

# Keysight X-Series Signal Analyzer

This manual provides documentation for the following  
X-Series Analyzers:

PXA Signal Analyzer N9030A  
MXA Signal Analyzer N9020A

N9030A Real-Time  
Spectrum Analyzer  
User's &  
Programmer's  
Reference

## Notices

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# 1 About the Analyzer

The X-Series signal analyzer measures and monitors complex RF and microwave signals. Analog baseband analysis is available on MXA. The analyzer integrates traditional spectrum measurements with advanced vector signal analysis to optimize speed, accuracy, and dynamic range. The analyzer has Windows 7<sup>®</sup> built in as an operating system, which expands its usability.

With a broad set of applications and demodulation capabilities, an intuitive user interface, outstanding connectivity and powerful one-button measurements, the analyzer is ideal for both R&D and manufacturing engineers working on cellular, emerging wireless communications, general purpose, aerospace and defense applications.

## Installing Application Software

If you want to install a measurement application after your initial hardware purchase, you need only to license it. All of the available applications are loaded in your instrument at the time of purchase.

Thus, when you purchase a new application, you will receive an entitlement certificate that you can use to obtain a license key for that application. To activate the new measurement application, enter the license key that you obtain into the instrument.

For the latest information on Keysight Spectrum/Signal Analyzer measurement applications and upgrade kits, visit the following internet URL.

[www.keysight.com/find/sa\\_upgrades](http://www.keysight.com/find/sa_upgrades)

### Viewing a License Key

Measurement applications that you purchased with your instrument have been installed and activated at the factory before shipment. The instrument requires a unique License Key for every measurement application purchased. The license key is a hexadecimal string that is specific to your measurement application, instrument model number and serial number. It enables you to install, or reactivate, that particular application.

Press **System, Show, System** to display the measurement applications that are currently licensed in your analyzer.

Go to the following location to view the license keys for the installed measurement applications:

**C:\Program Files\Agilent\Licensing**

You may want to keep a copy of your license key in a secure location. To do this, you can print out a copy of the display showing the license numbers. If you should lose your license key, call your nearest Keysight Technologies service or sales office for assistance.

### Obtaining and Installing a License Key

If you purchase an additional application that requires installation, you will receive an "Entitlement Certificate", which may be redeemed for a license key for one instrument. To obtain your license key, follow the instructions that accompany the certificate.

Installing a license key for the selected application can be done automatically using a USB memory device. To do this, you copy the license file to the USB memory device, at the root level. Follow the instructions that come with your software installation kit.

Installing a license key can also be done manually using the built-in license management application, which may be found via the instrument front panel keys at **System, Licensing. . .**, or on-disk at:

## C:\Program Files\Agilent\Licensing

You can also use these procedures to reinstall a license key that has been accidentally deleted, or lost due to a memory failure.

## Updating Measurement Application Software

All the software applications were loaded at the time of original instrument manufacture. It is a good idea to regularly update your software with the latest available version. This helps to ensure that you receive any improvements and expanded functionality.

Because the software was loaded at the initial purchase, further additional measurement applications may now be available. If the application you are interested in licensing is not available, you will need to do a software update. (To display a list of installed applications, press **System, Show, System.**)

Check the appropriate page of the Keysight web site for the latest available software versions, according to the name of your instrument, as follows:

[www.keysight.com/find/pxa\\_software](http://www.keysight.com/find/pxa_software)

[www.keysight.com/find/mxa\\_software](http://www.keysight.com/find/mxa_software)

[www.keysight.com/find/exa\\_software](http://www.keysight.com/find/exa_software)

[www.keysight.com/find/cxa\\_software](http://www.keysight.com/find/cxa_software)

[www.keysight.com/find/mxe\\_software](http://www.keysight.com/find/mxe_software)

You can load the updated software package into the instrument from a USB drive, or directly from the internet. An automatic loading program is included with the files.

## X-Series Options and Accessories

You can view an online list of available Options and Accessories for your instrument as follows:

1. Browse to one of the following URLs, according to the product name of your instrument:

[www.keysight.com/find/cxa](http://www.keysight.com/find/cxa)

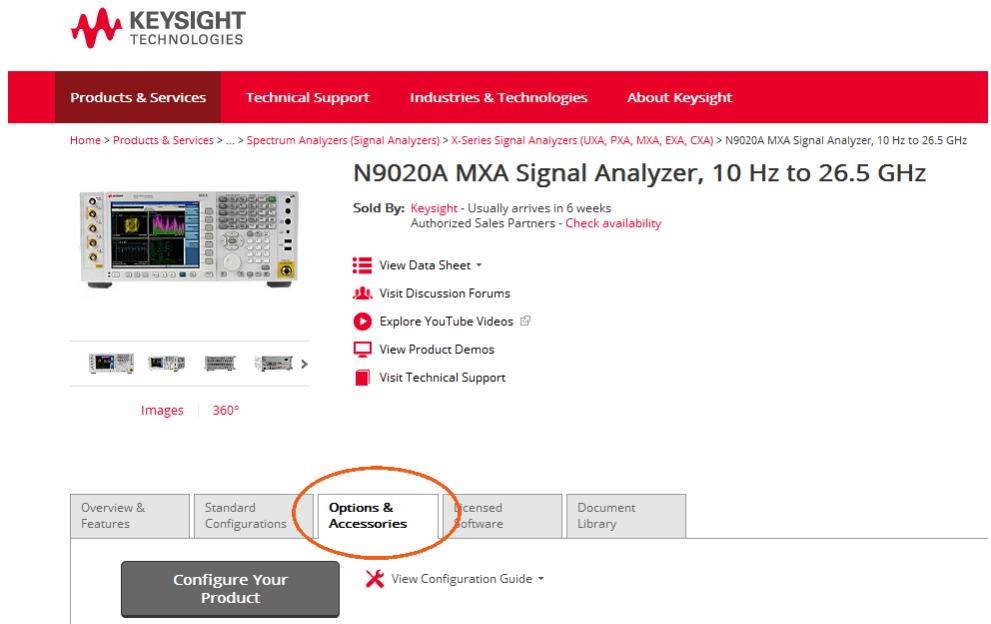
[www.keysight.com/find/exa](http://www.keysight.com/find/exa)

[www.keysight.com/find/mxa](http://www.keysight.com/find/mxa)

[www.keysight.com/find/pxa](http://www.keysight.com/find/pxa)

[www.keysight.com/find/mxe](http://www.keysight.com/find/mxe)

2. The home page for your instrument appears (in some cases, you may see an initial splash screen containing a button named View the Webpage, which you should click to display the home page).
3. Locate the Options tab, as highlighted in the example below, which shows the home page for the MXA.



4. Click the Options tab, to display a list of available options and accessories for your instrument.

## Front-Panel Features

The instrument's Front-panel features are fully detailed in the section "Front-Panel Features" (under the chapter "Front and Rear Panel Features") of the document:

[Getting Started Guide](#)

If you are viewing this information as a Help file in the instrument, then you can click on the link above to open the PDF document.



## Display Annotations

Display Annotations are fully detailed under the chapter "Front and Rear Panel Features" of the document:

[Getting Started Guide](#)

If you are viewing this information as a Help file in the instrument, then you can click on the link above to open the PDF document.

