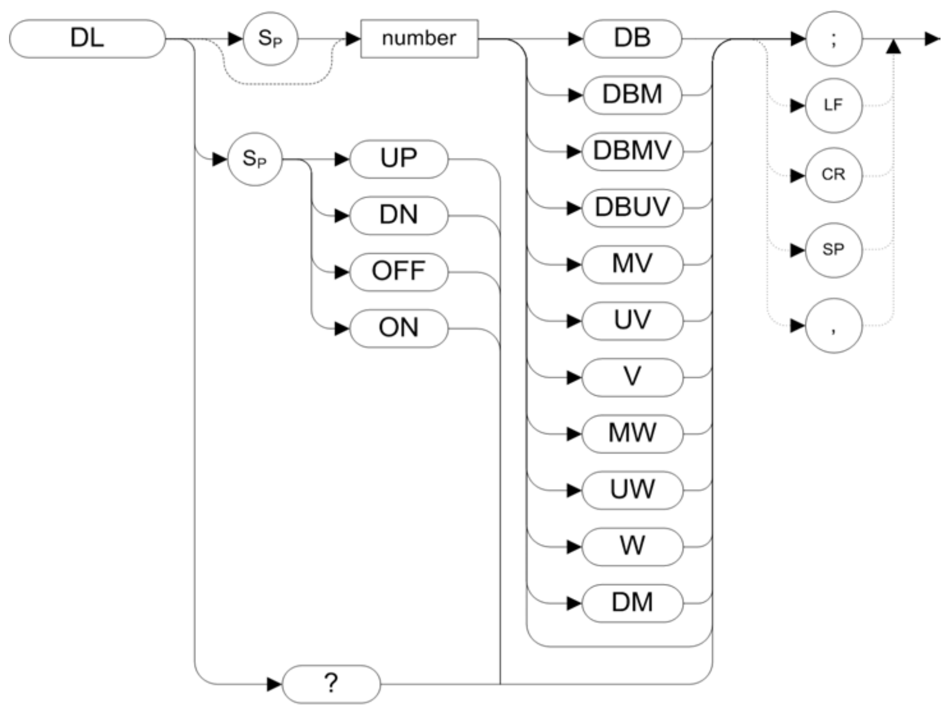
Query Data Type	`NEG|NRM|POS|SMP`
SCPI Equivalent Commands	`[:SENSe]:DETector[:FUNCtion] NEGative|NORMal|POSitive|SAMPle` `[:SENSe]:DETector[:FUNCtion]?`
Preset	`NRM`
Notes	The functions of `DET` are identical to the commands"KSa (Normal

Detection)" on page 786, "KSb (Positive Peak Detection)" on page 787, "KSd (Negative Peak Detection)" on page 789, and "KSe (Sample Detection)" on page 791

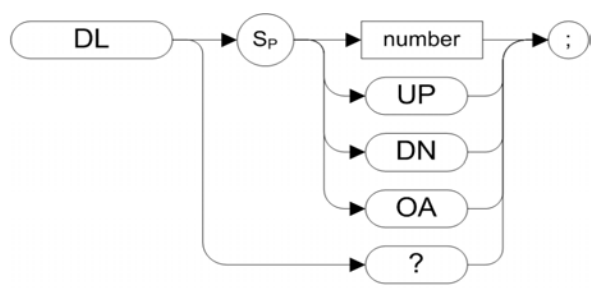
10.4.72 DL (Display Line)

Syntax

8560 series:



8566A/B, 8568A/B:



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Defines the level of the display line and displays it on the instrument screen.

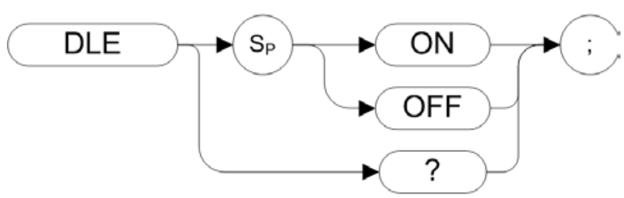
Format	DL <number>DB|DBM|DBMV|DBUV|MV|UV|V|MW|UW|W|DM Default units are DBM Range: dependent on the reference level DL UP DL DN (Step Increment: 1 major graticule division) DL ON|OFF DL OA DL?
Query Data Type	<number> (Unit: V in LN, DBM in LG)

SCPI Equivalent Commands	`:DISPlay:WINDow:TRACe:Y:DLINe <ampl>`
	`:DISPlay:WINDow:TRACe:Y:DLINe:STATE ON|OFF`
	`:DISPlay:WINDow:TRACe:Y:DLINe:STATE?`

Preset	OFF

10.4.73 DLE (Display Line Enable)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

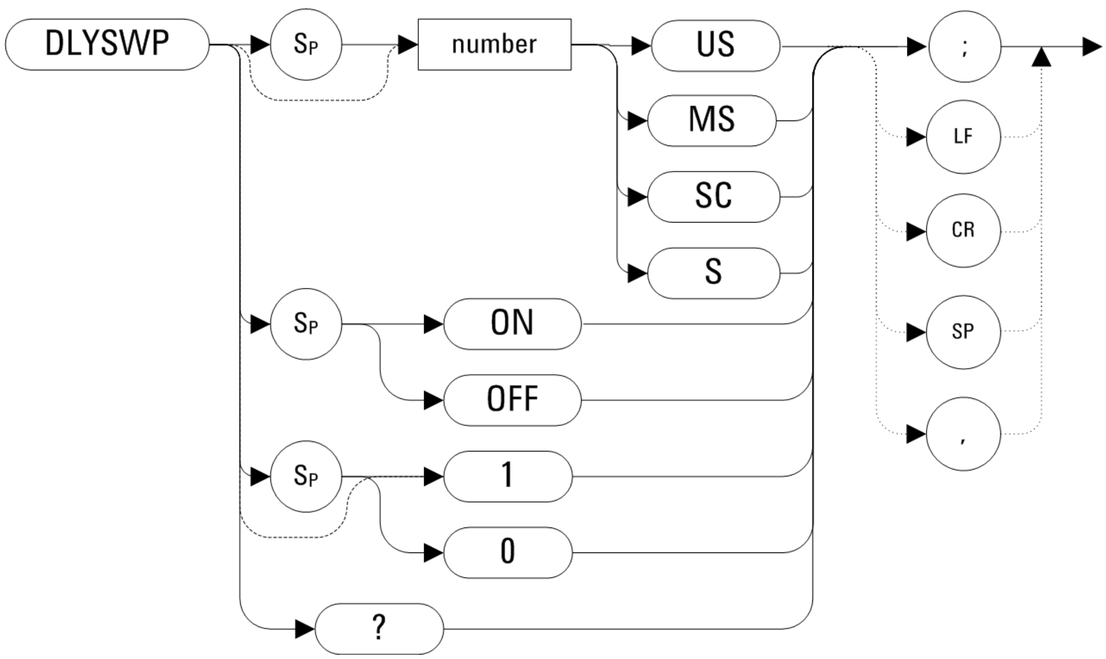
Enables or disables the display line.

Format	DLE ON|OFF DLE?

Query Data Type	ON|OFF
SCPI Equivalent Commands	`:DISPlay:WINDow:TRACe:Y:DLINe:STATE ON|OFF`
Preset	OFF
Couplings	Turning DL OFF, then ON again does not reset DL level

10.4.74 DLYSWP (Delay Sweep)

Syntax



Legacy Products

8560 series

Description

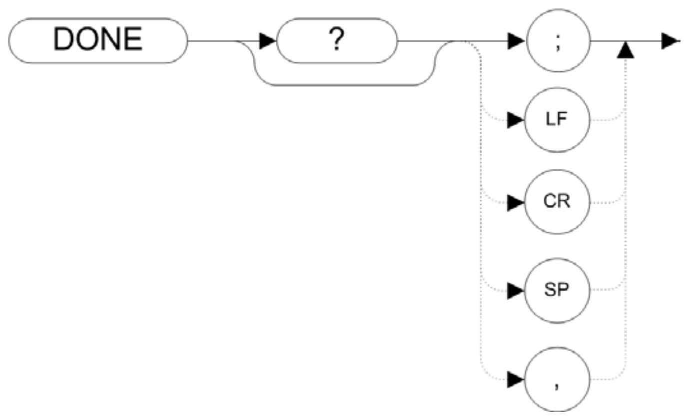
Delays the start of the sweep until the specified time after the trigger event has elapsed.

Format	DLYSWP <number>US|MS|SC|S Range: 2 µS to 65.535 S DLYSWP ON|OFF|1|0 DLYSWP?

Query Data Type	Returns the value of the sweep delay length in seconds, or a '0' indicating the delay sweep is turned OFF.
Preset	OFF, 2 µS

10.4.75 DONE (Done)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Allows you to determine when the instrument has parsed a list of commands and has executed all commands prior to and including `DONE`. The `DONE` command returns a value of "1" when all commands in a command string or command list have been completed.

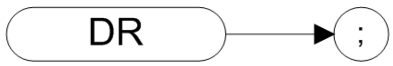
If a "TS (Take Sweep)" on page 929 command precedes the command list, the `TS` command acts as a synchronizing function, since the command list execution begins after the sweep has been completed.

Format	`DONE?`
Query Data Type	1

SCPI Equivalent Commands	`*WAI`
	or
	`*OPC?`
	see "*WAI - Wait-to-Continue" on page 644

10.4.76 DR (Display Read)

Syntax



Legacy Products

8566A/B, 8568A/B

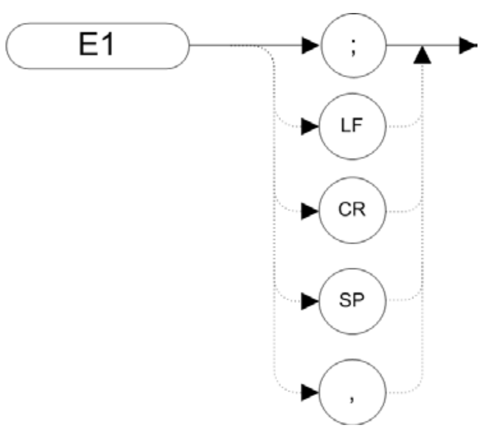
Description

Sends the contents of the current display address to the controller.

Format	DR
Query Data Type	N/A
SCPI Equivalent Commands	None

10.4.77 E1 (Peak Marker)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

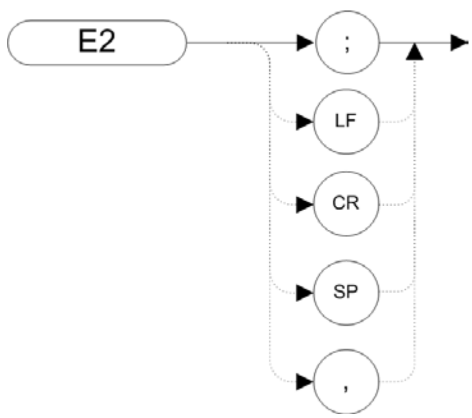
Description

Positions the marker at the signal peak.

Format	`E1`
Query Data Type	N/A
SCPI Equivalent Commands	`:CALCulate:MARKer[1]|2:MAXimum`
Notes	The functions of `E1` are identical to `MKPK` (without secondary keyword) and `MKPK HI`. See "MKPK (Marker Peak)" on page 846

10.4.78 E2 (Marker to Center Frequency)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

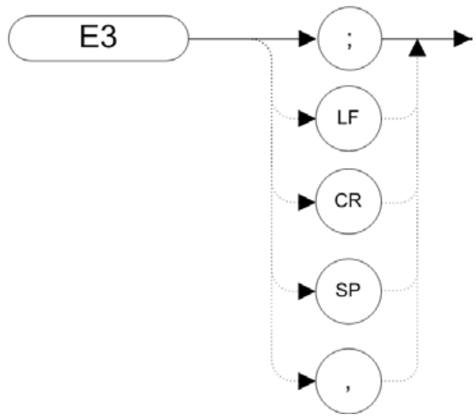
Description

Positions the marker on the screen at the center frequency position.

Format	`E2`
Query Data Type	N/A
SCPI Equivalent Commands	`:CALCulate:MARKer[1]|2|3|4|5|6[:SET]:CENTer`
Notes	Unlike "MKCF (Marker to Center Frequency)" on page 836, which moves the CF to the current position of the active marker, `E2` centers the active marker to the center frequency on the instrument screen

10.4.79 E3 (Delta Marker Step Size)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

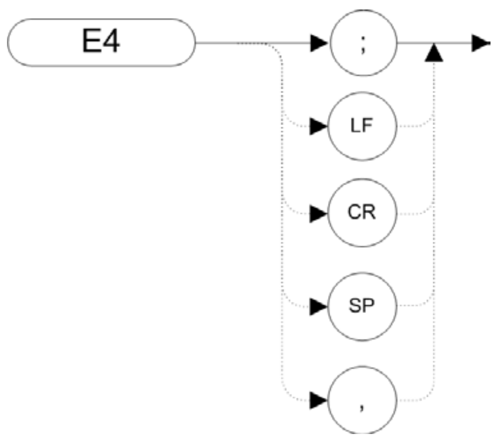
Description

Establishes the center frequency step size as being the frequency difference between the delta marker and the active marker.

Format	`E3`
Query Data Type	N/A
SCPI Equivalent Commands	`:CALCulate:MARKer[1]|2[:SET]:STEP`
Notes	The functions of `E3` are identical to the command "MKSS (Marker to Step Size)" on page 853

10.4.80 E4 (Marker to Reference Level)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

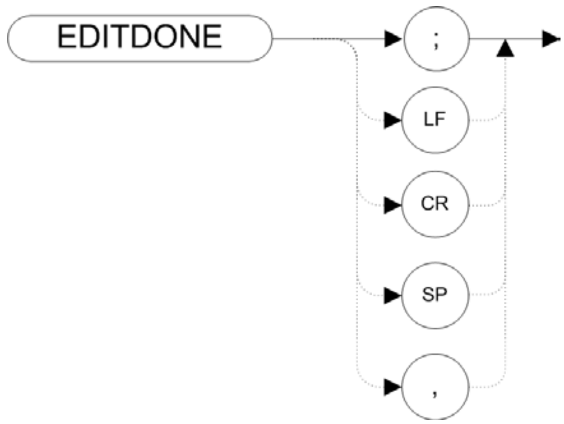
Description

Moves the active marker to the reference level.

Format	`E4`
Query Data Type	N/A
SCPI Equivalent Commands	`:CALCulate:MARKer[1]|2[:SET]:RLEVel`
Notes	Unlike "MKRL (Marker to Reference Level)" on page 851, this command moves to the level of the delta Marker when in delta Marker mode

10.4.81 EDITDONE (Edit Done)

Syntax



Legacy Products

8560 series

Description

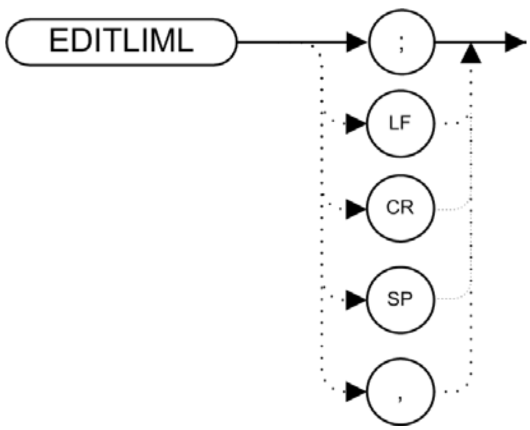
This command is used at the completion of limit-line editing, following an `EDITLIML` command.

You can enter the limit line data between the limit line commands beginning with "EDITLIML (Edit Limit Line)" on page 755 and ending with `EDITDONE`.

Format	`EDITDONE`
Query Data Type	N/A
SCPI Equivalent Commands	`:CALCulate:LLINe[1]|2:DATA <x>,<ampl>,<connect>,…`
Couplings	"EDITLIML (Edit Limit Line)" on page 755, "LIMIREL (Relative Limit Lines)" on page 813, "LIMF (Limit Line Frequency Value)" on page 809, "LIMU (Upper-Limit Amplitude)" on page 817, "LIML (Lower-Limit Amplitude)" on page 814, "LIMTSL (Slope Limit Line)" on page 817

10.4.82 EDITLIML (Edit Limit Line)

Syntax



Legacy Products

8560 series

Description

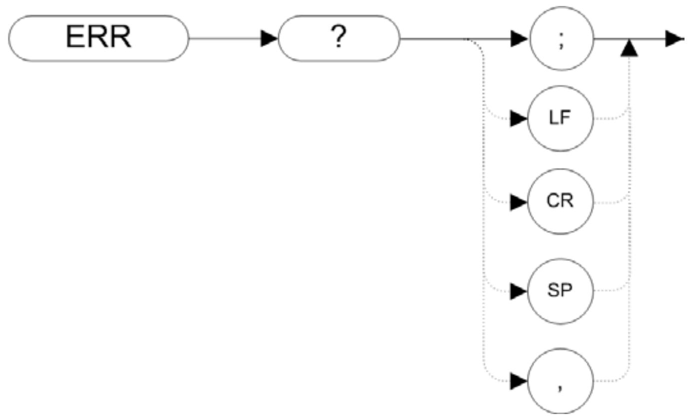
This command is used to initiate limit-line editing.

You can enter the limit line data between the limit line commands beginning with `EDITLIML` and ending with "EDITDONE (Edit Done)" on page 754.

Format	`EDITLIML`
Query Data Type	N/A
SCPI Equivalent Commands	None
Couplings	"EDITDONE (Edit Done)" on page 754, "LIMIREL (Relative Limit Lines)" on page 813, "LIMF (Limit Line Frequency Value)" on page 809, "LIMU (Upper-Limit Amplitude)" on page 817, "LIML (Lower-Limit Amplitude)" on page 814, "LIMTSL (Slope Limit Line)" on page 817

10.4.83 ERR (Error)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

The `ERR?` query returns a list of three-digit error codes if errors are present. A return value of “0” means that there are no errors present. Executing `ERR?` clears all GPIB errors.

If a command is a valid legacy command but not accepted by RLC Mode, no error message is generated and the response to `ERR?` is 0. However, if logging is enabled, the RLC Mode command log registers a “Cmd not Supported” error.

If a command is not a valid legacy command, a command error is generated; CMD ERR is displayed on the front panel and the response to `ERR?` is 112. If logging is enabled then "Cmd Error" is written to the command error log.

Error codes are provided in RLC Mode for some X-series errors such as external reference, hardware and alignment errors. The X-series error codes are translated to 8560 series error codes so that an error query returns the legacy instrument error code. To review the error via the front panel, select the **System** > **Show** > **Errors**.

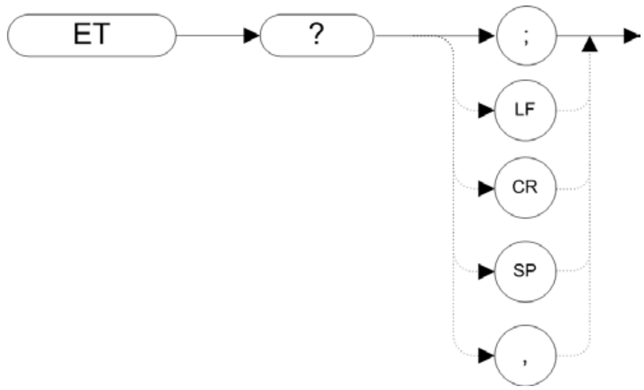
The following table shows the X-series error codes and the translated value.

X-Series Error Code	Description	8560 Series Error Code	Description
40	TG Alignment Failure	758	SYSTEM: Unknown system error
42	RF Alignment Failure	758	SYSTEM: Unknown system error
44	IF Alignment Failure	758	SYSTEM: Unknown system error
46	LO Alignment Failure	758	SYSTEM: Unknown system error
48	ADC Alignment Failure	758	SYSTEM: Unknown system error
50	FM Demod Alignment Failure	758	SYSTEM: Unknown system error
54	Extended Align Failure Sum	758	SYSTEM: Unknown system error
71	Characterize Preselector Failure	758	SYSTEM: Unknown system error
-200.3310	Execution Error; Preselector Centering failed	758	SYSTEM: Unknown system error
503	Frequency Reference Unlocked	336	10 MHz Ref Cal oscillator failed to lock when going to internal 10 MHz reference.
505	2nd LO Unlocked	336	10 MHz Ref Cal oscillator failed to lock when going to internal 10 MHz reference.
509	LO Unlocked	300	YTO UNL: YTO (1st LO) phase-locked loop (PLL) is unlocked.
513	IF Synthesizer Unlocked	450	IF SYSTM: IF hardware failure. Check other error messages.
515	Calibration Oscillator Unlocked	336	10 MHz Ref: Cal oscillator failed to lock when going to internal 10 MHz reference
521	External Ref missing or out of range	905,333	EXT REF: Unable to lock cal oscillator when set to external reference. Check that the external reference is within tolerance. 600 UNLK: 600 MHz reference oscillator PLL is unlocked

Format	ERR?
Query Data Type	0 if no error present. 3-digit number if error present. For valid codes, see table above.
SCPI Equivalent Commands	None
Preset	Remote error list cleared. Persistent errors are re-entered into the error list.

10.4.84 ET (Elapsed Time)

Syntax



Legacy Products

8560 series

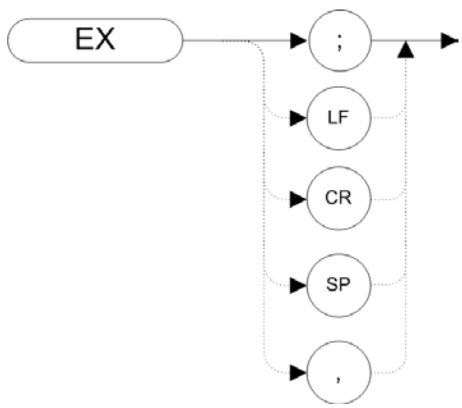
Description

Returns to the controller the elapsed time (in hours) of instrument operation.

Format	ET?
Query Data Type	<number> in hours.
SCPI Equivalent Commands	:SYSTem:PON:ETIMe?

10.4.85 EX (Exchange Trace A and Trace B)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

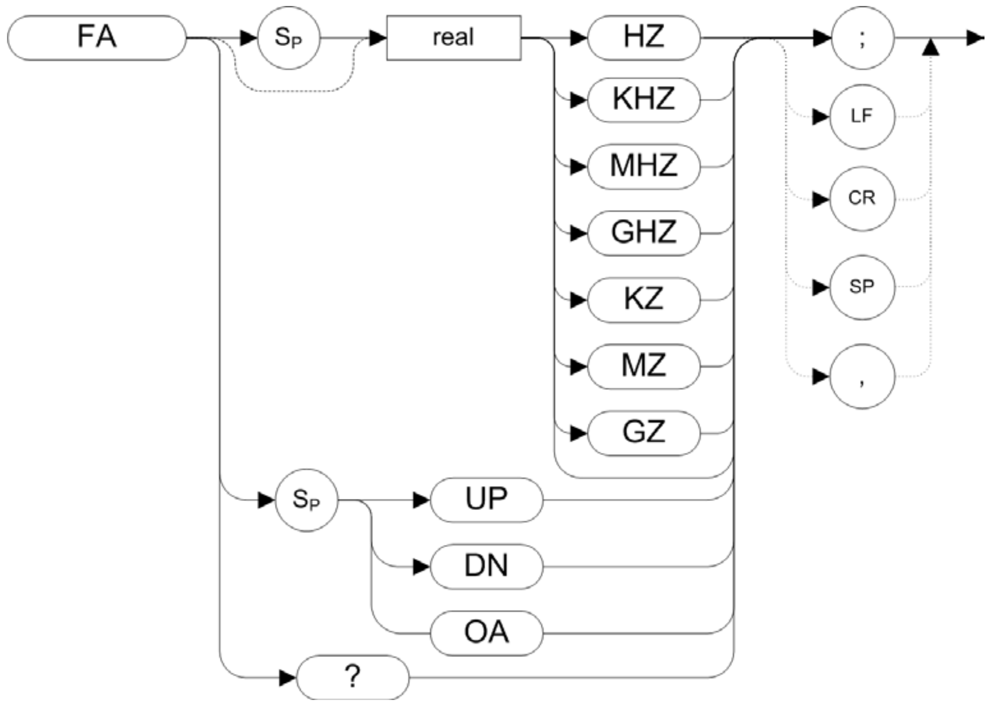
Description

This command exchanges Trace A and Trace B, point by point.

Format	EX
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of `EX` are identical to "AXB (Exchange Trace A and Trace B)" on page 715 and to the `XCH TRA,TRB` form of "XCH (Exchange)" on page 939.

10.4.86 FA (Start Frequency)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

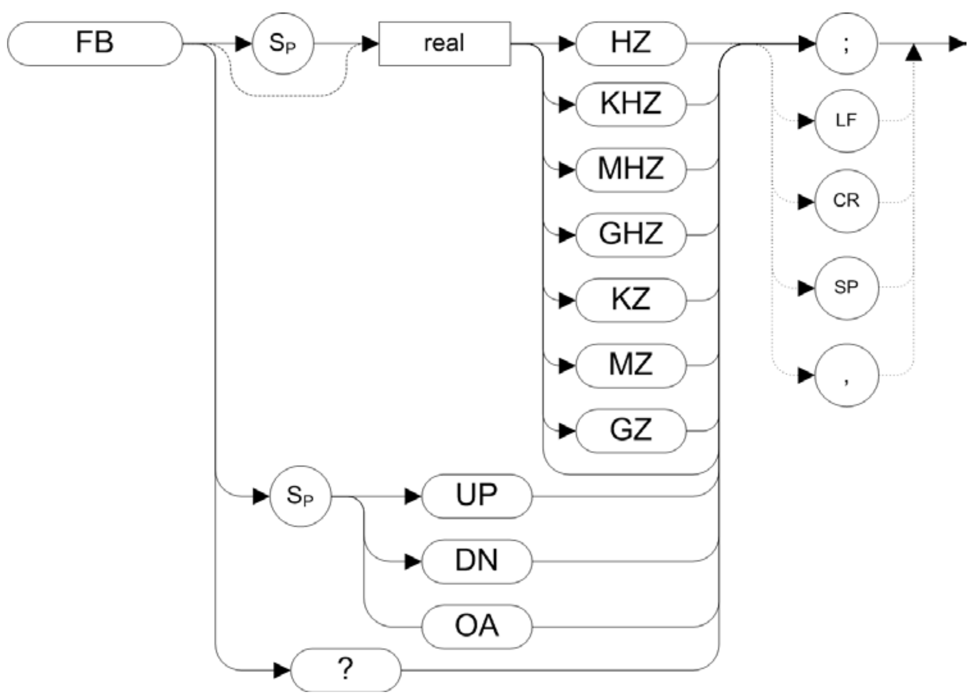
Specifies the start frequency value. The start frequency is equal to the center frequency minus the span divided by two (FA = CF − SP/2). Changing the start frequency changes the center frequency and span.

Format	FA <real>HZ|KHZ|MHZ|GHZ|KZ|MZ|GZ <real>: Default unit is Hz. Range: frequency range of the instrument FA UP|DN Step Increment: Frequency span divided by 10 FA OA Specifying OA returns only the current value to the controller. It does not set the active function to the start frequency

	FA?
Query Data Type	<real> in HZ
SCPI Equivalent Commands	`[:SENSE]:FREQuency:STARt <number> (HZ|KHZ|MHZ|GHZ)`
	`[:SENSE]:FREQuency:STARt?`
	`[:SENSE]:FREQuency:CENTer:STEP:AUTO?`
	`[:SENSE]:FREQuency:CENTer:STEP?`

10.4.87 FB (Stop Frequency)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

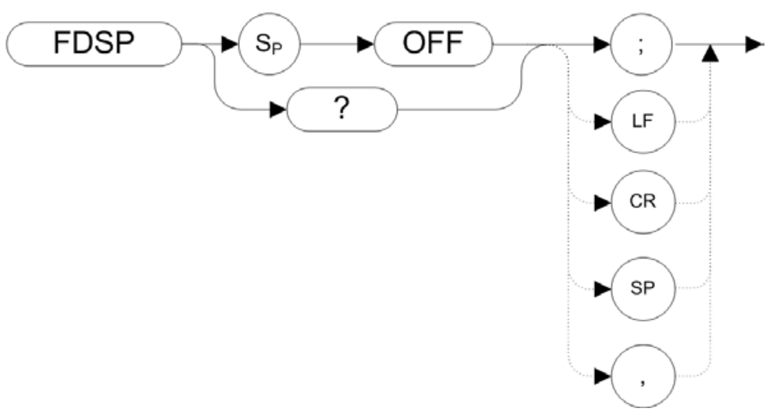
Specifies the stop frequency value. The stop frequency is equal to the center frequency plus the span divided by two (FB = CF + SP/2). Changing the stop frequency changes the center frequency and span.

Format	FB <real>HZ|KHZ|MHZ|GHZ|KZ|MZ|GZ

	<real>: Default unit is Hz. Range: frequency range of the instrument
	FB UP|DN
	Step Increment: Frequency span divided by 10
	FB OA
	Specifying OA returns only the current value to the controller. It does not set the active function to the start frequency
	FB?
Query Data Type	<real> in HZ
SCPI Equivalent Commands	`[:SENSE]:FREQuency:STOP <real> HZ|KHZ|MHZ|GHZ`
Preset	Instrument maximum frequency
Notes	The `OA` parameter only returns the current value to the controller. It does not set the active function to the stop frequency

10.4.88 FDSP (Frequency Display Off)

Syntax



Legacy Products

8560 series

Description

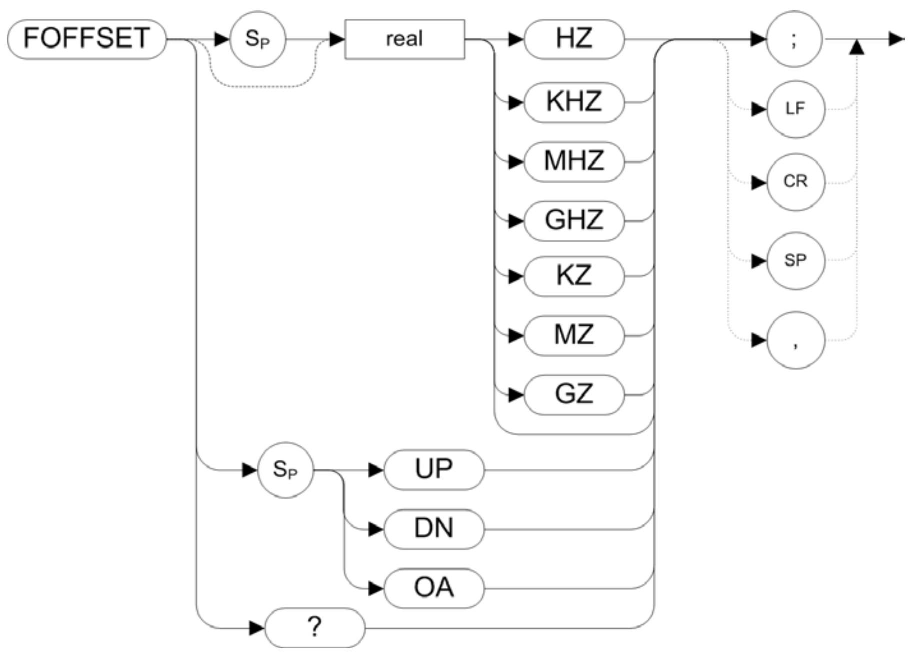
Turns the frequency annotation OFF.

Format	`FDSP OFF`
	`FDSP?`
Query Data Type	‘1’ or ‘0’, indicating ON or OFF
SCPI Equivalent Commands	See "ANNOT (Annotation)" on page 709

Preset	ON
Couplings	It is not possible enable or disable the frequency annotation alone, leaving other annotation unaffected. Thus, the FDSP command behaves in the same way as "ANNOT (Annotation)" on page 709. If the FDSP command has been used to disable the frequency annotation, sending the command ANNOT ON does **not** re-enable the display annotation. The display annotation is only enabled by sending the command "IP (Instrument Preset)" on page 781.

10.4.89 FOFFSET (Frequency Offset)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Selects a value that offsets the frequency scale for all absolute frequency readouts (for example, center frequency). Relative values such as span and marker delta are not offset.

When an offset is in effect, it is displayed beneath the bottom graticule line on the instrument screen.

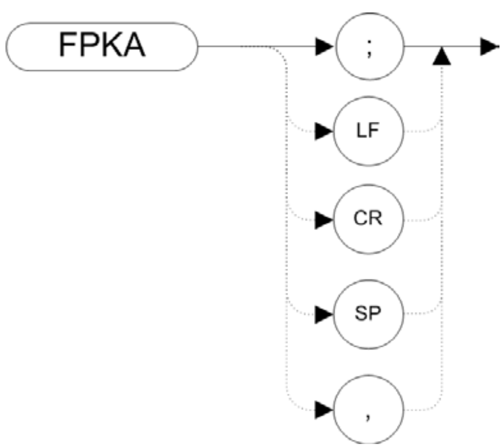
Execute `FOFFSET 0` or `IP` to turn off the offset.

Format	`FOFFSET <real> HZ|KHZ|MHZ|GHZ|KZ|MZ|GZ`
	<real>: Default unit is Hz
	`FOFFSET UP|DN`
	UP or DN changes by 10% of Span
	`FOFFSET OA`
	`FOFFSET?`

Query Data Type	<real>
SCPI Equivalent Commands	`[:SENSE]:FREQuency:OFFSet <number>` `[:SENSE]:FREQuency:OFFSet?`
Preset	0 Hz
Notes	The functions of `FOFFSET` are identical to "KSV (Frequency Offset)" on page 804

10.4.90 FPKA (Fast Preselector Peak)

Syntax



Legacy Products

8566A/B

Description

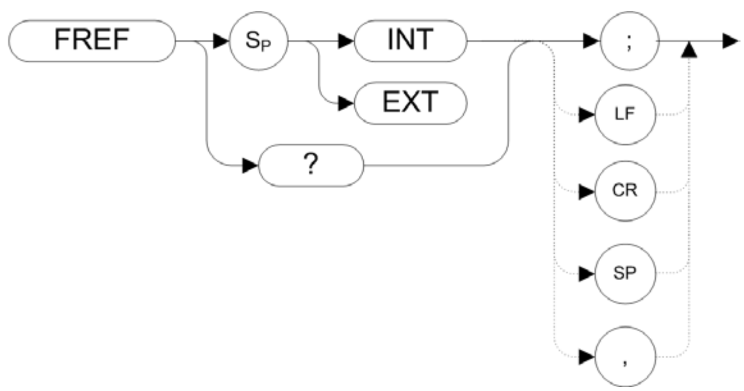
Automatically adjusts the preselector frequency to yield the greatest signal level at the active marker. The FPKA command peaks the preselector faster than the preselector-peak command, PP Although this command can be executed in all frequency spans, it performs best when the instrument is in zero span. Use the standard preselector peak for all other frequency spans.

The `FPKA` command also returns the amplitude value of active marker.

Format	FPKA
Query Data Type	Amplitude value of active marker
SCPI Equivalent Commands	`[:SENSe]:POWer[:RF]:PCENter`

10.4.91 FREF (Frequency Reference)

Syntax



Legacy Products

8560 series

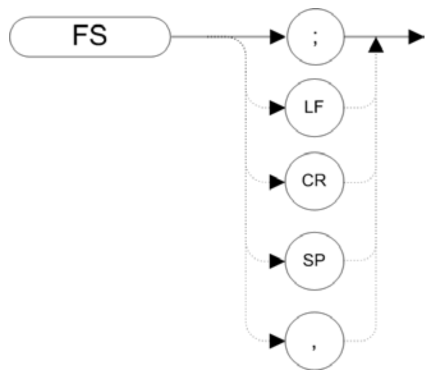
Description

Specifies whether an external source or an internal source is being used.

Format	FREF INT|EXT FREF?
Query Data Type	INT|EXT
SCPI Equivalent Commands	[:SENSe]:ROSCillator:SOURce:TYPE INTernal|EXTernal|SENSe [:SENSe]:ROSCillator:SOURce:TYPE? (See "Select Freq Ref Input" on page 518)

10.4.92 FS (Full Span)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

- 8560 series: Sets the frequency span of the instrument to full span. Resolution bandwidth, video bandwidth, and sweep time are all set to auto-coupled.
- 8566A/B, 8568A/B: Does an instrument preset, then sets the low band.

Whenever the frequency range of the instrument you are using does not match the remote language's own range, the span is limited by the capabilities of the replacement instrument. The tables below list the frequency ranges for all the supported remote languages when running on any supported X-series instrument.

Format	FS Range: see tables below
Query Data Type	N/A
SCPI Equivalent Commands	[:SENSe]:FREQuency:CENTer [:SENSe]:FREQuency:SPAN
Notes	The functions of FS are identical to "LF (Low Frequency Preset)" on page 808

PXA Series - Frequency Ranges Set by the FS Command

Remote Language	N9030A-503 Frequency Range	N9030A-508 Frequency Range	N9030A-513 Frequency Range	N9030A-526 Frequency Range
8560E/EC	0 Hz - 2.9 GHz	0 Hz - 2.9 GHz	0 Hz - 2.9 GHz	0 Hz - 2.9 GHz
8561E/EC	0 Hz - 3.6 GHz	0 Hz - 6.5 GHz	0 Hz - 6.5 GHz	0 Hz - 6.5 GHz
8562E/EC	0 Hz - 3.6 GHz	0 Hz - 8.4 GHz	0 Hz - 13.2 GHz	0 Hz - 13.2 GHz
8563E/EC	0 Hz - 3.6 GHz	0 Hz - 8.4 GHz	0 Hz - 13.6 GHz	0 Hz - 27.0 GHz
8564E/EC	0 Hz - 3.6 GHz	0 Hz - 8.4 GHz	0 Hz - 13.6 GHz	0 Hz - 27.0 GHz
8565E/EC	0 Hz - 3.6 GHz	0 Hz - 8.4 GHz	0 Hz - 13.6 GHz	0 Hz - 27.0 GHz
8566A	0 Hz - 2.5 GHz	0 Hz - 2.5 GHz	0 Hz - 2.5 GHz	0 Hz - 2.5 GHz
8566B	0 Hz - 2.5 GHz	0 Hz - 2.5 GHz	0 Hz - 2.5 GHz	0 Hz - 2.5 GHz
8568A	0 Hz - 1.5 GHz	0 Hz - 1.5 GHz	0 Hz - 1.5 GHz	0 Hz - 1.5 GHz
8568B	0 Hz - 1.5 GHz	0 Hz - 1.5 GHz	0 Hz - 1.5 GHz	0 Hz - 1.5 GHz

MXA Series - Frequency Ranges Set by the FS Command

Remote Language	N9020A-503 Frequency Range	N9020A-508 Frequency Range	N9020A-513 Frequency Range	N9020A-526 Frequency Range
8560E/EC	0 Hz - 2.9 GHz	0 Hz - 2.9 GHz	0 Hz - 2.9 GHz	0 Hz - 2.9 GHz
8561E/EC	0 Hz - 3.6 GHz	0 Hz - 6.5 GHz	0 Hz - 6.5 GHz	0 Hz - 6.5 GHz
8562E/EC	0 Hz - 3.6 GHz	0 Hz - 8.4 GHz	0 Hz - 13.2 GHz	0 Hz - 13.2 GHz
8563E/EC	0 Hz - 3.6 GHz	0 Hz - 8.4 GHz	0 Hz - 13.6 GHz	0 Hz - 27.0 GHz
8564E/EC	0 Hz - 3.6 GHz	0 Hz - 8.4 GHz	0 Hz - 13.6 GHz	0 Hz - 27.0 GHz
8565E/EC	0 Hz - 3.6 GHz	0 Hz - 8.4 GHz	0 Hz - 13.6 GHz	0 Hz - 27.0 GHz
8566A	0 Hz - 2.5 GHz	0 Hz - 2.5 GHz	0 Hz - 2.5 GHz	0 Hz - 2.5 GHz
8566B	0 Hz - 2.5 GHz	0 Hz - 2.5 GHz	0 Hz - 2.5 GHz	0 Hz - 2.5 GHz
8568A	0 Hz - 1.5 GHz	0 Hz - 1.5 GHz	0 Hz - 1.5 GHz	0 Hz - 1.5 GHz
8568B	0 Hz - 1.5 GHz	0 Hz - 1.5 GHz	0 Hz - 1.5 GHz	0 Hz - 1.5 GHz

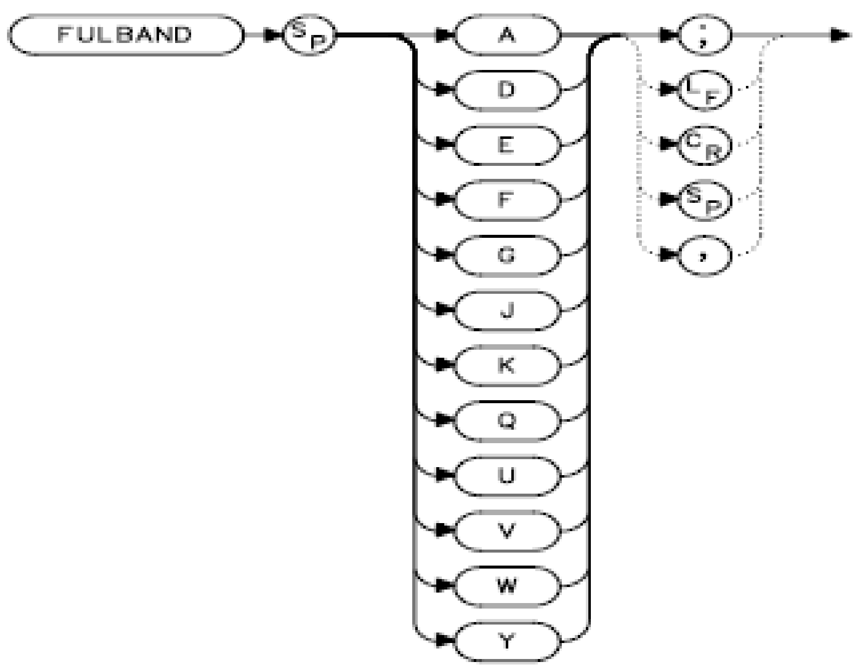
EXA Series - Frequency Ranges Set by the FS Command

Remote Language	N9010A-503 Frequency Range	N9010A-507 Frequency Range	N9010A-513 Frequency Range	N9010A-526 Frequency Range
8560E/EC	0 Hz - 2.9 GHz	0 Hz - 2.9 GHz	0 Hz - 2.9 GHz	0 Hz - 2.9 GHz
8561E/EC	0 Hz - 3.6 GHz	0 Hz - 6.5 GHz	0 Hz - 6.5 GHz	0 Hz - 6.5 GHz
8562E/EC	0 Hz - 3.6 GHz	0 Hz - 7.0 GHz	0 Hz - 13.2 GHz	0 Hz - 13.2 GHz
8563E/EC	0 Hz - 3.6 GHz	0 Hz - 7.0 GHz	0 Hz - 13.6 GHz	0 Hz - 27.0 GHz
8564E/EC	0 Hz - 3.6 GHz	0 Hz - 7.0 GHz	0 Hz - 13.6 GHz	0 Hz - 27.0 GHz
8565E/EC	0 Hz - 3.6 GHz	0 Hz - 7.0 GHz	0 Hz - 13.6 GHz	0 Hz - 27.0 GHz

Remote Language	N9010A-503 Frequency Range	N9010A-507 Frequency Range	N9010A-513 Frequency Range	N9010A-526 Frequency Range
8566A	0 Hz - 1.5 GHz	0 Hz - 2.5 GHz	0 Hz - 2.5 GHz	0 Hz - 2.5 GHz
8566B	0 Hz - 1.5 GHz	0 Hz - 2.5 GHz	0 Hz - 2.5 GHz	0 Hz - 2.5 GHz
8568A	0 Hz - 1.5 GHz	0 Hz - 1.5 GHz	0 Hz - 1.5 GHz	0 Hz - 1.5 GHz
8568B	0 Hz - 1.5 GHz	0 Hz - 1.5 GHz	0 Hz - 1.5 GHz	0 Hz - 1.5 GHz

10.4.93 FULBAND

Syntax



Legacy Products

8560 series

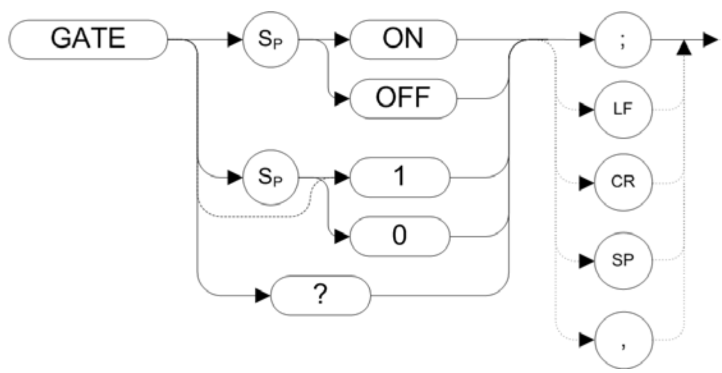
Description

Selects a commonly-used, external-mixer frequency band. The harmonic lock function ("HNLOCK (Harmonic Lock)" on page 776) is also set; this locks the harmonic of the chosen band.