## Rear-Panel Features

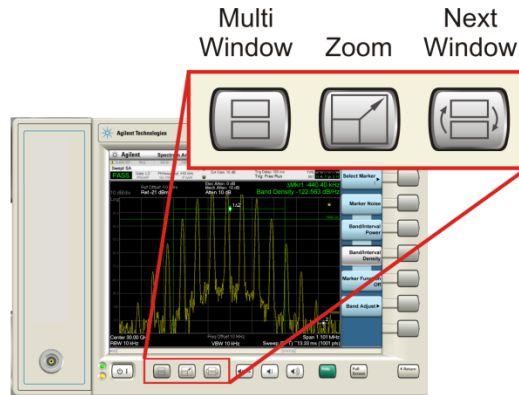
The instrument's Rear-panel features are fully detailed in the section "Rear-Panel Features" (under the chapter "Front and Rear Panel Features") of the document:

[Getting Started Guide](#)

If you are viewing this information as a Help file in the instrument, then you can click on the link above to open the PDF document.

## Window Control Keys

The instrument provides three front-panel keys for controlling windows. They are Multi Window, Zoom, and Next Window. These are all “immediate action” keys.



### Multi-Window



The **Multi Window** front-panel key will toggle you back and forth between the Normal View and the last Multi Window View (Zone Span, Trace Zoom or Spectrogram) that you were in, when using the Swept SA measurement of the Spectrum Analyzer Mode. It remembers which View you were in through a Preset. This “previous view” is set to Zone Span on a Restore Mode Defaults.

Key Path	<b>Front-panel key</b>
Initial S/W Revision	Prior to A.02.00

### Zoom

Zoom is a toggle function. Pressing this key once increases the size of the selected window. Pressing the key again returns the window to the original size.

When Zoom is on for a window, that window will get the entire primary display area. The zoomed window, since it is the selected window, is outlined in green.

Zoom is local to each Measurement. Each Measurement remembers its Zoom state. The Zoom state of each Measurement is part of the Mode’s state.

**NOTE**

**Data acquisition and processing for the other windows continues while a window is zoomed, as does all SCPI communication with the other windows.**

<b>Remote Command</b>	:DISPlay:WINDow:FORMat:ZOOM
<b>Remote Command</b>	:DISPlay:WINDow:FORMat:TILE

<b>Example</b>	:DISP:WIND:FORM:ZOOM sets zoomed :DISP:WIND:FORM:TILE sets un-zoomed
Preset	TILE
Initial S/W Revision	Prior to A.02.00

## Next Window

Selects the next window of the current view. When the Next Window key is pressed, the next window in the order of precedence becomes selected. If the selected window was zoomed, the next window will also be zoomed.

The window numbers are as follows. Note that these numbers also determine the order of precedence (that is, Next Window goes from 1 to 2, then 2 to 3, etc.):



### RTSA measurements:

Only two windows are available in the Spectrogram view under the Spectrum measurement and up to three windows are available in the Power vs. Time measurement, depending on the view set up.

<b>Remote Command</b>	:DISPlay:WINDow[:SElect] <number> :DISPlay:WINDow[:SElect]?
<b>Example</b>	:DISP:WIND 1
Preset	1
Min	1
Max	If <number> is greater than the number of windows, limit to <number of windows>
Initial S/W Revision	Prior to A.02.00

One and only one window is always selected. The selected window has the focus; this means that all window-specific key presses apply only to that window. You can tell which window is selected by the thick green border around it. If a window is not selected, its boundary is gray.

If a window in a multi-window display is zoomed it is still outlined in green. If there is only one window, the green outline is not used. This allows the user to distinguish between a zoomed window and a display with only one window.

The selected window is local to each Measurement. Each Measurement remembers which window is selected. The selected window for each Measurement is remembered in Mode state.

**NOTE**

When this key is pressed in Help Mode, it toggles focus between the table of contents window and the topic pane window.

## Full Screen

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 softkey labels, however the menus and active functions still work. (Though it would obviously be very hard to navigate without the key labels displayed.) Pressing **Full Screen** again while Full Screen is in effect cancels Full Screen.

Note that the banner and status lines are unaffected. You can get even more screen area for your data display by turning off the Meas Bar (in the Display menu) which also turns off the settings panel.

Full Screen is a Meas Global function. Therefore it is cancelled by the **Preset** key.

Key Path	Display
<b>Remote Command</b>	<b>:DISPlay:FSCReen[:STATe] OFF ON 0 1</b> <b>:DISPlay:FSCReen[:STATe]?</b>
Preset	Unaffected by Preset but set to Off by Restore Misc Defaults or shutdown and restart
State Saved	Not saved in instrument state.
<b>Backwards Compatibility SCPI</b>	<b>:DISPlay:MENU[:STATe] OFF ON 0 1</b> 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
Initial S/W Revision	Prior to A.02.00

## Display Enable (Remote Command Only)

Turns the display on/off, including the display drive circuitry. The backlight stays lit so you can tell that the instrument is on. The display enable setting is mode global. The reasons for turning the display off are three:

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

If you have turned off the display:

- and you are in local operation, the display can be turned back on by pressing any key or by sending the SYSTem:DEFaults MISC command or the DISPlay:ENABle ON (neither \*RST nor SYSTem:PRESet enable the display.)
- and you are in remote operation, the display can be turned back on by pressing the **Local** or **Esc** keys or by sending the SYSTem:DEFaults MISC command or the DISPlay:ENABle ON (neither \*RST nor SYSTem:PRESet enable the display.)

and you are using either the SYSTem:KLOCK command or GPIB local lockout, then no front-panel key press will turn the display back on. You must turn it back on remotely.