Format	FULBAND A|D|E|F|G|J|K|Q|U|V|W|Y
Query Data Type	N/A
SCPI Equivalent Commands	:MIXer:BAND A|ND|NE|NF|NG|NJ|NK|Q|U|V|W|NY

10.4.94 GATE (Gate)

Syntax



Preset State: GATE OFF

Legacy Products

8560 series

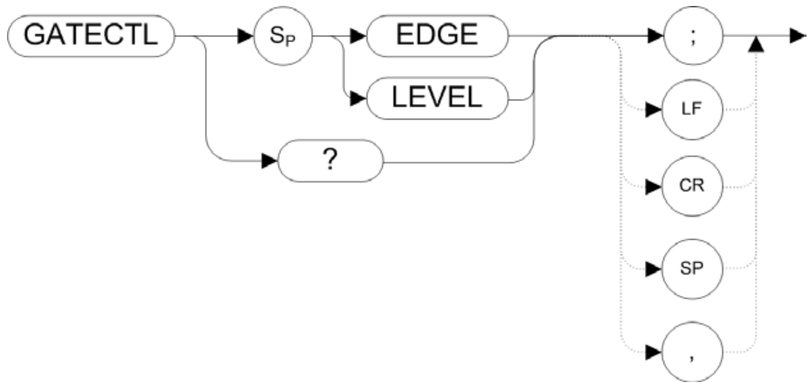
Description

Turns the time-gating function on or off. When the time-gating function is turned on, the instrument activates the time gate circuitry according to the parameters controlled by "GL (Gate Length)" on page 772, gate delay "GD (Gate Delay)" on page 771 and the gate trigger input.

Format	GATE ON|OFF|1|0 GATE?
Query Data Type	1|0
SCPI Equivalent Commands	`[:SENSe]:SWEep:EGATe[:STATe] OFF|ON|0|1`
Preset	OFF

10.4.95 GATECTL (Gate Control)

Syntax



Legacy Products

8560 series

Description

Selects between the edge and level mode for time gate function.

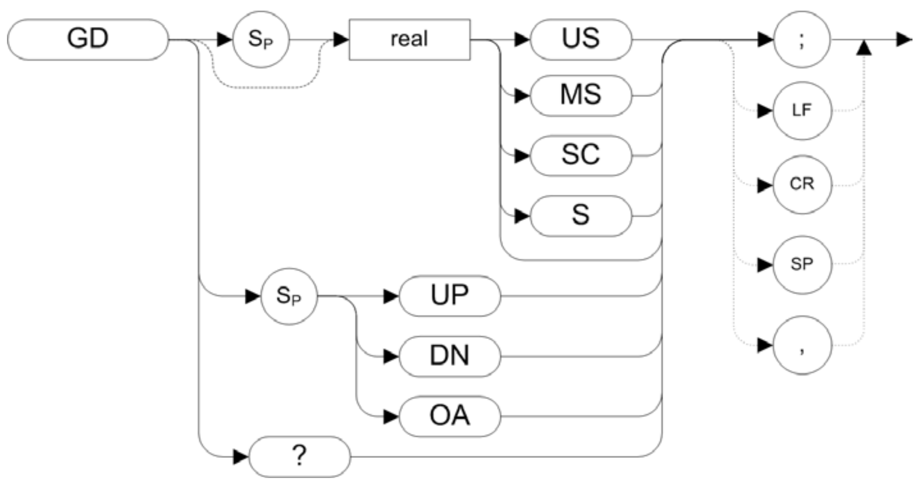
- In the edge mode, a specified trigger edge starts the gate delay timer that in turn starts the gate length timer.
- In the level mode, the gate follows the trigger input level.

The gate delay timer ("GD (Gate Delay)" on page 771) and the gate time length ("GL (Gate Length)" on page 772) are operational in the edge mode, but not in the level mode.

Format	GATECTL EDGE|LEVEL GATECTL?
Query Data Type	EDGE|LEVEL
SCPI Equivalent Commands	None
Preset	EDGE

10.4.96 GD (Gate Delay)

Syntax



Legacy Products

8560 series

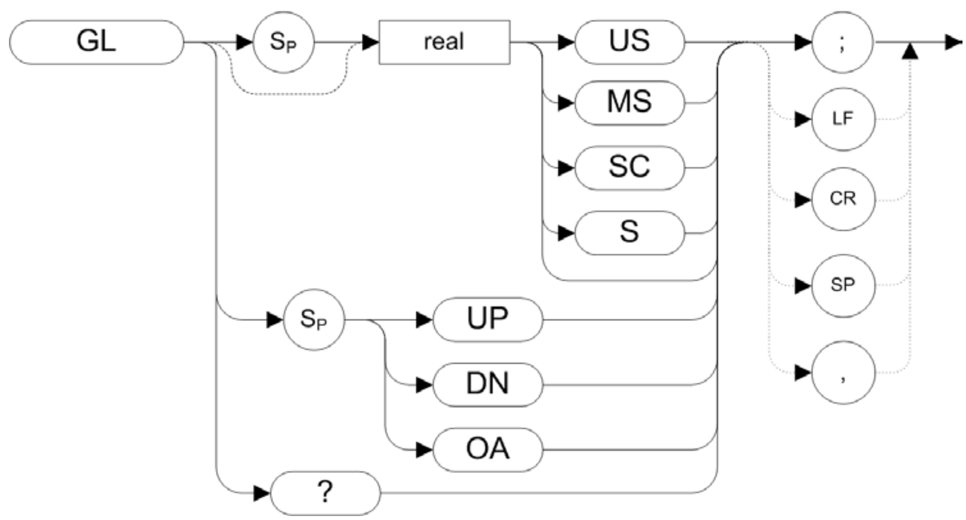
Description

Sets the delay time from when the gate trigger occurs to when the gate is turned on. GD only applies if "GATECTL (Gate Control)" on page 770 is set to EDGE.

Format	GD <real>US|MS|SC|S
	GD UP|DN
	GD OA
	GD?
Query Data Type	<real> S
SCPI Equivalent Commands	`[:SENSe]:SWEep:EGATe:DELay <time>`
Preset	3 µs

10.4.97 GL (Gate Length)

Syntax



Legacy Products

8560 series

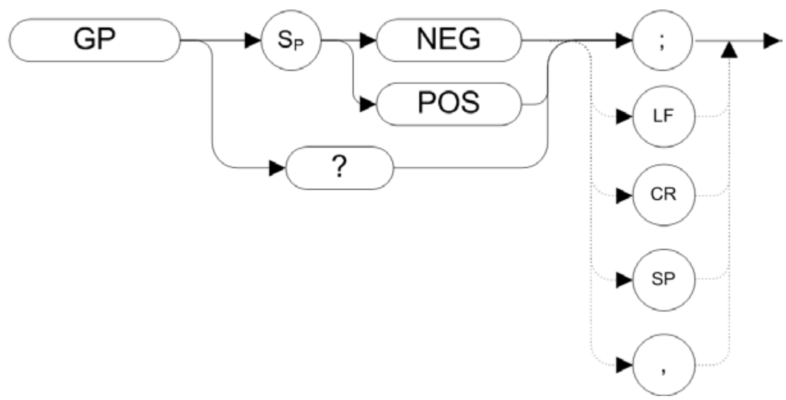
Description

Sets the length of time the time gate is turned on. `GL` only applies if "GATECTL (Gate Control)" on page 770 is set to EDGE.

Format	GL <real>US|MS|SC|S GL UP|DN GL OA GL?
Query Data Type	<real> S
SCPI Equivalent Commands	`[:SENSe]:SWEep:EGATe:LENGth <time>`
Preset	1 µs

10.4.98 GP (Gate Polarity)

Syntax



Legacy Products

8560 series

Description

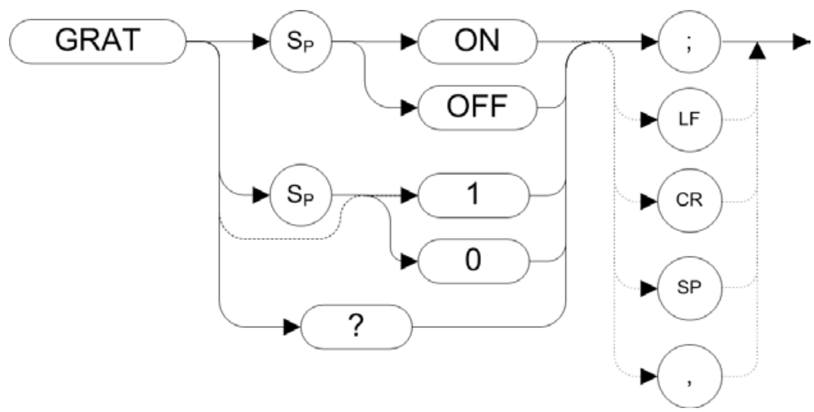
Sets the polarity (positive or negative) for the gate trigger.

- If the "GATECTL (Gate Control)" on page 770 is in EDGE mode, the gate delay timer can be triggered on either a positive or negative edge of the trigger input.
- If the Gate Control is in LEVEL mode and POSitive is selected, the gate is on when the trigger input is high. If the Gate Control is in LEVEL mode and NEGative is selected, the gate is on when the trigger is low.

Format	`GP NEG|POS` `GP?`
Query Data Type	`NEG|POS`
SCPI Equivalent Commands	`:SWEep:EGATe:POLarity NEG|POS`
Preset	`POS`

10.4.99 GRAT (Graticule)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

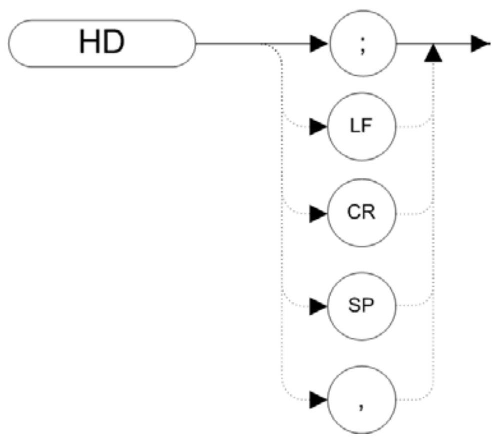
Description

Turns the graticule on or off.

Format	`GRAT ON|OFF|1|0` `GRAT?`
Query Data Type	`ON|OFF|1|0`
SCPI Equivalent Commands	`:DISPlay:GRATicule[:STATE] OFF|ON|0|1`
Preset	`ON`
Notes	The functions of `GRAT` are identical to "KSm (Graticule Off)" on page 799 and "KSn (Graticule On)" on page 800

10.4.100 HD (Hold Data Entry)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

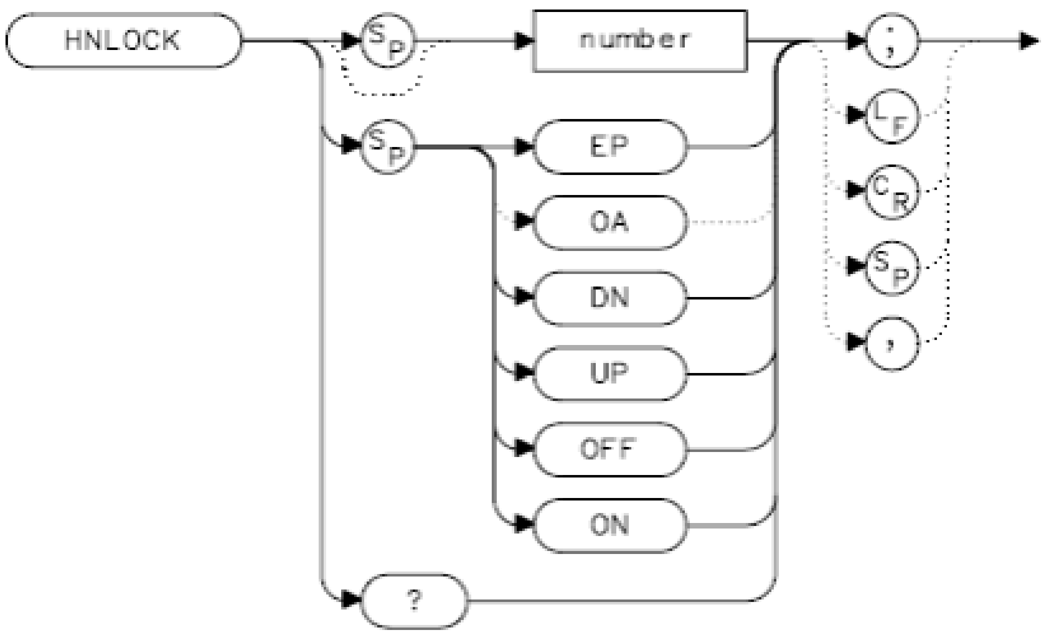
Description

Disables data entry via the instrument numeric keypad, knob, or step keys. The active function readout is blanked, and any active function is deactivated.

Format	HD
Query Data Type	N/A
SCPI Equivalent Commands	None

10.4.101 HNLOCK (Harmonic Lock)

Syntax



Legacy Products

8560 series

Description

Locks a chosen harmonic so only that harmonic is used to sweep an external frequency band.

To select a frequency band, use the "FULBAND" on page 768 command, which selects an appropriate harmonic for the desired band. To change the harmonic number, use HNLOCK.

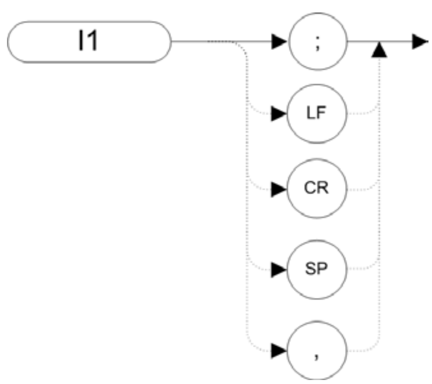
HNLOCK also works in internal-mixing modes.

Once "FULBAND" on page 768 or HNLOCK are set, only center frequencies and spans that fall within the frequency band of the current harmonic can be entered. When the "FS (Full Span)" on page 766 command is activated, the span is limited to the frequency band of the selected harmonic.

Format	HNLOCK <num> Range: 1 to 54 HNLOCK DN|UP|OFF|ON Step: 1 HNLOCK OA HNLOCK?
Query Data Type	<num>
SCPI Equivalent Commands	None
Preset	OFF
Couplings	Effective only when "MXRMODE (Mixer Mode)" on page 862 is EXT.

10.4.102 I1 (Set RF Coupling to DC)

Syntax



Legacy Products

8568A/B

Description

Sets the RF coupling to DC.

The tables below list the frequency specifications for all X-Series instruments, for both DC and AC coupling.

8568A/B Analyzer Frequency Coupling Specifications

	DC Coupled Range	AC Coupled Range		
Analyzer Model	Min. Freq.	Max. Freq.	Min. Freq.	Max. Freq.
8568A/B	100 Hz	1.5 GHz	100 kHz	1.5 GHz

EXA Series Instrument Frequency Coupling Specifications

	DC Coupled Range	AC Coupled Range		
Instrument Model (N9010A)	**Min. Freq.**	**Max. Freq.**	**Min. Freq.**	**Max. Freq.**
Option 503	9 kHz	3.6 GHz	10 MHz	3.6 GHz
Option 507	9 kHz	7.0 GHz	10 MHz	7.0 GHz
Option 513	9 kHz	13.6 GHz	10 MHz	13.6 GHz
Option 526	9 kHz	26.5 GHz	10 MHz	26.5 GHz

MXA Series Instrument Frequency Coupling Specifications

	DC Coupled Range	AC Coupled Range		
Instrument Model (N9020A)	**Min. Freq.**	**Max. Freq.**	**Min. Freq.**	**Max. Freq.**
Option 503	20 Hz	3.6 GHz	10 MHz	3.6 GHz
Option 508	20 Hz	8.4 GHz	10 MHz	8.4 GHz
Option 513	20 Hz	13.6 GHz	10 MHz	13.6 GHz
Option 526	20 Hz	26.5 GHz	10 MHz	26.5 GHz

PXA Series Instrument Frequency Coupling Specifications

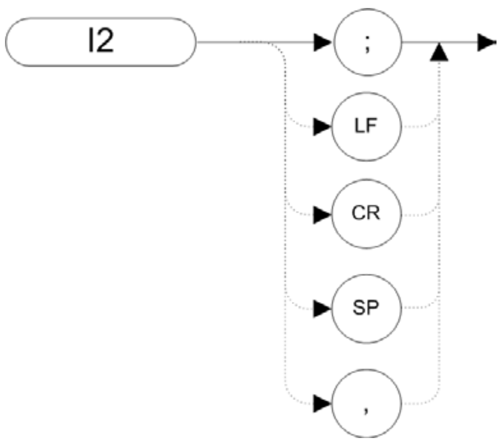
	DC Coupled Range	AC Coupled Range		
Instrument Model (N9030A)	**Min. Freq.**	**Max. Freq.**	**Min. Freq.**	**Max. Freq.**
Option 503	3 Hz	3.6 GHz	10 MHz	3.6 GHz
Option 508	3 Hz	8.4 GHz	10 MHz	8.4 GHz
Option 513	3 Hz	13.6 GHz	10 MHz	13.6 GHz
Option 526	3 Hz	26.5 GHz	10 MHz	26.5 GHz

The X-Series instruments only have a single RF input port.

Format	`I1`
Query Data Type	N/A
SCPI Equivalent Commands	`:INPut:COUPling DC`
	see "RF Coupling" on page 488

10.4.103 I2 (Set RF Coupling to AC)

Syntax



Legacy Products

8568A/B

Description

Sets the RF coupling to AC.

The tables below list the frequency specifications for all X-Series instruments for both DC and AC coupling.

8568A/B Analyzer Frequency Coupling Specifications

	DC Coupled Range	AC Coupled Range		
Analyzer Model	**Min. Freq.**	**Max. Freq.**	**Min. Freq.**	**Max. Freq.**
8568A/B	100 Hz	1.5 GHz	100 kHz	1.5 GHz

EXA Series Instrument Frequency Coupling Specifications

	DC Coupled Range	AC Coupled Range		
Instrument Model (N9010A)	**Min. Freq.**	**Max. Freq.**	**Min. Freq.**	**Max. Freq.**
Option 503	9 kHz	3.6 GHz	10 MHz	3.6 GHz
Option 507	9 kHz	7.0 GHz	10 MHz	7.0 GHz
Option 513	9 kHz	13.6 GHz	10 MHz	13.6 GHz
Option 526	9 kHz	26.5 GHz	10 MHz	26.5 GHz

MXA Series Instrument Frequency Coupling Specifications

	DC Coupled Range	AC Coupled Range		
Instrument Model (N9020A)	**Min. Freq.**	**Max. Freq.**	**Min. Freq.**	**Max. Freq.**
Option 503	20 Hz	3.6 GHz	10 MHz	3.6 GHz
Option 508	20 Hz	8.4 GHz	10 MHz	8.4 GHz
Option 513	20 Hz	13.6 GHz	10 MHz	13.6 GHz
Option 526	20 Hz	26.5 GHz	10 MHz	26.5 GHz

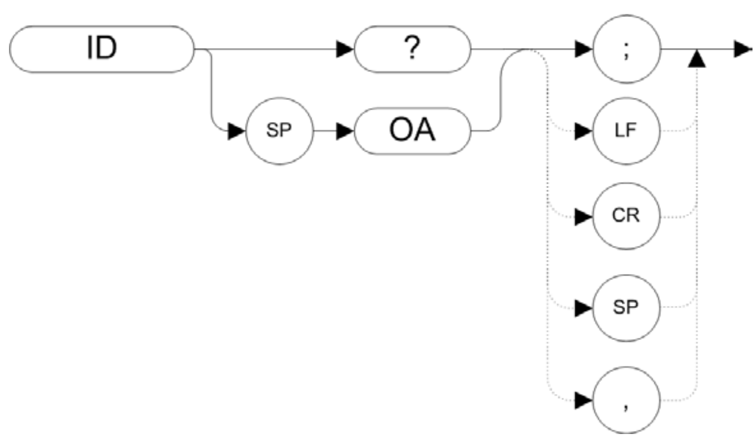
PXA Series Instrument Frequency Coupling Specifications

	DC Coupled Range	AC Coupled Range		
Instrument Model (N9030A)	**Min. Freq.**	**Max. Freq.**	**Min. Freq.**	**Max. Freq.**
Option 503	3 Hz	3.6 GHz	10 MHz	3.6 GHz
Option 508	3 Hz	8.4 GHz	10 MHz	8.4 GHz
Option 513	3 Hz	13.6 GHz	10 MHz	13.6 GHz
Option 526	3 Hz	26.5 GHz	10 MHz	26.5 GHz

Format	`I2`
Query Data Type	N/A
SCPI Equivalent Commands	`:INPut:COUPling AC` see "RF Coupling" on page 488
Notes	The X-Series instruments only have a single RF input port

10.4.104 ID (Identify)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

The `ID?` query returns the current remote language to the controller (for example, “HP8563E”).

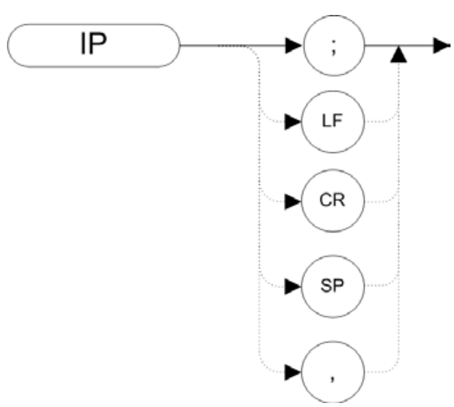
The response value is determined by your remote language selection. This is configured via the **Compatibility Model** selection in the **Meas Setup** menu when in RLC Mode. The remote language selection can also be set using the SCPI command `:SYSTem:LANGuage` (see "Compatibility Model" on page 237).

`ID?` also works when the instrument is not in RLC Mode. In this case the instrument model number is returned. The string that is returned is identical to the second field of text that is returned from the `*IDN?` command.

Format	`ID OA` `ID?`
Query Data Type	See Description above.
SCPI Equivalent Commands	`*IDN?` is similar; see "*IDN? - Identification Query" on page 639

10.4.105 IP (Instrument Preset)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Performs an instrument preset, setting the instrument back to its factory settings. `IP` does not affect the contents of any data or trace registers or stored preselector data. `IP` does not clear the input or output data buffers on the 8560-series analyzers, but does clear them on the 8566A/B, 8568A/B.

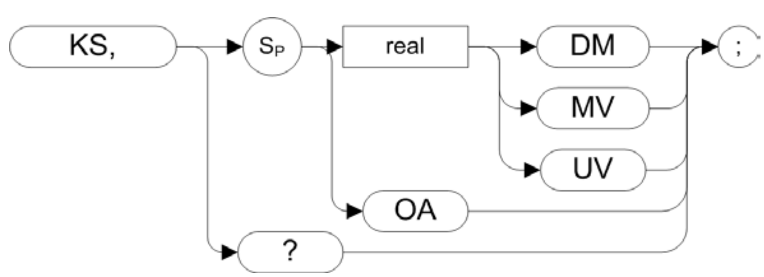
Instrument preset automatically occurs when you turn on the instrument. `IP` is a good starting point for many measurement processes. When `IP` is executed remotely, the instrument does not necessarily execute a complete sweep, however. You should execute a "TS (Take Sweep)" on page 929 to ensure that the trace data is valid after an `IP`.

RLC Mode executes this command after any language switch on the X-Series instrument.

Format	`IP`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of `IP` are identical to the command "KST (Fast Preset)" on page 803. If the external amplifier gain has been set, executing `IP` does not reset this value. This is to protect the instrument.

10.4.106 KS, (Mixer Level)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

Specifies the maximum signal level that is applied to the input mixer for a signal that is equal to or below the reference level.

The effective mixer level is equal to the reference level minus the input attenuator setting. When KS, is activated, the effective mixer level can be set from –10 dBm to –70 dBm in 10 dB steps.

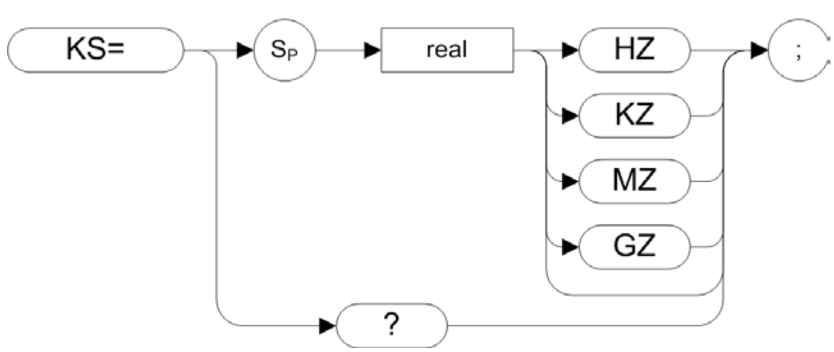
As the reference level is changed, the coupled input attenuator automatically changes to limit the maximum signal at the mixer input to your specified setting for signals less than or equal to the reference level.

Format	`KS, <real>DM|MV|UV`
	`KS, OA`
	`KS,?`

Query Data Type	`<real>`
SCPI Equivalent Commands	`[:SENSe]:POWer[:RF]:MIXer:RANGe[:UPPer] <real> dBm` `[:SENSe]:POWer[:RF]:MIXer:RANGe[:UPPer]?`
Preset	– 10 dBm
Notes	The functions of `KS,` are identical to "ML (Mixer Level)" on page 858 If the external amplifier gain has been set, executing `IP` does not reset this value. This is to protect the instrument

10.4.107 KS= (8566A/B: Automatic Preselector Tracking, 8568A/B: Marker Counter Resolution)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

- 8566A/B: Reinstates automatic preselector tracking, after KS/ has been executed. Normally, the center of the preselector filter automatically tracks signal responses in the four frequency bands of the 2 to 22 GHz range

  The KS/ command allows manual adjustment of the preselector tracking. X-Series instruments can consume this command with no action

- 8568A/B: Specifies the resolution of the marker frequency counter

Format	KS= <real>HZ|KZ|MZ|GZ KS=?
Query Data Type	<real>
SCPI Equivalent Commands	:CALCulate:MARKer[1]:FCOunt:RESolution <freq>
Notes	For 8568A/B, the functions of KS= are identical to "MKFCR (Marker Counter Resolution)" on page 840

10.4.108 KS((Lock Registers)

Syntax

Legacy Products

8566A/B, 8568A/B

Description

Secures the contents of state registers one through six. When the registers are secured, "SV (Save State)" on page 910 and "SAVES (Save State)" on page 895 cannot save more instrument states in the registers, but instead cause the display of "SAVE LOCK" on the instrument display.

To save an instrument state in a locked register, first execute "KS) (Unlock Registers)" on page 785 to unlock the registers.

The recall function of the instrument is not affected by this function.

Format	KS(

Query Data Type	N/A
SCPI Equivalent Commands	None
Preset	Unlocked
Couplings	This state is not affected by `IP`

10.4.109 KS) (Unlock Registers)

Syntax

Legacy Products

8566A/B, 8568A/B

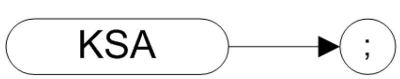
Description

Unlocks the state registers, where instrument states are stored with "SV (Save State)" on page 910 and "SAVES (Save State)" on page 895.

Format	`KS)`
Query Data Type	N/A
SCPI Equivalent Commands	None
Preset	Unlocked
Couplings	This state is not affected by IP

10.4.110 KSA (Amplitude in dBm)

Syntax



Legacy Products

8566A/B, 8568A/B

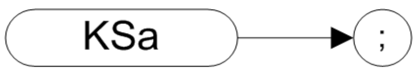
Description

Sets the amplitude readout (reference level, marker, display line and threshold) to dBm units.

Format	`KSA`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of the KSA command are identical to `AUNITS DBM`. See "AUNITS (Absolute Amplitude Units)" on page 712

10.4.111 KSa (Normal Detection)

Syntax



Legacy Products

8566A/B, 8568A/B

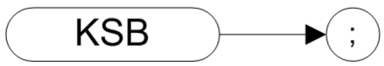
Description

Selects normal input detection. That is, it enables the *Rosenfell* detection algorithm that selectively chooses between positive and negative values.

Format	`KSa`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of `KSa` are identical to `DET NRM`. See "DET (Detection Mode)" on page 745

10.4.112 KSB (Amplitude in dBmV)

Syntax



Legacy Products

8566A/B, 8568A/B

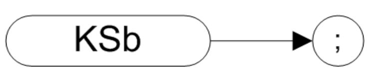
Description

Sets the amplitude readout (reference level, marker, display line and threshold) to dBmV units.

Format	KSB
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of KSB are identical to AUNITS DBMV. See "AUNITS (Absolute Amplitude Units)" on page 712.

10.4.113 KSb (Positive Peak Detection)

Syntax



Legacy Products

8566A/B, 8568A/B

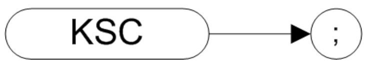
Description

Enables positive peak input detection for displaying trace information. Trace elements are only updated when the detected signal level is greater than the previous signal level.

Format	`KSb`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of `KSb` are identical to `DET POS`. See "DET (Detection Mode)" on page 745

10.4.114 KSC (Amplitude in dBµV)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

Sets the amplitude readout (reference level, marker, display line and threshold) to dBµV units.

Format	`KSC`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of `KSC` are identical to `AUNITS DBUV`. See "AUNITS (Absolute Amplitude Units)" on page 712

10.4.115 KSc (A Plus B to A)

Syntax

Legacy Products

8566A/B, 8568A/B

Description

Performs a point-by-point addition of Trace A and Trace B, and sends the results to Trace A. Thus, if your input signal remains unchanged, `KSc` can restore the original trace after an `AMB` or a `C2` command has been executed.

Format	`KSc`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of `KSc` are identical to "APB (Trace A Plus Trace B to A)" on page 710

10.4.116 KSD (Amplitude in Volts)

Syntax

Legacy Products

8566A/B, 8568A/B

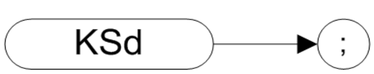
Description

Sets the amplitude readout (reference level, marker, display line and threshold) to voltage units.

Format	`KSD`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of `KSD` are identical to `AUNITS V`. See "AUNITS (Absolute Amplitude Units)" on page 712

10.4.117 KSd (Negative Peak Detection)

Syntax



Legacy Products

8566A/B, 8568A/B

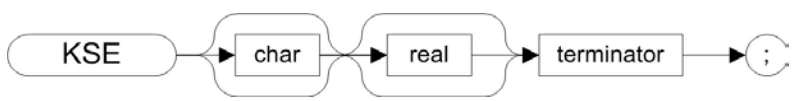
Description

Selects negative-peak input detection for displaying trace information. Each trace element is updated with the minimum value detected during the sweep.

Format	KSd
Query Data Type	N/A
SCPI Equivalent Commands	[:SENSe]:DETector[:FUNCtion] NEGative
Notes	The functions of KSd are identical to DET NEG. See "DET (Detection Mode)" on page 745

10.4.118 KSE (Title Mode)

Syntax



Legacy Products

8566A/B, 8568A/B

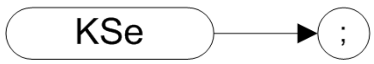
Description

Activates the title mode, writing a message to the top line of the display.

Format	KSE <char><real><terminator> The only characters that this application accepts as <terminator> are '@' and Carriage Return.
Query Data Type	N/A

10.4.119 KSe (Sample Detection)

Syntax



Legacy Products

8566A/B, 8568A/B

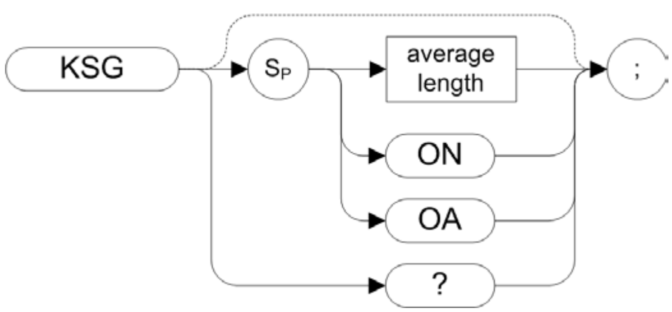
Description

Selects sample input detection for displaying trace information.

Format	`KSe`
Query Data Type	N/A
SCPI Equivalent Commands	`[:SENSe]:DETector[:FUNCtion] SAMPle`
Notes	The functions of `KSe` are identical to `DET SMP`. See "DET (Detection Mode)" on page 745

10.4.120 KSG (Video Averaging On)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

Enables video averaging. The averaged trace is displayed in Trace A.

Format	`KSG <average length>`
	`KSG ON`
	`KSG OA`
	`KSG?`
	If video averaging is off when either `KSG?` or `KSG OA` is sent to the instrument, video averaging is turned `ON` and the current average count is returned to the controller

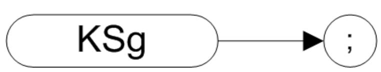
Query Data Type	Current average count

SCPI Equivalent Commands	`:TRACe:COPY TRACE#,TRACE3`
	`:TRACe3:TYPE WRITe`
	`[:SENSe]:DETector[:FUNCtion] SAMPle`
	`:TRACe#:TYPE AVERage`
	`[:SENSe]:AVERage:COUNT <integer>`

Preset	Preset state is `OFF` If `ON`, <average length> is preset to 100
Notes	The functions of `KSG` are identical to `VAVG ON`. See "VAVG (Video Average)" on page 931

10.4.121 KSg (Display Off)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

Turns the instrument's display Off.

Format	KSg
Query Data Type	N/A

SCPI Equivalent Commands	:DISPlay:ENABle OFF
Notes	On the legacy spectrum analyzers, this command turned the CRT beam power off to avoid unnecessary wear on the CRT. Although this command is supported, displays used on the X-Series instruments have a much longer life than the CRTs used in the legacy spectrum analyzers.

10.4.122 KSH (Video Averaging Off)

Syntax

Legacy Products

8566A/B, 8568A/B

Description

Switches video averaging Off.

Format	`KSH`
Query Data Type	N/A

SCPI Equivalent Commands	`:TRACe3:MODE BLANk`
	`:TRACe#:TYPE WRITe`
	See "View/Blank" on page 339

Notes	The functions of `KSH` are identical to `VAVG OFF`. See "VAVG (Video Average)" on page 931

10.4.123 KSh (Display On)

Syntax

Legacy Products

8566A/B, 8568A/B

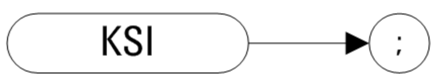
Description

Turns the instrument's display On.

Format	KSh
Query Data Type	N/A
SCPI Equivalent Commands	:DISPlay:ENABle ON
Notes	On the early models of spectrum analyzers, CRT beam power was often switched Off to prevent wear of the CRT. This command was used to turn the CRT beam power on again. Although this command is supported, displays used on the X-Series instruments have a much longer life than the CRTs used in the legacy spectrum analyzers.

10.4.124 KSI (Extend Reference Level)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

In legacy analyzers, KSI extends the reference level range to maximum limits of –139.9 dBm and +60 dBm.

RLC Mode accepts this command but takes no action, because the standard reference level lower limit of X-Series instruments covers the “extended” range of the legacy instruments.

Format	KSI
Query Data Type	N/A
SCPI Equivalent Commands	None
Preset	Off

10.4.125 KSi (Exchange Trace B and Trace C)

Syntax

Legacy Products

8566A/B, 8568A/B

Description

Exchanges Trace B data with Trace C data.

Trace C cannot be an active trace. This means that the data in Trace C cannot be updated as the instrument sweeps. To ensure that the current settings of the instrument are reflected in the data exchanged between Trace B and Trace C, you must follow the four step process below.

1. Select single sweep mode ("S2 (Single Sweep)" on page 894 or "SNGLS (Single Sweep)" on page 901)
2. Select the desired instrument settings
3. Take one complete sweep using the command "TS (Take Sweep)" on page 929
4. Exchange the data

Format	`KSi`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of `KSi` are identical to "BXC (Exchange Trace B and Trace C)" on page 724 and the `XCH TRB,TRC` form of "XCH (Exchange)" on page 939

10.4.126 KSj (View Trace C)

Syntax

Legacy Products

8566A/B, 8568A/B

Description

Displays Trace C.

Format	KSj
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of KSj are identical to VIEW TRC. See "VIEW (View Trace)" on page 937

10.4.127 KSK (Marker to Next Peak)

Syntax

Legacy Products

8566A/B, 8568A/B

Description

If there is a marker on the screen, this command moves this marker to the next signal peak of lower amplitude.

Format	KSK
Query Data Type	N/A
SCPI Equivalent Commands	:CALCulate:MARKer[1]|2:MAXimum:NEXT :CALCulate:MARKer:PEAK:EXCursion <rel_ampl> :CALCulate:MARKer:PEAK:THReshold <ampl>
Notes	The functions of KSK are similar to the MKPK NH form of "MKPK (Marker Peak)" on page 846, except that KSK does not take into account the marker peak threshold value or the marker peak excursion value

For more details on marker peak threshold, see the command "MKPT (Marker Threshold)" on page 847 and "TH (Threshold)" on page 920

For more details on marker peak excursion, see the command "MKPX (Marker Peak Excursion)" on page 848

10.4.128 KSk (Blank Trace C)

Syntax

Legacy Products

8566A/B, 8568A/B

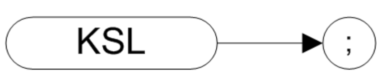
Description

Blanks Trace C.

Format	`KSk`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of `KSk` are identical to `BLANK TRC`. See "BLANK (Blank Trace)" on page 721

10.4.129 KSL (Marker Noise Off)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

Disables the noise density function which displays the RMS noise density at the marker. `KSL` does not blank the marker.

Format	`KSL`
Query Data Type	N/A
SCPI Equivalent Commands	`:CALCulate:MARKer[1]|2:FUNCtion OFF`
Notes	The functions of `KSL` are identical to `MKNOISE OFF`. See "MKNOISE (Marker Noise)" on page 844

10.4.130 KSl (Transfer Trace B to Trace C)

Syntax

Legacy Products

8566A/B, 8568A/B

Description

Transfers Trace B data to Trace C

Trace C cannot be an active trace. This means that the data in Trace C cannot be updated as the instrument sweeps. To ensure that the current settings of the instrument are reflected in the data transferred from Trace B to Trace C, you must follow the four step process below.

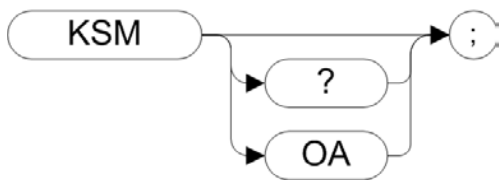
1. Select single sweep mode ("S2 (Single Sweep)" on page 894 or "SNGLS (Single Sweep)" on page 901)
2. Select the desired instrument settings
3. Take one complete sweep using the command "TS (Take Sweep)" on page 929
4. Transfer the data

Format	`KSl`
Query Data Type	N/A

SCPI Equivalent Commands	None
Notes	The functions of `KS1` are identical to "BTC (Transfer Trace B to Trace C)" on page 723

10.4.131 KSM (Marker Noise On)

Syntax



Legacy Products

8566A/B, 8568A/B

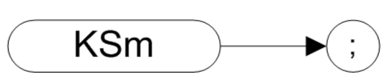
Description

Displays the noise density at the marker. The noise density is normalized to a 1 Hz bandwidth.

Format	`KSM OA` `KSM?`
Query Data Type	Noise density at the marker
SCPI Equivalent Commands	`:CALCulate:MARKer[1]|2:FUNCtion NOISe`
Notes	The functions of `KSM` are identical to `MKNOISE ON`. See "MKNOISE (Marker Noise)" on page 844

10.4.132 KSm (Graticule Off)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

Blanks the graticule on the instrument display.

Format	KSm
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of KSm are identical to GRAT OFF. See "GRAT (Graticule)" on page 774

10.4.133 KSN (Marker Minimum)

Syntax

Legacy Products

8566A/B, 8568A/B

Description

Moves the marker to the minimum value detected.

Format	KSN
Query Data Type	N/A
SCPI Equivalent Commands	:CALCulate:MARKer[1]|2:MINimum
Notes	The functions of KSN are identical to "MKMIN (Marker Minimum)" on page 842

10.4.134 KSn (Graticule On)

Syntax

Legacy Products

8566A/B, 8568A/B

Description

Turns on the graticule on the instrument display.

Format	`KSn`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of `KSn` are identical to `GRAT ON`. See "GRAT (Graticule)" on page 774

10.4.135 KSO (Marker Span)

Syntax

Legacy Products

8566A/B, 8568A/B

Description

This command operates only when the delta marker is On (see "MKD (Marker Delta)" on page 837 or "M3 (Delta Marker)" on page 821).

When the delta marker is on and `KSO` is executed, the left marker specifies the start frequency, and the right marker specifies the stop frequency.

If the delta marker is off, the command does nothing.

Format	`KSO`
Query Data Type	N/A
SCPI Equivalent Commands	`:CALCulate:MARKer2[:SET]:DELTA:SPAN`
Notes	The functions of `KSO` are identical to "MKSP (Marker Span)" on page 852 If the active marker is not a delta marker, there is no change in its position

10.4.136 KSo (Annotation Off)

Syntax

Legacy Products

8566A/B, 8568A/B

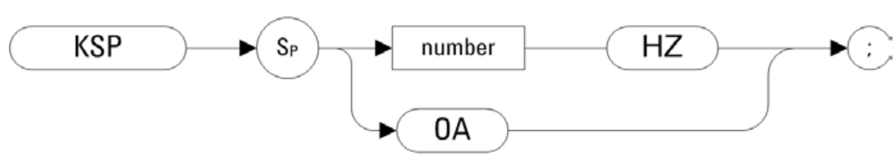
Description

Blanks the annotation on the instrument display.

Format	KSo
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of KSo are identical to ANNOT OFF. See "ANNOT (Annotation)" on page 709

10.4.137 KSP (GPIB Address)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

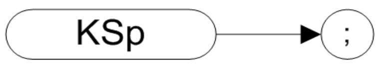
Allows you to display or change the current read/write HP-IB address of the instrument.

Note that the “HZ” in the command format string is required.

Format	KSP OA KSP <integer> HZ
Query Data Type	<integer>
SCPI Equivalent Commands	:SYSTem:COMMunicate:GPIB[:SELF]:ADDRess <integer> see "GPIB Address" on page 369
Preset	Factory preset address: 18

10.4.138 KSp (Annotation On)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

Activates the annotation on the instrument display.

Format	`KSp`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of `KSp` are identical to `ANNOT ON`. See "ANNOT (Annotation)" on page 709

10.4.139 KST (Fast Preset)

Syntax

Legacy Products

8566A/B, 8568A/B

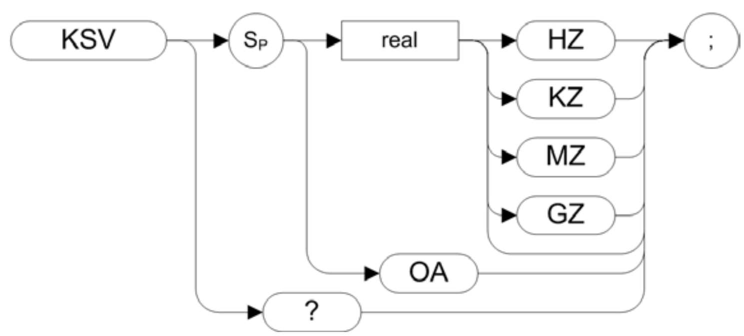
Description

Performs an instrument preset, setting the instrument back to its factory settings.