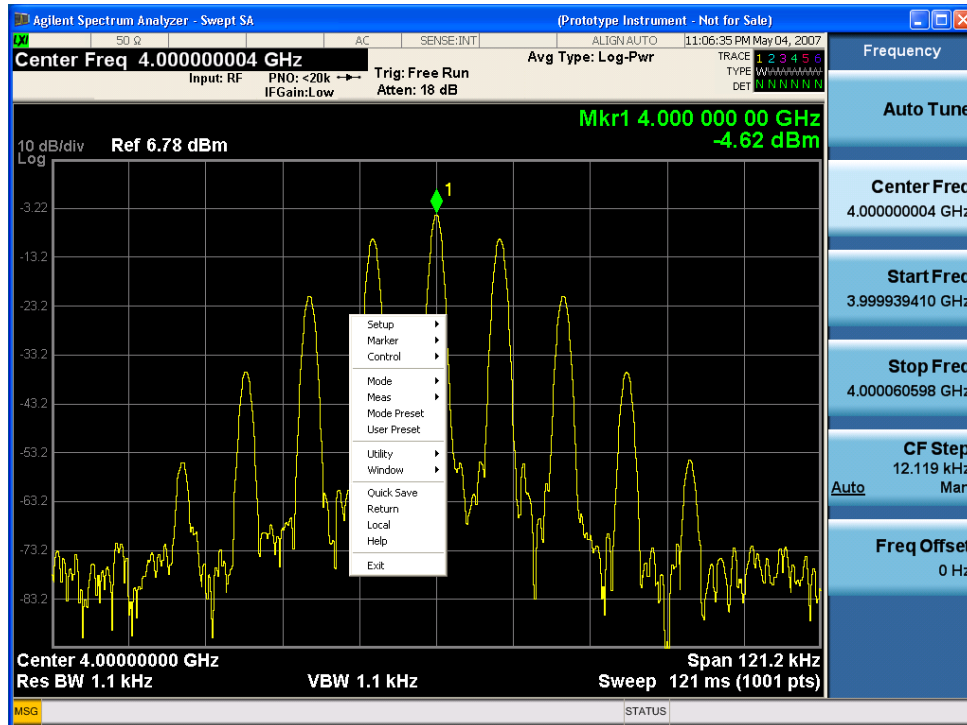
<b>Remote Command</b>	:DISPlay:ENABle OFF ON 0 1 :DISPlay:ENABle?
<b>Example</b>	DISP:ENAB OFF
Couplings	DISP:ENAB OFF turns Backlight OFF and DISP:ENAB ON turns Backlight ON. However, settings of Backlight do not change the state of DISP:ENAB
Preset	On Set by SYST:DEF MISC, but Not affected by *RST or SYSTem:PRESet.
State Saved	Not saved in instrument state.
Backwards Compatibility Notes	SYST:PRES no longer turns on DISPlay:ENABle as it did in legacy analyzers
Initial S/W Revision	Prior to A.02.00

## Mouse and Keyboard Control

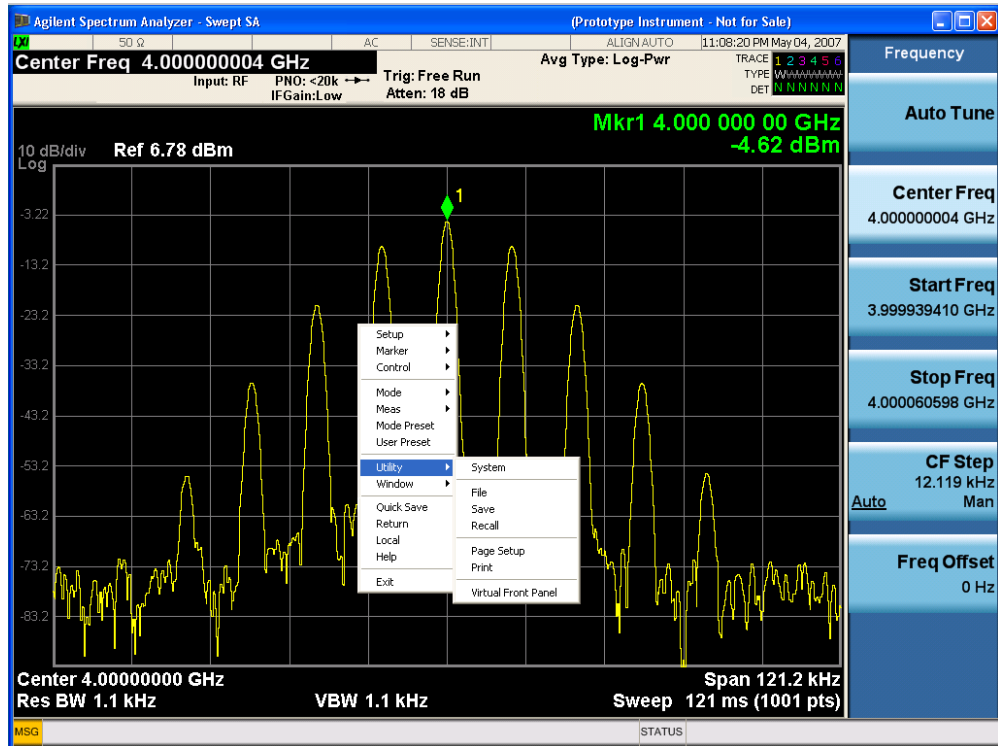
If you do not have access to the instrument front-panel, there are several ways that a mouse and PC Keyboard can give you access to functions normally accessed using the front-panel keys.

### Right-Click

If you plug in a mouse and right-click on the analyzer screen, a menu will appear as below:

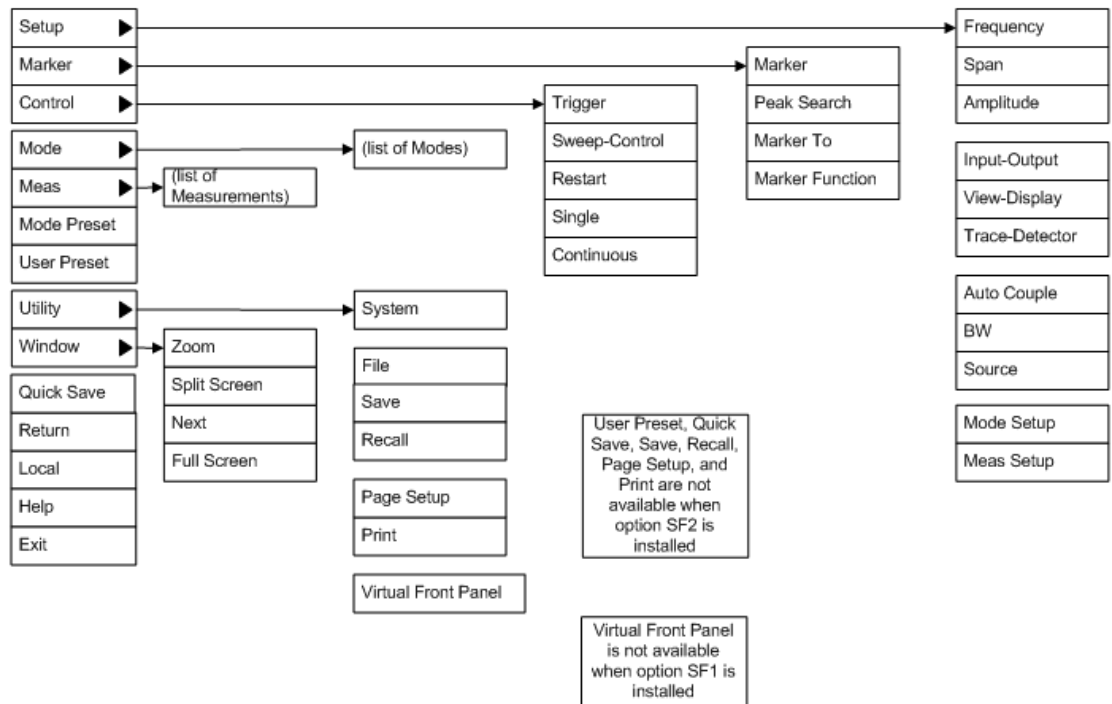


Placing the mouse on one of the rows marked with a right arrow symbol will cause that row to expand, as for example below where the mouse is hovered over the “Utility” row:



This method can be used to access any of the front-panel keys by using a mouse; as for example if you are accessing the instrument through Remote Desktop.