Format	KST
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	There is no fast preset for X-Series instruments. Instead, the Code Compatibility software performs an instrument preset (IP) when the KST command is issued. The functions of KST are therefore identical to "IP (Instrument Preset)" on page 781

10.4.140 KSV (Frequency Offset)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

Allows you to specify a value that offsets the frequency scale for all absolute frequency readouts, for example, center frequency. Relative values, for example, span and delta marker, are not offset.

Format	KSV
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of KSV are identical to "FOFFSET (Frequency Offset)" on page 763

10.4.141 KSx (External Trigger)

Syntax

Legacy Products

8566A/B, 8568A/B

Description

Activates the normal external trigger mode. When `KSx` is executed, the RF input signal is only displayed when the external trigger level exceeds the trigger threshold level.

Format	`KSx`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of `KSx` are identical to `TM EXT`. See "TM (Trigger Mode)" on page 924 If an 8566A/B or an 8568A/B analyzer is in zero span and the sweep time is less than 20 msec, the display is refreshed only when a fresh trace has been taken. This can cause the displayed trace to flicker In X-Series instruments, all traces are displayed continuously, so are therefore free of flicker

10.4.142 KSy (Video Trigger)

Syntax

Legacy Products

8566A/B, 8568A/B

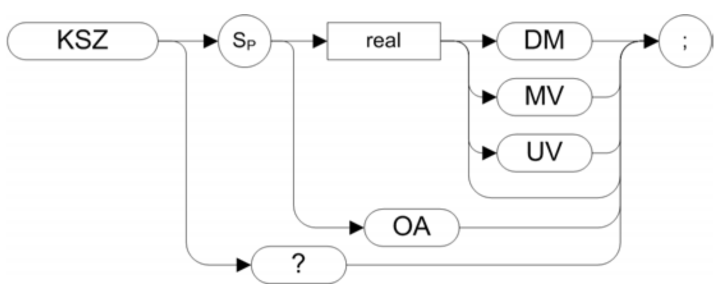
Description

Activates the normal video trigger mode. When `KSy` is executed, the RF input signal is only displayed when the video trigger signal, which is internally triggered off the input signal, exceeds the trigger threshold level.

Format	`KSy`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of `KSy` are identical to the `TM VID` form of "TM (Trigger Mode)" on page 924 and to "T4 (Video Trigger)" on page 916. If an 8566A/B or an 8568A/B analyzer is in zero span and the sweep time is less than 20 msec, the display is refreshed only when a fresh trace has been taken. This can cause the displayed trace to flicker. In X-Series instruments, all traces are displayed continuously, so are therefore free of flicker.

10.4.143 KSZ (Reference Level Offset)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

Offsets all amplitude readouts on the display but without affecting the trace.

Once activated, `KSZ` displays the amplitude offset on the left side of the screen.

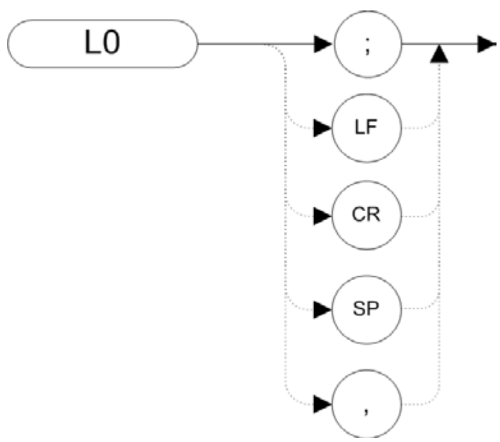
Sending `KSZ 0`, or presetting the instrument, eliminates an amplitude offset.

Format	`KSZ <real>DM|MV|UV`
	8566A/B only supports unit DM
	`KSZ OA`
	`KSZ?`

Query Data Type	`<real>`
SCPI Equivalent Commands	`:DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel:OFFSet <rel_ampl>` `:DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel:OFFSet?`
Preset	0
Notes	The functions of `KSZ` are identical to "ROFFSET (Reference Level Offset)" on page 890

10.4.144 L0 (Display Line Off)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Disables the display line.

Format	`L0`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of `L0` are identical to `DLE OFF`. See "DLE (Display Line Enable)" on page 747

10.4.145 LF (Low Frequency Preset)

Syntax

Legacy Products

8566A/B

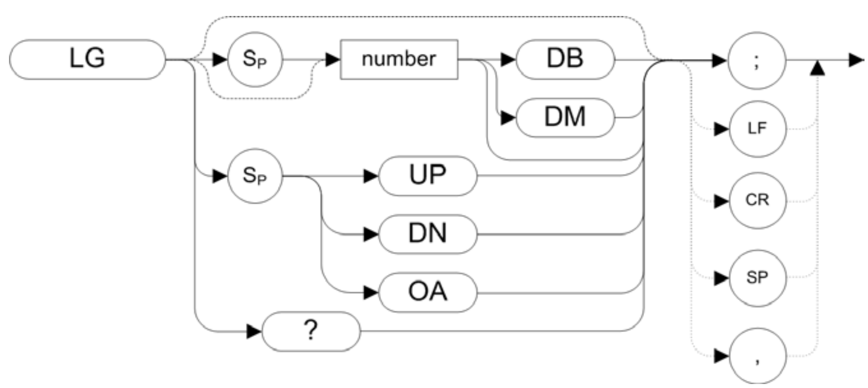
Description

Performs a low frequency preset. That is, it selects a Start Frequency of 0 Hz and a Stop Frequency of 2.5 GHz, a Reference Level of 0 dBm, and sets all coupled functions to automatic.

Format	LF
Query Data Type	N/A
SCPI Equivalent Commands	None

10.4.146 LG (Logarithmic Scale)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Specifies the amplitude (vertical graticule divisions) as logarithmic units, without changing the reference level.

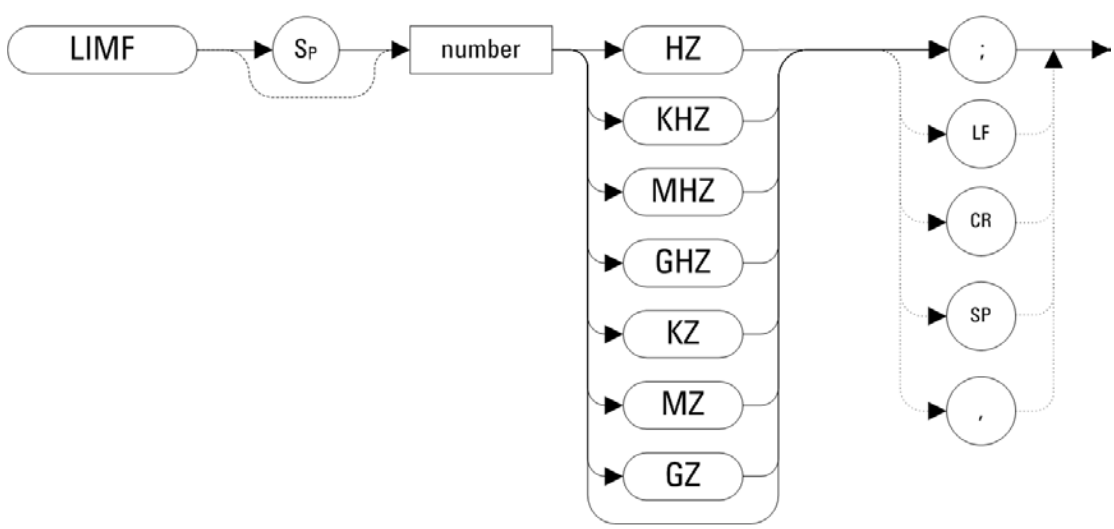
Format	LG <number>DB|DM Range: 1, 2, 5, and 10 LG UP|DN LG OA LG?
Query Data Type	<number> DB When in linear mode, `LG?` returns "0"

SCPI Equivalent Commands	`:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:SPACing LINear|LOGarithmic`
	`:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:SPACing?`
	`:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:PDIVision <ampl> dB`
	`:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:PDIVision?`

Preset	10 dB

10.4.147 LIMF (Limit Line Frequency Value)

Syntax



Legacy Products

8560 series

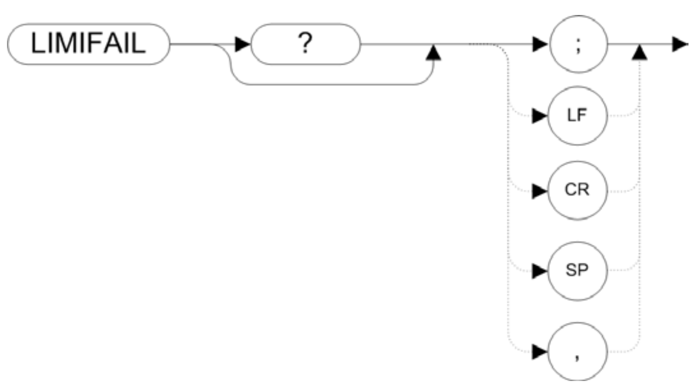
Description

This command is used to enter a frequency value for a limit-line segment.

Format	`LIMF <number>HZ|KHZ|MHZ|GHZ|KZ|MZ|GZ` The response to the query `LIMF?` is **not** supported
Query Data Type	N/A
SCPI Equivalent Commands	None
Preset	N/A
Couplings	"EDITLIML (Edit Limit Line)" on page 755, "EDITDONE (Edit Done)" on page 754

10.4.148 LIMIFAIL (Limits Failed)

Syntax



Legacy Products

8560 series

Description

Returns a number between 0 and 3, which specifies whether the active trace passed or failed the upper and lower limit line tests.

Format	LIMIFAIL?
Query Data Type	The meanings of the returned numbers (0-3) are shown in the "Query Data Type Codes" on page 811 table below.
SCPI Equivalent Commands	:CALCulate:LLINe[1]|2:FAIL?

10.4.149 Query Data Type Codes

Results of the LIMIFAIL Query

Result	Meaning
0	The active trace passed both the upper and the lower limit tests. This value is also returned if there are no limits, or if `LIMITST` is OFF.
1	The active trace failed the lower limit test.
2	The active trace failed the upper limit test.
3	The active trace failed both the upper and the lower limit tests.

10.4.150 LIMIPURGE (Delete Current Limit Line)

Syntax

Legacy Products

8560 series

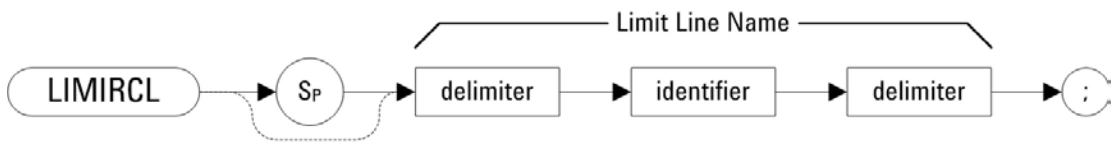
Description

Deletes the current limit line.

Format	LIMIPURGE
Query Data Type	N/A
SCPI Equivalent Commands	`:CALCulate:LLINe:ALL:DELete`

10.4.151 LIMIRCL (Recall Limit Line)

Syntax



Legacy Products

8560 series

Description

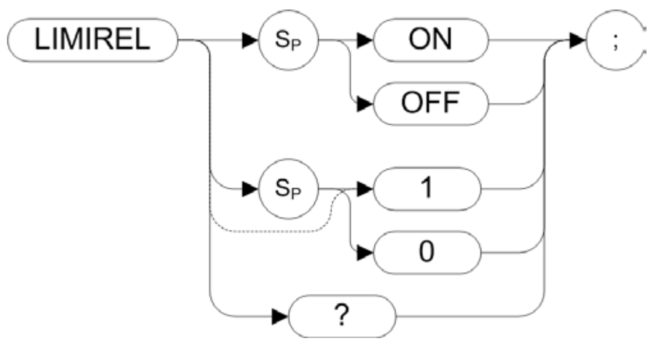
Recalls a limit-line set from the limit-line table in the module user memory. The table is stored in user memory with the command "LIMISAV (Save Limit Line)" on page 813. The command displays a limit line, which is recalled by the name assigned to it. A limit line may be saved and given a name using `LIMISAV`, or entered from the front panel with the screen-title function.

To display the line, send the command `LIMITST 1` (see "LIMITST (Activate Limit Line Test Function)" on page 816).

Format	LIMIRCL delimeter identifier delimiter
Query Data Type	N/A
SCPI Equivalent Commands	:MMEMory:LOAD:LIMit LLINE1|LLINE2, <“filename”> see "Limit" on page 582

10.4.152 LIMIREL (Relative Limit Lines)

Syntax



Legacy Products

8560 series

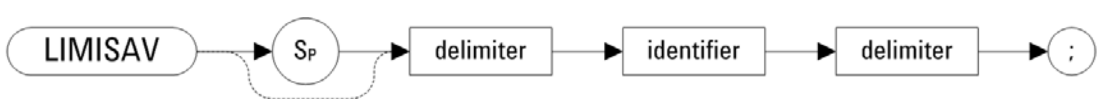
Description

Specifies whether the current limit lines are fixed or relative.

Format	LIMIREL ON|OFF|1|0 LIMIREL?
Query Data Type	1|0
SCPI Equivalent Commands	:CALCulate:LLINe:CMODe FIXed|RELative
Preset	OFF

10.4.153 LIMISAV (Save Limit Line)

Syntax



Legacy Products

8560 series

Description

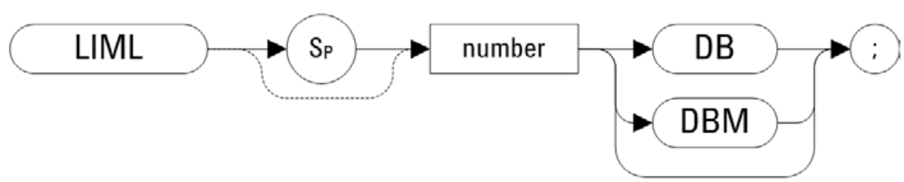
Saves the active limit line to module memory under the name assigned to it. Any previously existing limit line having the same name is overwritten with the new limit-line table data.

Refer also to the command "LIMIRCL (Recall Limit Line)" on page 812.

Format	LIMISAV delimeter identifier delimiter
Query Data Type	N/A
SCPI Equivalent Commands	:MMEMory:STORe:LIMit LLINE1|LLINE2, <“filename”> see "Limit" on page 560

10.4.154 LIML (Lower-Limit Amplitude)

Syntax



Legacy Products

8560 series

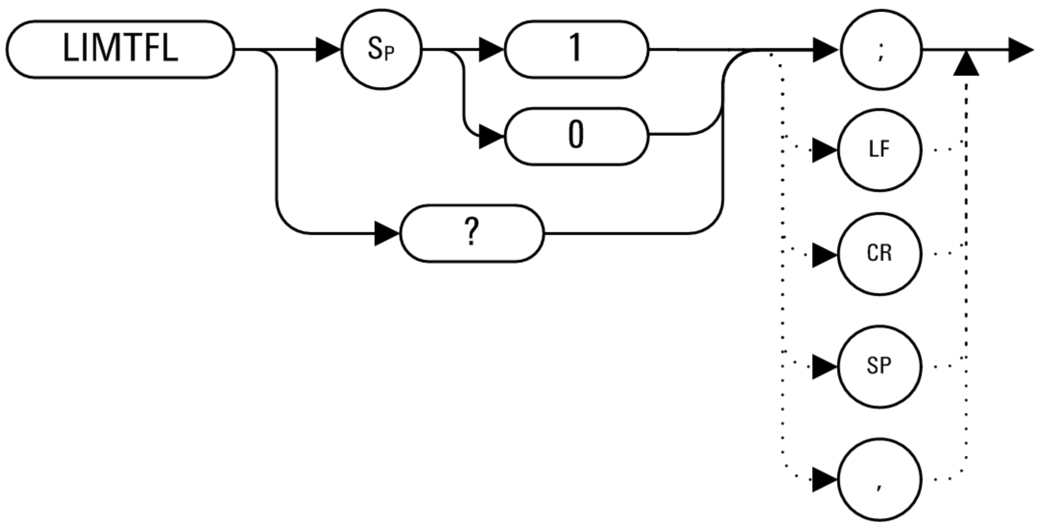
Description

Assigns the lower-limit amplitude value to a limit-line segment.

Format	LIML <number>DB|DBM
Query Data Type	N/A. The query is not supported by RLC Mode.
SCPI Equivalent Commands	None

10.4.155 LIMTFL (Flat Limit Line)

Syntax



Legacy Products

8560 series

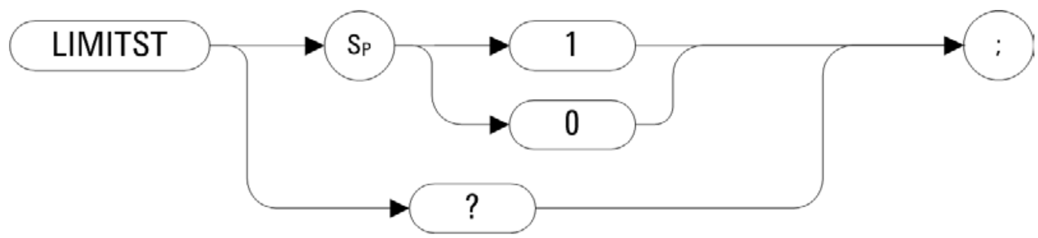
Description

Used with the command "SEDI (Edit Limit Line Segment)" on page 897 to make the selected limit-line segment flat.

Format	LIMTFL 0|1
	LIMTFL?
Query Data Type	0|1
SCPI Equivalent Commands	None

10.4.156 LIMITST (Activate Limit Line Test Function)

Syntax



Legacy Products

8560 series

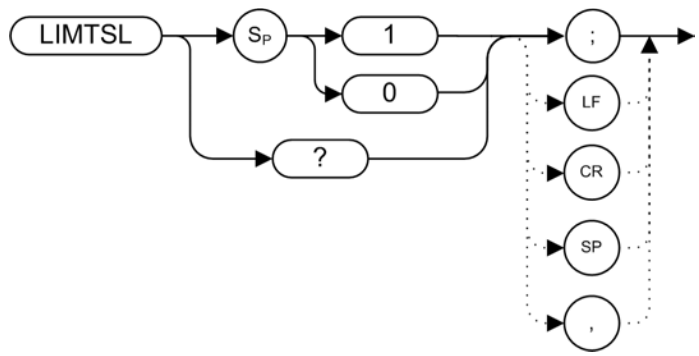
Description

Activates the limit-line test function, which compares the trace data in the current sweep with the limits set up in the limit table of the active limit line. The results of the current active trace compared with the active limit line can be read using the command "LIMIFAIL (Limits Failed)" on page 810. When this option is set to `1 (ON)`, the active limit-line test limits are displayed on-screen, along with a `LIMIT FAILED` message if the trace data fails.

Format	LIMITST 1|0 LIMITST?
Query Data Type	1|0
SCPI Equivalent Commands	`:CALCulate:LLINe[1]|2:DISPlay OFF|ON|0|1` `:CALCulate:LLINe:TEST OFF|ON|0|1`
Preset	0

10.4.157 LIMTSL (Slope Limit Line)

Syntax



Legacy Products

8560 series

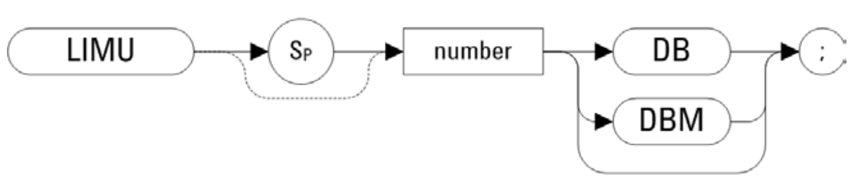
Description

Makes the selected limit-line segment sloped.

Format	LIMTSL 0|1 LIMTSL?
Query Data Type	0|1
SCPI Equivalent Commands	None
Preset	1 (Sloped)

10.4.158 LIMU (Upper-Limit Amplitude)

Syntax



Legacy Products

8560 series

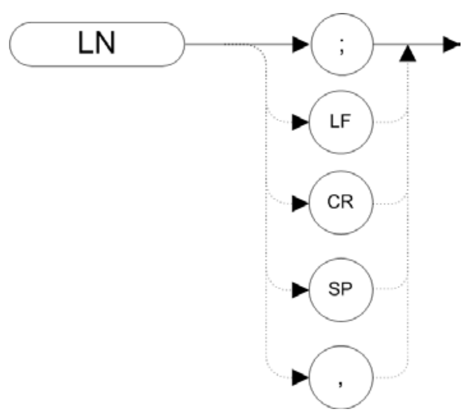
Description

Assigns the upper-limit amplitude value to a limit-line segment.

Format	LIMU <number>DB|DBM
Query Data Type	N/A (Query is not supported)
SCPI Equivalent Commands	None

10.4.159 LN (Linear Scale)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

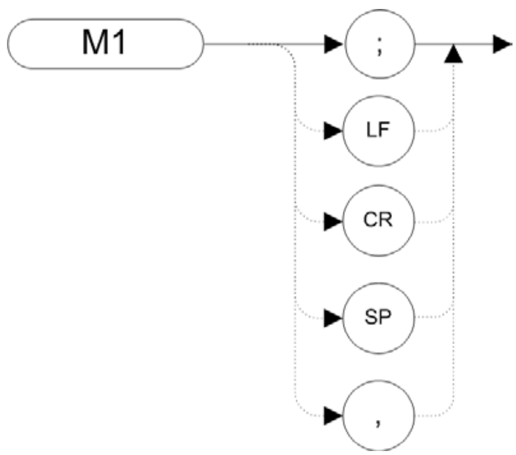
Scales the amplitude (vertical graticule divisions) proportional to the input voltage (that is, linearly), without changing the reference level. The bottom line of the graticule represents 0 V.

Format	LN

Query Data Type	N/A
SCPI Equivalent Commands	`:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:SPACing LINear`
Preset	Off

10.4.160 M1 (Marker Off)

Syntax



Legacy Products

8566A/B, 8568A/B

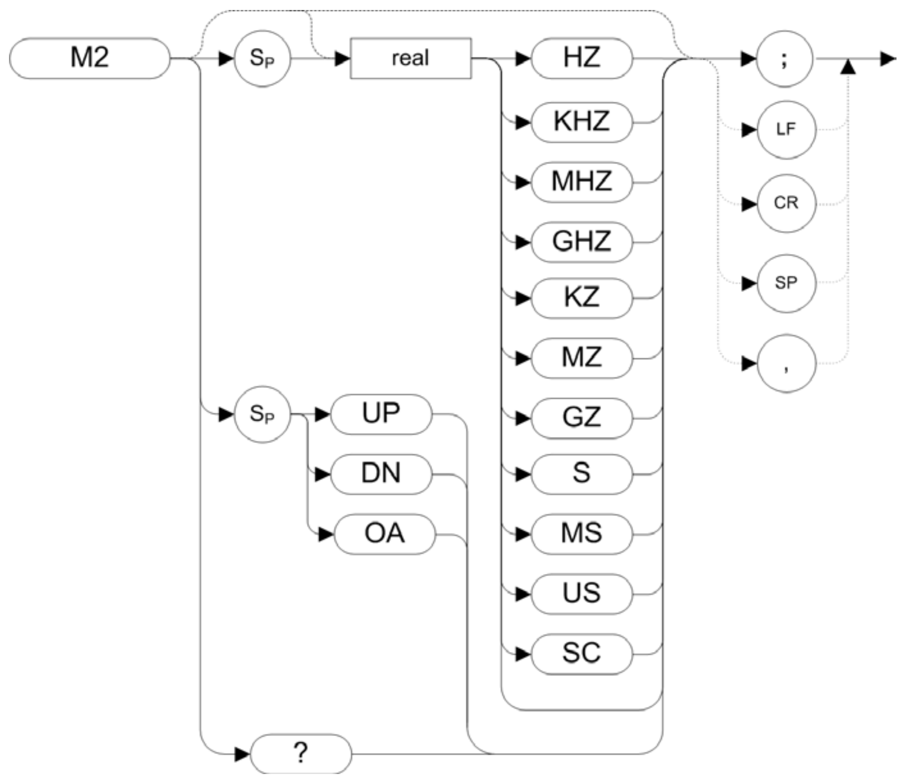
Description

Blanks any markers showing on the display.

Format	`M1`
Query Data Type	N/A
SCPI Equivalent Commands	`:CALCulate:MARKer#:MODE OFF` see "Marker Mode" on page 191
Notes	Unlike the `MKOFF ALL` form of "MKOFF (Marker Off)" on page 845, `M1` also blanks inactive markers

10.4.161 M2 (Marker Normal)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

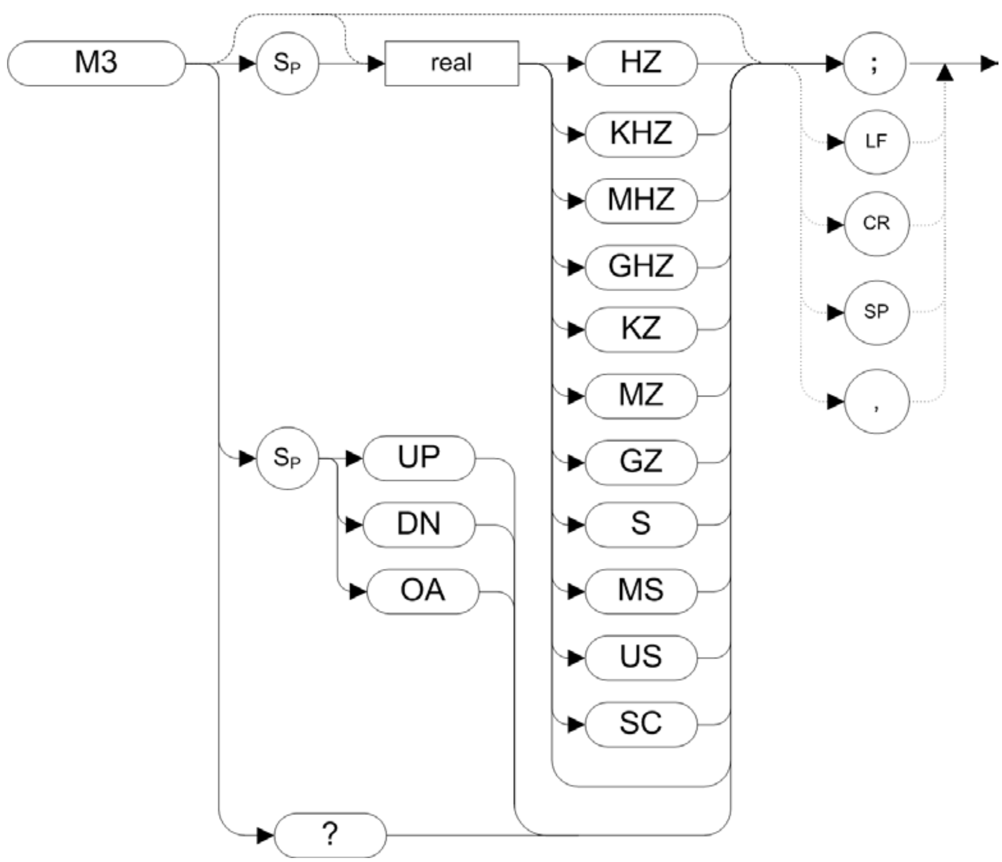
Moves the active marker to the marker frequency. If the active marker type is not currently Normal (for example, if it is Delta), the `M2` command changes it to a Normal marker.

Format	`M2 <real>HZ|KHZ|MHZ|GHZ|KZ|MZ|GZ|S|MS|US|SC`
	`M2 UP|DN`
	UP or DN increments 10% of span
	`M2 OA`
	`M2?`

Query Data Type	`<real>`
	See "MKF (Marker Frequency)" on page 838
SCPI Equivalent Commands	`:CALCulate:MARKer[1]|2:X <freq|time>`
	`:CALCulate:MARKer:MODE POSition`
	See "Marker Mode" on page 191
Notes	The functions of `M2` are identical to "MKN (Marker Normal)" on page 843.
	If the active marker has not been declared with "MKACT (Activate Marker)" on page 834, a Normal marker is turned on and this active marker is assumed to be marker number 1.

10.4.162 M3 (Delta Marker)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

Computes the frequency and amplitude difference between the active marker and the delta (or difference) marker.

If a delta marker is not displayed on the screen, `M3` places one at the specified frequency or on the right hand edge of the display. If an active marker is not displayed on the screen, `M3` places an active marker at the center of the screen.

Format	`M3 <real>HZ|KHZ|MHZ|GHZ|KZ|MZ|GZ|S|MS|US|SC`
	`M3 UP|DN`
	UP or DN increments 10% of span
	`M3 OA`
	`M3?`

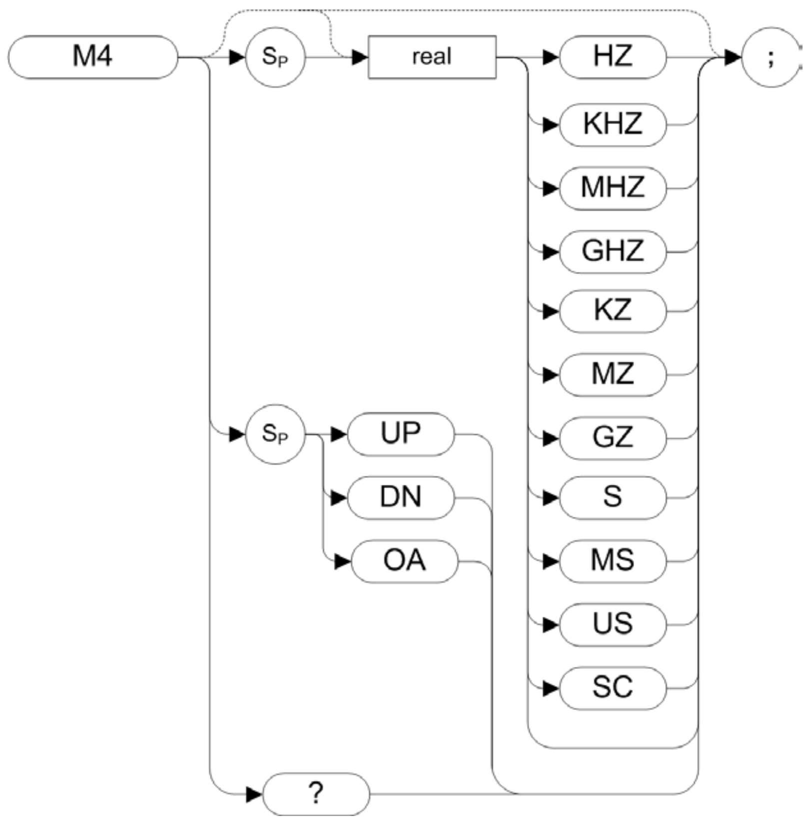
Query Data Type	`<real>`

SCPI Equivalent Commands	`:CALCulate:MARKer2:MODE POSition|DELTa|OFF`
	`:CALCulate:MARKer2:REFerence 1`
	`:CALCulate:MARKer2:X <freq|time>`
	See "Marker Mode" on page 191

Preset	0
Notes	The functions of `M3` are identical to "MKD (Marker Delta)" on page 837 The active marker is the number 1 marker unless otherwise specified by the command "MKACT (Activate Marker)" on page 834

10.4.163 M4 (Marker Zoom)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

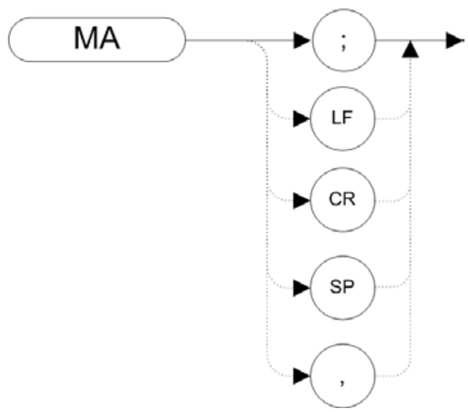
This command increases or decreases the frequency span. With the `UP/DN` parameters, the change is by one step. With a numeric value, the command moves the marker's horizontal (X) position to the specified position in frequency or time.

Format	M4 <real>HZ|KHZ|MHZ|GHZ|KZ|MZ|GZ|S|MS|US|SC M4 UP|DN UP or DN increases or decreases the frequency span by one step M4 OA The OA option only returns the current value to the controller; it

	does not set the active function to the active marker.
	M4?
Query Data Type	<real>
SCPI Equivalent Commands	None

10.4.164 MA (Marker Amplitude Output)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

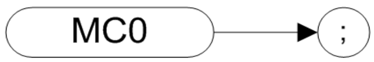
Description

Returns the amplitude level of the active marker if the marker is on the screen. If both the active marker and the delta marker are displayed, the command returns the amplitude difference between the two markers.

Format	`MA`
Query Data Type	8566A/B, 8568A/B: dependent on the currently set trace data format (see "TDF (Trace Data Format)" on page 919, MDS, O1, O2, O3, or O4)
	8560 Series: Amplitude is always returned as an ASCII value (TDF P)
SCPI Equivalent Commands	`:CALCulate:MARKer[1]|2|3|4|5|6:Y?`
	see "Marker Mode" on page 191
Notes	The functions of `MA` are identical to "MKA (Marker Amplitude)" on page 833

10.4.165 MC0 (Marker Frequency Counter Off)

Syntax



Legacy Products

8568A/B

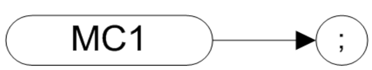
Description

Turns the marker frequency counter off.

Format	`MC0`
Query Data Type	N/A
SCPI Equivalent Commands	`:CALCulate:MARKer[1]|2|3|4|5|6:FCOunt[:STATe] OFF`
Preset	Off
Notes	The functions of `MC0` are identical to `MKFC OFF`. See "MKFC (Marker Counter)" on page 839

10.4.166 MC1 (Marker Frequency Counter On)

Syntax



Legacy Products

8568A/B

Description

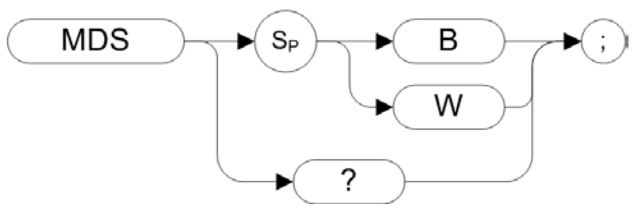
Turns the marker frequency counter on.

Format	`MC1`
Query Data Type	N/A

SCPI Equivalent Commands	:CALCulate:MARKer[1]|2|3|4|5|6:FCOunt[:STATe] ON :CALCulate:MARKer[1]|2|3|4|5|6:FCOunt:X?
Preset	Off
Notes	The functions of MC1 are identical to MKFC ON. See "MKFC (Marker Counter)" on page 839

10.4.167 MDS (Measurement Data Size)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

Formats binary data in one of the following formats:

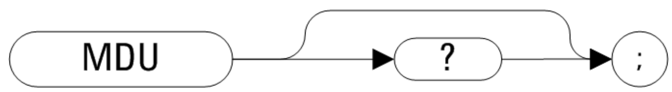
B	Selects a data size of one byte (8 bits).
W	Selects a data size of one word (16 bits).

If no keyword is specified in the command, the default value of W is assumed.

Format	MDS B|[W] MDS?
Query Data Type	B|W
SCPI Equivalent Commands	None
Preset	W

10.4.168 MDU (Measurement Data Units)

Syntax



Legacy Products

8566A/B, 8568A/B

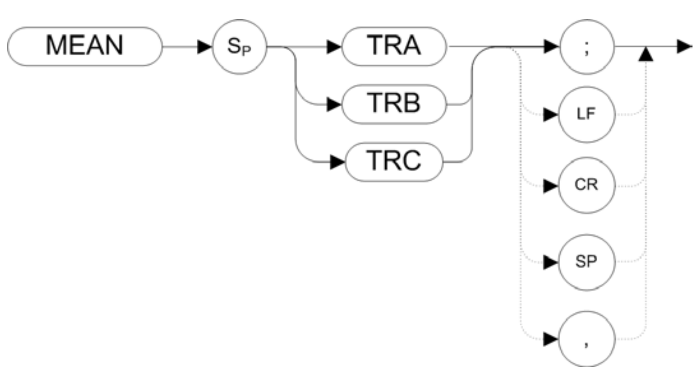
Description

Returns the measurement data units, as a list of four values. RLC Mode returns the values in display units.

Format	MDU[?]
Query Data Type	The four data values returned are as follows: 1. Lower vertical scale limit 2. Upper vertical scale limit 3. Baseline (dBm) 4. Reference level (dBm)
SCPI Equivalent Commands	None

10.4.169 MEAN (Trace Mean)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

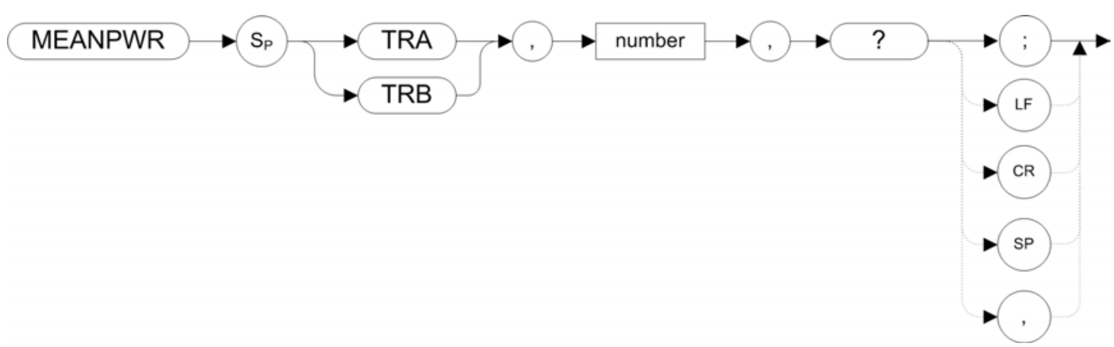
Description

Returns the mean value of the specified trace in display units.

Format	MEAN TRA|TRB TRA corresponds to Trace 1 and TRB corresponds to Trace 2.
Query Data Type	Mean value of the specified trace in display units.
SCPI Equivalent Commands	`CALCulate:DATA[1|2|3|4|5|6:COMPress? MEAN` `TRACe:MATH:MEAN? TRACE1|TRACE2|TRACE3|TRACE4|TRACE5|TRACE6`

10.4.170 MEANPWR (Mean Power measurement)

Syntax



Legacy Products

8560 series

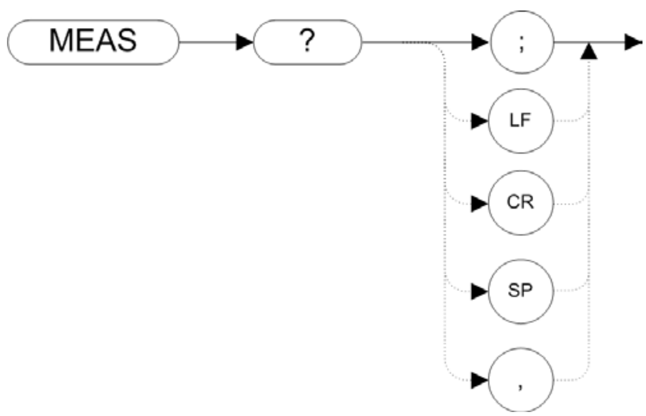
Description

Measures the average power of the carrier during that portion of the time when it is on. The on state is defined as the time when the signal is within a selected number of dB of its peak level. The range of amplitudes that is defined as the on state can be set with the command. The amplitude range is set relative to the peak value of the signal.

Format	`MEANPWR TRA|TRB,<number>,?`
	Range: 0.01 dB to 100 dB
Query Data Type	<number> in double.
SCPI Equivalent Commands	None
Notes	`MEANPWR` is similar to "CARRON (Carrier On Power)" on page 729, except that `CARRON` defines 'on' as that time when the signal is within 20 dB of its peak level

10.4.171 MEAS (Meas)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Returns the current sweep status.

- If the instrument is set to sweep and make measurements continuously, the command returns `CONTS`
- If it is set to make a single sweep with a single measurement, the command returns `SNGLS`

The instrument can be set to single sweep using the command "SNGLS (Single Sweep)" on page 901 and it can be set to continuous sweep using the command "CONTS (Continuous Sweep)" on page 737.

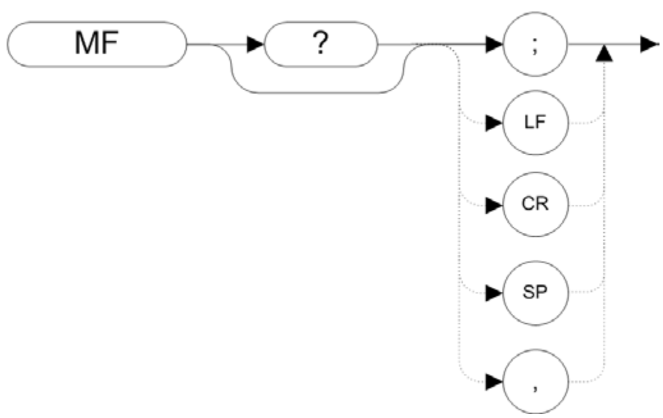
Format	`MEAS?`

Query Data Type	SNGLS|CONTS
SCPI Equivalent Commands	Note that the following SCPI command is not supported in RLC Mode: :INITiate:CONTinuous? See "Sweep/Measure" on page 317: the response values for this command differ from those of the legacy command

10.4.172 MF (Marker Frequency Output)

Syntax

8560 series:



8566A/B, 8568A/B:

Legacy Products

8560 series, 8566A/B, 8568A/B

Description

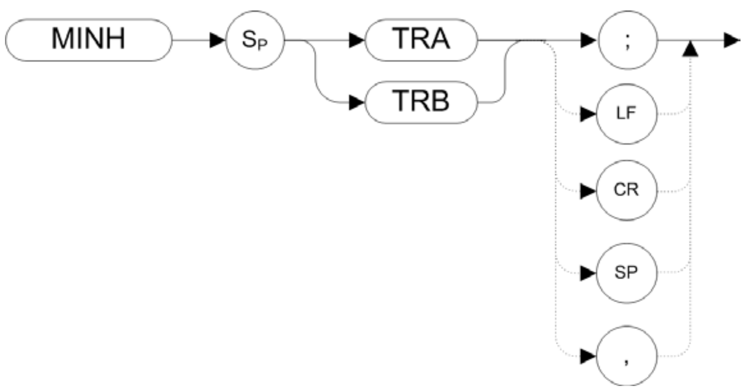
Returns the frequency (or time) of the on-screen active marker. If both an active marker and the delta marker are on the screen, the frequency difference is returned.

Format	8560 series: MF? 8566A/B, 8568A/B: MF
Query Data Type	8566A/B, 8568A/B: Dependent on the current trace data format (see "TDF (Trace Data Format)" on page 919, MDS, O1, O2, O3 and

	04)
	8560 series: Always returned as an ASCII value (TDF P)
SCPI Equivalent Commands	`:CALCulate:MARKer[1]|2|3|4|5|6:X?`
	see "Marker Mode" on page 191
Notes	8566 and 8568 only: If the active marker has marker frequency count set to On when using the MF command, the marker frequency count value is returned to the controller.

10.4.173 MINH (Minimum Hold)

Syntax



Legacy Products

8560 series

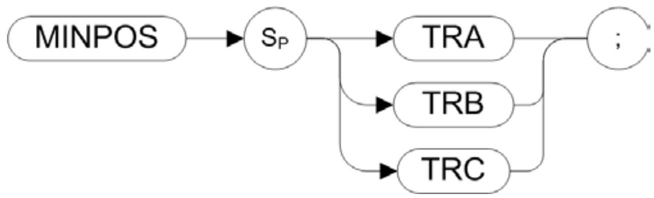
Description

Updates the chosen trace with the minimum signal level detected at each trace-data point from subsequent sweeps.

Format	MINH TRA|TRB
Query Data Type	N/A
SCPI Equivalent Commands	TRACe[1|2|3|4|5|6:TYPE MINHold
	See "Trace Type" on page 335
Preset	After a Preset, all Minhold traces are set to 1000 dBm.

10.4.174 MINPOS (Minimum X Position)

Syntax



Legacy Products

8566A/B, 8568A/B

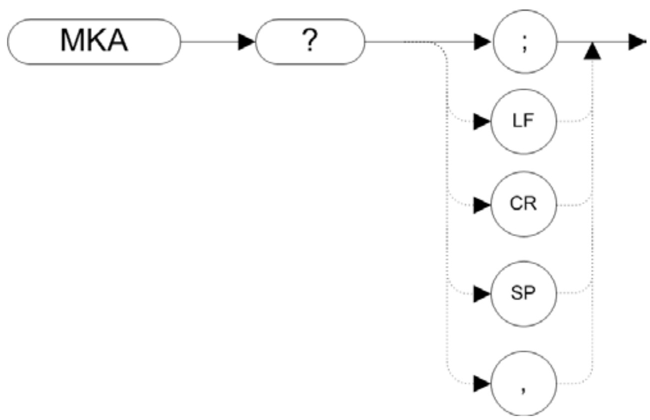
Description

Returns the X co-ordinate value that corresponds to the minimum amplitude of the specified trace.

Format	MINPOS TRA|TRB|TRC
Query Data Type	Value in X-axis display units.
SCPI Equivalent Commands	:CALCulate:MARKer12:TRACe 1|2|3|4|5|6 :CALCulate:MARKer12:MINimum :CALCulate:MARKer12:X? (See "Marker Mode" on page 191)

10.4.175 MKA (Marker Amplitude)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

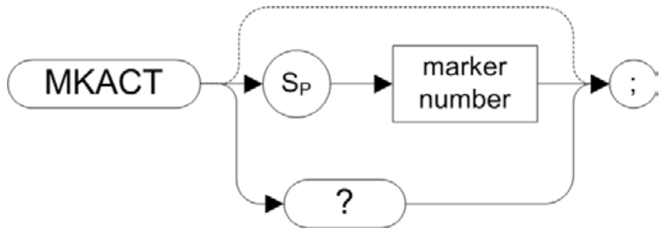
Description

Returns the amplitude level of the active marker if the marker is on the screen. If both the active marker and the delta marker are displayed, the command returns the amplitude difference between the two markers.

Format	`MKA?`
Query Data Type	8560 Series: The marker amplitude is always returned as an ASCII value (`TDF P`) 8566 and 8568 Series: Specifies the amplitude of the active marker in dBm when the active marker is the fixed or amplitude type (see "MKTYPE (Marker Type)" on page 857)
SCPI Equivalent Commands	`:CALCulate:MARKer1|2:Y?` see "Marker Mode" on page 191
Notes	The functions of `MKA` are identical to "MA (Marker Amplitude Output)" on page 824

10.4.176 MKACT (Activate Marker)

Syntax



Legacy Products

8566A/B, 8568A/B

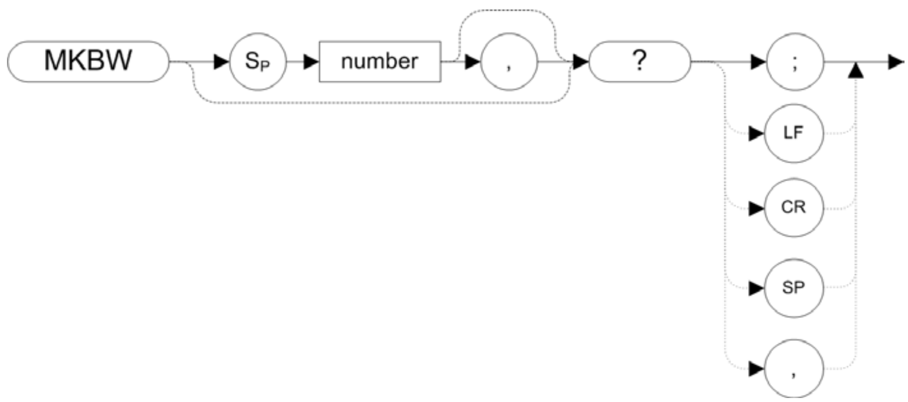
Description

Specifies the active marker. There can be four different markers, but only one marker can be active at any time.

Format	MKACT <integer> Range: 1,2,3,4. Default: 1 MKACT?
Query Data Type	<integer>
SCPI Equivalent Commands	None
Preset	1

10.4.177 MKBW (Marker Bandwidth)

Syntax



Legacy Products

8560 series

Description

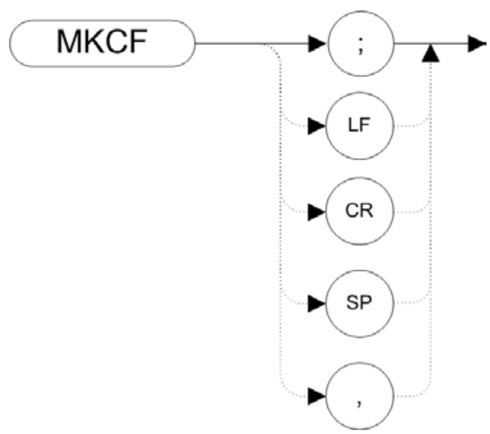
Returns the bandwidth at the specified power level relative to an on-screen marker (if present) or the signal peak (if no on-screen marker is present).

Format	MKBW <number>?
Query Data Type	<number>

SCPI Equivalent Commands	`:CALCulate:BANDwidth[:STATe] ON`
	`:CALCulate:BANDwidth:NDB <rel_ampl>`
	`:CALCulate:BANDwidth:RESult?`
	`:CALCulate:BANDwidth[:STATe] OFF`

10.4.178 MKCF (Marker to Center Frequency)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

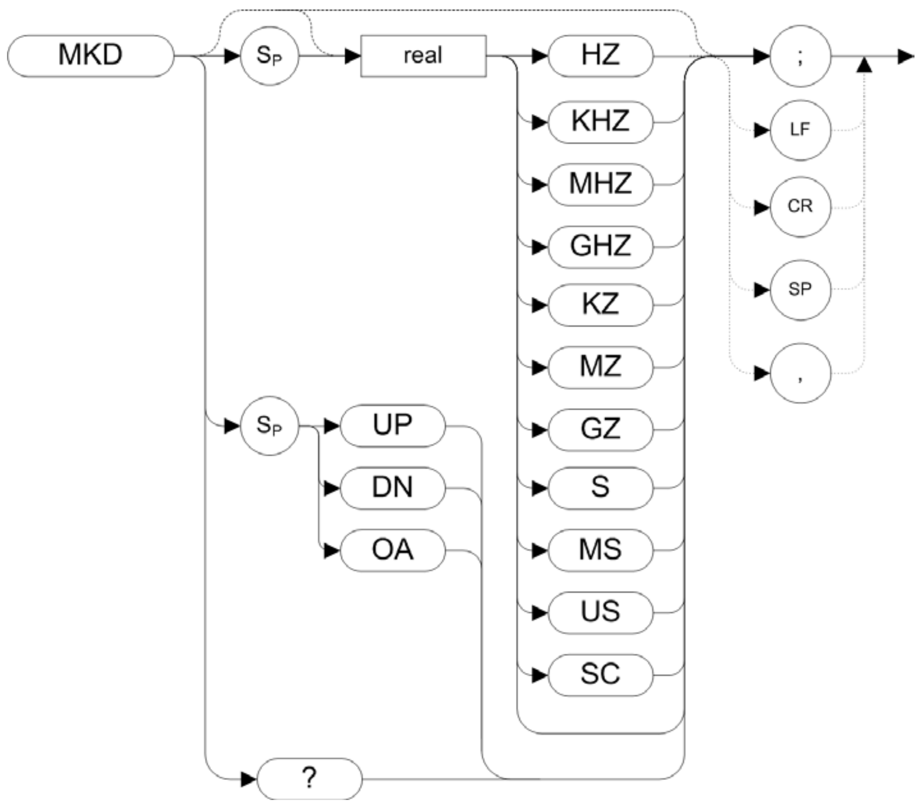
Description

Sets the center frequency equal to the marker frequency and moves the marker to the center of the screen.

Format	`MKCF`
Query Data Type	N/A
SCPI Equivalent Commands	`:CALCulate:MARKer[1]|2|3|4|5|6:X:CENTer`
	see "Marker Mode" on page 191
Notes	The functions of `MKCF` are identical to "E2 (Marker to Center Frequency)" on page 751

10.4.179 MKD (Marker Delta)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Computes the frequency and amplitude difference of the active marker and the delta marker. These values are displayed on the screen.

If a delta marker is not displayed on the screen, the command places one at the specified frequency or on the left or right hand edge of the display.

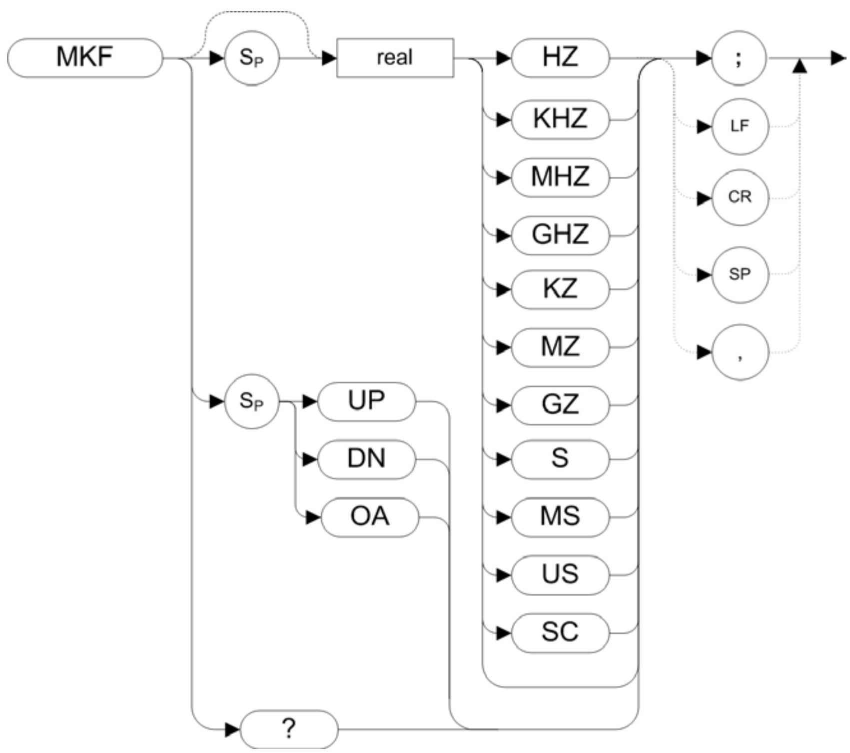
If an active marker is not displayed on the screen, the command places an active marker at the center of the screen.

Format	MKD <real>HZ|KHZ|MHZ|GHZ|KZ|MZ|GZ|S|MS|US|SC

	MKD UP|DN
	UP or DN specifies 10% of the current span.
	MKD OA
	MKD?
Query Data Type	<real>
SCPI Equivalent Commands	:CALCulate:MARKer2:MODE POSition|DELTa|OFF
	:CALCulate:MARKer2:REFerence 1
	:CALCulate:MARKer2:X
	(See "Marker Mode" on page 191)
Preset	0
Notes	For 8566A/B and 8568A/B, the functions of MKD are identical to "M3 (Delta Marker)" on page 821.

10.4.180 MKF (Marker Frequency)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

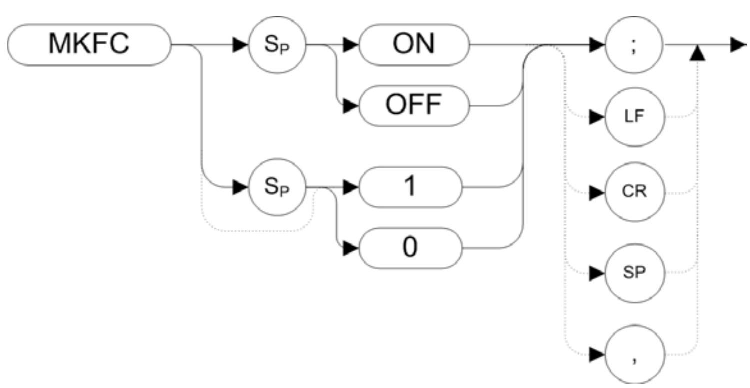
Specifies the frequency value of the active marker.

8566 and 8568 only: If the active marker has marker frequency count set to On when using the MKF? command, the marker frequency count value is returned to the controller.

Format	MKF <real>HZ|KHZ|MHZ|GHZ|KZ|MZ|GZ|S|MS|US|SC
	MKF UP|DN
	UP or DN specifies 10% of the current span.
	MKF OA
	MKF?
Query Data Type	8560 Series: The data is returned in ASCII format.
	For all other languages, the format of the returned data is determined by "TDF (Trace Data Format)" on page 919 command and, if `TDF B` (binary data format) has been selected, by "MDS (Measurement Data Size)" on page 826.
SCPI Equivalent Commands	:CALCulate:MARKer[1]|2:X
	see "Marker Mode" on page 191

10.4.181 MKFC (Marker Counter)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

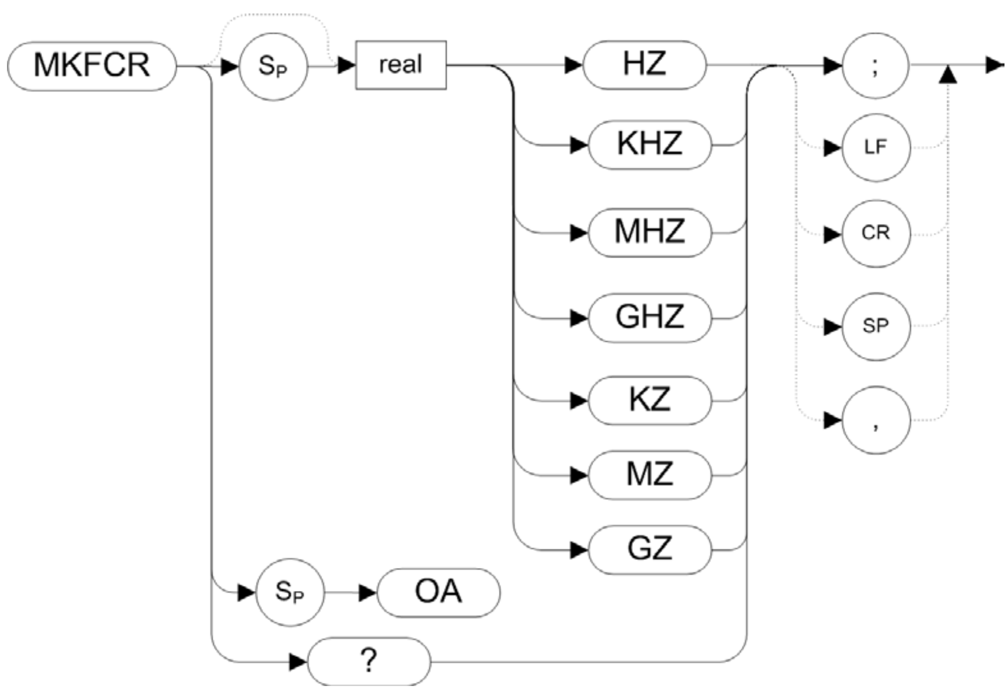
Turns on or off the marker frequency counter. The resolution of the frequency marker counter is determined by "MKFC (Marker Counter)" on page 839.

Format	`MKFC ON|OFF|1|0`
Query Data Type	N/A
SCPI Equivalent Commands	`:CALCulate:MARKer[1]|2|3|4|5|6:FCOunt ON|OFF` `:CALCulate:MARKer2:FCOunt:X?`
Preset	`OFF`
Notes	The functions of `MKFC` are identical to "MC0 (Marker Frequency Counter Off)" on page 825 and "MC1 (Marker Frequency Counter On)" on page 825

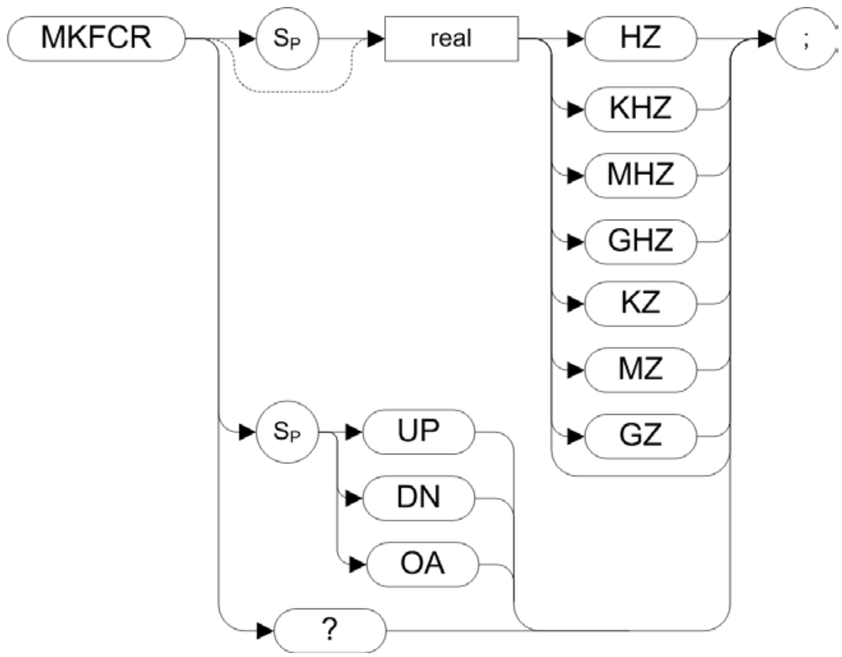
10.4.182 MKFCR (Marker Counter Resolution)

Syntax

8560 series:



8566A/B, 8568A/B:



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

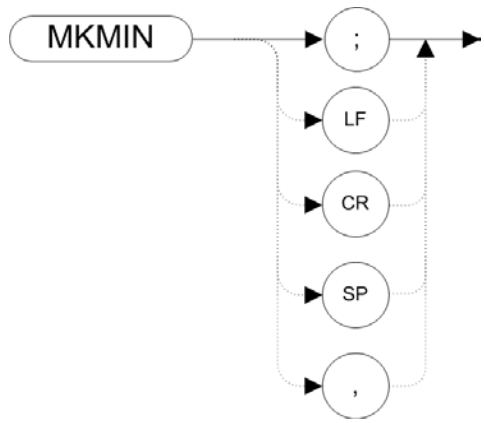
Sets the resolution of the marker frequency counter. The marker counter resolution value is always given either in Hertz or in seconds depending on whether the instrument is operating in the frequency domain or the time domain.

Format	`MKFCR <real>HZ|KHZ|MHZ|GHZ|KZ|MZ|GZ`
	8566A/B, 8568A/B only:
	`MKFCR UP|DN`
	`MKFCR OA`
	`MKFCR?`

Query Data Type	<real> in Hz or S
SCPI Equivalent Commands	`:CALCulate:MARKer[1]:FCOunt:RESolution <freq>`
Preset	10 kHz
Notes	For 8566A/B, 8568A/B, the functions of `MKFCR` are identical to "KS= (8566A/B: Automatic Preselector Tracking, 8568A/B: Marker Counter Resolution)" on page 783

10.4.183 MKMIN (Marker Minimum)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

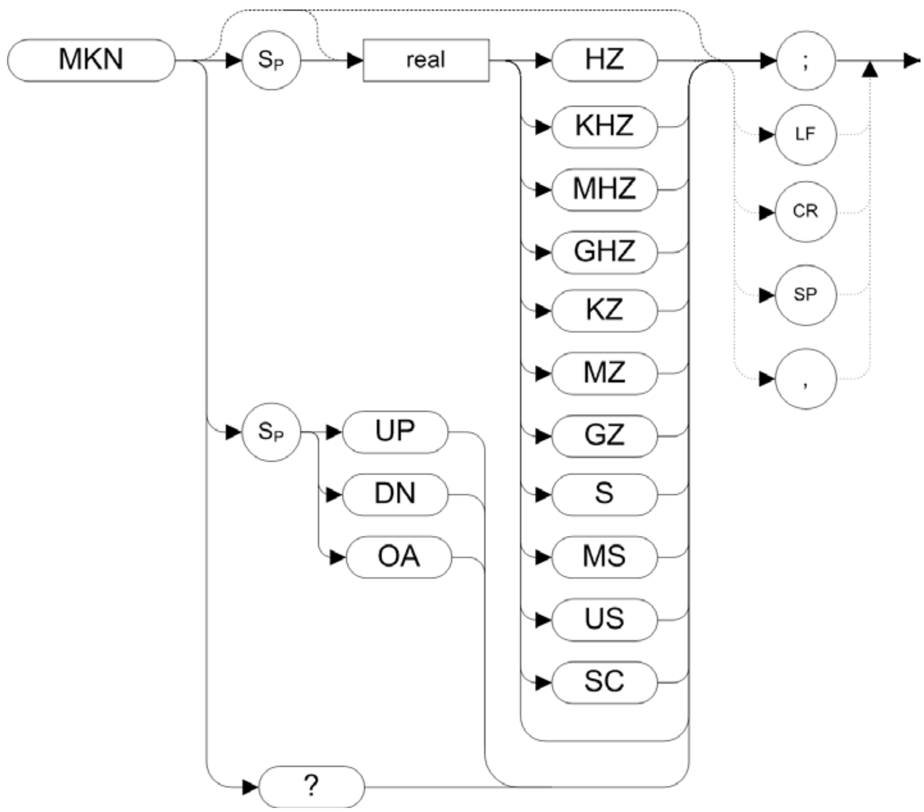
Description

Moves the active marker to the minimum value detected.

Format	`MKMIN`
Query Data Type	N/A
SCPI Equivalent Commands	`:CALCulate:MARKer[1]|2:MINimum`
Notes	For 8566A/B, 8568A/B, the functions of `MKMIN` are identical to "KSN (Marker Minimum)" on page 800

10.4.184 MKN (Marker Normal)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Moves the active marker to the specified frequency.

If no marker is currently turned on, a normal marker is turned on.

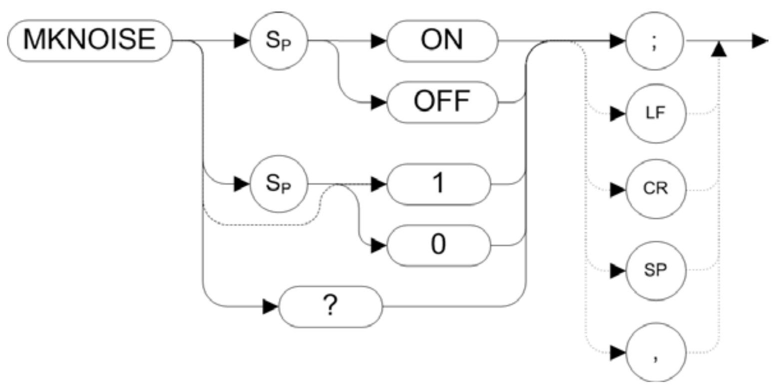
If the active marker type is not currently Normal (for example, it is Delta), the command changes it to a Normal marker.

Format	MKN <real>HZ|KHZ|MHZ|GHZ|KZ|MZ|GZ|S|MS|US|SC MKN UP|DN UP or DN specifies 10% of the current span.

	MKN OA
	MKN?
Query Data Type	See "MKF (Marker Frequency)" on page 838.
SCPI Equivalent Commands	:CALCulate:MARKer[1]|2:X
	:CALCulate:MARKer:MODE POSition
	(See "Marker Mode" on page 191)
Notes	The functions of `MKN` are identical to "M2 (Marker Normal)" on page 820.

10.4.185 MKNOISE (Marker Noise)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

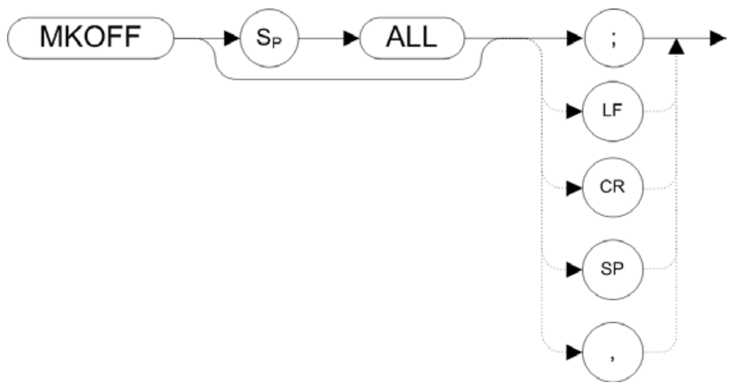
Displays the average RMS noise density at the marker.

Format	`MKNOISE ON|OFF|1|0`
	`MKNOISE?`
Query Data Type	1|0
SCPI Equivalent Commands	`:CALCulate:MARKer[1]|2:FUNCtion NOISe`
	`:CALCulate:MARKer[1]|2:FUNCtion OFF`
	`:CALCulate:MARKer[1]|2:FUNCtion?`
	Returns OFF|NOIS

Preset	OFF
Notes	For 8566A/B, 8568A/B, the functions of MKNOISE are identical to "KSM (Marker Noise On)" on page 799

10.4.186 MKOFF (Marker Off)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

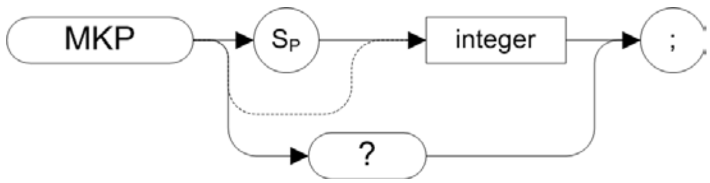
Description

Turns off either the active marker or all the markers. If the ALL parameter is omitted, only the active marker is turned off.

Format	MKOFF [ALL]
Query Data Type	N/A
SCPI Equivalent Commands	:CALCulate:MARKer#:MODE OFF see "Marker Mode" on page 191

10.4.187 MKP (Marker Position)

Syntax



Legacy Products

8566A/B, 8568A/B

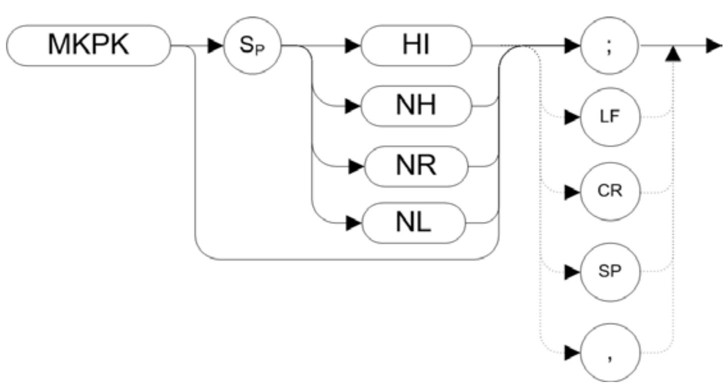
Description

Specifies the marker position horizontally, in display units.

Format	MKP <integer> Range: 1 to 1001 MKP?
Query Data Type	<integer>
SCPI Equivalent Commands	:CALCulate:MARKer[1]|2:X see "Marker Mode" on page 191

10.4.188 MKPK (Marker Peak)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

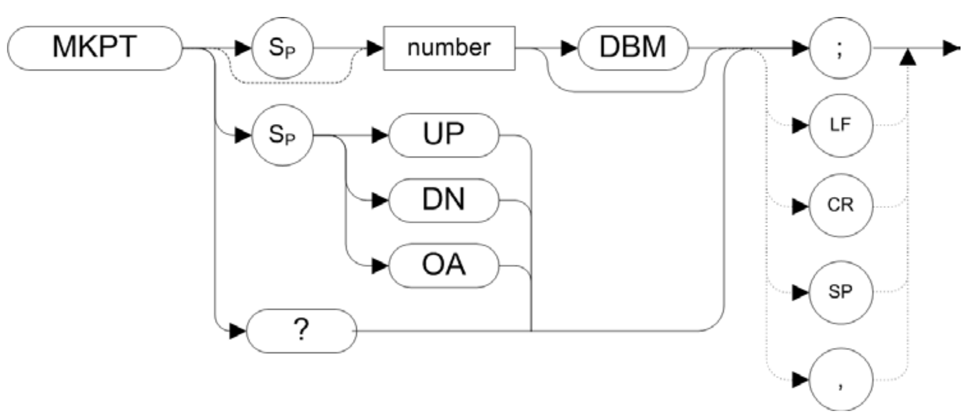
Executing MKPK HI, or simply MKPK (no secondary keyword), positions the active marker at the highest signal detected. If an active marker is on the screen, the MKPK parameters move the marker as follows:

HI (highest)	Moves the active marker to the highest peak
NH (next highest)	Moves the active marker to the next signal peak of lower amplitude
NR (next right)	Moves the active marker to the next signal peak to the right of the current marker
NL (next left)	Moves the active marker to the next signal peak to the left of the current marker

Format	MKPK [HI]|NH|NR|NL
Query Data Type	N/A
SCPI Equivalent Commands	:CALCulate:MARKer[1]|2:MAXimum :CALCulate:MARKer[1]|2:MAXimum:NEXT :CALCulate:MARKer[1]|2:MAXimum:LEFT|RIGHt
Notes	The functions of MKPK (no secondary keyword) and MKPK HI are identical to "E1 (Peak Marker)" on page 750 For 8566A/B, 8568A/B, the functions of MKPK NH are similar to "KSK (Marker to Next Peak)" on page 796, except that KSK does not take in to account the marker peak excursion or marker peak threshold values. For more details on marker peak excursion, see "MKPX (Marker Peak Excursion)" on page 848

10.4.189 MKPT (Marker Threshold)

Syntax



Legacy Products

8560 series

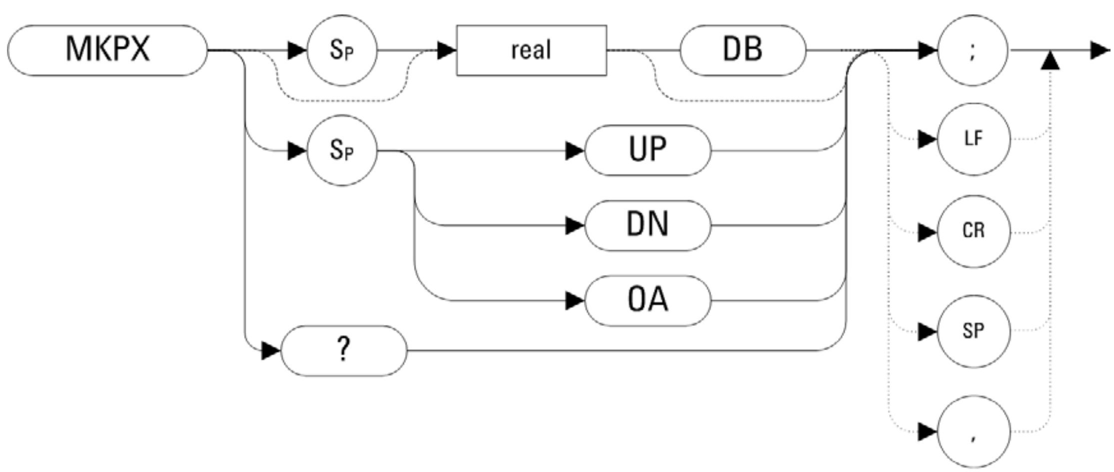
Description

Sets the minimum amplitude level from which a peak on the trace can be detected.

Format	MKPT <number>DBM MKPT UP|DN UP or DN increments by one step size MKPT OA MKPT?
Query Data Type	<number>
SCPI Equivalent Commands	`:CALCulate:MARKer:PEAK:THReshold <ampl>` See "Peak Threshold" on page 202
Preset	−130 dBm

10.4.190 MKPX (Marker Peak Excursion)

Syntax



Preset State: 6 dB

Legacy Products

8560 series, 8566A/B, 8568A/B

Description

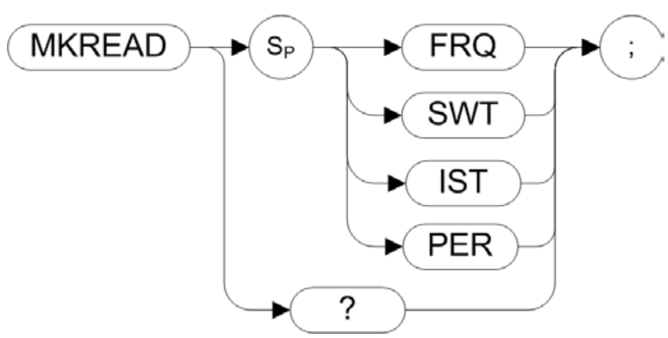
Specifies the minimum signal excursion for the instrument's internal peak identification routine.

The default value is 6 dB. In this case, any signal with an excursion of less than 6 dB on either side of the marker would not be identified. Thus, if an `MKPK NH` command were to be executed on such a signal, the instrument would not place a marker on this signal peak.

Format	MKPX <real>DB
	MKPX UP|DN
	UP or DN increments by one vertical display division
	MKPX OA
	MKPX?
Query Data Type	<real>
SCPI Equivalent Commands	`:CALCulate:MARKer:PEAK:EXCursion <rel_ampl>`

10.4.191 MKREAD (Marker Readout)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

Selects the type of active trace information displayed by the instrument marker readout.

The `MKREAD` command can select the following types of active trace information:

FRQ	frequency
SWT	sweep time
IST	inverse sweep time
PER	period

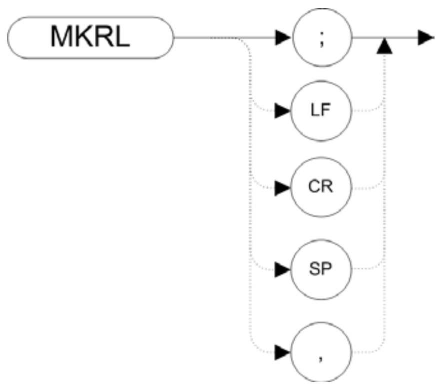
The results of the data depend on the `MKREAD` parameter and the frequency span, and whether the marker delta function is used.

MKREAD Type	Non-Zero Span	Non-Zero Span Delta	Zero Span	Zero Span Delta
FRQ	Reads frequency	Reads delta frequency	N/A	N/A
SWT	Reads time since the start of sweep	Reads delta time between end points	Waveform measurements of detected modulation	Waveform measurements of detected modulation
IST	N/A	N/A	N/A	Computes frequency corresponding to delta of markers. Performs 1/ (T1 – T2)
PER	Period of frequency	(Pulse measurement) delta time	N/A	N/A

Format	MKREAD FRQ|SWT|IST|PER MKREAD?
Query Data Type	FRQ|SWT|IST|PER
SCPI Equivalent Commands	`:CALCulate:MARKer[1]|2:X:READout FREQuency|TIME|ITIMe|PERiod` `:CALCulate:MARKer[1]|2:X:READout:AUTO ON`
Preset	FRQ
Notes	The Inverse Sweep Time (IST) readout is only available when using a delta marker in zero span FFT (Fast Fourier Transform) is not available in RLC Mode

10.4.192 MKRL (Marker to Reference Level)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

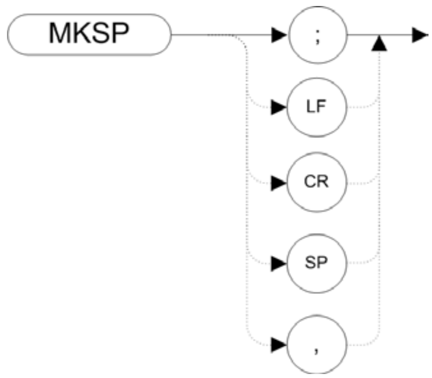
Description

Moves the active marker to the reference level.

Format	`MKRL`
Query Data Type	N/A
SCPI Equivalent Commands	`:CALCulate:MARKer[1]|2[:SET]:RLEVel`
Notes	The functions of `MKRL` are identical to "E4 (Marker to Reference Level)" on page 753

10.4.193 MKSP (Marker Span)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

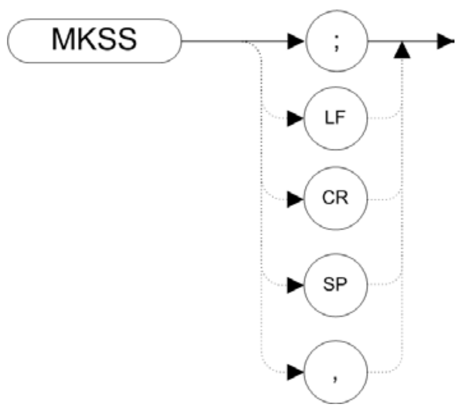
Description

This command operates only when the delta marker is On (see "MKD (Marker Delta)" on page 837 or "M3 (Delta Marker)" on page 821). When the delta marker is On and `MKSP` is executed, the delta marker and active marker determine the start and stop frequencies. The left marker specifies the start frequency, and the right marker specifies the stop frequency. If marker delta is Off, there is no operation.

Format	`MKSP`
Query Data Type	N/A
SCPI Equivalent Commands	`:CALCulate:MARKer2[:SET]:DELTA:SPAN`
Notes	For 8566A/B, 8568A/B, The functions of `MKSP` are identical to "KSO (Marker Span)" on page 801 If the active marker is not a delta marker, there is no change in its position

10.4.194 MKSS (Marker to Step Size)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

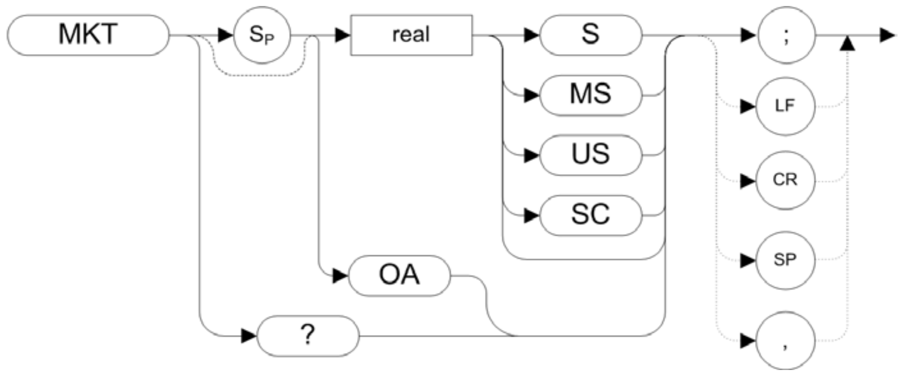
Description

Sets the center-frequency step-size equal to the marker frequency. If the instrument is in the delta mode, the step size is set to the frequency difference between the active and the delta marker.

Format	MKSS
Query Data Type	N/A
SCPI Equivalent Commands	:CALCulate:MARKer[1]|2[:SET]:STEP
Notes	When the marker is a delta marker, the functions of MKSS are identical to "E3 (Delta Marker Step Size)" on page 752

10.4.195 MKT (Marker Time)

Syntax



Legacy Products

8560 series

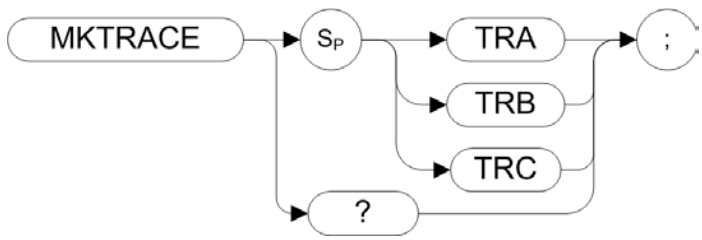
Description

Places a marker at a position that corresponds to a specified point in time during the sweep.

Format	MKT <real>S|MS|US|SC
	Default unit of time is seconds ('S' or 'SC').
	MKT OA
	MKT?
Query Data Type	<real>
SCPI Equivalent Commands	:CALCulate:MARKer[1]|2:X
	see "Marker Mode" on page 191
Preset	½ Sweep time

10.4.196 MKTRACE (Marker Trace)

Syntax



Legacy Products

8566A/B, 8568A/B

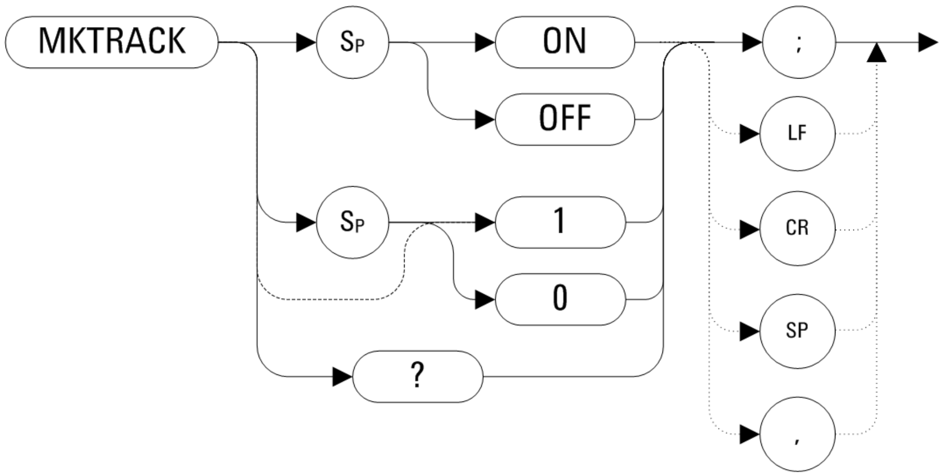
Description

Moves the active marker to the corresponding position in Trace 1, Trace 2, or Trace 3.

Format	MKTRACE TRA|TRB|TRC TRA corresponds to Trace 1, TRB corresponds to Trace 2, and TRC corresponds to Trace 3. MKTRACE?
Query Data Type	TRA|TRB|TRC
SCPI Equivalent Commands	None

10.4.197 MKTRACK (Marker Track)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

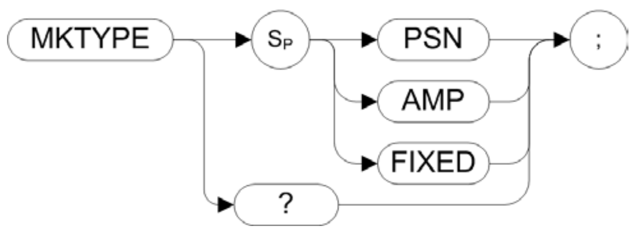
Moves the signal on which the active marker is located to the center of the instrument display and keeps the signal peak at center screen.

To keep a drifting signal at center screen, place the active marker on the desired signal before turning on `MKTRACK`.

Format	`MKTRACK ON|OFF|1|0`
	`MKTRACK?`
Query Data Type	8560 series: 0 |1
	8566A/B, 8568A/B: ON|OFF
SCPI Equivalent Commands	`:CALCulate:MARKer#:TRCKing[:STATe] OFF|ON|0|1`
Preset	`OFF`
Notes	For 8566A/B, 8568A/B, the functions of `MKTRACK` are identical to "MT0 (Marker Track Off)" on page 859 and "MT1 (Marker Track On)" on page 860

10.4.198 MKTYPE (Marker Type)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

Specifies the type of marker.