The array of keys thus available is shown below:





## PC Keyboard

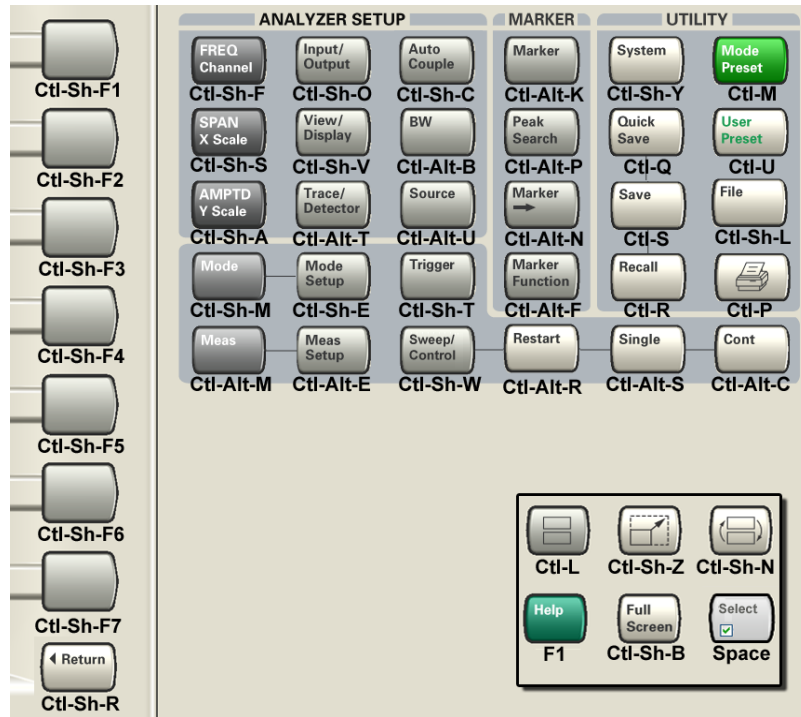
If you have a PC keyboard plugged in (or via Remote Desktop), certain key codes on the PC keyboard map to front-panel keys on the GPSA front panel. These key codes are shown below:

<b>Front-panel key</b>	<b>Key code</b>
Frequency	CTRL+SHIFT+F
Span	CTRL+SHIFT+S
Amplitude	CTRL+SHIFT+A
Input/Output	CTRL+SHIFT+O
View/Display	CTRL+SHIFT+V
Trace/Detector	CTRL+ALT+T
Auto Couple	CTRL+SHIFT+C
Bandwidth	CTRL+ALT+B
Source	CTRL+ALT-U
Marker	CTRL+ALT+K
Peak Search	CTRL+ALT+P
Marker To	CTRL+ALT+N
Marker Function	CTRL+ALT+F
System	CTRL+SHIFT+Y
Quick Save	CTRL+Q
Save	CTRL+S
Recall	CTRL+R
Mode Preset	CTRL+M
User Preset	CTRL+U
Print	CTRL+P
File	CTRL+SHIFT+L
Mode	CTRL+SHIFT+M
Measure	CTRL+ALT+M
Mode Setup	CTRL+SHIFT+E
Meas Setup	CTRL+ALT+E
Trigger	CTRL+SHIFT+T
Sweep/Control	CTRL+SHIFT+W
Restart	CTRL+ALT+R
Single	CTRL+ALT+S
Cont	CTRL+ALT+C
Zoom	CTRL+SHIFT+Z
Next Window	CTRL+SHIFT+N

<b>Front-panel key</b>	<b>Key code</b>
Split Screen	CTRL+L
Full Screen	CTRL+SHIFT+B
Return	CTRL+SHIFT+R
Mute	Mute
Inc Audio	Volume Up
Dec Audio	Volume Down
Help	F1
Control	CTRL
Alt	ALT
Enter	Return
Cancel	Esc
Del	Delete
Backspace	Backspace
Select	Space
Up Arrow	Up
Down Arrow	Down
Left Arrow	Left
Right Arrow	Right
Menu key 1	CTRL+SHIFT+F1
Menu key 2	CTRL+SHIFT+F2
Menu key 3	CTRL+SHIFT+F3
Menu key 4	CTRL+SHIFT+F4
Menu key 5	CTRL+SHIFT+F5
Menu key 6	CTRL+SHIFT+F6
Menu key 7	CTRL+SHIFT+F7
Backspace	BACKSPACE
Enter	ENTER
Tab	Tab
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8

Front-panel key	Key code
9	9
0	0

This is a pictorial view of the table:



## Instrument Security & Memory Volatility

If you are using the instrument in a secure environment, you may need details of how to clear or sanitize its memory, in compliance with published security standards of the United States Department of Defense, or other similar authorities.

For X-Series instruments, this information is contained in the document "Security Features and Document of Volatility". This document is **not** included in the Documentation DVD, or the instrument's on-disk library, but it may be downloaded from Keysight's web site.

To obtain a copy of the document, click on or browse to the following URL:

[www.keysight.com/find/security](http://www.keysight.com/find/security)

To locate and download the document, select Model Number "N9020A", then click "Submit". Then, follow the on-screen instructions to download the file.

## 2 About the Real-Time Spectrum Analyzer Measurement Application

The Real-time Spectrum Analyzer Measurement application uses ASICs and FPGAs to convert sampled signal data into signal spectra at a very high rate, nearly 300,000 spectra per second. Spectrum data is combined to create information-rich displays such as density (also called histograms). Alternatively, the stream of spectra can be sequentially tested against limits and logical criteria to produce a spectrum-specific and behavior-specific frequency-mask trigger (FMT).

In addition, PXAs and MXAs with the RTSA option offer the following:

- **Wider bandwidth:** As the signal bandwidths and spans to be analyzed continue to increase, greater bandwidth is necessary. The PXA and MXA have the required combination of IF bandwidth, signal sampling and signal process to handle 160 MHz continuously. This gap-free bandwidth applies not only to real-time spectrum analysis but also FMT, gap-free time capture and real-time magnitude calculations for IF magnitude triggering.
- **Better dynamic range:** The PXA and MXA allow small signals to be detected in the presence of large ones by providing 75 dB of spurious-free dynamic range across its full 160-MHz analysis bandwidth. Dynamic range is enhanced by the low noise floor of the PXA and MXA and, when dealing with very small signals, can be further enhanced by adding the low noise path (LNP) option, which improves sensitivity while simultaneously handling high-level signals.
- **Higher probability of intercept:** The term POI comes from the field of signal surveillance and reflects the likelihood that a transient signal will be detected. The PXA and MXA advanced processing architecture combines with its 160-MHz analysis bandwidth and wide dynamic range to provide 100 percent POI for signals with durations as short as 3.57 ms.

## Defining Real-time Analysis

In a spectrum or signal analyzer with a digital intermediate frequency (IF) section, Real-time operation is a state in which all signal samples are processed for some sort of measurement result or triggering operation. In most cases the measurement results are scalar, power or magnitude, corresponding to traditional spectrum measurements.

In addition to the gap-free analysis, a real-time RF analyzer may be defined as having four more key attributes:

- high-speed measurement
- consistent measurement speed
- frequency mask triggering
- advanced composite displays

In general, the stream of spectra from real-time processing can be used in one of two ways; the spectra can be combined into a composite spectrum display or successively compared to a limit mask to implement frequency-mask triggering. Both of these capabilities are present in the RTSA option.