Type	Function	Commands Used to Position Marker
PSN	Allows the marker to be positioned horizontally in display units (default)	"MKP (Marker Position)" on page 846 "MKF (Marker Frequency)" on page 838
AMP	Allows the marker to be positioned according to amplitude	"MKA (Marker Amplitude)" on page 833
FIXED	Allows a marker to be placed at any fixed point on the display	"MKP (Marker Position)" on page 846 "MKF (Marker Frequency)" on page 838 "MKA (Marker Amplitude)" on page 833

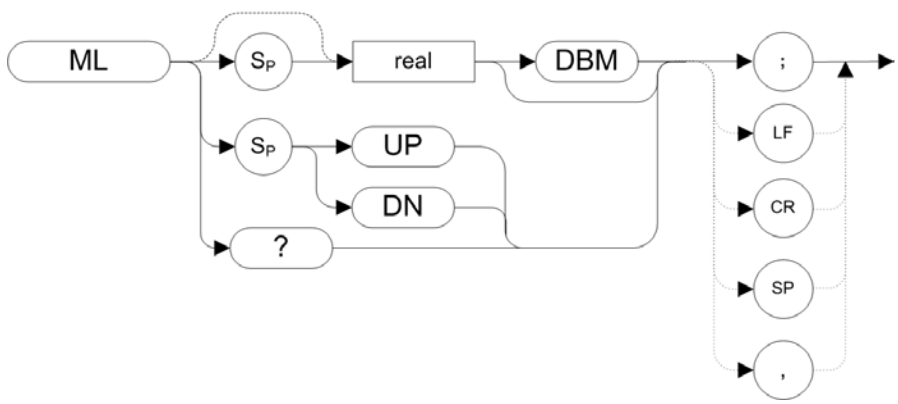
Format	MKTYPE PSN|AMP|FIXED MKTYPE?
Query Data Type	PSN|AMP|FIXED
SCPI Equivalent Commands	:CALCulate:MARKer#:MODE POSition :CALCulate:MARKer#:MODE FIXed :CALCulate:MARKer#:X :CALCulate:MARKer#:Y (See "Marker Mode" on page 191)

Preset	PSN
Notes	Marker type can only be set for an active marker. The marker type is reset to PSN when the marker is turned off (using "MKOFF (Marker Off)" on page 845), or when the instrument is preset.

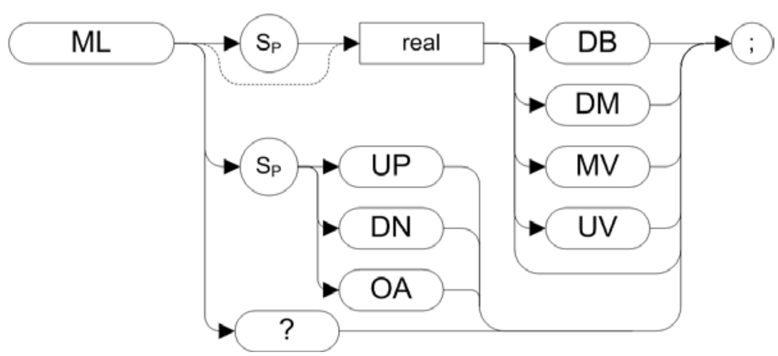
10.4.199 ML (Mixer Level)

Syntax

8560 series:



8566A/B, 8568A/B:



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Specifies the maximum signal level that is applied to the input mixer for a signal that is equal to or below the reference level.

The effective mixer level is equal to the reference level minus the input attenuator setting.

If an external amplifier gain value is set, the mixer level is determined using the following equation:

– Mixer Level = Ref. Level - Attenuation + Ext. Amplifier Gain

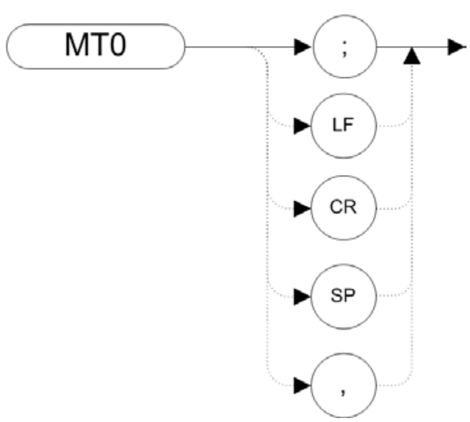
The external amplifier gain is not preset by doing an `IP` command in case the instrument is measuring a large signal. This is to protect the instrument from damage from a large signal.

Format	`ML <real>DB|DM|MV|UV`
	`ML UP|DN`
	UP or DN increments by 10 dB
	`ML OA`
	`ML?`

Query Data Type	<real> in dBm
SCPI Equivalent Commands	`[:SENSe]:POWer[:RF]:MIXer:RANGe[:UPPer] <ampl> dBm` `[:SENSe]:POWer[:RF]:MIXer:RANGe[:UPPer]?`
Preset	–10 dBm
Notes	For 8566A/B, 8568A/B, the functions of `ML` are identical to "KS, (Mixer Level)" on page 782

10.4.200 MT0 (Marker Track Off)

Syntax



Legacy Products

8566A/B, 8568A/B

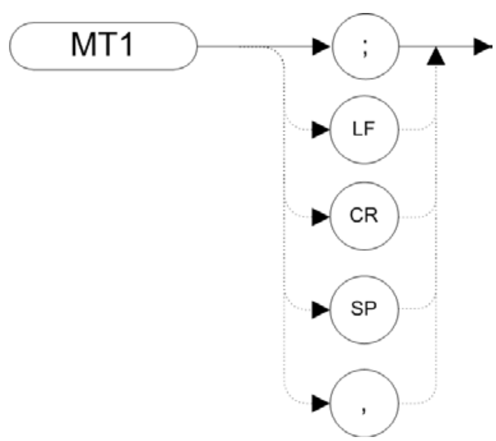
Description

Disables the marker tracking mode.

Format	`MT0`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of `MT0` are identical to `MKTRACK OFF`. See "MKTRACK (Marker Track)" on page 856

10.4.201 MT1 (Marker Track On)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

Moves the signal on which the active marker is located to the center of the instrument display and keeps the signal peak at center screen.

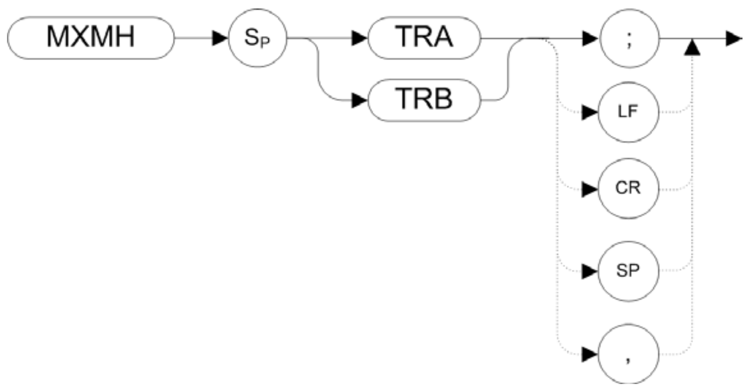
To keep a drifting signal at center screen, place the active marker on the desired signal before issuing an `MT1` command.

Format	`MT1`
Query Data Type	N/A

SCPI Equivalent Commands	None
Notes	The functions of `MT1` are identical to `MKTRACK ON`. See "MKTRACK (Marker Track)" on page 856

10.4.202 MXMH (Maximum Hold)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

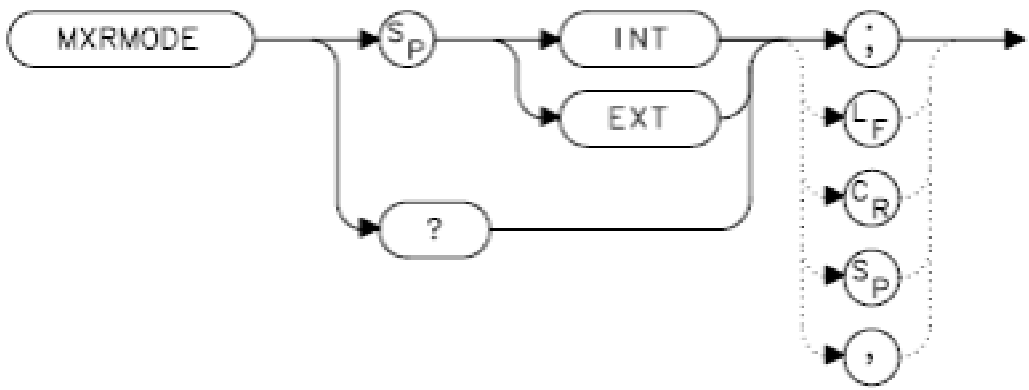
Updates each trace element with the maximum level detected.

`MXMH` updates the specified trace (either Trace A or Trace B) with a new value from a detector only if the new value is larger than the previous trace data value.

Format	`MXMH TRA|TRB`
	TRA corresponds to Trace 1 and TRB corresponds to Trace 2
Query Data Type	N/A
SCPI Equivalent Commands	`:TRACe[1|2|3|4|5|6:TYPE MAXHold`
	`[:SENSe]:AVERage:COUNt <integer>`
Notes	The functions of `MXMH` are identical to "A2 (Maximum Hold for Trace A)" on page 682 and "B2 (Maximum Hold for Trace B)" on page 717

10.4.203 MXRMODE (Mixer Mode)

Syntax



Legacy Products

8560 series

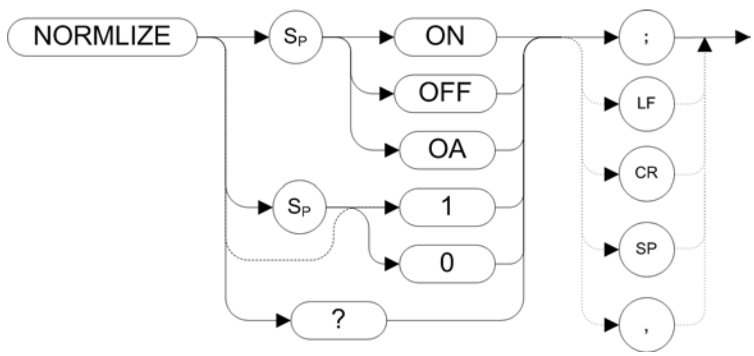
Description

Specifies the mixer mode. You can select either the internal mixer (INT) or an external mixer (EXT).

Format	MXRMODE INT|EXT
Query Data Type	INT|EXT
Preset	INT
SCPI Equivalent Commands	None

10.4.204 NORMLIZE (Normalize Trace Data)

Syntax



Legacy Products

8560 series

Description

Activates or de-activates the normalization routine for stimulus-response measurements. This function subtracts trace B from trace A, offsets the result by the value of the normalized reference position (NRL) and displays the result in trace A.

Normalization is automatically turned off by an instrument preset (`IP`), or at power on.

Normalization is not available when using linear mode and is mutually exclusive of other trace math.

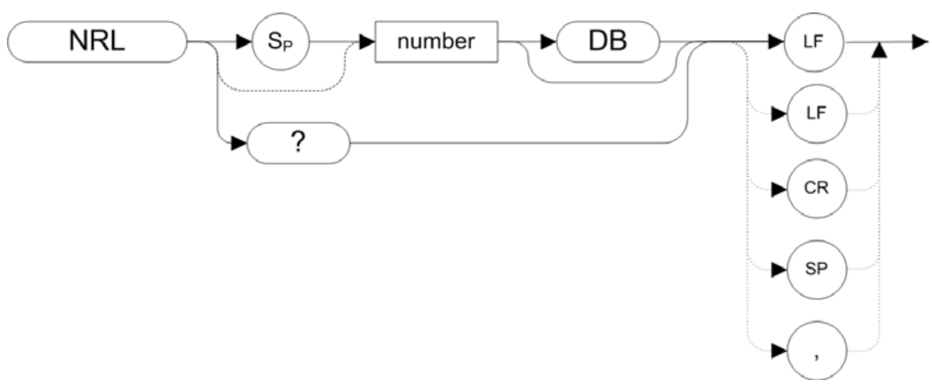
Format	NORMLIZE ON|OFF|1|0 NORMLIZE OA The OA option only returns the current value to the controller; it does **not** set the active function to the normalization state NORMLIZE?
Query Data Type	1|0

SCPI Equivalent Commands	`:TRACe:COPY TRACE1, TRACE3`
	if necessary
	`:TRACe[2]:UPDate OFF`
	blank Trace2, which corresponds to TRB
	`:TRACe[2]:DISPlay OFF`
	`:CALCulate:NTData[:STATe] OFF|ON|0|1`

	:CALCulate:NTData[:STATe]?
Preset	OFF
Couplings	NORMLIZE sets Trace B to Blank mode and turns AMBPL or AMB off. All trace math is mutually exclusive, so turning one on turns the other off and *vice versa*. Similarly, when Normalize is on and you change Trace B to Clearwrite or Maxhold (that is, Active), Normalize is turned off
Errors	Accurate normalization occurs only if the reference trace and the measured trace are on-screen. If any of these traces are off-screen, an error message will be displayed

10.4.205 NRL (Normalized Reference Level)

Syntax



Legacy Products

8560 series

Description

Sets the normalized reference level. Intended for use with the NORMLIZE command. When using NRL, the input attenuator and IF step gains are not affected. This function is a trace-offset function enabling the user to offset the displayed trace without introducing hardware switching errors into the stimulus-response measurement.

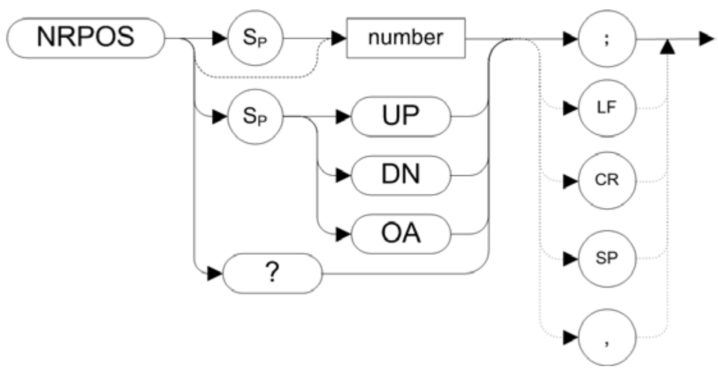
The unit of measurement for NRL is dB.

Format	NRL <number>DB NRL?

Query Data Type	Returns the current Normalized Reference Level
SCPI Equivalent Commands	`:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:NRLevel <rel ampl>`
Preset	0 dB

10.4.206 NRPOS (Normalized Reference Position)

Syntax



Legacy Products

8560 series

Description

Adjusts the normalized reference-position that corresponds to the position on the graticule where the difference between the measured and calibrated traces reside. The dB value of the normalized reference position is equal to the normalized reference level. The normalized reference position can be adjusted between 0.0 and 10.0, corresponding to the bottom and top graticule lines, respectively.

Format	NRPOS <number> Range: Min = 0; Max = 10 NRPOS UP|DN UP or DN increments by 1.0 NRPOS OA NRPOS?
Query Data Type	Returns the current Normalized Reference Position
SCPI Equivalent Commands	`:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:NRPosition <integer>`
Preset	10

10.4.207 O1 (Format - Display Units)

Syntax

Legacy Products

8566A/B, 8568A/B

Description

Transmits trace amplitude and position information as decimal values in display units.

Format	O1
Query Data Type	N/A
SCPI Equivalent Commands	None

10.4.208 O2 (Format - Two 8-Bit Bytes)

Syntax

Legacy Products

8566A/B, 8568A/B

Description

Transmits trace amplitude and position information as two 8-bit binary numbers (one instruction word).

Format	O2
Query Data Type	N/A
SCPI Equivalent Commands	None

10.4.209 O3 (Format - Real Amplitude Units)

Syntax

Legacy Products

8566A/B, 8568A/B

Description

Transmits trace vertical axis information only, in measurement units of Hz, dBm, dB, volts or seconds.

Format	O3
Query Data Type	N/A
SCPI Equivalent Commands	None

10.4.210 O4 (Format - One 8-Bit Byte)

Syntax

Legacy Products

8566A/B, 8568A/B

Description

Transmits trace amplitude information only as a binary number.

Format	O4
Query Data Type	N/A
SCPI Equivalent Commands	None
Preset	N/A

Couplings	TDF B ("TDF (Trace Data Format)" on page 919) or "O2 (Format - Two 8-Bit Bytes)" on page 866

10.4.211 OA or ? (Query Active Function)

Legacy Products

8566A/B, 8568A/B

Description

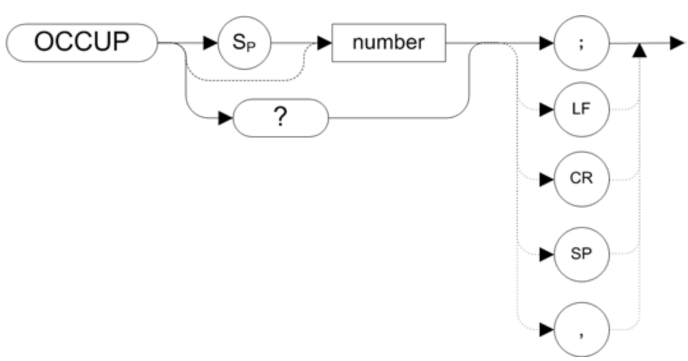
Query active function.

The active functions are ACPBW, ACPSP, AT, CF, CRTHPOS, CRTVPOS, DA, DL, DOTDENS, FA, FB, FMGAIN, GD, GL, LG, MKA, MKD, MKFCR, MKN, MKPAUSE, MKPX, ML, NDB, NRL, RB, RCLS, ROFFSET, RL, RLPOS, SAVES, SAVRCLN, SETDATE, SETTIME, SP, SQLCH, SRCALC, SRCAT, SRCPOFS, SRCPSWP, SRCPWR, SRCTK, SS, ST, TH, TVLINE, VB, VBR, and user-defined active function specified by the ACTDEF command.

Format	OA|? Note that OA sets the active function, whereas ? does not. Thus, for example, SP CF? 100MZ sets the Span, whereas SP CF OA 100 MZ sets the Center Frequency.
Query Data Type	Depends on active function.
SCPI Equivalent Commands	None

10.4.212 OCCUP (Percent Occupied Power Bandwidth)

Syntax



Legacy Products

8560 series

Description

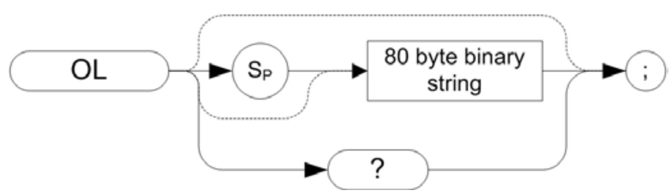
This command is used to query the current value of the percent occupied power. This value is set by "DELMKBW (Occupied Power Bandwidth Within Delta Marker)" on page 744 and "PWRBW (Power Bandwidth)" on page 877. This command can also be used to set the percent occupied power.

Format	`OCCUP <number>`
	`OCCUP?`
	Range: 0.10 to 100

Query Data Type	`<number>`
SCPI Equivalent Commands	None
Preset	90

10.4.213 OL (Output Learn String)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

Transmits information to the controller that describes the state of the instrument when the `OL` command is executed. This information is called the “Learn String.”

The Learn String can be sent from the controller memory back to the instrument to restore the instrument to its original state.

The `OL` command is not completely supported, due to differences between the X-Series and 8566/8568. The following table outlines each byte of the array and the bits supported within that byte.

Byte	Support Information
1	Fixed decimal value 31
2	Fixed decimal value 118
3 to 9	*Supported*
10	*Supported*
11	*Unsupported*: Fixed decimal 0
12 to 17	*Supported*
18	*Supported*: Bits 6, 2, 1 and 0 *Unsupported*: Bits 7, 5, 4, and 3
19	*Supported*: Bits 7, 6, 4, 3, and 0 Bit 5 on X-Series only *Unsupported*: Bits 1 and 2
20	*Supported*: Trigger Mode, Sweep Mode, TRB Clearwrite status Unsupported: Recorder Output
21	*Supported*
22	*Unsupported*: Fixed decimal 0
23 to 25	*Supported*
26	*Supported*: Scale Type, Log Scale Factor, and Display State *Unsupported*: XY Recorder
27	*Supported*
28	*Unsupported*: Fixed decimal 0
29 to 30	*Supported*
31	*Unsupported*: Fixed decimal 0
32 to 37	*Supported*
38	*Unsupported*: Fixed decimal 0
39 to 45	*Supported*
46 to 47	VAVG count limit, value returned is always current count value * 2.
48 to 53	*Supported*
54 to 57	If active marker is a delta marker, active marker absolute Y position only supported for X-Series
58 to 61	If active marker is a delta marker, reference marker absolute Y position only supported for X-Series
62	*Unsupported*: Fixed decimal 0
63	*Supported*
64	*Supported*: Log Amp Units, R3, R2, and R4

Byte	Support Information
	Unsupported: Stop sweep
65	*Supported*: Lin Amp Units, TRC View Status
	Unsupported: Bits 5 and 4 (always set HI)
66 to 71	*Supported*
72	*Unsupported*: Fixed decimal 0
73	*Supported*: Video Avg
	Unsupported: Power on last, Ext Ref Lvl, Fast HP-IB, Bit 4 (always set HI)
74 to 77	*Unsupported*: Fixed decimal 0
78	*Unsupported*
79	*Unsupported*: Fixed decimal 0
80	Fixed decimal 162

Format	OL <80-byte string>
	OL?
Query Data Type	See table above.
SCPI Equivalent Commands	None

10.4.214 OT (Output Trace Annotations)

Syntax

Legacy Products

8566A/B, 8568A/B

Description

Sends 32 character-strings to the controller. Each of the 32 character-strings can be up to 64 characters long.

The significance of each string is as follows:

Index	Content
1	"BATTERY"
2	"CORR'D"
3	resolution bandwidth
4	video bandwidth

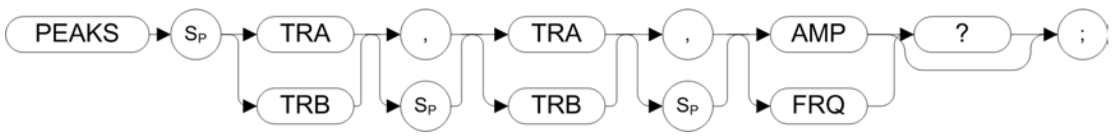
Index	Content
5	sweep time
6	attenuation
7	reference level
8	scale
9	trace detection
10	center frequency or start frequency
11	span or stop frequency
12	reference level offset
13	display line
14	threshold
15	marker frequency
16	marker amplitude
17	frequency offset
18	video averaging
19	title
20	"PL1 UNLOCK"
21	"PL2 UNLOCK"
22	"Y-I-O UNLOCK"
23	"HET UNLOCK"
24	"M/N UNLOCK"
25	"REFUNLOCK"
26	"EXT/OVEN"
27	"MEASUNCAL"
28	frequency diagnostics
29	-
30	"SRQ"
31	center frequency "STEP"
32	active function

Format	OT
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The 'data invalid indicator' status report in string 27 of the returned text is only supported on X-Series instruments.

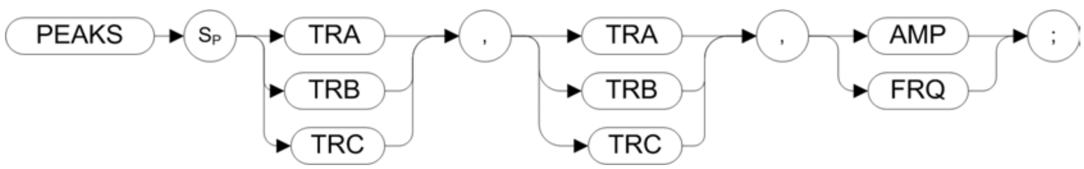
10.4.215 PEAKS (Peaks)

Syntax

8560 series:



8566A/B, 8568A/B:



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

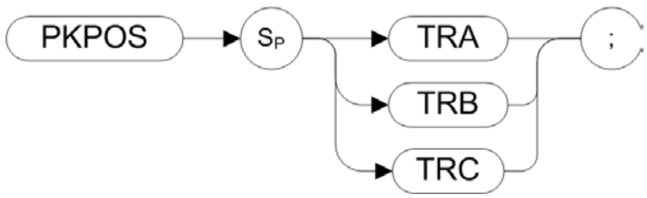
Sorts the signal peaks in the source trace by frequency or amplitude, and sends the results to destination trace.

Format	PEAKS TRA|TRB|TRC,TRA|TRB|TRC,AMP|FRQ[?] The first trace specified is the destination; the second trace specified is the source
Query Data Type	Number of peaks found

SCPI Equivalent Commands	`:CALCulate:MARKer:PEAK:SORT FREQuency|AMPLitude`
	`:CALCulate:DATA[1]|2|3|4:PEAK?`
	`:TRACe[:DATA] TRACE[1]|2|3`

10.4.216 PKPOS (Peak Position)

Syntax



Legacy Products

8568

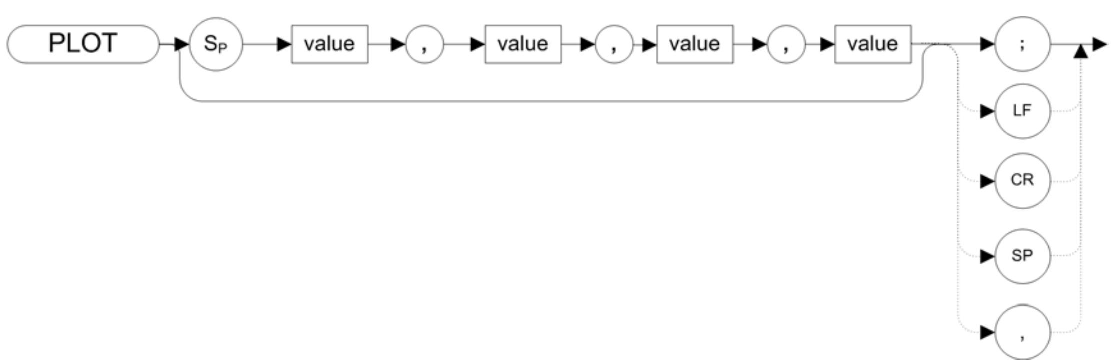
Description

Returns the X co-ordinate value of the maximum peak in the specified trace.

Format	PKPOS TRA|TRB|TRC
Query Data Type	The X co-ordinate value of the maximum peak in the specified trace.
SCPI Equivalent Commands	:CALCulate:MARKer12:MAXimum :CALCulate:MARKer12:X? (See "Marker Mode" on page 191)

10.4.217 PLOT (Plot)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Allows you transfer trace data, graticule and annotation information to a printer using a parallel port.

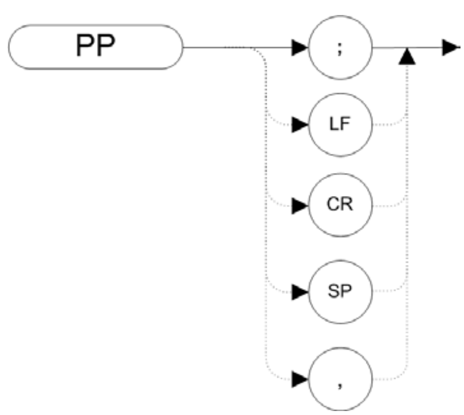
The legacy analyzers transferred data directly to a plotter via the GPIB connection. `PLOT` now transfers data to a printer, and prints the entire screen.

Although `PLOT` reads in plotter dimension values, RLC Mode ignores these.

Format	PLOT <value>,<value>,<value>,<value> RLC Mode ignores all plotter dimension <value> parameters.
Query Data Type	N/A
SCPI Equivalent Commands	:HCOPY[:IMMediate] (see "Print" on page 587)
Notes	In legacy instruments, `PLOT` also returns HPGL. RLC Mode does not return HPGL.

10.4.218 PP (Preselector Peak)

Syntax



Legacy Products

8560 series, 8566A/B

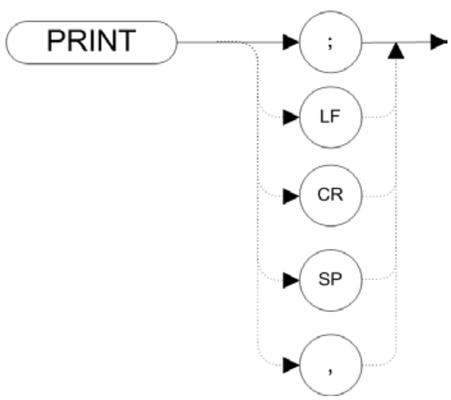
Description

Optimizes preselector tracking to peak the amplitude of a signal at the active marker. If a marker is not on the screen, PP places a marker at the highest signal level, and optimizes preselector tracking at that frequency.

Format	PP
Query Data Type	N/A
SCPI Equivalent Commands	[:SENSe]:POWer[:RF]:PCENter
Notes	This command is only supported when the X-series instrument's maximum frequency limit is greater than 3.6 GHz. If the command is sent to an instrument with a maximum frequency limit of 3.6 GHz or less, the command is not executed, and no error is generated

10.4.219 PRINT (Print)

Syntax



Legacy Products

8560 series

Description

Transfers trace data, graticule and annotation of the screen directly to the instrument's default printer.

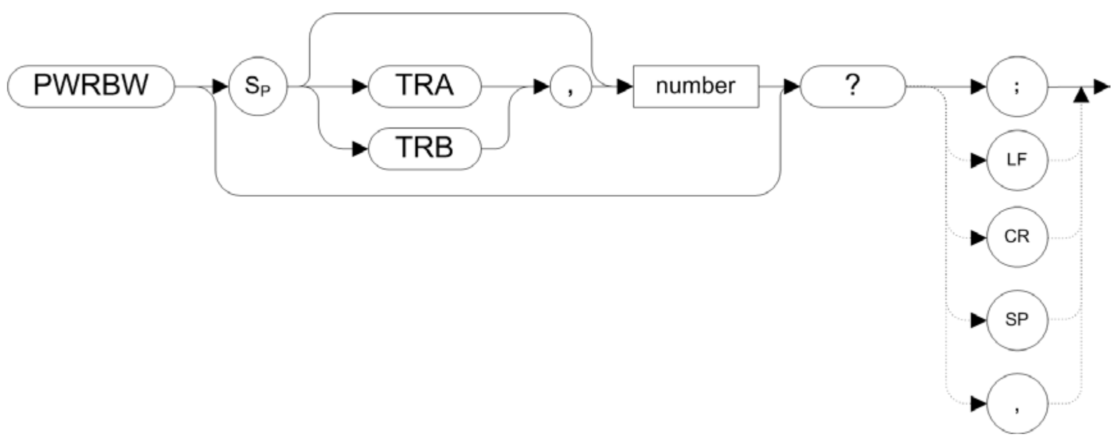
Format	PRINT [0|1] RLC Mode ignores all parameters for this command.

Query Data Type	N/A
SCPI Equivalent Commands	`:HCOPY[:IMMediate]`
	(see "Print" on page 587)

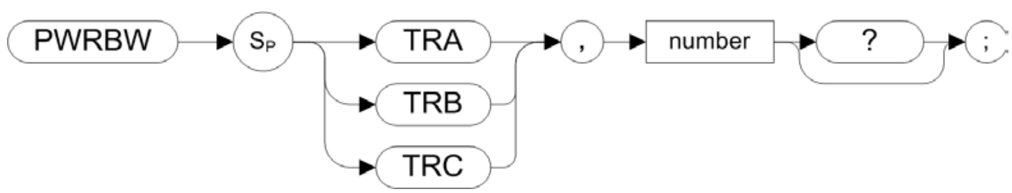
10.4.220 PWRBW (Power Bandwidth)

Syntax

8560 Series:



8566A/B, 8568A/B:



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

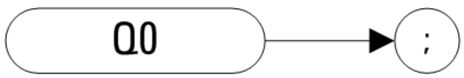
Computes the combined power of all signal responses in the specified trace, and returns the bandwidth of the specified percentage of total power. The number in the command is a percentage value, that is, it has a range of 0 to 100.

Format	8560 series: PWRBW TRA|TRB, <real>,?
	8566A/B, 8568A/B: PWRBW TRA|TRB|TRC, <real>
	Range: 0-100 (percentage)

Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	If the percent total power is 100%, the power bandwidth equals the frequency span. On the 8566A/B analyzers, this command stops the trace. That is not the case for RLC Mode.

10.4.221 Q0 (Set Detector to EMI Peak Detection)

Syntax



Legacy Products

8568A/B

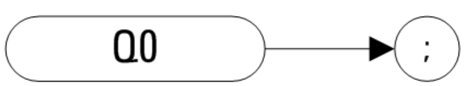
Description

Sets the detector function to EMI Peak detection. This is the same as the Peak detector but uses CISPR related bandwidths.

Format	`Q0`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The effect of `Q0` is identical to that of the `DET EPK` command. See "DET (Detection Mode)" on page 745

10.4.222 Q1 (Set Detector to Quasi Peak Detection)

Syntax



Legacy Products

8568A/B

Description

Sets the detector function to Quasi Peak detection. This is a fast-rise, slow-fall detector used to make CISPR compliant EMI measurements.

Format	`Q1`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The effect of `Q1` is identical to that of the `DET QPD` command. See "DET (Detection Mode)" on page 745

10.4.223 R1 (Illegal Command SRQ)

Syntax

Legacy Products

8566A/B, 8568A/B

Description

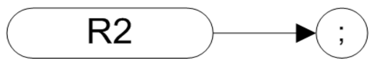
Deactivates all instrument service requests (SRQs) except `SRQ140`, the illegal-command service request.

The function is identical to `RQS 32` (see "RQS (Request Service Conditions)" on page 891).

Format	`R1`
Query Data Type	N/A
SCPI Equivalent Commands	None

10.4.224 R2 (End-of-Sweep SRQ)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

Activates the end-of-sweep and illegal-command service requests.

The function is identical to `RQS 36` (see "RQS (Request Service Conditions)" on page 891).

Format	`R2`
Query Data Type	N/A
SCPI Equivalent Commands	None

10.4.225 R3 (Hardware Broken SRQ)

Syntax

Legacy Products

8566A/B, 8568A/B

Description

Activates the hardware-broken and illegal-command service requests.

The function is identical to `RQS 40` (see "RQS (Request Service Conditions)" on page 891).

Format	R3
Query Data Type	N/A
SCPI Equivalent Commands	None

10.4.226 R4 (Units-Key-Pressed SRQ)

Syntax

Legacy Products

8566A/B, 8568A/B

Description

Activates the units-key-pressed and illegal-command SRQs.

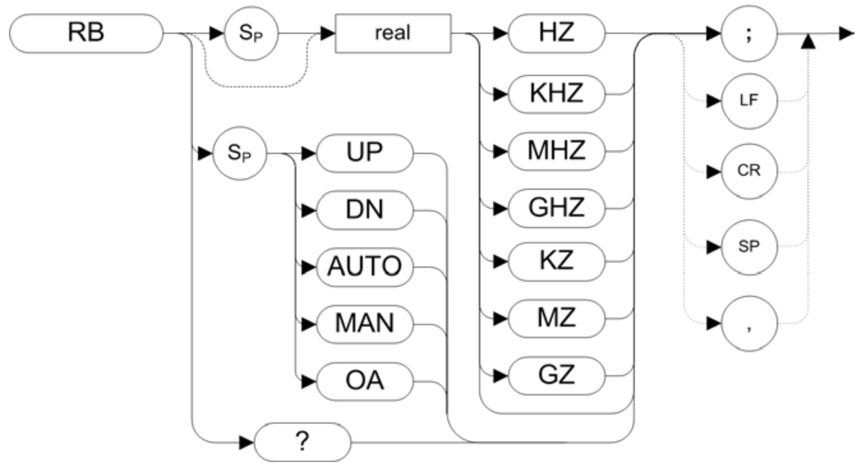
The function is identical to RQS 34 (see "RQS (Request Service Conditions)" on page 891).

Format	R4
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	X-Series instruments cannot replicate the units-key-pressed Service Request since no front panel interaction is supported

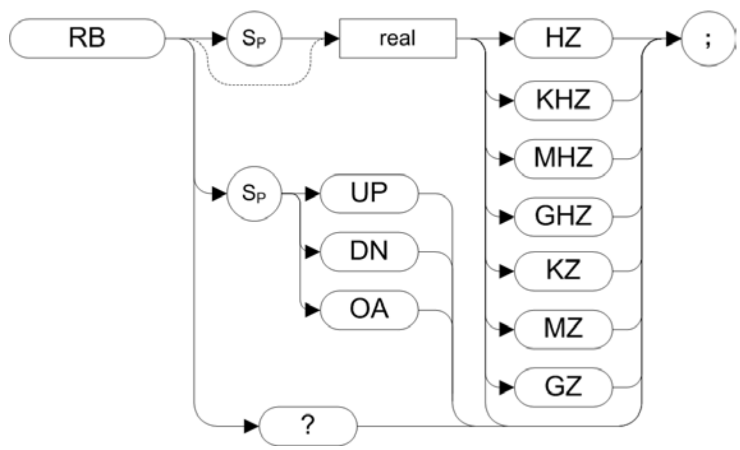
10.4.227 RB (Resolution Bandwidth)

Syntax

8560 series:



8566A/B, 8568A/B:



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

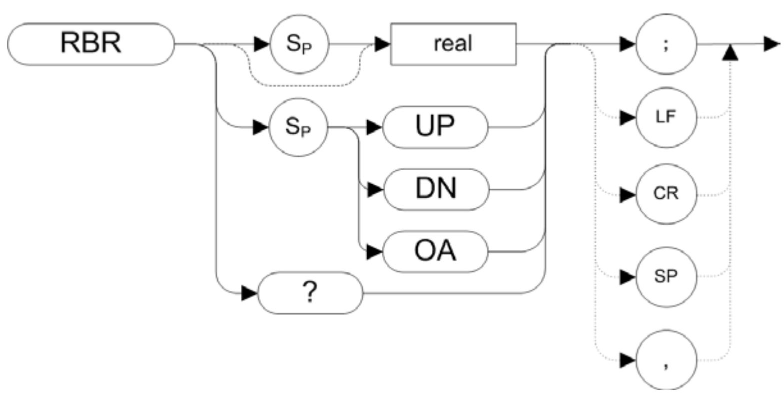
Specifies the resolution bandwidth. Available bandwidths are 1 Hz, 3 Hz, 10 Hz, 30 Hz, 300 Hz, 1 kHz, 3 kHz, 30 kHz, 100 kHz, 300 kHz, 1 MHz, and 3 MHz. The resolution bandwidths, video bandwidths, and sweep time are normally coupled, but executing `RB` decouples them. Execute "CR (Couple Resolution Bandwidth)" on page 739 to re-establish coupling.

Format	`RB <real>HZ|KHZ|MHZ|GHZ|KZ|MZ|GZ`
	`RB UP|DN`
	UP or DN increments in a 1, 3, 10 sequence
	`RB AUTO|MAN` (8560 series only)

	RB OA
	RB?
Query Data Type	N/A
SCPI Equivalent Commands	[:SENSe]:BANDwidth[:RESolution] <real>
	[:SENSe]:BANDwidth[:RESolution]?
	[:SENSe]:BANDwidth[:RESolution]:AUTO OFF|ON|0|1
	[:SENSe]:BANDwidth[:RESolution]:AUTO?
Preset	8560 series: Coupled mode, 1 MHz
	8566A/B, 8568A/B: Coupled mode, 3 MHz
Notes	Default values on X-Series instruments may vary from the legacy analyzers. Refer to the X-Series User's and Programmer's Reference for the selected Mode to find out any restrictions that may apply

10.4.228 RBR (Resolution Bandwidth to Span Ratio)

Syntax



Legacy Products

8560 series

Description

Sets the coupling ratio between the frequency span and the resolution bandwidth. It allows you to set the Span/RBW ratio to 1/<value>, where <value> is set by the user.

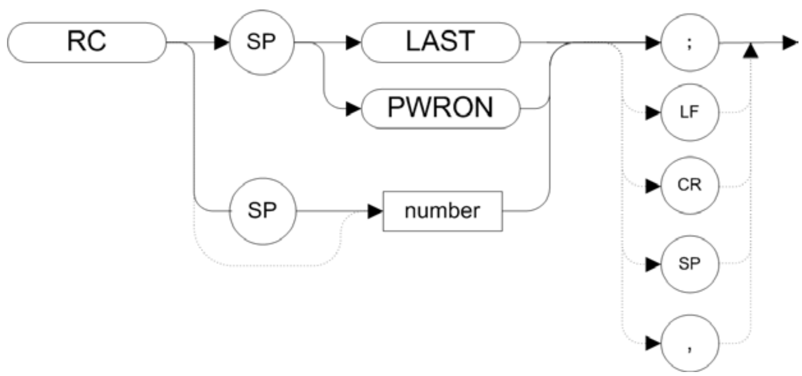
Format	RBR <real>
	RBR UP|DN
	UP or DN increments in a 1, 2, 5 sequence

	RBR OA
	RBR?
Query Data Type	<real> in RBR units
SCPI Equivalent Commands	[:SENSe]:FREQuency:SPAN:BANDwidth [:RESolution]:RATio <integer>

10.4.229 RC (Recall State)

Syntax

8560 series:



8566A/B, 8568A/B:

Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Recalls instrument state data from the specified state register in the instrument's memory.

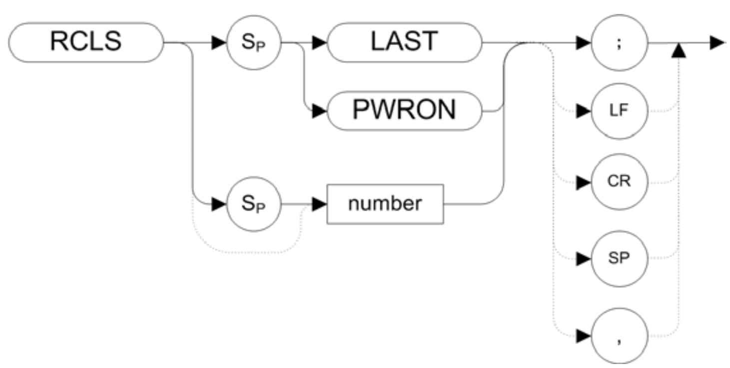
- Registers 1 through 6 are reserved for the user, and contain instrument states (such as front panel configuration) saved with "SAVES (Save State)" on page 895 or "SV (Save State)" on page 910.
- Option LAST: recalls the instrument state that existed previous to executing the IP command or switching the instrument off. 8566/8 instruments use register 7 for this purpose.

– Option PWRON: sets the instrument state to the same state that occurred when the instrument was switched on. This state was originally saved using the SAVES command.

Format	RC <integer> Range: 1-6 RC LAST|PWRON See Description above
Query Data Type	N/A
SCPI Equivalent Commands	*RCL <integer>
Notes	The functions of RC are identical to "RCLS (Recall State)" on page 885

10.4.230 RCLS (Recall State)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Recalls instrument state data from the specified state register in the instrument's memory.

– Registers 1 through 6 are reserved for the user, and contain instrument states (such as front panel configuration) saved with "SAVES (Save State)" on page 895 or "SV (Save State)" on page 910.

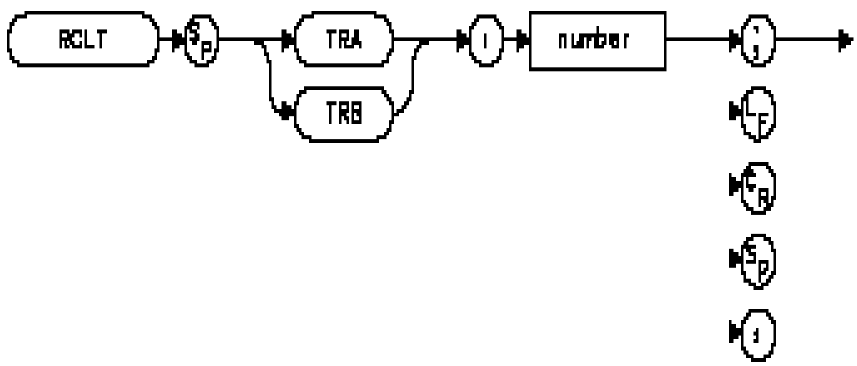
– Option LAST: recalls the instrument state that existed previous to executing the IP command or switching the instrument off. 8566/8 instruments use register 7 for this purpose.

– Option PWRON: sets the instrument state to the same state that occurred when the instrument was switched on. This state was originally saved using SAVES.

Format	RCLS <integer>
	Range: 1-6
	RCLS LAST|PWRON
	See Description above
Query Data Type	N/A
SCPI Equivalent Commands	*RCL <integer>
Notes	The functions of RCLS are identical to "RC (Recall State)" on page 884

10.4.231 RCLT (Recall Trace)

Syntax



Legacy Products

8560 series

Description

Recalls previously saved trace data, amplitude factors, or limit-line data from the specified trace register. Trace data is recalled with instrument state, date, and screen title.

If an Agilent 85620A mass memory module is attached to the spectrum analyzer, trace registers 5, 6, and 7 are used by the Agilent 85620A module.

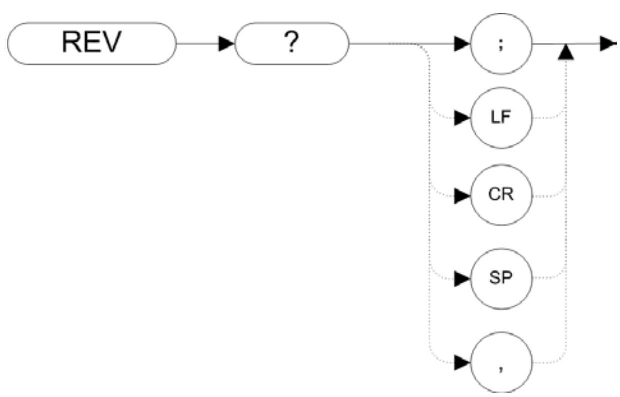
If an integer less than zero is specified, the value defaults to zero; if an integer greater than 7 is specified, the value defaults to 7.

Format	RCLT TRA|TRB, <integer> – TRA recalls data to trace A – TRB recalls data to trace B – <integer> Range: 0-7
Query Data Type	N/A

SCPI Equivalent Commands	`:MMEMory:LOAD:TRACe:TUPDate`
	As Saved – to ensure trace update not changed to Off
	`:MMEMory:LOAD:TRACe TRACE1 Register#`
	where Register# matches the <integer> parameter passed into RCLT. Trace TRA
	`:MMEMory:LOAD:TRACe TRACE2 Register#`
	where Register# matches the <integer> parameter passed into RCLT. Trace TRB

10.4.232 REV (Revision)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Returns the firmware revision number.

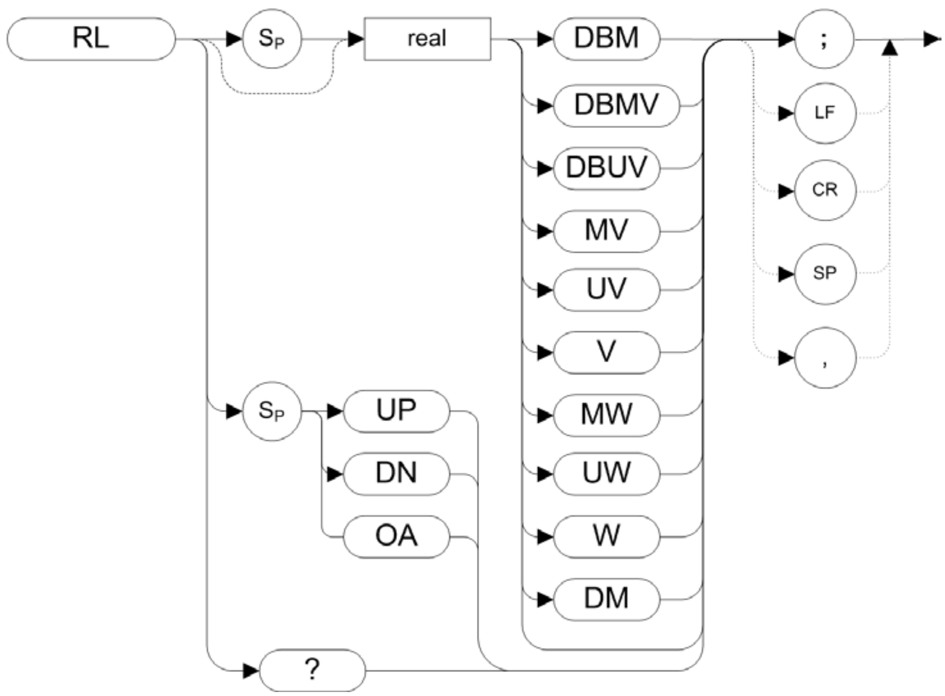
In X-Series instruments, this command returns the build date of the RLC Mode application that you have installed in your instrument. The date is returned in YYMMDD format (where YY is the number of years since 1950, and MM is the month and DD is the date).

Format	REV?
Query Data Type	Firmware revision number.
SCPI Equivalent Commands	None

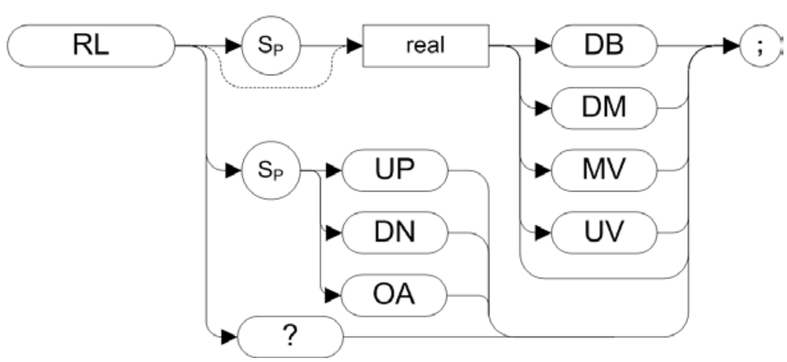
10.4.233 RL (Reference Level)

Syntax

8560 series:



8566A/B, 8568A/B:



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

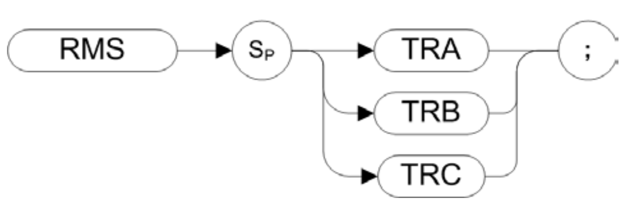
Specifies the amplitude level of the top graticule line on the display. This represents the reference level.

Signal levels above +30 dBm will damage the instrument.

Format	8560 series: RL <real>DBM|DBMV|DBUV|MV|UV|V|MW|UW|W|DM 8566A/B, 8568A/B: RL <real>DB|DM|MV|UV Range (MXA and PXA): –170 dBm to +30 dBm, with 0 dB attenuation Range (EXA): –170 dBm to +23 dBm RL UP|DN UP or DN increments by one vertical division in log mode, and in a 1, 2, 5 sequence in linear mode RL OA RL?
Query Data Type	<real> in dBm [LG] or V [LN]
SCPI Equivalent Commands	`:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:RLEVel <real>`
Preset	0
Couplings	If the display line is on, changing the reference level does not adjust the position of the display line
Notes	The Reference Level range for the 8566A/B and 8568A/B is –89.9 dBm to +30 dBm

10.4.234 RMS (Root Mean Square Value)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

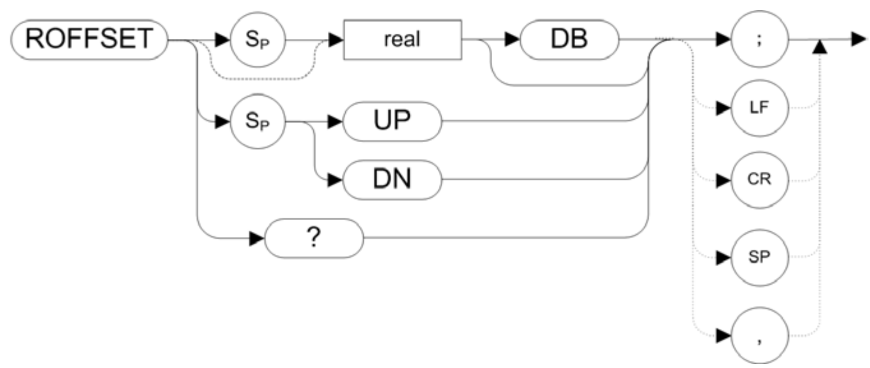
Returns the RMS value of the trace, in display units.

Format	RMS TRA|TRB|TRC
Query Data Type	RMS value of the trace, in display units.
SCPI Equivalent Commands	None

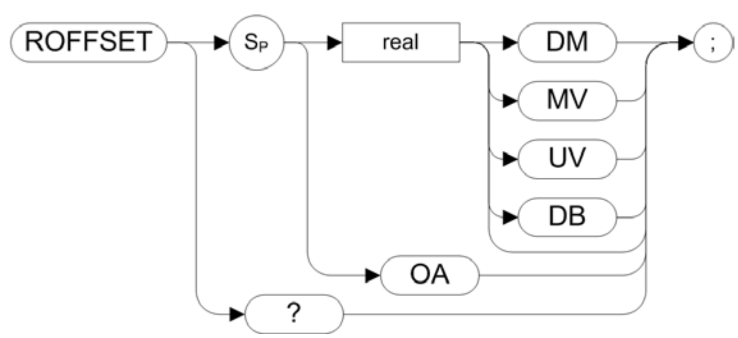
10.4.235 ROFFSET (Reference Level Offset)

Syntax

8560 series:



8566A/B, 8568A/B:



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Offsets all amplitude readouts without affecting the trace.

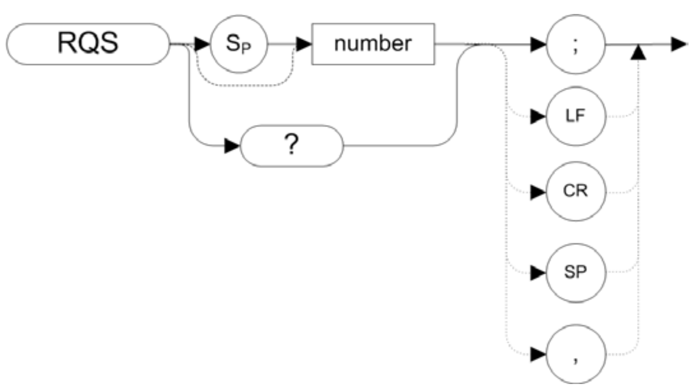
Once activated, ROFFSET displays the amplitude offset on the left side of the screen.

Sending ROFFSET 0 or presetting the instrument eliminates any amplitude offset.

Format	ROFFSET <real>DM|MV|UV|DB ROFFSET UP|DN (8560 series only) UP or DN increments one vertical division ROFFSET OA ROFFSET?
Query Data Type	<real> in dB
SCPI Equivalent Commands	:DISPlay:WINDow[1]:TRAC:eY[:SCALe]:RLEVel:OFFSet <rel_ampl> :DISPlay:WINDow[1]:TRACe:Y[:SCALe]:RLEVel:OFFSet?
Preset	0
Notes	For 8566A/B, 8568A/B, the functions of ROFFSET are identical to "KSZ (Reference Level Offset)" on page 806

10.4.236 RQS (Request Service Conditions)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Sets a bit mask for service requests, each service request has a corresponding bit number and decimal equivalent of that bit number as shown in the table below. Use the decimal equivalents to set the bit mask.

For example, to set a mask for bits 4 and 5, add the decimal equivalents (16 + 32 = 48), then send RQS 48.

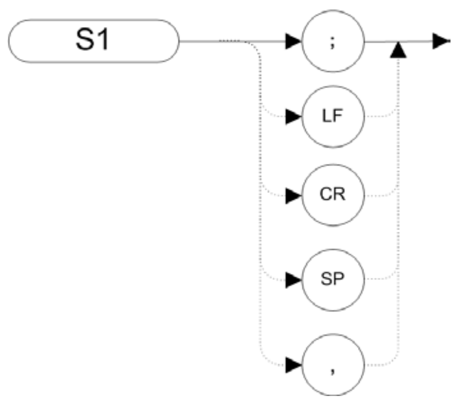
Status Byte Definition

Bit#	State	Description
7		
6	RQS	Request Service
5	Error Present	
4	Command Complete	Any command completed.
3		
2	End of Sweep	Any sweep completed.
1	Message	Display message appears.
0	Trigger	Trigger activated.

Format	RQS <bit number> RQS OA RQS?
Query Data Type	The current bit mask.
SCPI Equivalent Commands	*SRE *SRE? STATus:OPERation:ENABle <integer> STATus:OPERation:ENABle? STATus:OPERation:NTRansition <integer> STATus:OPERation:NTRansition?

10.4.237 S1 (Continuous Sweep)

Syntax



Legacy Products

8566A/B, 8568A/B

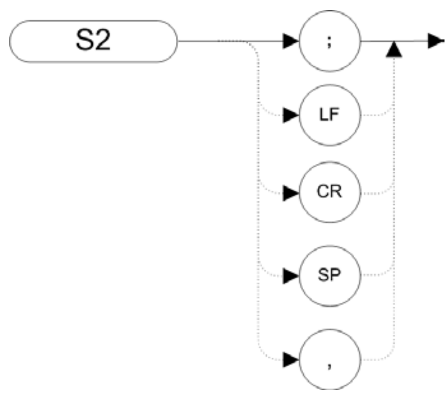
Description

Sets the instrument to continuous sweep mode. In the continuous sweep mode, the instrument takes its next sweep as soon as possible after the current sweep (as long as the trigger conditions are met). A sweep may temporarily be interrupted by data entries made over the remote interface.

Format	`S1`
Query Data Type	N/A
SCPI Equivalent Commands	Note that the following SCPI command is not supported in RLC Mode: `:INITiate:CONTinuous 1` see "Sweep/Measure" on page 317
Notes	The functions of `S1` are identical to "CONTS (Continuous Sweep)" on page 737

10.4.238 S2 (Single Sweep)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

Sets the instrument to single sweep mode. Each subsequent time that this command is sent, one sweep is started if the trigger conditions are met.

Format	`S2`
Query Data Type	N/A
SCPI Equivalent Commands	Note that the following SCPI command is not supported in RLC Mode: `:INITiate:CONTinuous 0` see "Sweep/Measure" on page 317
Notes	The functions of `S2` are similar to "SNGLS (Single Sweep)" on page 901

10.4.239 SADD (Add Limit Line Segment)

Syntax

Legacy Products

8560 series

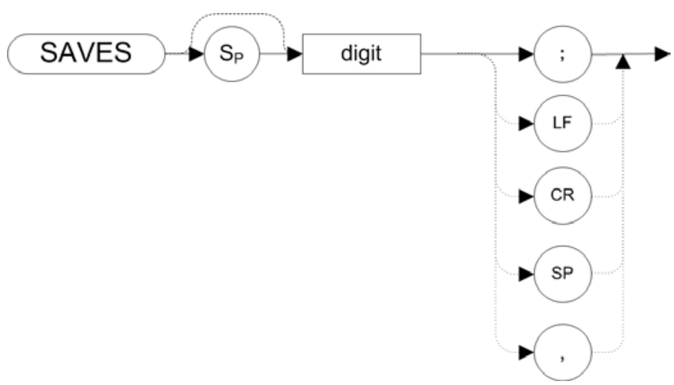
Description

Used to add a limit-line segment to the current limit line.

Format	SADD
Query Data Type	N/A
SCPI Equivalent Commands	None

10.4.240 SAVES (Save State)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

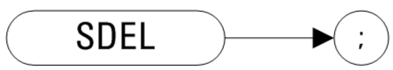
Saves the current state of the instrument in any of the registers one through six.

Format	`SAVES <integer>`
	Range: 1-6
	`SAVES PWRON`
	PWRON sets the instrument to the state it was in when power was turned on.

Query Data Type	N/A
SCPI Equivalent Commands	`*SAV <integer>`
Notes	The functions of `SAVES` are identical to "SV (Save State)" on page 910

10.4.241 SDEL (Delete Limit Line Segment)

Syntax



Legacy Products

8560 series

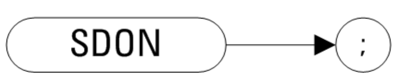
Description

Deletes the limit-line segment specified with the command "SEDI (Edit Limit Line Segment)" on page 897.

Format	SDEL
Query Data Type	N/A
SCPI Equivalent Commands	None

10.4.242 SDON (Terminate SEDI Command)

Syntax



Legacy Products

8560 series

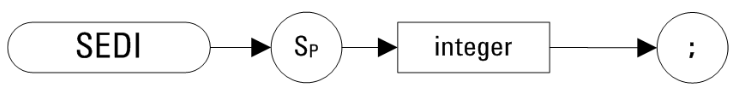
Description

Used to terminate the command "SEDI (Edit Limit Line Segment)" on page 897.

Format	SDON
Query Data Type	N/A
SCPI Equivalent Commands	None

10.4.243 SEDI (Edit Limit Line Segment)

Syntax



Legacy Products

8560 series

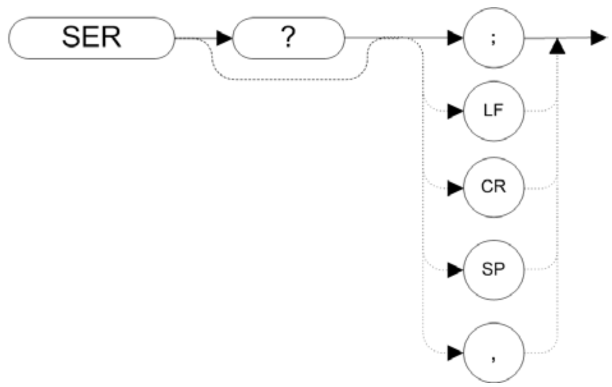
Description

Activates the limit-line segment you identify by its segment number in the limit-line table.

Format	SEDI <integer>
Query Data Type	N/A
SCPI Equivalent Commands	None

10.4.244 SER (Serial Number)

Syntax



Legacy Products

8560 series

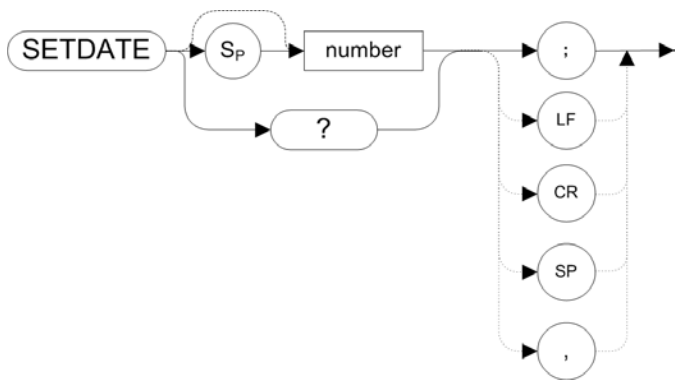
Description

Returns the X-series instrument serial number to the controller.

Format	SER OA SER?
Query Data Type	Serial number.
SCPI Equivalent Commands	`*IDN?` see "*IDN? - Identification Query" on page 639

10.4.245 SETDATE (Set Date)

Syntax



Legacy Products

8560 series

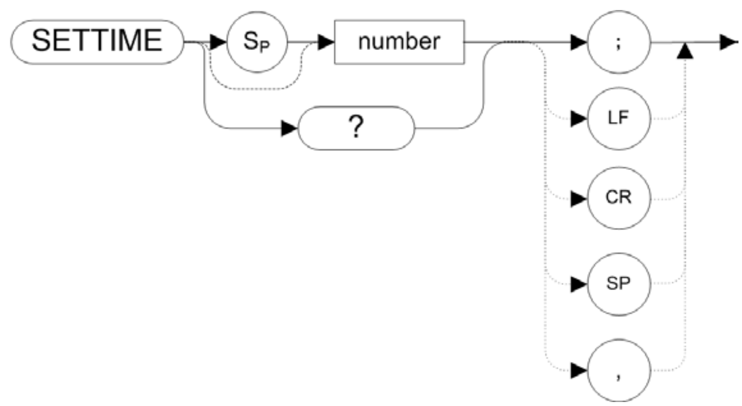
Description

Sets the date of the real-time clock of the instrument. The date takes the form YYMMDD (Year, Month, Day)

Format	SETDATE <number>
	SETDATE?
Query Data Type	YYMMDD
SCPI Equivalent Commands	:SYSTem:DATE “YYYY,MM,DD”

10.4.246 SETTIME (Set Time)

Syntax



Legacy Products

8560 series

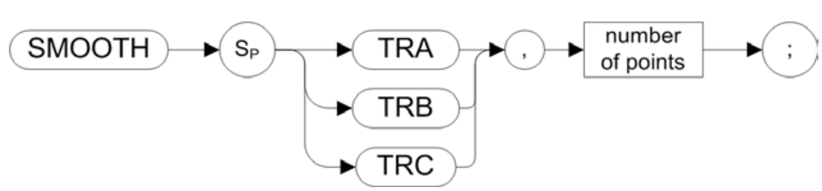
Description

Sets the date of the real-time clock of the instrument. The time takes the form HHMMSS (Hour, Minute, Second).

Format	SETTIME <number>
	SETTIME?
Query Data Type	HHMMSS
SCPI Equivalent Commands	:SYSTem:TIME “HH,MM,SS”

10.4.247 SMOOTH (Smooth Trace)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

Smooths the trace according to the number of points specified for the running average.

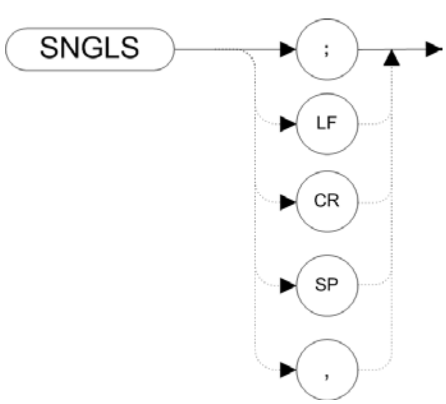
Each point value is replaced with the average of the values (in measurement units) of the given number of points centered on it. Increasing the number of points increases smoothing at the cost of decreasing resolution. If the number of points is an even number, then the number of points is increased by one.

Smoothing decreases at the endpoints.

Format	`SMOOTH TRA|TRB|TRC,<number>` TRA corresponds to Trace 1, TRB corresponds to Trace 2, and TRC corresponds to Trace 3
Query Data Type	N/A
SCPI Equivalent Commands	`:TRACe:MATH:SMOoth TRACE(1|2|3|4|5|6)` `:CALCulate:DATA:COMPress? ...`
Notes	Prerequisite Commands: "TS (Take Sweep)" on page 929 when using trace data Some differences may be noticed between the smoothed trace in the legacy analyzers and the smoothed trace using the same signal in X-Series instruments

10.4.248 SNGLS (Single Sweep)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

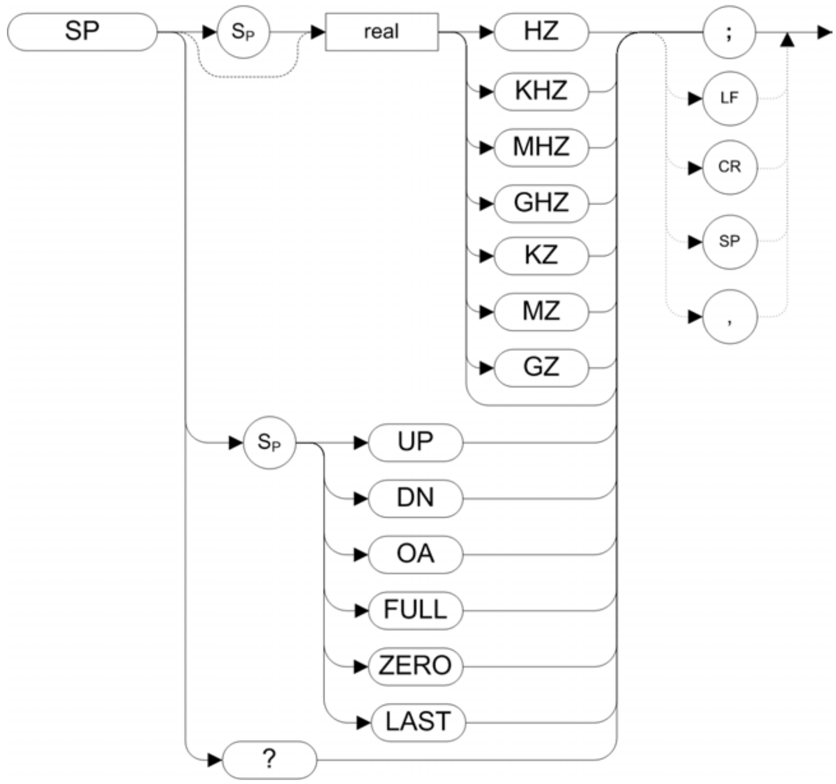
Sets the instrument to single-sweep mode. Each time "TS (Take Sweep)" on page 929 is sent, one sweep taken as long as the trigger conditions are met.

Format	`SNGLS`
Query Data Type	N/A
SCPI Equivalent Commands	Note that the following SCPI command is not supported in RLC Mode: `:INITiate:CONTinuous 0` see "Sweep/Measure" on page 317
Notes	The functions of `SNGLS` are identical to "S2 (Single Sweep)" on page 894

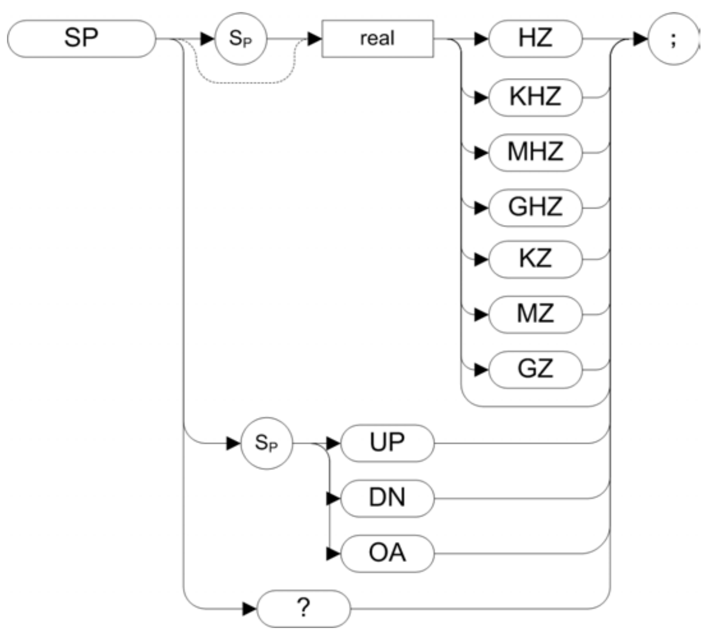
10.4.249 SP (Frequency Span)

Syntax

8560 series:



8566A/B, 8568A/B:



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Changes the total displayed frequency range symmetrically about the center frequency.

Format	`SP <real>HZ|KHZ|MHZ|GHZ|KZ|MZ|GZ`
	`SP UP|DN`
	Step Increment: 1, 2, 5, 10 sequence (up to the stop frequency of the instrument)
	8560 series only:
	`SP FULL|ZERO|LAST`
	`SP OA`
	`SP?`

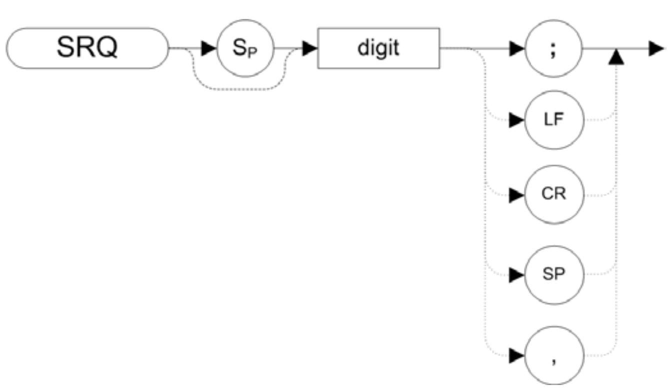
Query Data Type	<real> in Hz

SCPI Equivalent Commands	`[:SENSe]:FREQuency:SPAN <freq>`
	`[:SENSe]:FREQuency:SPAN?`
	`[:SENSe]:FREQuency:SPAN:PREVious`

Preset	856x: Full Span 8566: 20 GHz
Couplings	If resolution and video bandwidths are coupled to the span width, the bandwidths change with the span width to provide a predetermined level of resolution and noise averaging. Likewise, the sweep time changes to maintain a calibrated display, if coupled All of these functions are normally coupled, unless "RB (Resolution Bandwidth)" on page 881, "VB (Video Bandwidth)" on page 933, or "ST (Sweep Time)" on page 906 have been executed

10.4.250 SRQ (Service Request)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

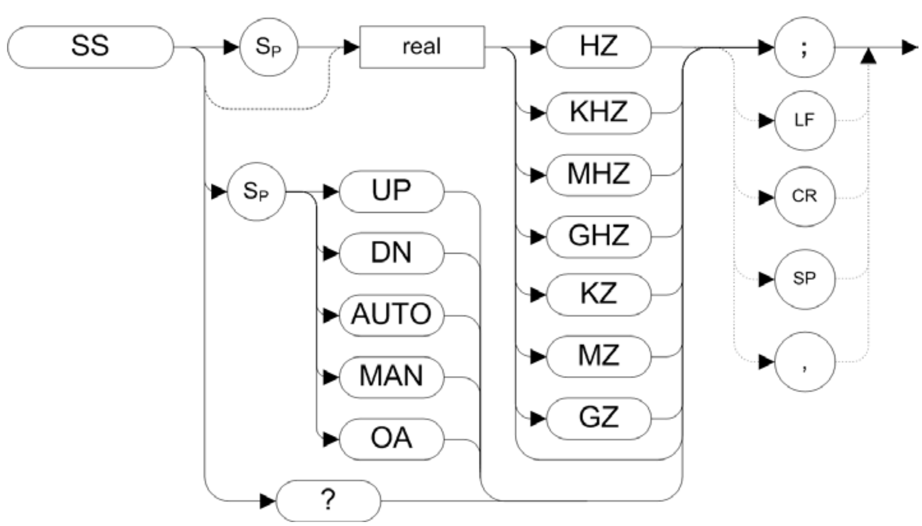
Sends a service request to the controller when the SRQ operand fits the mask supplied with "RQS (Request Service Conditions)" on page 891.

Format	SRQ <digit>
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	RLC Mode does not support the setting of bit 1 (units-key-pressed) of the status byte. Bit 1 of the status byte is always set to Off.

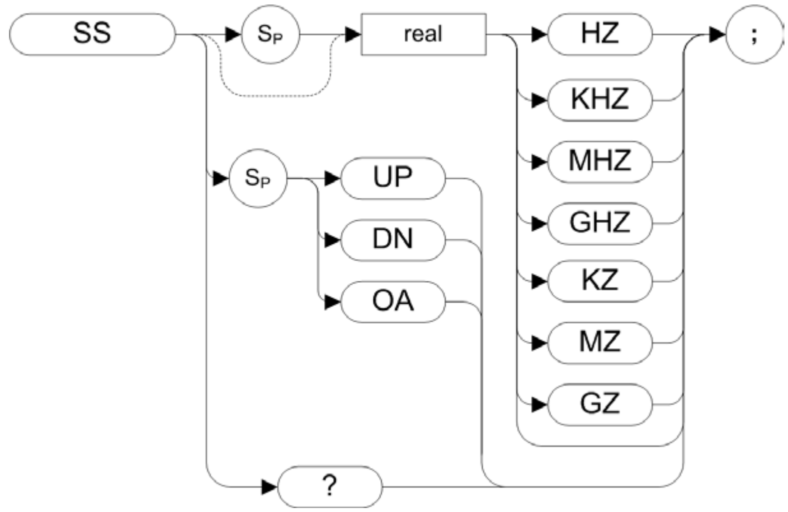
10.4.251 SS (Center Frequency Step Size)

Syntax

8560 series:



8566A/B, 8568A/B:



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

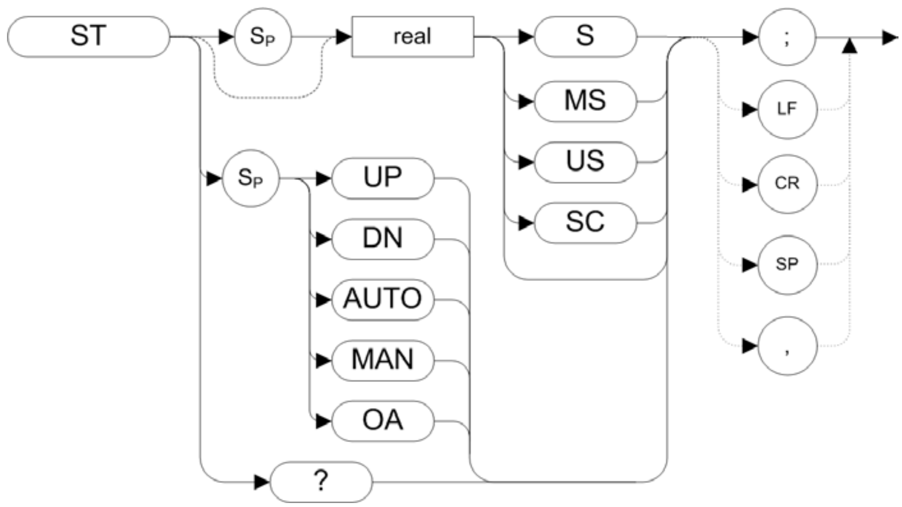
Specifies the center frequency step size.

Format	SS <real>HZ|KHZ|MHZ|GHZ|KZ|MZ|GZ
	Range: 25 to hardware maximum
	SS UP|DN
	UP or DN increments in a 1, 2, 5, 10 sequence
	SS AUTO|MAN (8560 series only)
	SS OA
	SS?
Query Data Type	<real> in Hz
SCPI Equivalent Commands	`[:SENSe]:FREQuency:CENTer:STEP:AUTO ON|OFF`
	`[:SENSe]:FREQuency:CENTer:STEP[:INCRement] <freq>`
Preset	10 percent of span (1/4 of Res BW if zero-span)

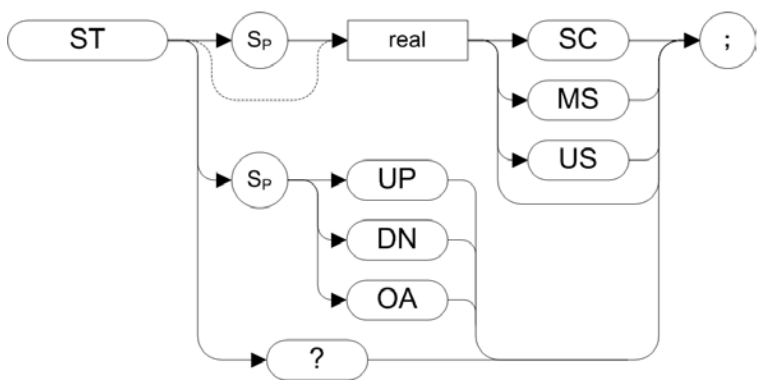
10.4.252 ST (Sweep Time)

Syntax

8560 series:



8566A/B, 8568A/B:



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

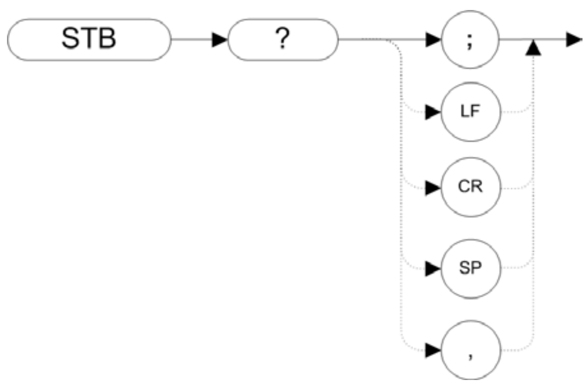
Specifies the time in which the instrument sweeps the displayed frequency or time span.

Format	ST <real>S|MS|US|SC ST UP|DN UP or DN: Increments in a 1,2,5 sequence ST AUTO|MAN (8560 series only) ST OA ST? The `OA` option in the `ST` command behaves in the same manner as the `ST?` query, in that it returns the current value to the controller. However, the `OA` option does **not** set the active function

	to Sweep Time
Query Data Type	<real> in seconds
SCPI Equivalent Commands	`[:SENSe]:SWEep:TIME <time>`
	`[:SENSe]:SWEep:TIME:AUTO ON`
Preset	AUTO

10.4.253 STB (Status Byte Query)

Syntax



Legacy Products

8560 series

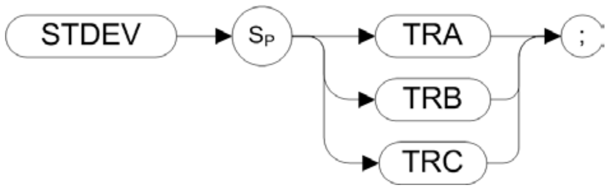
Description

Returns to the controller the decimal equivalent of the bits set in the status byte (see "RQS (Request Service Conditions)" on page 891 and "SRQ (Service Request)" on page 904). STB is equivalent to a serial poll.

Format	`STB?`
Query Data Type	Status Byte (8 bits)
SCPI Equivalent Commands	`*STB?`

10.4.254 STDEV (Standard Deviation of Trace Amplitudes)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

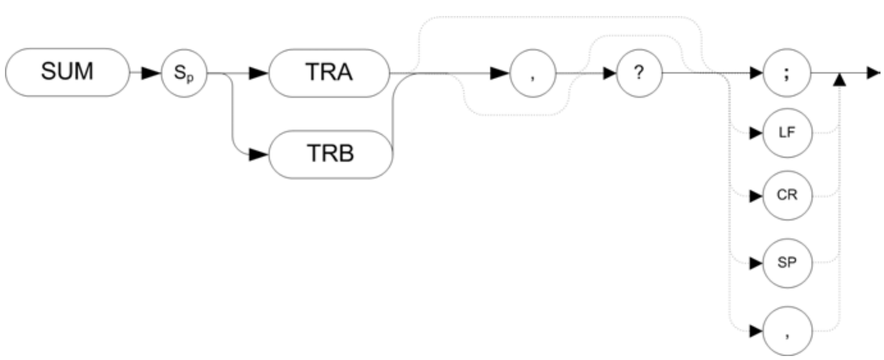
Returns the standard deviation of the trace amplitude in display units.

Format	STDEV TRA|TRB|TRC TRA corresponds to Trace 1, TRB corresponds to Trace 2, and TRC corresponds to Trace 3.
Query Data Type	Standard deviation of the trace amplitude in display units.
SCPI Equivalent Commands	:TRACe[:DATA]? TRACE(1|2|3|4|5|6)
Notes	Prerequisite Commands: "TS (Take Sweep)" on page 929 when using trace data

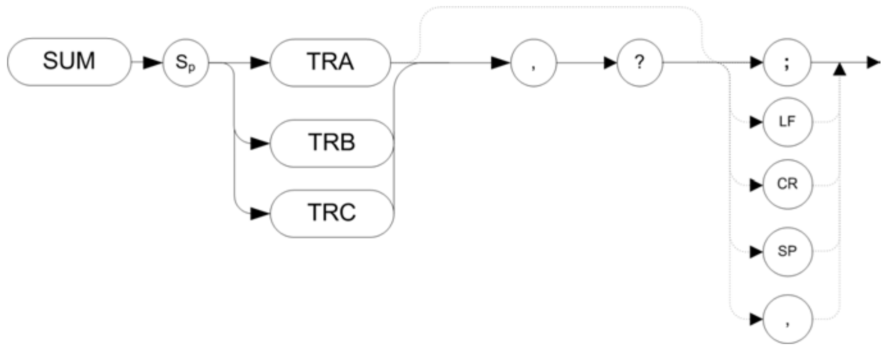
10.4.255 SUM (Sum)

Syntax

8560 Series:



8566A/B, 8568A/B:



Legacy Products

8560 series

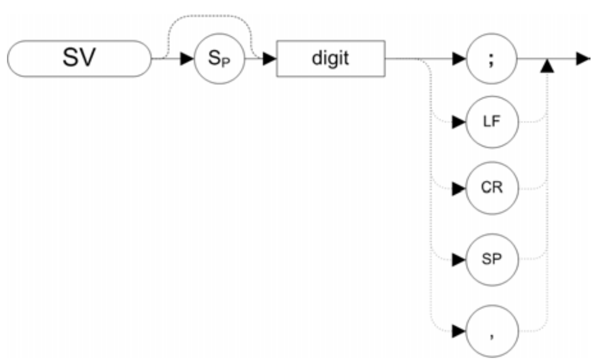
Description

Returns the sum of all the trace values to the controller.

Format	SUM TRA|TRB|TRC(,)(?)
Query Data Type	Sum of all the trace values. The 8560 series returns display units, range (0-610)*601 points, or, if "TDF (Trace Data Format)" on page 919 is set to M, it returns ASCII.
SCPI Equivalent Commands	None

10.4.256 SV (Save State)

Syntax



Legacy Products

8566A/B, 8568A/B

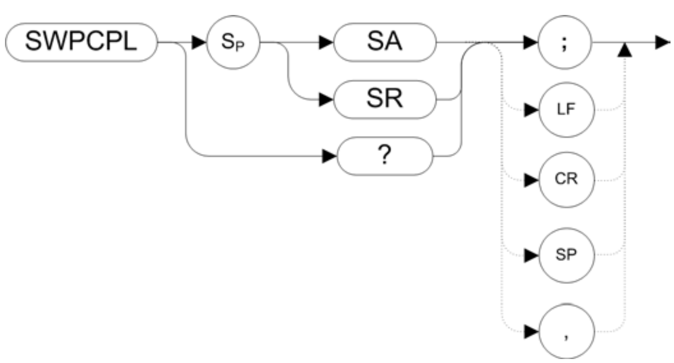
Description

Saves the current state of the instrument in any of the registers one through six.

Format	`SV <integer>`
Query Data Type	N/A
SCPI Equivalent Commands	`*SAV <integer>`
Notes	The functions of `SV` are identical to "SAVES (Save State)" on page 895

10.4.257 SWPCPL (Sweep Couple)

Syntax



Legacy Products

8560 series

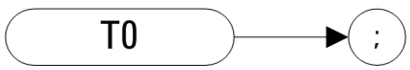
Description

Selects either a stimulus-response (SR) or signal-analyzer (SA) auto-coupled sweep time. In stimulus response mode, auto-coupled sweep times are usually much faster for swept response measurements. Stimulus response auto-coupled sweep times are typically valid in stimulus-response measurements when the system frequency span is less than 20 times the bandwidth of the device under test.

Format	SWPCPL SA|SR SWPCPL?
Query Data Type	SA|SR
SCPI Equivalent Commands	`[:SENSe]:SWEep:TIME:AUTO:RULes NORMal|ACCuracy|SRESponse` `[:SENSe]:SWEep:TIME:AUTO:RULes?`
Preset	SA

10.4.258 T0 (Turn Off Threshold Level)

Syntax



Legacy Products

8566A/B, 8568A/B

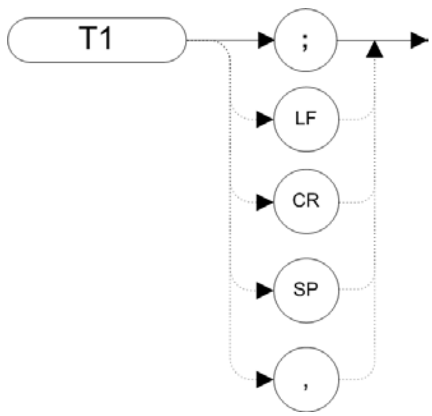
Description

Removes the threshold boundary and its readout from the display.

Format	`T0`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of `T0` are identical to `THE OFF`. See "THE (Threshold Enable)" on page 921

10.4.259 T1 (Free Run Trigger)

Syntax



Legacy Products

8566A/B, 8568A/B

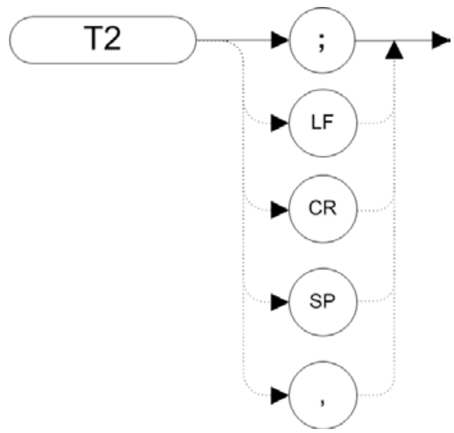
Description

Sets the instrument sweep to free run trigger mode.

Format	`T1`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of `T1` are identical to `TM FREE`. See "TM (Trigger Mode)" on page 924

10.4.260 T2 (Line Trigger)

Syntax



Legacy Products

8566A/B, 8568A/B

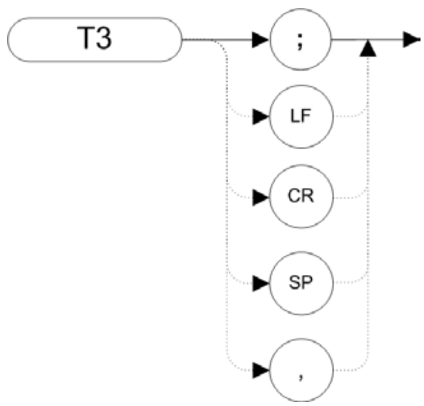
Description

Sets the instrument sweep to line trigger mode.