## 3 Programming the Analyzer

This section provides introductory information about the programming documentation included with your product.

- ["What Programming Information is Available?" on page 60](#)
- ["List of SCPI Commands" on page 61](#)
- ["STATus Subsystem " on page 81](#)
- ["IEEE 488.2 Common Commands" on page 128](#)

## What Programming Information is Available?

X-Series Documentation can be accessed through the Additional Documentation page in the instrument Help system and is included on the Documentation DVD shipped with the instrument. It can also be found online at:  
[http://www.keysight.com/find/mxa\\_manuals](http://www.keysight.com/find/mxa_manuals).

The following resources are available to help you create programs for automating your X-Series measurements:

Resource	Description
X-Series Programmer's Guide	Provides general SCPI programming information on the following topics: <ul style="list-style-type: none"><li>– Programming the X-Series Applications</li><li>– Programming fundamentals</li><li>– Programming examples</li></ul> Note that SCPI command descriptions for measurement applications are <b>not</b> in this manual, but are included in the User's and Programmer's Reference manuals and the embedded help.
User's and Programmer's Reference manuals	Describes all front-panel keys and softkeys, including SCPI commands for a measurement application. Note that: <ul style="list-style-type: none"><li>– Each measurement application has its own User's and Programmer's Reference.</li><li>– The content in this manual is duplicated in the instrument's Help (the Help that you see for a key is identical to what you see in this manual).</li></ul>
Embedded Help in your instrument	Describes all front-panel keys and softkeys, including SCPI commands, for a measurement application. Note that the content that you see in Help when you press a key is identical to what you see in the User's and Programmer's Reference.
X-Series Getting Started Guide	Provides valuable sections related to programming including: <ul style="list-style-type: none"><li>– Licensing New Measurement Application Software - After Initial Purchase</li><li>– Configuring instrument LAN Hostname, IP Address, and Gateway Address</li><li>– Using the controller to connect to the instrument remotely</li><li>– Using the Embedded Web Server Telnet connection to communicate SCPI</li></ul> This printed document is shipped with the instrument.
Keysight Application Notes	Printable PDF versions of pertinent application notes.
Keysight VISA User's Guide	Describes the Keysight Virtual Instrument Software Architecture (VISA) library and shows how to use it to develop I/O applications and instrument drivers on Windows PCs.



## List of SCPI Commands

\*

\*CAL?  
\*CLS  
\*ESE  
\*ESE?  
\*ESR?  
\*IDN?  
\*OPC  
\*OPC?  
\*OPT?  
\*RCL  
\*RST  
\*SAV  
\*SRE  
\*SRE?  
\*STB?  
\*TRG  
\*TST?  
\*WAI

A

ABORT

C

CALC:MARKer[n]:FUNction:BAND:RIGHT  
CALCulate:BWIDth|BANDwidth:NDB  
CALCulate:BWIDth|BANDwidth:NDB?  
CALCulate:BWIDth|BANDwidth:RESult?  
CALCulate:BWIDth|BANDwidth:RLEft?  
CALCulate:BWIDth|BANDwidth:RRIGHT?  
CALCulate:BWIDth|BANDwidth[:STATe]  
CALCulate:BWIDth|BANDwidth[:STATe]?  
CALCulate:CLIMits:FAIL?  
CALCulate:DATA<n>:COMPRESS?  
CALCulate:DATA[n]?  
CALCulate:DATA[1]|2|...|6:PEAKs?  
CALCulate:DATA[1]|2|...|6:PEAKs?  
CALCulate:DATA:RTDensity?  
CALCulate:FPOWER:POWER[1,2,...,999]?  
CALCulate:FPOWER:POWER[1,2,...,999]:CONFigure  
CALCulate:FPOWER:POWER[1,2,...,999]:DEFine  
CALCulate:FPOWER:POWER[1,2,...,999]:DEFine?  
CALCulate:FPOWER:POWER[1,2,...,999]:FETCh?  
CALCulate:FPOWER:POWER[1,2,...,999]:INITiate  
CALCulate:FPOWER:POWER[1,2,...,999]:READ?

```

CALCulate:FPOWer:POWer[1,2,...,999]:READ1?
CALCulate:FPOWer:POWer[1,2,...,999]:READ2?
CALCulate:FPOWer:POWer[1,2,...,999]:RESet
CALCulate:LLINe:ALL:DELeTe
CALCulate:LLINe[1]|2|...|6:AMPLitude:CMODE:RELative
CALCulate:LLINe[1]|2|...|6:AMPLitude:CMODE:RELative?
CALCulate:LLINe[1]|2|...|6:AMPLitude:INTerpolate:TYPE
CALCulate:LLINe[1]|2|...|6:AMPLitude:INTerpolate:TYPE?
CALCulate:LLINe[1]|2|...|6:BUILd
CALCulate:LLINe[1]|2|...|6:COMMeNt
CALCulate:LLINe[1]|2|...|6:COMMeNt?
CALCulate:LLINe:CONTRol:DOMain
CALCulate:LLINe:CONTRol:DOMain?
CALCulate:LLINe[1]|2|...|6:CONTRol:INTerpolate:TYPE
CALCulate:LLINe[1]|2|...|6:CONTRol:INTerpolate:TYPE?
CALCulate:LLINe[1]|2|...|6:COpy
CALCulate:LLINe[1]|2|...|6:DELeTe
CALCulate:LLINe[1]|2|...|6:DESCRiption
CALCulate:LLINe[1]|2|...|6:DESCRiption?
CALCulate:LLINe[1]|2|...|6:DISPlay
CALCulate:LLINe[1]|2|...|6:DISPlay?
CALCulate:LLINe[1]|2|...|6:FREQuency:CMODE:RELative
CALCulate:LLINe[1]|2|...|6:FREQuency:CMODE:RELative?
CALCulate:LLINe[1]|2|...|6:MARGin
CALCulate:LLINe[1]|2|...|6:MARGin?
CALCulate:LLINe[1]|2|...|6:MARGin:STATE
CALCulate:LLINe[1]|2|...|6:MARGin:STATE?
CALCulate:LLINe[1]|2|...|6:OFFSet:UPDate
CALCulate:LLINe[1]|2|...|6:OFFSet:X
CALCulate:LLINe[1]|2|...|6:OFFSet:X?
CALCulate:LLINe[1]|2|...|6:OFFSet:Y
CALCulate:LLINe[1]|2|...|6:OFFSet:Y?
CALCulate:LLINe[1]|2:STATE
CALCulate:LLINe:TEST
CALCulate:LLINe:TEST?
CALCulate:LLINe[1]|2|...|6:TRACe
CALCulate:LLINe[1]|2|...|6:TRACe?
CALCulate:LLINe[1]|2|...|6:TYPE
CALCulate:LLINe[1]|2|...|6:TYPE?
CALCulate:MARKer:AOFF
CALCulate:MARKer:COUPLe[:STATE]
CALCulate:MARKer:COUPLe[:STATE]?
CALCulate:MARKer[1]|2|...|12:CPSeArCh[:STATE]
CALCulate:MARKer[1]|2|...|12:CPSeArCh[:STATE]?
CALCulate:MARKer[1]|2|...|12:FUNCTion
CALCulate:MARKer[1]|2|...|12:FUNCTion?
CALCulate:MARKer[1]|2|...|12:FUNCTion:BAND:LEFT
CALCulate:MARKer[1]|2|...|12:FUNCTion:BAND:LEFT?
CALCulate:MARKer[1]|2|...|12:FUNCTion:BAND:RIGHT
CALCulate:MARKer[1]|2|...|12:FUNCTion:BAND:RIGHT?
CALCulate:MARKer[1]|2|...|12:FUNCTion:BAND:SPAN
CALCulate:MARKer[1]|2|...|12:FUNCTion:BAND:SPAN?
CALCulate:MARKer[1]|2|...|12:LINes[:STATE]