Format	`T2`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of `T2` are identical to `TM LINE`. See "TM (Trigger Mode)" on page 924

10.4.261 T3 (External Trigger)

Syntax



Legacy Products

8566A/B, 8568A/B

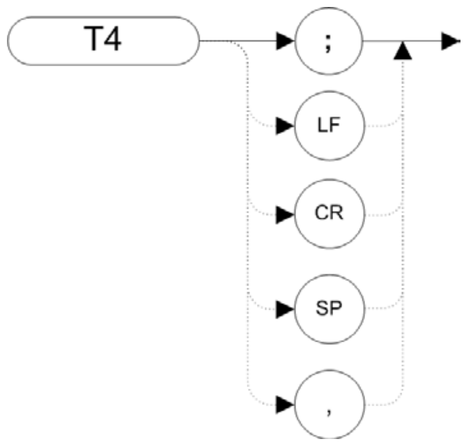
Description

Sets the instrument sweep to external trigger mode.

Format	`T3`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of `T3` are identical to `TM EXT`. See "TM (Trigger Mode)" on page 924

10.4.262 T4 (Video Trigger)

Syntax



Legacy Products

8566A/B, 8568A/B

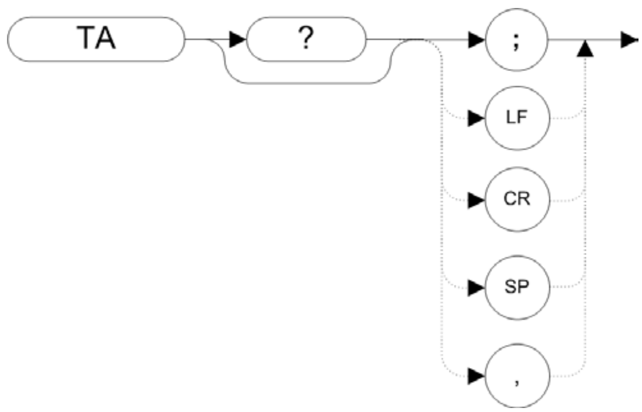
Description

Sets the instrument sweep to video trigger mode.

Format	`T4`
Query Data Type	N/A
SCPI Equivalent Commands	None
Notes	The functions of `T4` are identical to `TM VID`. See "TM (Trigger Mode)" on page 924

10.4.263 TA (Trace A)

Syntax



Legacy Products

8566A/B, 8568A/B

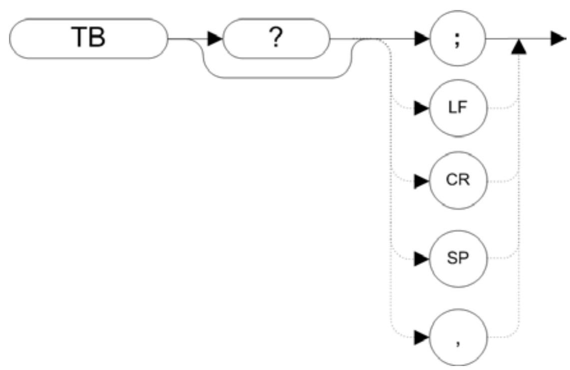
Description

Returns trace A amplitude values from the instrument to the controller.

Format	`TA?`
Query Data Type	The display unit values are transferred in sequential order (from left to right) as seen on the screen. Display unit values can be transferred to the controller in any one of the four output formats as determined by "O1 (Format - Display Units)" on page 866, "O2 (Format - Two 8-Bit Bytes)" on page 866, "O3 (Format - Real Amplitude Units)" on page 867 and "O4 (Format - One 8-Bit Byte)" on page 867 The format of the returned data is also affected by "TDF (Trace Data Format)" on page 919, and if `TDF B` (binary data format) has been selected, by "MDS (Measurement Data Size)" on page 826
SCPI Equivalent Commands	`:TRACe[:DATA]? TRACE(1|2|3|4|5|6)` `:FORMat:[:TRACe][:DATA]`

10.4.264 TB (Trace B)

Syntax



Legacy Products

8566A/B, 8568A/B

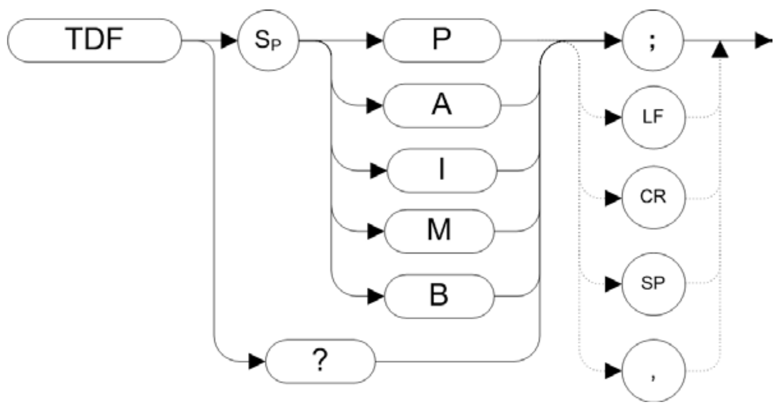
Description

Returns trace B amplitude values from the instrument to the controller.

Format	`TB?`
Query Data Type	The display unit values are transferred in sequential order (from left to right) as seen on the screen. Display unit values can be transferred to the controller in any one of the four output formats as determined by "O1 (Format - Display Units)" on page 866, "O2 (Format - Two 8-Bit Bytes)" on page 866, "O3 (Format - Real Amplitude Units)" on page 867 and "O4 (Format - One 8-Bit Byte)" on page 867 The format of the returned data is also affected by "TDF (Trace Data Format)" on page 919, and, if `TDF B` (binary data format) has been selected, by "MDS (Measurement Data Size)" on page 826
SCPI Equivalent Commands	`:TRACe? TRACE(1|2|3|4|5|6)` `:FORMat[:TRACe][:DATA]`

10.4.265 TDF (Trace Data Format)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Formats trace information for return to the controller.

The different trace data formats are as follows:

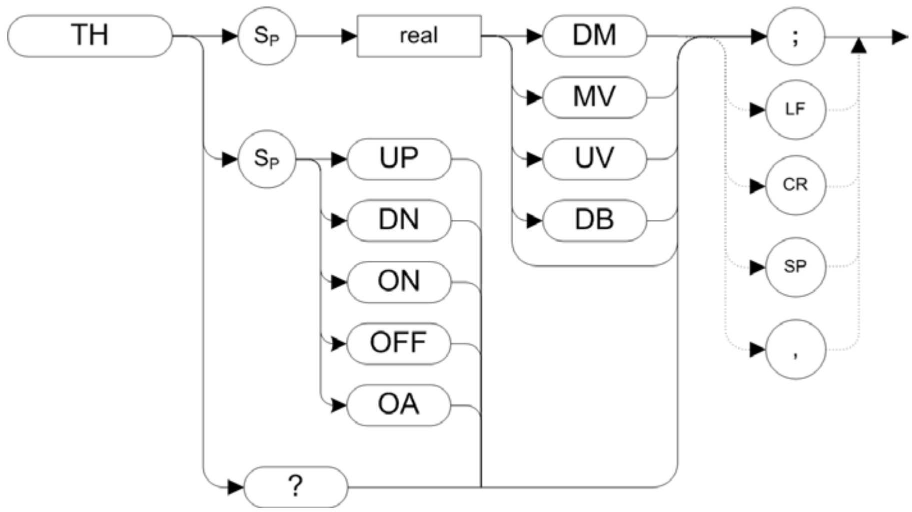
Option	Format
P	Parameter data format. Numbers are in Hz, Volts, Watts, dBm, dBmV, DBuV, DBV.
A	Returns data as an A-block data field. `MDS` determines whether data comprises one or two 8-bit bytes. (See "MDS (Measurement Data Size)" on page 826.)
I	Returns data as an I-block data field. `MDS` determines whether data comprises one or two 8-bit bytes. (See "MDS (Measurement Data Size)" on page 826.)
M	ASCII data format.
B	Binary data format. `MDS` determines whether data comprises one or two 8-bit bytes. (See "MDS (Measurement Data Size)" on page 826.)

Format	`TDF P|A|I|M|B` `TDF?`
Query Data Type	`P|A|I|M|B`
SCPI Equivalent Commands	`:FORMat[:TRACe][:DATA] ASCii | INTeger,32 | REAL,32 | REAL,64`
Preset	`P`

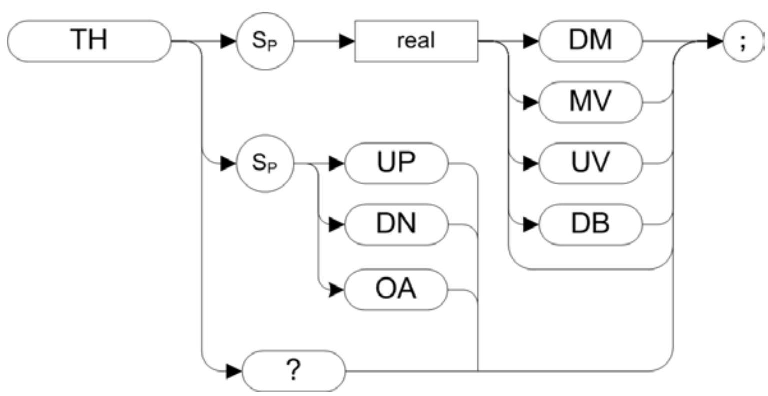
10.4.266 TH (Threshold)

Syntax

8560 series:



8566A/B, 8568A/B:



Legacy Products

8560 series, 8566A/B, 8568A/B

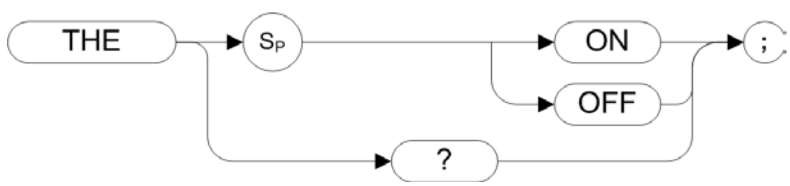
Description

Blanks signal responses below the threshold level, similar to a base line clipper. The threshold level is nine major divisions below the reference level, unless otherwise specified.

Format	TH <real>DM|MV|UV|DB TH UP|DN UP or DN increments by one step size TH ON|OFF (8560 series only) TH OA TH?
Query Data Type	<real> in dB
SCPI Equivalent Commands	`:CALCulate:MARKer:PEAK:THReshold <ampl>` See "Peak Threshold" on page 202
Preset	–130 dBm

10.4.267 THE (Threshold Enable)

Syntax



Legacy Products

8566A/B, 8568A/B

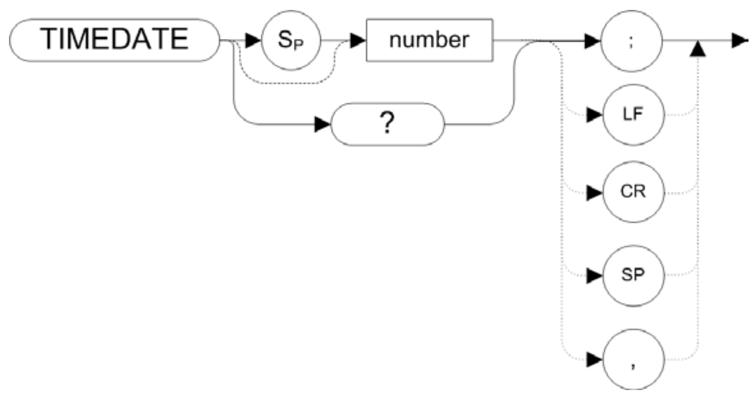
Description

Turns the threshold on or off.

Format	THE ON|OFF THE?
Query Data Type	ON|OFF
SCPI Equivalent Commands	None
Preset	OFF

10.4.268 TIMEDATE (Time Date)

Syntax



Legacy Products

8560 series

Description

Sets and returns the date and time of the real-time clock of the instrument. The number takes the form YYMMDDHHMMSS (Year, Month, Day, Hour, Minute, Second).

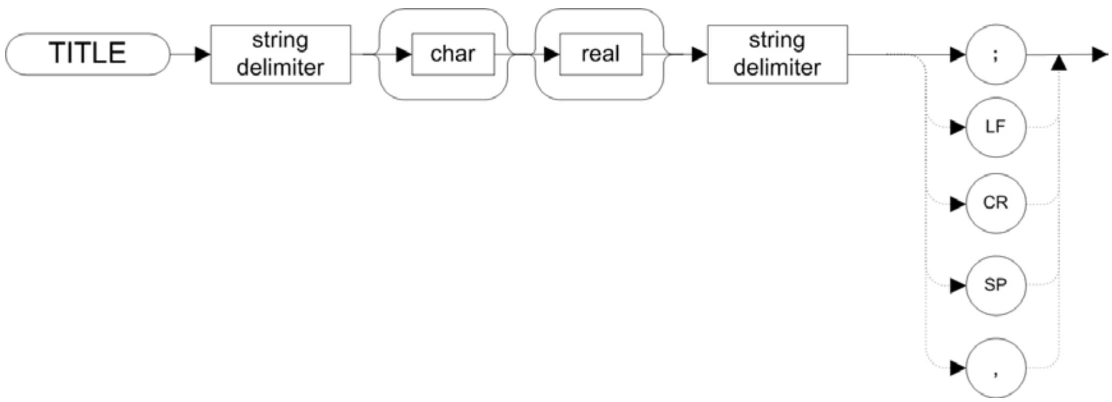
`TIMEDATE ON` and `TIMEDATE OFF` commands are supported on some models of the 8560 series. This set of commands displays or hides the time and date in the graticule.

RLC Mode does **not** support these commands, but accepts them and does not display a CMD ERR error or CMD NOT SUPPORTED error.

Format	TIMEDATE <number>
	TIMEDATE?
Query Data Type	<number> (YYMMDDHHMMSS)
SCPI Equivalent Commands	:SYSTem:DATE …
	:SYSTem:DATE?
	:SYSTem:TIME …
	:SYSTem:TIME?
Notes	This command changes the system clock of the instrument and may invalidate any time-based licenses installed on the instrument.

10.4.269 TITLE (Title)

Syntax



Legacy Products

8560 series

Description

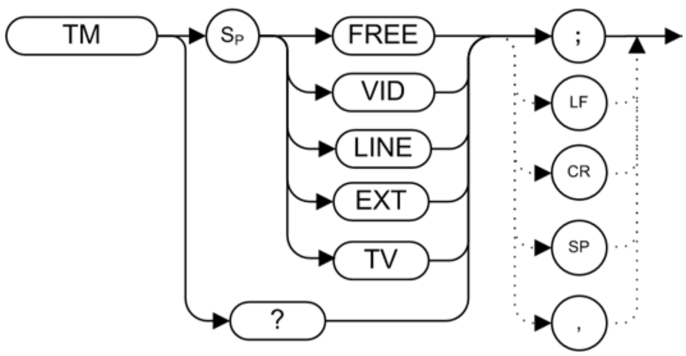
Activates the screen title mode, enabling you to enter your own title for the screen. Valid string delimiters, which must be used to start and terminate the title, are listed below.

See the 8560 Series User’s Guide for more details.

Format	TITLE <string delimiter>(<char>)(<real>)<string delimiter> Valid string delimiters: !, ", $, %, &, ’, /, :, =, \, ~, @
Query Data Type	N/A

10.4.270 TM (Trigger Mode)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Selects a trigger mode: free, line, video, or external.

The options are as follows:

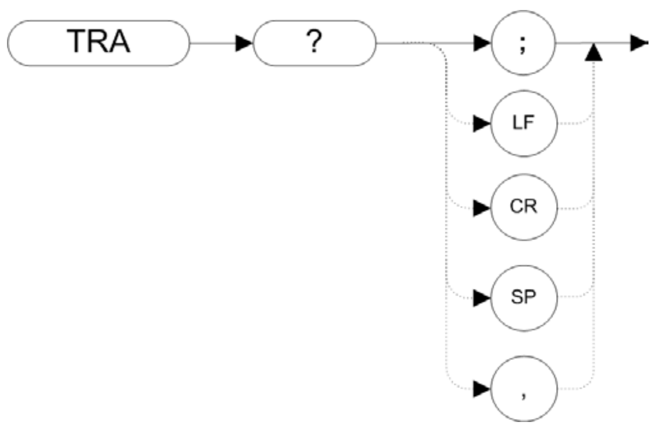
Option	Mode Selected
EXT	External mode. Connect an external trigger source to J5 EXT/GATE TRIG INPUT on the rear panel of the instrument. The source must range from 0 to 5 V (TTL). The trigger occurs on the rising, positive edge of the signal (about 1.5 V)
FREE	Free-run mode. Sweep triggers occur as fast as the instrument will allow
LINE	Line mode. Sweep triggers occur at intervals synchronized to the line frequency
VID	Video mode. Sweep triggers occur whenever the positively-sloped part of the input signal passes through the video trigger level. This trigger level can be changed (refer to the VTL command), and a dashed line appears on the screen to denote (approximately) the selected level. Video triggering is not available for resolution bandwidths ≤100 Hz
TV	Allows TV triggering if Options 101 and 102, or Option 301 is installed. The functions of `TM TV` and `TV TRIG` are similar. `TM TV` does **not** select the TV line number, set up the amplitude level, change the span, change the bandwidth, or change the sweep time

Format	`TM FREE|VID|LINE|EXT|TV` `TM?`
Query Data	`FREE|VID|LINE|EXT|TV`

Type	
SCPI Equivalent Commands	`:TRIGger[:SEQuence]:SOURce EXTernal1|EXTernal2|IMMediate|LINE|FRAMe|RFBurst|VIDeo|TV`
Preset	`FREE`
Notes	The functions of TM are identical to "T1 (Free Run Trigger)" on page 913, "T2 (Line Trigger)" on page 914, "T3 (External Trigger)" on page 915 and "T4 (Video Trigger)" on page 916

10.4.271 TRA (Trace Data Input and Output)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

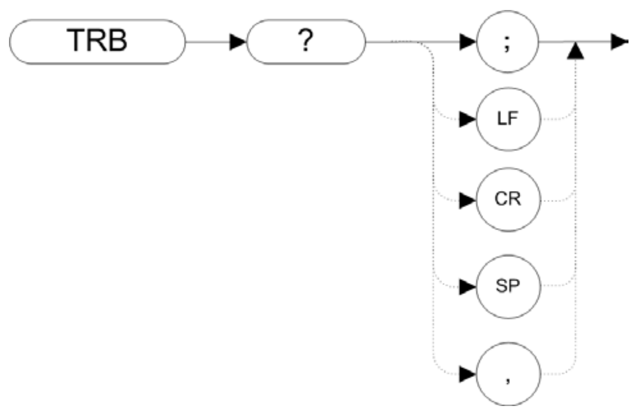
Transfers Trace A amplitude values from the instrument to the controller.

Format	`TRA?`
Query Data Type	The format depends on the trace data format selected. See "TDF (Trace Data Format)" on page 919 for details on formatting

SCPI Equivalent Commands	`:TRACe? TRACE(1|2|3|4|5|6)`
	`:FORMat[:TRACe][:DATA] ...`
	`:FORMat:BORDer NORMal|SWAPped`

10.4.272 TRB (Trace Data Input and Output)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

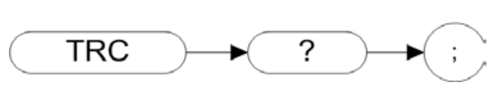
Transfers Trace B amplitude values between the instrument and the controller.

Format	`TRB?`
Query Data Type	The format depends on the trace data format selected. See "TDF (Trace Data Format)" on page 919 for details on formatting

SCPI Equivalent Commands	`:TRACe? TRACE(1|2|3|4|5|6)`
	`:FORMat[:TRACe][:DATA] ...`
	`:FORMat:BORDer NORMal|SWAPped`

10.4.273 TRC (Trace Data Input and Output)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

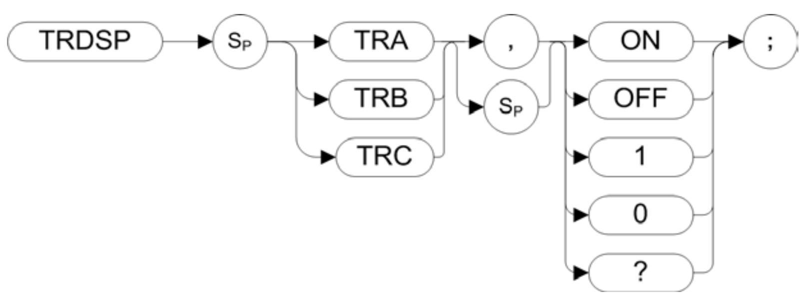
Transfers Trace Amplitude values from the instrument to the controller.

Format	`TRC?`
Query Data Type	The format depends on the trace data format selected. See "TDF (Trace Data Format)" on page 919 for details on formatting

SCPI Equivalent Commands	`:TRACe? TRACE(1|2|3|4|5|6)`
	`:FORMat[:TRACe][:DATA] ...`
	`:FORMat:BORDer NORMal|SWAPped`

10.4.274 TRDSP (Trace Display)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

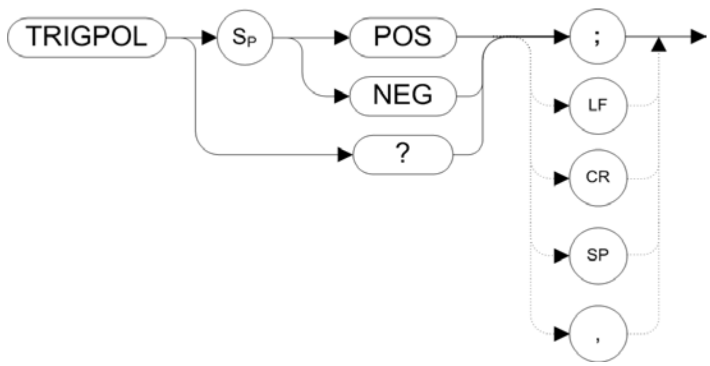
Displays a trace or turns it off.

Format	TRDSP TRA|TRB|TRC ON|OFF|1|0 TRDSP TRA|TRB|TRC ? (Not supported in 8566A/B)
Query Data Type	1|0
SCPI Equivalent Commands	:TRACe#:DISPlay[:STATe] ON|OFF|1|0 (see "View/Blank" on page

	339)
Preset	ON for TRA, OFF for TRB and TRC

10.4.275 TRIGPOL (Trigger Polarity)

Syntax



Legacy Products

8560 series

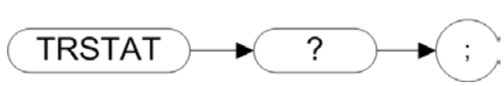
Description

Selects the edge (positive or negative) of the trigger input that causes the trigger event. `TRIGPOL` is available in all trigger modes.

Format	TRIGPOL POS|NEG TRIGPOL?
Query Data Type	POS|NEG
SCPI Equivalent Commands	`:TRIGger[:SEQuence]:SLOPe POSitive|NEGative`
Preset	POS

10.4.276 TRSTAT (Trace State)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

Returns trace states to the controller. Valid trace states are Clear-write, View, Blank, Maximum Hold, and Off.

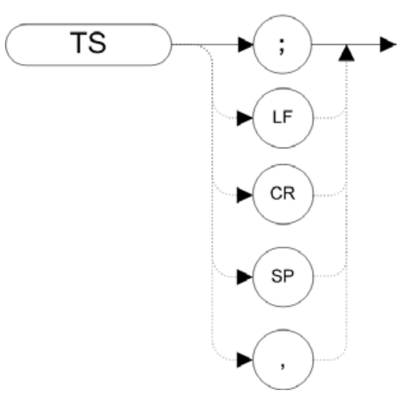
Possible Trace States

Trace State Description	Trace State Data Returned
Clear-write	CLRW
View	VIEW
Blank	BLANK
Maximum Hold	MXMH
Off	No data is returned

Format	TRSTAT?
Query Data Type	CLRW|VIEW|BLANK|MXMH
SCPI Equivalent Commands	:TRACe[1]|2|3:UPDate? :TRACe[1]|2|3:DISPlay? (See "View/Blank" on page 339)

10.4.277 TS (Take Sweep)

Syntax



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Starts and completes one full sweep before the next command is executed. A `TS` command is required for each sweep in the single-sweep mode. `TS` always restarts a sweep even if a sweep is already in progress.

Format	`TS`
Query Data Type	N/A

SCPI Equivalent Commands	Note that the following SCPI commands are not supported in RLC Mode:
	`:INITiate[:IMMediate]`
	`*OPC?`

10.4.278 USERREV

Syntax

USERREV ""|"NNNNNNN"

Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Modifies the response returned by the query "REV (Revision)" on page 887. This command sets the response to be either the supplied parameter value, or else, if this command's parameter is empty or missing, the system-defined value.

This is an RLC Mode "extension" command, which is not defined in the command set of any legacy instrument.

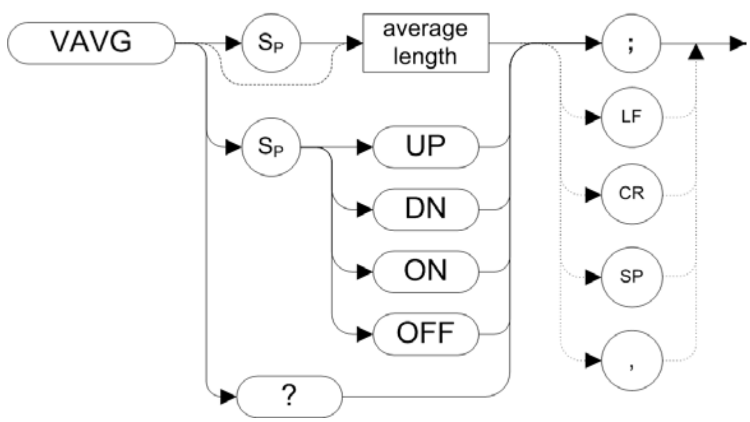
Format	USERREV ""|"NNNNNNN" "N" is any digit 0-9
Query Data Type	N/A
SCPI Equivalent Commands	None

Preset	System-defined value
Notes	Usually, you need to set the REV? response only once with this command, and the setting is retained while power is on. However, you will need to set the response again in the following 3 cases: 1. Keysight recovery 2. Instrument software upgrade 3. Restore Mode Defaults

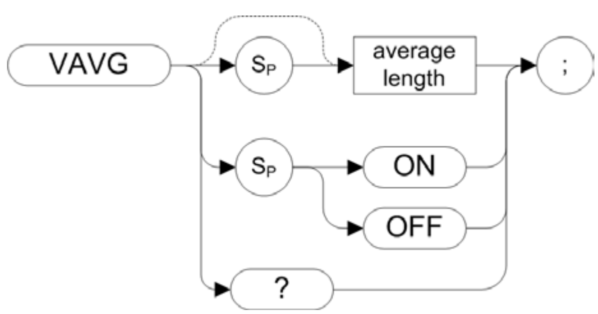
10.4.279 VAVG (Video Average)

Syntax

8560 series:



8566A/B, 8568A/B:



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

Enables the video-averaging function, which averages trace points to smooth the displayed trace. The `VAVG?` query returns the number of averages for the 8560 series of analyzers.

There are a few differences in the way video averaging works in RLC Mode, compared to the legacy analyzers. See the following table for a summary of these differences.

Legacy Analyzers - Video Averaging Behavioral Differences

Condition	Legacy Spectrum Analyzers	RLC Mode
All conditions.	*8566 and 8568 only* - Original trace is displayed in Trace C	Only displays the averaged trace. The averaged trace is displayed in Trace A
Average Count value set to 0.	Cannot be set to 0	Video averaging is turned off if the Averaging Count is set to 0
Change in Average Count setting to a higher value.	*8566 and 8568 only* - Continues counting from where the previous value left off	Resets the counter to zero and starts the measurement again
Change in average counter setting to a lower value.	*8566 and 8568 only* - Updates the screen annotation with the lower averaging value	If the new count value has not been reached, continues until the new lower count has been reached If the new, lower count value has already been reached, the instrument will stop and wait until you take a new sweep
Averaging turned on.	Sweep time remains unchanged	Sweep time changes due to the selection of the sample detector
Change in resolution bandwidth, video bandwidth, sweep time, reference level or attenuation.	*8566 and 8568 only* - In single sweep mode, resets counter to zero and starts the averaging again	Continues the measurement without resetting the counter
Change in center frequency or span.	In single sweep mode, resets counter to zero and starts the averaging again *8566 and 8568 only* - Also resets the counter after changes in RBW, VBW, Sweep Time, Ref. Level and Attenuation	In single sweep mode the X-Series instrument uses all stored averages. Does not reset the counter after changes in RBW, VBW, Sweep Time, Ref. Level and Attenuation

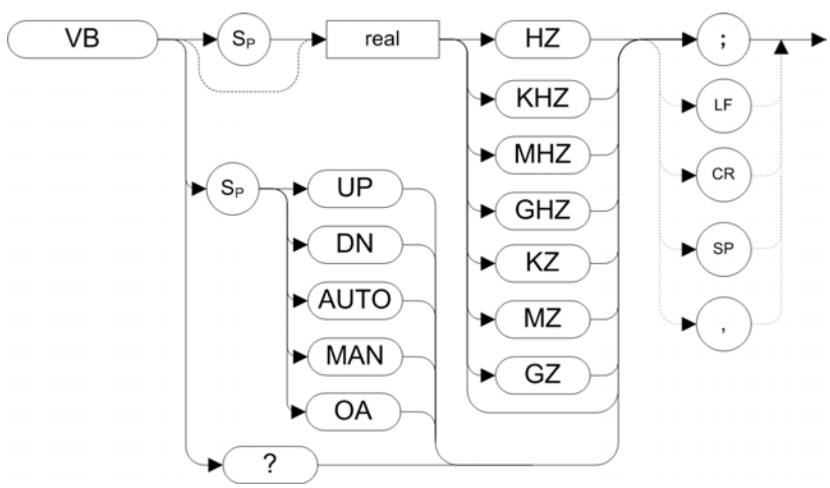
Format	`VAVG <average length>` Range: Integer from 1 to 999

	`VAVG UP|DN` (8560 series only)
	UP or DN: Increments by 1
	`VAVG ON|OFF`
	`VAVG?`
Query Data Type	<number>, or 0 if it is OFF
SCPI Equivalent Commands	`:TRACe#:TYPE AVERage (for VAVG ON)`
	`:TRACe#:TYPE WRITe (for VAVG OFF)`
	`[:SENSe]:AVERage:COUNT <integer>`
Preset	100, OFF
Notes	For 8566A/B, 8568A/B, the functions of `VAVG` are identical to "KSG (Video Averaging On)" on page 791 or "KSH (Video Averaging Off)" on page 793

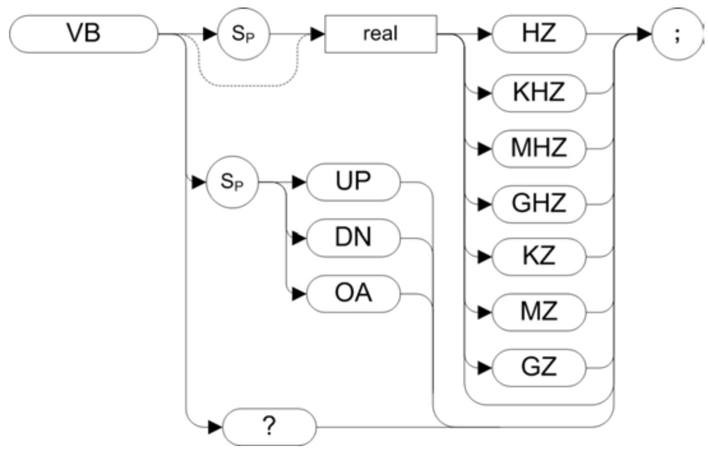
10.4.280 VB (Video Bandwidth)

Syntax

8560 series:



8566A/B, 8568A/B:



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

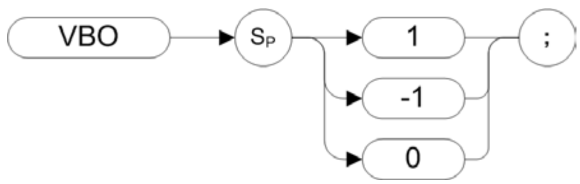
Specifies the video bandwidth, which is a post-detection, low-pass filter.

When auto coupled, the video bandwidth is calculated as Resolution Bandwidth x Video Resolution Bandwidth Ratio. See "VBO (Video Bandwidth Coupling Offset)" on page 935 for more details.

Format	`VB <real>HZ|KHZ|MHZ|GHZ|KZ|MZ|GZ`
	`VB UP|DN`
	UP or DN increments in a 1, 3, 10 sequence
	`VB AUTO|MAN` (8560 series only)
	`VB OA`
	`VB?`
Query Data Type	<real>
SCPI Equivalent Commands	`[:SENSe]:BANDwidth:VIDeo <freq>`
	`[:SENSe]:BANDwidth:VIDeo:AUTO ON`
Preset	Coupled mode, 1 MHz

10.4.281 VBO (Video Bandwidth Coupling Offset)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

Specifies the relationship between the video and resolution bandwidths which is maintained when these bandwidths are coupled. The bandwidths are usually coupled unless "RB (Resolution Bandwidth)" on page 881 or "VB (Video Bandwidth)" on page 933 have been executed.

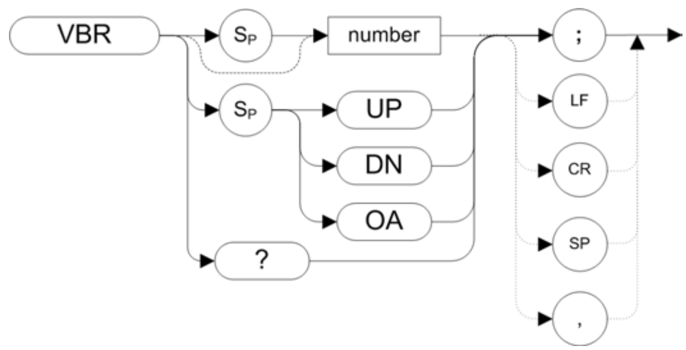
The options specify the behavior as follows:

Option	Behavior
1	The video bandwidth is one step higher than the resolution bandwidth. That is, the video bandwidth:resolution bandwidth ratio is 3.
–1	The video bandwidth is one step lower than the resolution bandwidth. That is, the video bandwidth:resolution bandwidth ratio is 0.3.
0	The ratio remains fixed at 1. That is, the resolution bandwidth and the video bandwidth are always equal.

Format	`VBO 1|-1|0`
Query Data Type	N/A
SCPI Equivalent Commands	None

10.4.282 VBR (Video Bandwidth to Resolution Bandwidth Ratio)

Syntax



Legacy Products

8560 series

Description

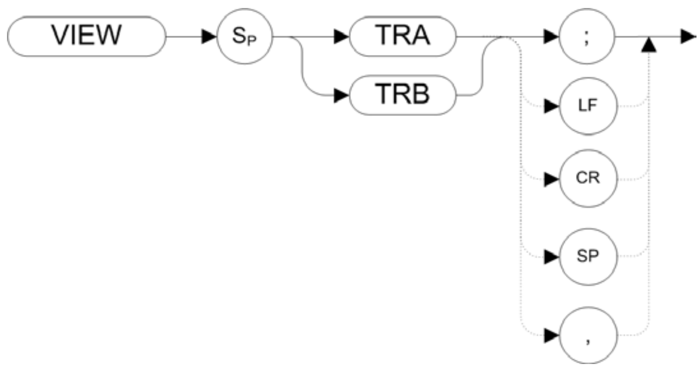
Specifies the relationship between the video and resolution bandwidths that is maintained when these bandwidths are coupled.

Format	VBR <number>
	<number> Range: 0.003 to 3
	VBR UP|DN
	UP or DN: increment in a 1, 3, 10 sequence
	VBR OA
	VBR?
Query Data Type	<number>
SCPI Equivalent Commands	`[:SENSe]:BANDwidth:VIDeo:RATio <real>`
Preset	1
Notes	VBR uses the legacy signal analyzer settings for video bandwidth only if "Limit RBW/VBW" on page 241 is set to ON

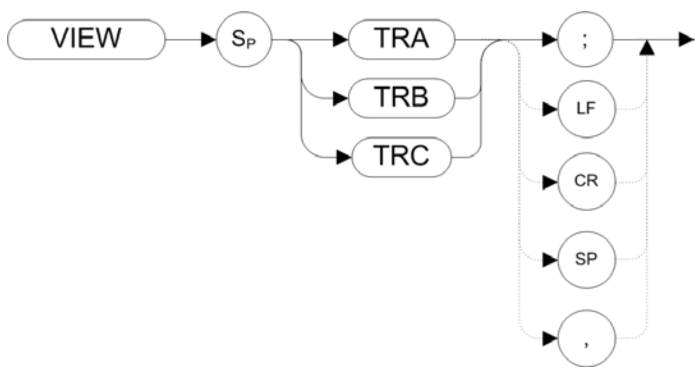
10.4.283 VIEW (View Trace)

Syntax

8560 series:



8566A/B, 8568A/B:



Legacy Products

8560 series, 8566A/B, 8568A/B

Description

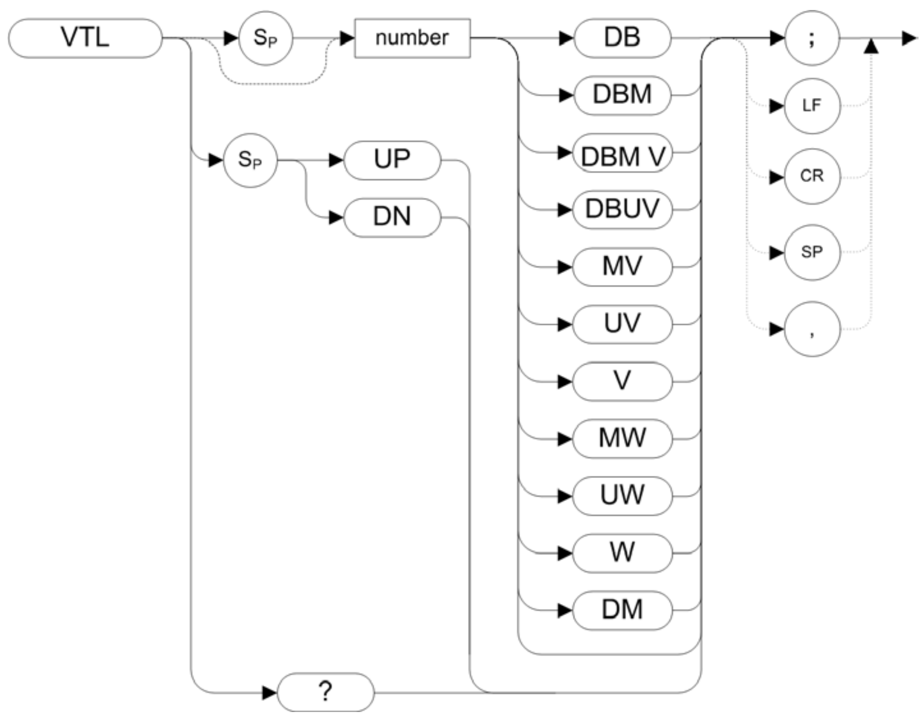
Displays Trace A, Trace B, or Trace C, and stops taking new data into the viewed trace.

Format	`VIEW TRA|TRB|TRC` TRA corresponds to Trace 1 and TRB corresponds to Trace 2.
Query Data Type	N/A
SCPI Equivalent Commands	`:TRACe[1]|2|3|4|5|6:UPDate OFF`

	`:TRACe[1|2|3|4|5|6:DISPlay[:STATe] ON`
	See "View/Blank" on page 339
Notes	The functions of `VIEW` are identical to "A3 (View Mode for Trace A)" on page 683 and "B3 (View Mode for Trace B)" on page 718
	For 8566A/B, 8568A/B, `VIEW` is also identical to "KSj (View Trace C)" on page 795

10.4.284 VTL (Video Trigger Level)

Syntax



Legacy Products

8560 series

Description

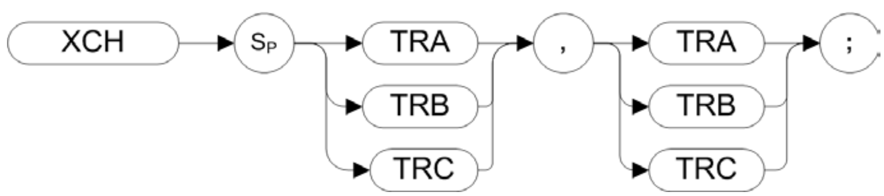
Sets the signal level that triggers a sweep.

Format	`VTL <number> DB|DBM|DBMV|DBUV|MV|UV|V|MW|UW|W|DM`
	<number> Range: –220 to 30

	`VTL UP|DN`
	UP or DN increments by 1 vertical division
	`VTL?`
Query Data Type	`<real>`
SCPI Equivalent Commands	`:TRIGger[:SEQuence]:VIDeo:LEVel <ampl>`
Preset	0 dBm
Notes	Setting a value for VTL sets the trigger mode to `VIDEO`, even if it was not already set to `VIDEO`. See "TM (Trigger Mode)" on page 924

10.4.285 XCH (Exchange)

Syntax



Legacy Products

8566A/B, 8568A/B

Description

Exchanges the contents of the source and destination traces. The traces are analyzed and adjusted to fit the number of display points on the screen.

Format	`XCH TRA|TRB|TRC,TRA|TRB|TRC`
Query Data Type	N/A

SCPI Equivalent Commands	`:TRACe#:DISPlay[:STATe]?`
	`:TRACe#:UPDate[:STATe]?`
	`:TRACe:EXCHange TRACE#, TRACE#`
	`:TRACe#:DISPlay[:STATe]`
	`:TRACe#:UPDate[:STATe]`
	See "View/Blank" on page 339

Notes	The functions of `XCH TRA,TRB` are identical to "AXB (Exchange Trace A and Trace B)" on page 715 and "EX (Exchange Trace A and Trace B)" on page 759

The functions of `XCH TRB,TRC` are identical to "BXC (Exchange Trace B and Trace C)" on page 724 and "KSi (Exchange Trace B and Trace C)" on page 795

10.5 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.

10.5.1 Mode Control

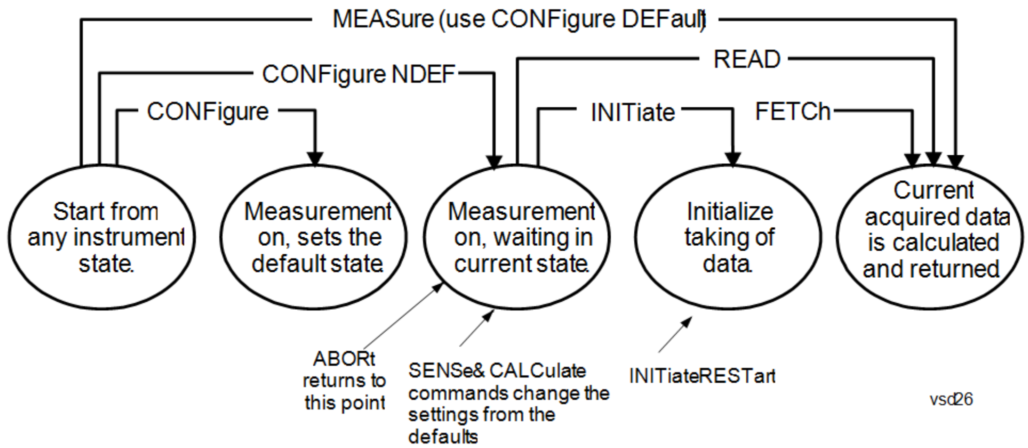
You can use either `INSTrument:SELect` (:INST:SEL) or `INSTrument:NSELect` (:INST:NSEL) to select the instrument's"Mode" on page 49.

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 50.

10.5.2 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 942	Switches to the desired measurement
"INITiate" on page 943	Starts the measurement
"FETCh" on page 943	Queries the data
"READ" on page 944	Starts the measurement and queries the data
"MEASure" on page 945	Switches to the desired measurement, starts the measurement and queries the data



10.5.2.1 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

10.5.2.2 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.

10.5.2.3 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.

10.5.2.4 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.

10.5.2.5 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.

10.6 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.

10.6.1 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 952 gives detailed programming information for each of the X-Series status registers.

10.6.1.1 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.

10.6.1.2 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 637. Individual status registers can be set and queried using the commands in the "STATus Subsystem Registers and Commands" on page 952 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.

10.6.1.3 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.

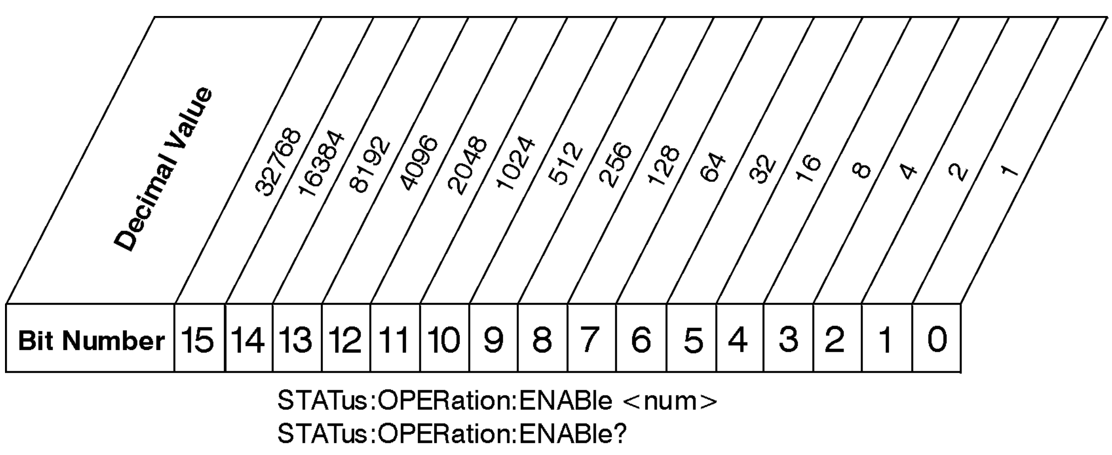
NOTE **When you read the instrument's status byte register with a serial poll, the RQS bit is reset to 0. Other bits in the register are not affected.**

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)

10.6.1.4 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)

10.6.2 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 953 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.

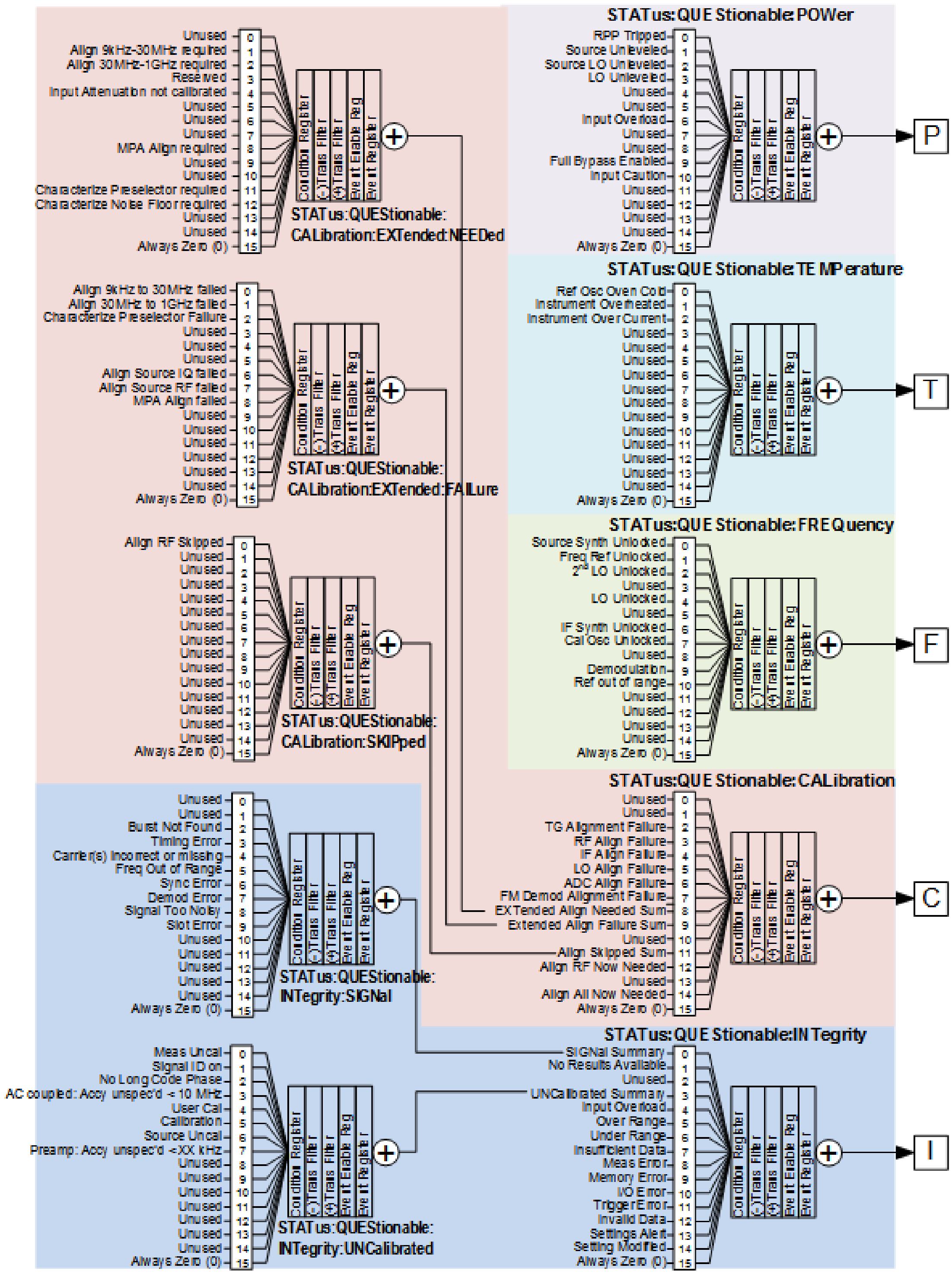
The STATus subsystem controls and queries the SCPI-defined instrument status reporting structures. Each status register has a set of five commands used for querying or masking that particular register.

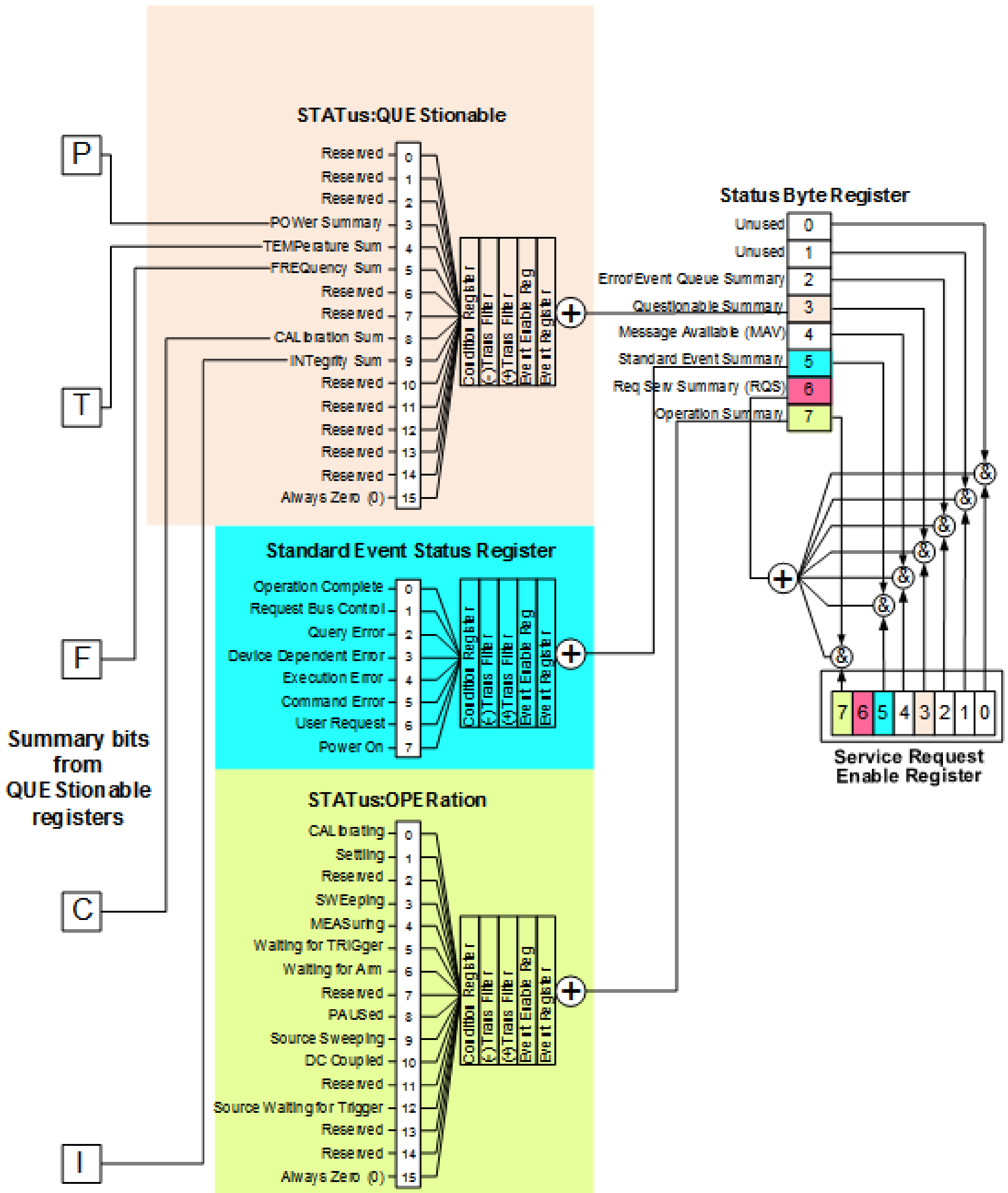
Numeric values for bit patterns can be entered using decimal or hexadecimal representations. (i.e. 0 to 32767 is equivalent to #H0 to #H7FFF. It is also equal to all ones, 111111111111111). See "Status Register Bit Parameters" on page 951 for information about using bit patterns for variable parameters.

10.6.2.1 Status Register Diagram

The following diagram provides a graphical overview of the entire X-Series Status Register Subsystem.

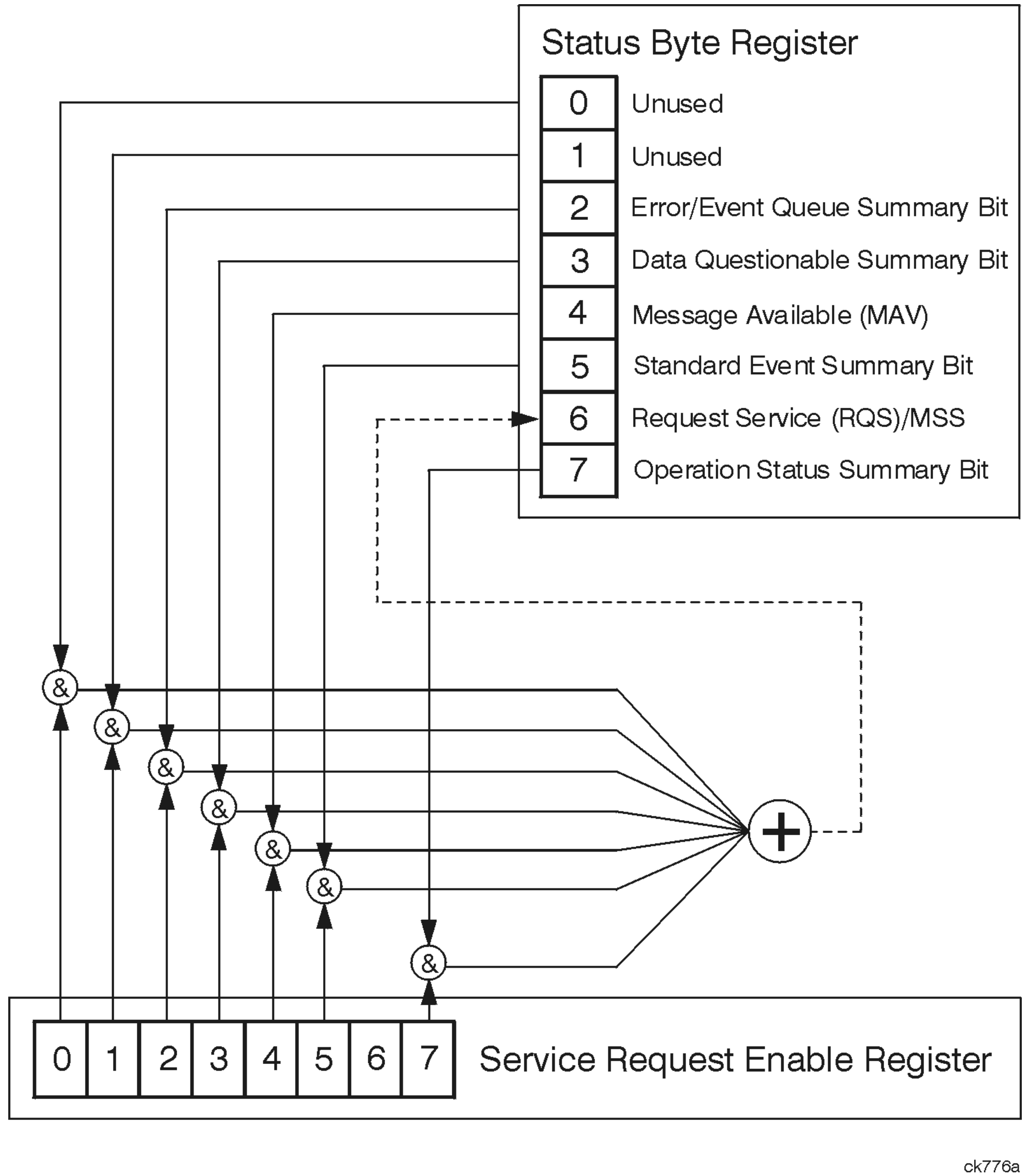
For readability, the diagram is split into two sections.

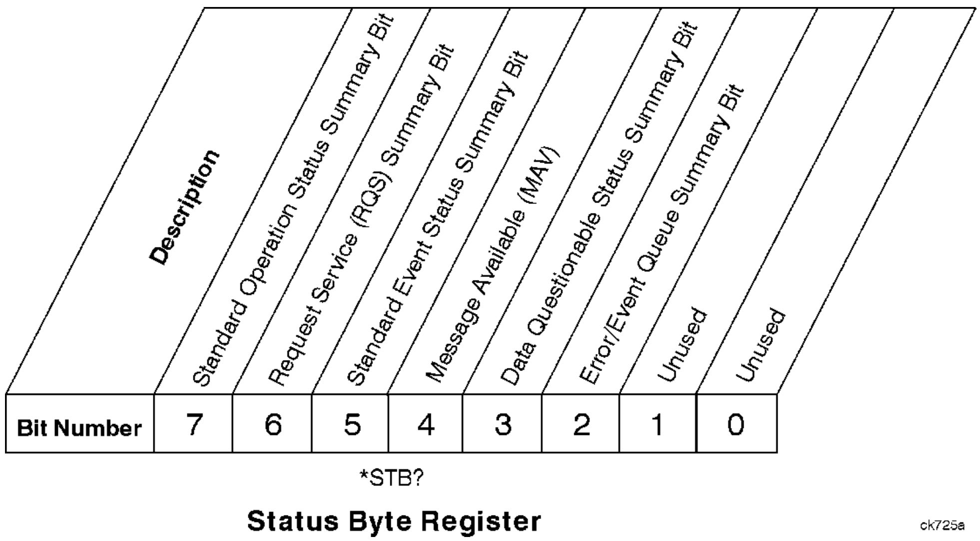

Unused
Align 9kHz-30MHz required
Align 30MHz-1GHz required
Reserved
Input Attenuation not calibrated
Unused
Unused
Unused
MPA Align required
Unused
Unused
Characterize Preselector required
Characterize Noise Floor required
Unused
Unused
Always Zero (0)
Condition Register
(-)Trans Filter
(+)Trans Filter
Event Enable Reg
Event Register
STATus:QUEStionable:
CALibration:EXTended:NEEDed
Align 9kHz to 30MHz failed
Align 30MHz to 1GHz failed
Characterize Preselector Failure
Unused
Unused
Unused
Align Source IQ failed
Align Source RF failed
MPA Align failed
Unused
Unused
Unused
Unused
Unused
Unused
Always Zero (0)
STATus:QUEStionable:
CALibration:EXTended:FAILure
Align RF Skipped
Unused
Always Zero (0)
STATus:QUEStionable:
CALibration:SKIPped
Unused
Unused
Burst Not Found
Timing Error
Carrier(s) Incorrect or missing
Freq Out of Range
Sync Error
Demod Error
Signal Too Noisy
Slot Error
Unused
Unused
Unused
Unused
Unused
Always Zero (0)
STATus:QUEStionable:
INTegrity:SIGNal
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
Unused
Unused
Unused
Unused
Unused
Unused
Unused
Always Zero (0)
STATus:QUEStionable:
INTegrity:UNCalibrated
STATus:QUEStionable:POWer
RPP Tripped
Source Unleveled
Source LO Unleveled
LO Unleveled
Unused
Unused
Input Overload
Unused
Unused
Full Bypass Enabled
Input Caution
Unused
Unused
Unused
Unused
Always Zero (0)
P
STATus:QUEStionable:TEMPerature
Ref Osc Oven Cold
Instrument Overheated
Instrument Over Current
Unused
Always Zero (0)
T
STATus:QUEStionable:FREQuency
Source Synth Unlocked
Freq Ref Unlocked
2nd LO Unlocked
Unused
LO Unlocked
Unused
IF Synth Unlocked
Cal Osc Unlocked
Unused
Demodulation
Ref out of range
Unused
Unused
Unused
Unused
Always Zero (0)
F
STATus:QUEStionable:CALibration
Unused
Unused
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
Unused
Align Skipped Sum
Align RF Now Needed
Unused
Align All Now Needed
Always Zero (0)
C
STATus:QUEStionable:INTegrity
SIGNal Summary
No Results Available
Unused
UNCalibrated Summary
Input Overload
Over Range
Under Range
Insufficient Data
Meas Error
Memory Error
I/O Error
Trigger Error
Invalid Data
Settings Alert
Setting Modified
Always Zero (0)
I



10.6.2.2 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 953.


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



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 643

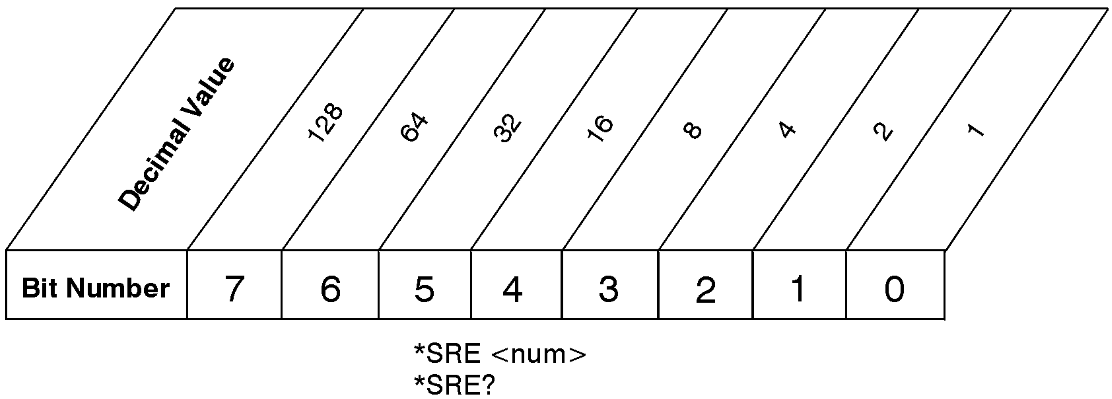
Service Request Enable Register

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

See also "*SRE - Service Request Enable" on page 643

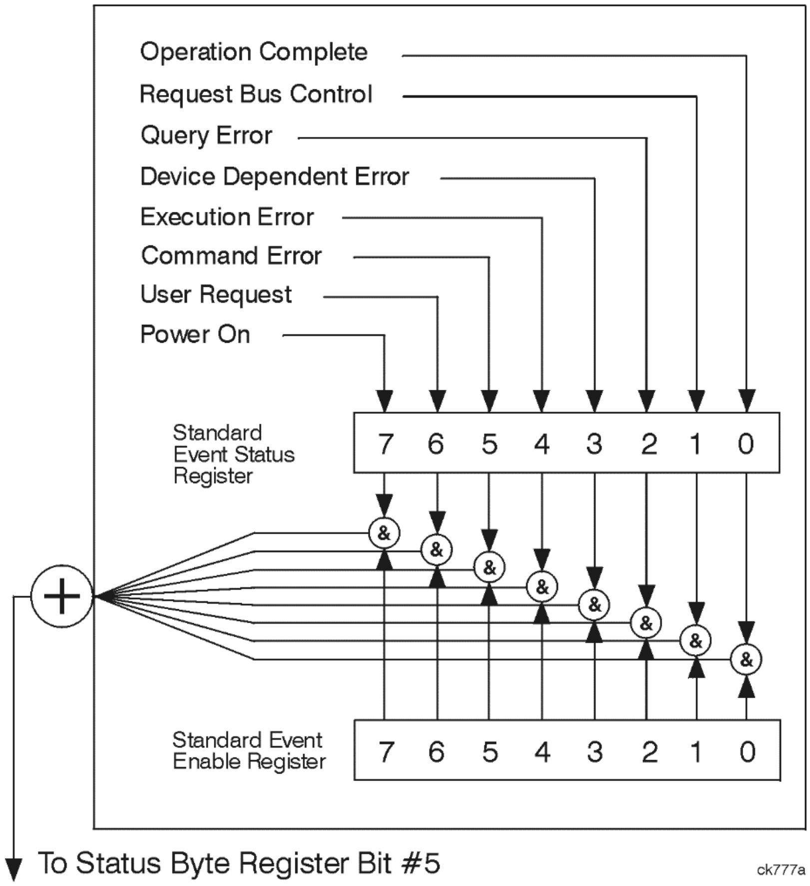
Preset the Status Byte

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:

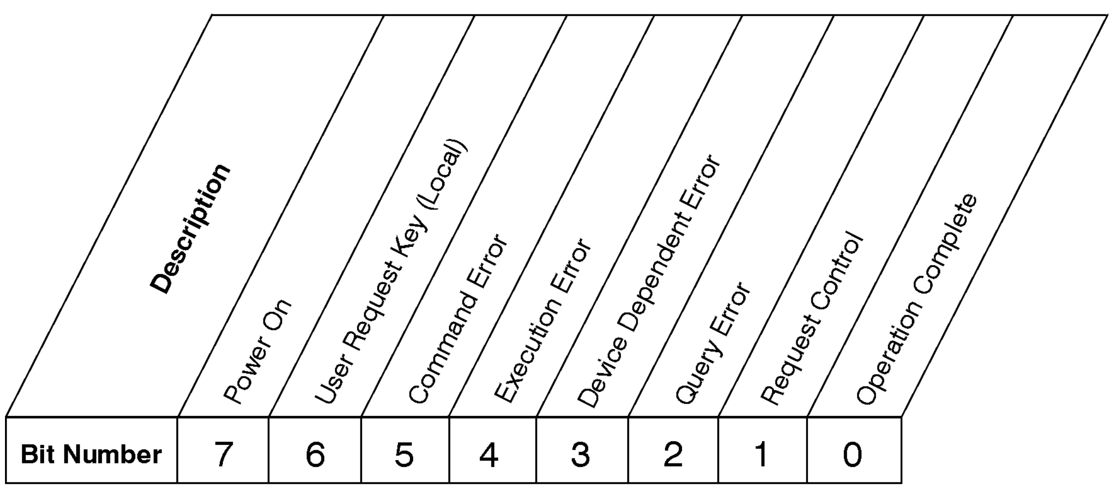
IEEE Standard 488.2–1992

Remote Command	`:STATus:PRESet`
Example	`:STAT:PRES`

10.6.2.3 Standard Event Status Register



The standard event status register contains the following bits:



*ESR?

Standard Event Status Register

ck727a

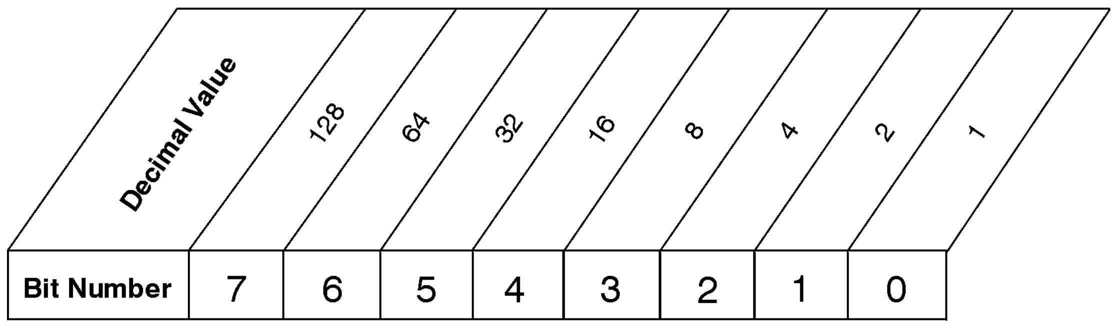
Bit	Description
0	A 1 in this bit position indicates that all pending operations were completed following execution of the *OPC command
1	This bit is for GPIB handshaking to request control. Currently it is set to 0 because there are no implementations where the spectrum analyzer controls another instrument
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 639

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).



*ESE <num>
*ESE?

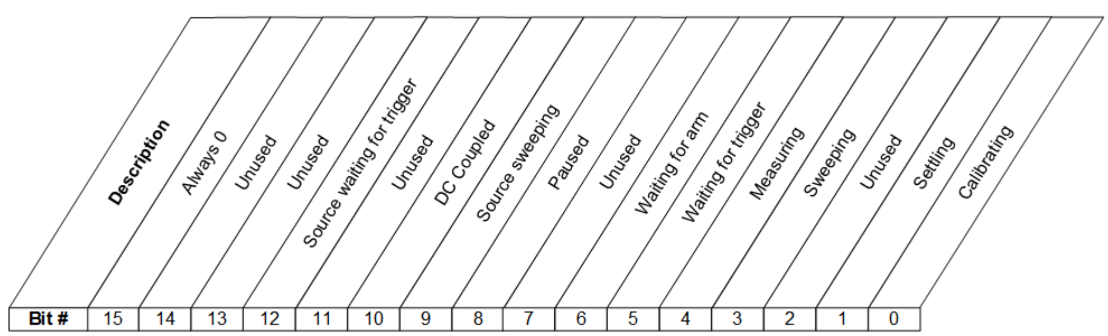
Standard Event Status Enable Register

See also "*ESE - Standard Event Status Enable" on page 638

10.6.2.4 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 640.



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

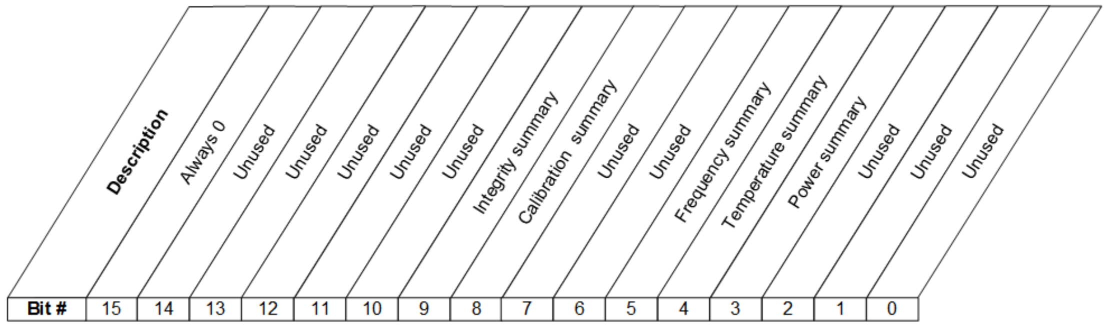
Backwards Compatibility

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.

10.6.2.5 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 965
– "Questionable Enable" on page 966
– "Questionable Event Query" on page 966
– "Questionable Negative Transition" on page 967
– "Questionable Positive Transition" on page 967

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

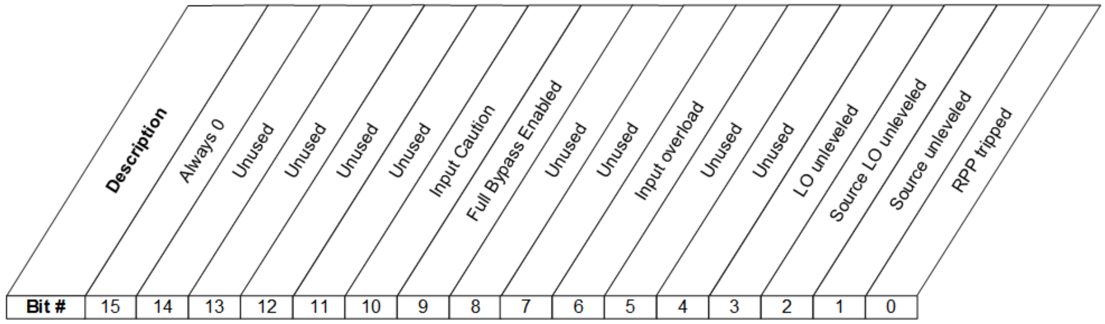
Questionable Positive Transition

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

10.6.2.6 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 968

– "Questionable Power Enable" on page 969

– "Questionable Power Event Query" on page 969

– "Questionable Power Negative Transition" on page 969

– "Questionable Power Positive Transition" on page 970

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

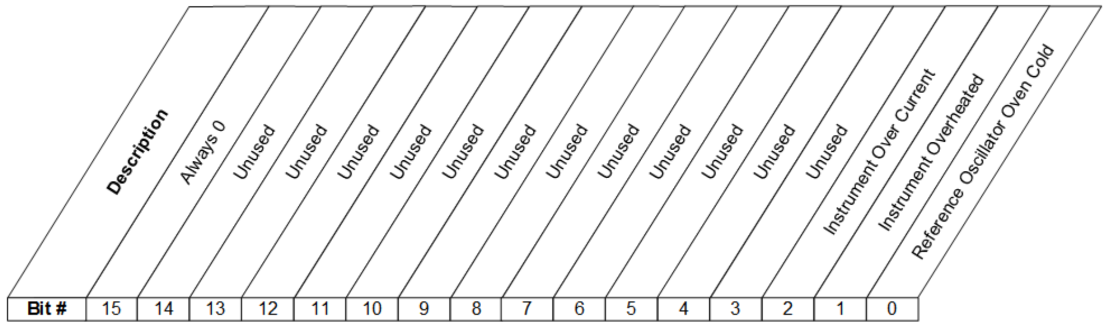
Questionable Power Positive Transition

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

10.6.2.7 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 971
– "Questionable Temperature Enable" on page 972
– "Questionable Temperature Event Query" on page 972
– "Questionable Temperature Negative Transition" on page 972
– "Questionable Temperature Positive Transition" on page 973

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

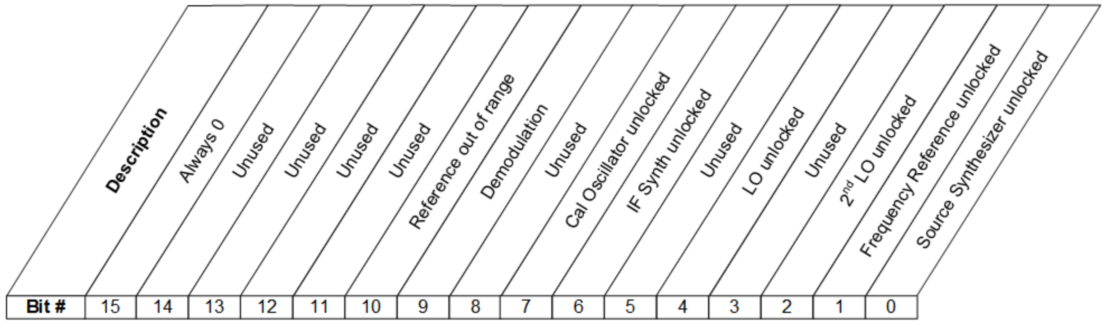
Questionable Temperature Positive Transition

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

10.6.2.8 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 974

– "Questionable Frequency Enable" on page 975

– "Questionable Frequency Event Query" on page 975

– "Questionable Frequency Negative Transition" on page 976

– "Questionable Frequency Positive Transition" on page 976

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

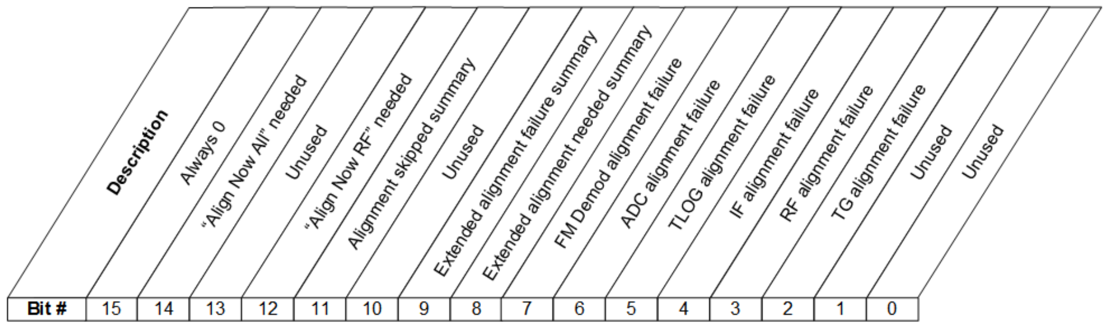
This command determines which bits in the Questionable Frequency Condition register will set the corresponding bit in the Questionable Frequency Event register when the condition register bit has a positive transition (0 to 1). The variable `<integer>` is the sum of the decimal values of the bits that 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

10.6.2.9 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 978
– "Questionable Calibration Enable" on page 978
– "Questionable Calibration Event Query" on page 978
– "Questionable Calibration Negative Transition" on page 979
– "Questionable Calibration Positive Transition" on page 979

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

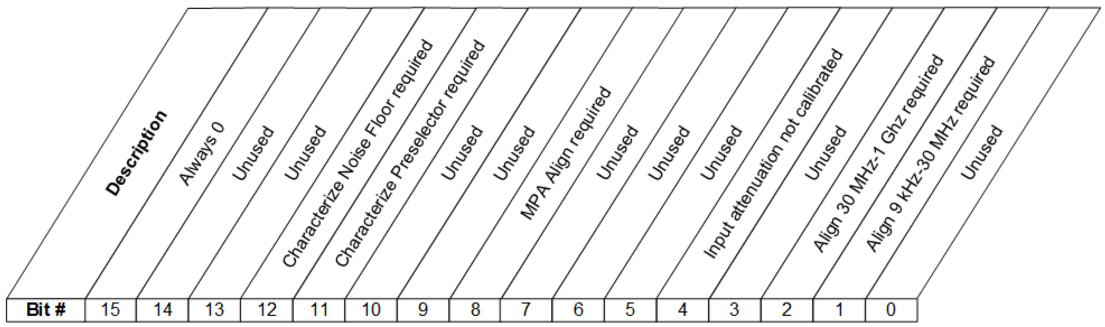
Questionable Calibration Positive Transition

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

10.6.2.10 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 981
– "Questionable Calibration Extended Needed Enable" on page 981
– "Questionable Calibration Extended Needed Event Query" on page 981
– "Questionable Calibration Extended Needed Negative Transition" on page 982
– "Questionable Calibration Extended Needed Positive Transition" on page 982

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

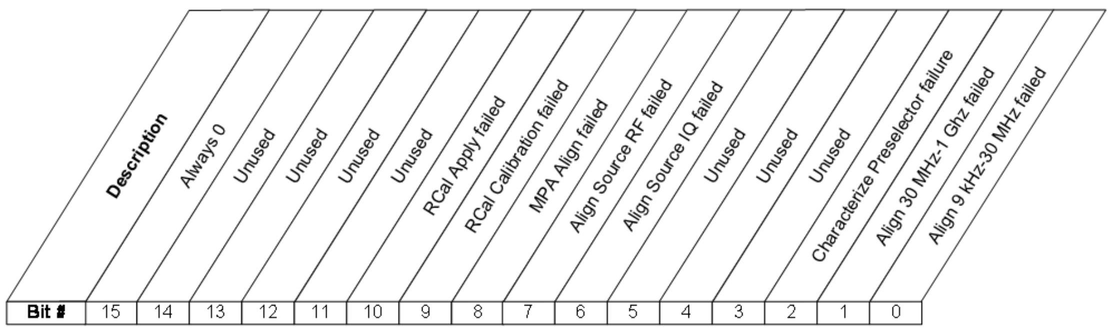
This command determines which bits in the Questionable Calibration Extended Needed Condition register will set the corresponding bit in the Questionable Calibration Extended Needed Event register when the condition register bit has a positive transition (0 to 1). The variable <integer> is the sum of 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

10.6.2.11 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 984

– "Questionable Calibration Extended Failure Enable" on page 984

– "Questionable Calibration Extended Failure Event Query" on page 984

– "Questionable Calibration Extended Failure Negative Transition" on page 985

– "Questionable Calibration Extended Failure Positive Transition" on page 985

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

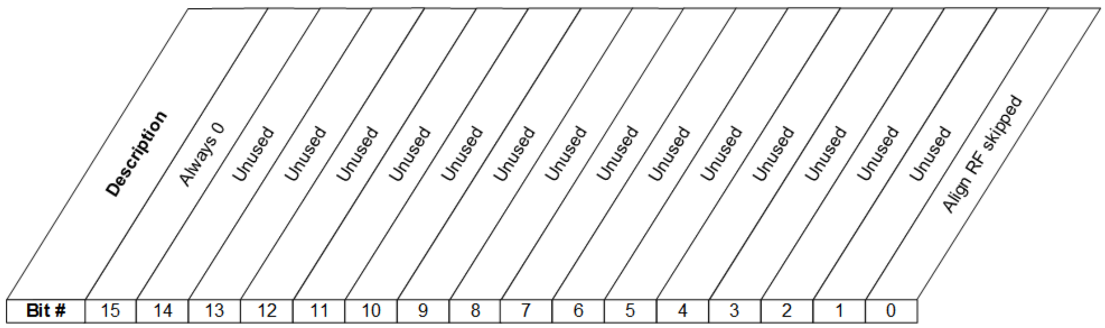
This command determines which bits in the Questionable Calibration Extended Failure Condition register will set the corresponding bit in the Questionable Calibration Extended Failure Event register when the condition register bit has a positive transition (0 to 1). The variable `<integer>` is the sum 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

10.6.2.12 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 401, "Align Now All" on page 407 and "Align Now RF" on page 410

See:

- "Questionable Calibration Skipped Condition" on page 986
- "Questionable Calibration Skipped Enable" on page 987
- "Questionable Calibration Skipped Event Query" on page 987
- "Questionable Calibration Skipped Negative Transition" on page 988
- "Questionable Calibration Skipped Positive Transition" on page 988

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

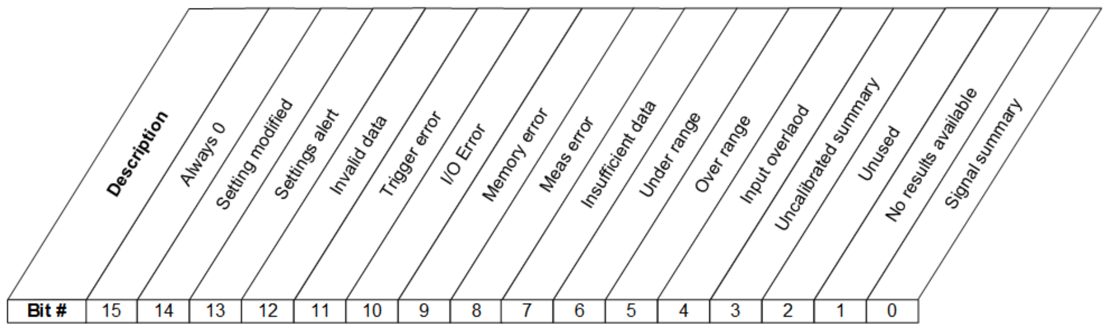
This command determines which bits in the Questionable Calibration Skipped Condition register will set the corresponding bit in the Questionable Calibration Skipped Event register when the condition register bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values 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

10.6.2.13 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 990
– "Questionable Integrity Enable" on page 990
– "Questionable Integrity Event Query" on page 991
– "Questionable Integrity Negative Transition" on page 991
– "Questionable Integrity Positive Transition" on page 991

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

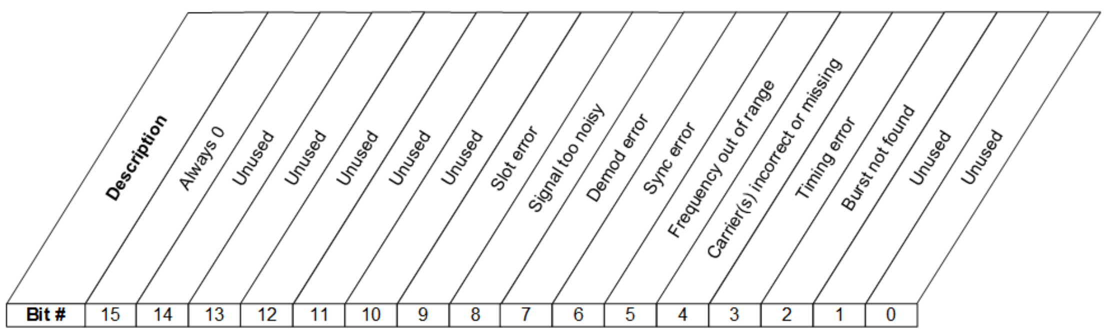
This command determines which bits in the Questionable Integrity Condition register will set the corresponding bit in the Questionable Integrity Event register when the condition register bit has a positive transition (0 to 1). The variable `<integer>` is the sum of the decimal values of the bits that 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

10.6.2.14 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 993
- "Questionable Integrity Signal Enable" on page 993
- "Questionable Integrity Signal Event Query" on page 994
- "Questionable Integrity Signal Negative Transition" on page 994
- "Questionable Integrity Signal Positive Transition" on page 994

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

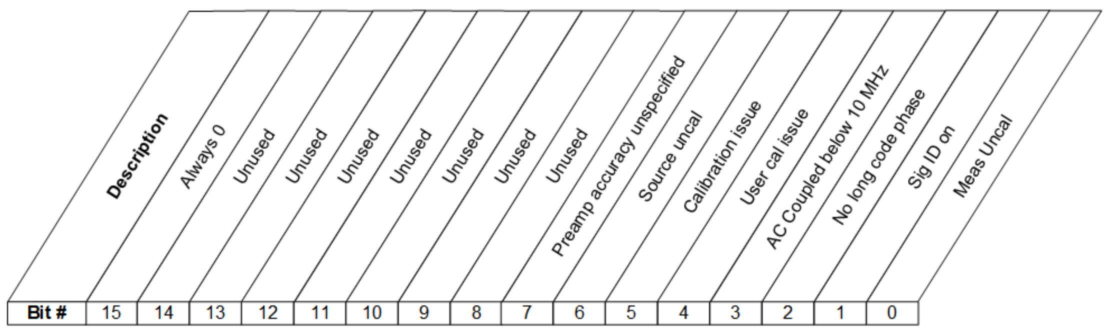
This command determines which bits in the Questionable Integrity Signal Condition register will set the corresponding bit in the Questionable Integrity Signal Event register when the condition register bit has a positive transition (0 to 1). The variable `<integer>` is the sum of the decimal values of 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

10.6.2.15 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 996
– "Questionable Integrity Uncalibrated Enable" on page 996
– "Questionable Integrity Uncalibrated Event Query" on page 997
– "Questionable Integrity Uncalibrated Negative Transition" on page 997
– "Questionable Integrity Uncalibrated Positive Transition" on page 998

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

Edition 9, September 2021
N9061-90001
www.keysight.com