```

```

CALCulate:MARKer[1]|2|...|12:LINEs[:STATE]?
CALCulate:MARKer[1]|2|...|12:MAXimum
CALCulate:MARKer[1]|2|...|12:MAXimum:LEFT
CALCulate:MARKer[1]|2|...|12:MAXimum:NEXT
CALCulate:MARKer[1]|2|...|12:MAXimum:RIGHT
CALCulate:MARKer[1]|2|...|12:MINimum
CALCulate:MARKer[1]|2|...|12:MODE
CALCulate:MARKer[1]|2|...|12:MODE
CALCulate:MARKer[1]|2|...|12:MODE?
CALCulate:MARKer[n]:X:POSition:STOP
CALCulate:MARKer:PEAK:EXCursion
CALCulate:MARKer:PEAK:EXCursion?
CALCulate:MARKer:PEAK:EXCursion:STATE
CALCulate:MARKer:PEAK:EXCursion:STATE?
CALCulate:MARKer:PEAK:SEARCh:MODE
CALCulate:MARKer:PEAK:SEARCh:MODE?
CALCulate:MARKer:PEAK:SORT
CALCulate:MARKer:PEAK:SORT?
CALCulate:MARKer:PEAK:TABLE:DTLimit
CALCulate:MARKer:PEAK:TABLE:DTLimit:STATE
CALCulate:MARKer:PEAK:TABLE:DTLimit:STATE?
CALCulate:MARKer:PEAK:TABLE:READout
CALCulate:MARKer:PEAK:TABLE:READout?
CALCulate:MARKer:PEAK:TABLE:STATE
CALCulate:MARKer:PEAK:TABLE:STATE?
CALCulate:MARKer:PEAK:THReshold
CALCulate:MARKer:PEAK:THReshold?
CALCulate:MARKer:PEAK:THReshold:STATE
CALCulate:MARKer:PEAK:THReshold:STATE?
CALCulate:MARKer[1]|2|...|12:PTPeak
CALCulate:MARKer[1]|2|...|12:REFerence
CALCulate:MARKer[1]|2|...|12:REFerence?
CALCulate:MARKer[1]|2|...|12[:SET]:CENTer
CALCulate:MARKer[1]|2|...|12[:SET]:DELTA:CENTer
CALCulate:MARKer[1]|2|...|12[:SET]:DELTA:SPAN
CALCulate:MARKer[1]|2|...|12[:SET]:RLeve1
CALCulate:MARKer[1]|2|...|12[:SET]:SPAN
CALCulate:MARKer[1]|2|...|12[:SET]:START
CALCulate:MARKer[1]|2|...|12[:SET]:STEP
CALCulate:MARKer[1]|2|...|12[:SET]:STOP
CALCulate:MARKer[1]|2|...|12:STATE
CALCulate:MARKer[1]|2|...|12:STATE
CALCulate:MARKer[1]|2|...|12:STATE
CALCulate:MARKer[1]|2|...|12:STATE?
CALCulate:MARKer:TABLE[:STATE]
CALCulate:MARKer:TABLE[:STATE]?
CALCulate:MARKer[1]|2|...|12:TRACe
CALCulate:MARKer[1]|2|...|12:TRACe
CALCulate:MARKer[1]|2|...|12:TRACe?
CALCulate:MARKer[1]|2|...|12:TRACe?
CALCulate:MARKer[1]|2|...|12:TRACe:AUTO
CALCulate:MARKer[1]|2|...|12:TRACe:AUTO?
CALCulate:MARKer[1]|2|...|12:X

```

```

CALCulate:MARKer[1] | 2 | ... | 12:X?
CALCulate:MARKer[1] | 2 | ... | 4:X:CENTer
CALCulate:MARKer[1] | 2 | ... | 12:X:POSition
CALCulate:MARKer[1] | 2 | ... | 12:X:POSition?
CALCulate:MARKer[1] | 2 | ... | 4:X:POSition:CENTer
CALCulate:MARKer[1] | 2 | ... | 4:X:POSition:SPAN
CALCulate:MARKer[1] | 2 | ... | 4:X:POSition:SPAN?
CALCulate:MARKer[1] | 2 | ... | 4:X:POSition:START
CALCulate:MARKer[1] | 2 | ... | 4:X:POSition:START?
CALCulate:MARKer[1] | 2 | ... | 4:X:POSition:STOP
CALCulate:MARKer[1] | 2 | ... | 4:X:POSition:STOP?
CALCulate:MARKer[1] | 2 | ... | 12:X:READout
CALCulate:MARKer[1] | 2 | ... | 12:X:READout?
CALCulate:MARKer[1] | 2 | ... | 12:X:READout:AUTO
CALCulate:MARKer[1] | 2 | ... | 12:X:READout:AUTO?
CALCulate:MARKer[1] | 2 | ... | 4:X:SPAN
CALCulate:MARKer[1] | 2 | ... | 4:X:START
CALCulate:MARKer[1] | 2 | ... | 4:X:STOP
CALCulate:MARKer[1] | 2 | ... | 12:Y
CALCulate:MARKer[1] | 2 | ... | 12:Y?
CALCulate:MARKer[1] | 2 | ... | 12:Z?
CALCulate:MARKer[1] | 2 | ... | 12:Z:POSition
CALCulate:MARKer[1] | 2 | ... | 12:Z:POSition?
CALCulate:MATH
CALCulate:MATH?
CALCulate:NTData[:STATE]
CALCulate:NTData[:STATE]?
CALibration[:ALL]
CALibration[:ALL]?
CALibration[:ALL]:NPENding
CALibration:AUTO
CALibration:AUTO
CALibration:AUTO?
CALibration:AUTO:ALERT
CALibration:AUTO:ALERT?
CALibration:AUTO:MODE
CALibration:AUTO:MODE?
CALibration:AUTO:TIME:OFF?
CALibration:DATA:BACKup
CALibration:DATA:DEFault
CALibration:DATA:REStore
CALibration:EMIXer
CALibration:EMIXer?
CALibration:EXPIred?
CALibration:FREQuency:REFerence:COARse
CALibration:FREQuency:REFerence:COARse?
CALibration:FREQuency:REFerence:FINE
CALibration:FREQuency:REFerence:FINE?
CALibration:FREQuency:REFerence:MODE
CALibration:FREQuency:REFerence:MODE?
CALibration:IQ:FLATness:I
CALibration:IQ:FLATness:IBAR
  
```

CALibration:IQ:FLATness:I|IBAR|Q|QBAR:TIME?  
CALibration:IQ:FLATness:Q  
CALibration:IQ:FLATness:QBAR  
CALibration:IQ:ISOLation  
CALibration:IQ:ISOLation:TIME?  
CALibration:IQ:PROBe:I  
CALibration:IQ:PROBe:IBar  
CALibration:IQ:PROBe:I|IBAR|Q|QBAR:TIME?  
CALibration:IQ:PROBe:I|Q:CLEar  
CALibration:IQ:PROBe:Q  
CALibration:IQ:PROBe:QBar  
CALibration:NFLoor  
CALibration:NFLoor?  
CALibration:NRF  
CALibration:NRF?  
CALibration:NRF:NPENding  
CALibration:REFErence:CLOCK?  
CALibration:REFErence:CLOCK:END?  
CALibration:REFErence:CLOCK:INITialize?  
CALibration:RF  
CALibration:RF?  
CALibration:RF:NPENding  
CALibration:RFPSelector:ALERT  
CALibration:RFPSelector:ALERT?  
CALibration:RFPSelector:CONDUCTed  
CALibration:RFPSelector:CONDUCTed?  
CALibration:RFPSelector:FULL  
CALibration:RFPSelector:FULL?  
CALibration:RFPSelector:RADiated  
CALibration:RFPSelector:RADiated?  
CALibration:RFPSelector:SCHEDuler:RECurrence  
CALibration:RFPSelector:SCHEDuler:RECurrence?  
CALibration:RFPSelector:SCHEDuler:RECurrence:DAY  
CALibration:RFPSelector:SCHEDuler:RECurrence:DAY?  
CALibration:RFPSelector:SCHEDuler:RECurrence:WEEK  
CALibration:RFPSelector:SCHEDuler:RECurrence:WEEK?  
CALibration:RFPSelector:SCHEDuler:STATE  
CALibration:RFPSelector:SCHEDuler:STATE?  
CALibration:RFPSelector:SCHEDuler:TASK  
CALibration:RFPSelector:SCHEDuler:TASK?  
CALibration:RFPSelector:SCHEDuler:TIME:NEXT?  
CALibration:RFPSelector:SCHEDuler:TIME:START  
CALibration:RFPSelector:SCHEDuler:TIME:START?  
CALibration:SOURce:STATE  
CALibration:SOURce:STATE?  
CALibration:TEMPerature:CURRent?  
CALibration:TEMPerature:LALL?  
CALibration:TEMPerature:LPReselector?  
CALibration:TEMPerature:LRF?  
CALibration:TEMPerature:NFLoor?  
CALibration:TEMPerature:RFPSelector:LCONDUCTed?  
CALibration:TEMPerature:RFPSelector:LRADiated?  
CALibration:TIME:ELAPsed:NFLoor?

CALibration:TIME:LALL?  
CALibration:TIME:LPreselector?  
CALibration:TIME:LRF?  
CALibration:TIME:NFLoor?  
CALibration:TIME:REfERENCE:CLOCK?  
CALibration:TIME:RFPSelector:LCONducted?  
CALibration:TIME:RFPSelector:LRADIated?  
CALibration:YTF  
CALibration:YTF?  
CALibration:YTF:NPENding  
CONF  
CONFigure?  
COUPlE

## D

DISPlay:<measurement>:ANNotation:TITLe:DATA  
DISPlay:<measurement>:ANNotation:TITLe:DATA?  
DISPlay:ACTivefunc[:STATE]  
DISPlay:ACTivefunc[:STATE]?  
DISPlay:ANNotation:MBAR[:STATE]  
DISPlay:ANNotation:MBAR[:STATE]?  
DISPlay:ANNotation:SCReen[:STATE]  
DISPlay:ANNotation:SCReen[:STATE]?  
DISPlay:BACKlight  
DISPlay:BACKlight?  
DISPlay:BACKlight:INTensity  
DISPlay:BACKlight:INTensity?  
DISPlay:ENABle  
DISPlay:ENABle?  
DISPlay:FSCReen[:STATE]  
DISPlay:FSCReen[:STATE]?  
DISPlay:MENU[:STATE]  
DISPlay:VIEW  
DISPlay:VIEW?  
DISPlay:VIEW:DENSity:AADJust  
DISPlay:VIEW:DENSity:CNONlinear  
DISPlay:VIEW:DENSity:CNONlinear?  
DISPlay:VIEW:DENSity:CPALettes  
DISPlay:VIEW:DENSity:CPALettes?  
DISPlay:VIEW:DENSity:HDHue  
DISPlay:VIEW:DENSity:HDHue?  
DISPlay:VIEW:DENSity:LDHue  
DISPlay:VIEW:DENSity:LDHue?  
DISPlay:VIEW:DENSity:PERsistence  
DISPlay:VIEW:DENSity:PERsistence?  
DISPlay:VIEW:DENSity:PERsistence:INFinite  
DISPlay:VIEW:DENSity:PERsistence:INFinite?  
DISPlay:VIEW:SPECTrogram:AADJust  
DISPlay:VIEW:SPECTrogram:BOTTom  
DISPlay:VIEW:SPECTrogram:BOTTom?  
DISPlay:VIEW:SPECTrogram:HUE

DISPlay:VIEW:SPECTrogram:HUE?  
 DISPlay:VIEW:SPECTrogram:REFerence  
 DISPlay:VIEW:SPECTrogram:REFerence?  
 DISPlay:VIEW:SPECTrogram:TRACe:COUPlE  
 DISPlay:VIEW:SPECTrogram:TRACe:COUPlE?  
 DISPlay:VIEW:SPECTrogram:TRACe:SELection  
 DISPlay:VIEW:SPECTrogram:TRACe:SELection?  
 DISPlay:WINDow[1]:ANNOtation[:ALL]  
 DISPlay:WINDow[1]:ANNOtation[:ALL]?  
 DISPlay:WINDow:FORMat:TILE  
 DISPlay:WINDow:FORMat:ZOOM  
 DISPlay:WINDow[:SELection]  
 DISPlay:WINDow[:SELection]?  
 DISPlay:WINDow[1]:TRACe:GRATICule:GRID[:STATE]  
 DISPlay:WINDow[1]:TRACe:GRATICule:GRID[:STATE]?  
 DISPlay:WINDow[1]:TRACe:X:FLINE[1]|2|...|4  
 DISPlay:WINDow[1]:TRACe:X:FLINE[1]|2|...|4?  
 DISPlay:WINDow[1]:TRACe:X:FLINE[1]|2|...|4:STATE  
 DISPlay:WINDow[1]:TRACe:X:FLINE[1]|2|...|4:STATE?  
 DISPlay:WINDow[1]:TRACe:X[:SCALE]:OFFSet  
 DISPlay:WINDow[1]:TRACe:X:TLINE[1]|2|...|4  
 DISPlay:WINDow[1]:TRACe:X:TLINE[1]|2|...|4?  
 DISPlay:WINDow[1]:TRACe:X:TLINE[1]|2|...|4:STATE  
 DISPlay:WINDow[1]:TRACe:X:TLINE[1]|2|...|4:STATE?  
 DISPlay:WINDow[1]:TRACe:Y:DLINE[1]|2|...|4  
 DISPlay:WINDow[1]:TRACe:Y:DLINE[1]|2|...|4?  
 DISPlay:WINDow[1]:TRACe:Y:DLINE[1]|2|...|4:STATE  
 DISPlay:WINDow[1]:TRACe:Y:DLINE[1]|2|...|4:STATE?  
 DISPlay:WINDow[1]:TRACe:Y[:SCALE]:NRLevel  
 DISPlay:WINDow[1]:TRACe:Y[:SCALE]:NRLevel?  
 DISPlay:WINDow[1]:TRACe:Y[:SCALE]:NRPosition  
 DISPlay:WINDow[1]:TRACe:Y[:SCALE]:NRPosition?  
 DISPlay:WINDow[1]:TRACe:Y[:SCALE]:PDIVision  
 DISPlay:WINDow[1]:TRACe:Y[:SCALE]:PDIVision?  
 DISPlay:WINDow[1]:TRACe:Y[:SCALE]:RLEVEL  
 DISPlay:WINDow[1]:TRACe:Y[:SCALE]:RLEVEL?  
 DISPlay:WINDow[1]:TRACe:Y[:SCALE]:RLEVEL:OFFSet  
 DISPlay:WINDow[1]:TRACe:Y[:SCALE]:RLEVEL:OFFSet?  
 DISPlay:WINDow[1]:TRACe:Y[:SCALE]:SPACing  
 DISPlay:WINDow[1]:TRACe:Y[:SCALE]:SPACing?

## F

FORMat:BORDER  
 FORMat:BORDER?  
 FORMat[:TRACe][:DATA]  
 FORMat[:TRACe][:DATA]?

## G

GLoBal:DEFault

GLOBAL:FREQUENCY:CENTER[:STATE]  
GLOBAL:FREQUENCY:CENTER[:STATE]?

H

HCOPY:ABORT  
HCOPY[:IMMEDIATE]  
HCOPY:SDUMP:DATA?

I

INITIATE:CONTINUOUS  
INITIATE:CONTINUOUS?  
INITIATE[:IMMEDIATE]  
INITIATE:PAUSE  
INITIATE:RESTART  
INITIATE:RESUME  
INPUT<1|2>:PRESELECTION[:STATE]  
INPUT<1|2>:PRESELECTION[:STATE]?  
INPUT<1|2>:TYPE  
INPUT<1|2>:TYPE?  
INPUT:COUPLING  
INPUT:COUPLING?  
INPUT:COUPLING:I|Q  
INPUT:COUPLING:I|Q?  
INPUT:IMPEDANCE:IQ  
INPUT:IMPEDANCE:IQ?  
INPUT:IMPEDANCE:REFERENCE  
INPUT:IMPEDANCE:REFERENCE?  
INPUT[1]:IQ:BALANCED[:STATE]  
INPUT[1]:IQ:BALANCED[:STATE]?  
INPUT:IQ[:I]:DIFFERENTIAL  
INPUT:IQ[:I]:DIFFERENTIAL?  
INPUT[1]:IQ[:I]:IMPEDANCE  
INPUT[1]:IQ[:I]:IMPEDANCE?  
INPUT:IQ:MIRRORED  
INPUT:IQ:MIRRORED?  
INPUT:IQ:Q:DIFFERENTIAL  
INPUT:IQ:Q:DIFFERENTIAL?  
INPUT[1]:IQ:Q:IMPEDANCE  
INPUT[1]:IQ:Q:IMPEDANCE?  
INPUT[1]:IQ:TYPE  
INPUT[1]:IQ:TYPE?  
INPUT:MIXER  
INPUT:MIXER?  
INPUT:OFFSET:I|Q  
INPUT:OFFSET:I|Q?  
INST:NSEL  
INST:NSEL  
INSTRUMENT:CATALOG?  
INSTRUMENT:CONFIGURE:<mode>:<meas>



INSTRument:COUPle:DEFault  
INSTRument:COUPle:FREQuency:CENTer  
INSTRument:COUPle:FREQuency:CENTer?  
INSTRument:DEFault  
INSTRument:NSElect  
INSTRument:NSElect?  
INSTRument[:SElect]  
INSTRument[:SElect]  
INSTRument[:SElect]  
INSTRument[:SElect]  
INSTRument[:SElect]  
INSTRument[:SElect]?  
INST:SEL  
INST:SEL  
INST:SEL  
INST:SEL

## L

LXI:IDENTify[:STATe]  
LXI:IDENTify[:STATe]?

## M

MMEMory:CATalog?  
MMEMory:CDIRectory  
MMEMory:CDIRectory?  
MMEMory:COPI  
MMEMory:COPI:DEVIce  
MMEMory:DATA  
MMEMory:DATA?  
MMEMory:DELeTe  
MMEMory:LOAD:CORRection  
MMEMory:LOAD:CORRection  
MMEMory:LOAD:FMT  
MMEMory:LOAD:FMT  
MMEMory:LOAD:FMT  
MMEMory:LOAD:LIMit  
MMEMory:LOAD:STATe  
MMEMory:LOAD:STATe  
MMEMory:LOAD:TRACe  
MMEMory:LOAD:TRACe:DATA  
MMEMory:LOAD:TRACe:REGister  
MMEMory:MDIRectory  
MMEMory:MOVE  
MMEMory:RDIRectory  
MMEMory:REGister:STATe:LABel  
MMEMory:REGister:STATe:LABel?  
MMEMory:RMEDIA:LABel  
MMEMory:RMEDIA:LABel?  
MMEMory:RMEDIA:LIST?

MMEemory:RMEDia:SIZE?  
MMEemory:RMEDia:WPRotect?  
MMEemory:STORE:CORRection  
MMEemory:STORE:CORRection  
MMEemory:STORE:FMT  
MMEemory:STORE:FMT  
MMEemory:STORE:FMT  
MMEemory:STORE:LIMit  
MMEemory:STORE:RESuLts:DENSity  
MMEemory:STORE:RESuLts:MTABle  
MMEemory:STORE:RESuLts:PTABle  
MMEemory:STORE:RESuLts:SPECTrogram  
MMEemory:STORE:SCREen  
MMEemory:STORE:SCREen:THEMe  
MMEemory:STORE:SCREen:THEMe?  
MMEemory:STORE:STATE  
MMEemory:STORE:STATE  
MMEemory:STORE:TRACe  
MMEemory:STORE:TRACe:DATA  
MMEemory:STORE:TRACe:REGister

## S

[ :SENSe ] : <measurement> : TRIGger : SOURce  
[ :SENSe ] : <measurement> : TRIGger : SOURce  
[ :SENSe ] : ACPR : TRIGger : SOURce  
[ :SENSe ] : ACQuisition : MSDuration?  
[ :SENSe ] : ACQuisition : POINts?  
[ :SENSe ] : ACQuisition : POINts : PVTime?  
[ :SENSe ] : ACQuisition : TIME  
[ :SENSe ] : ACQuisition : TIME?  
[ :SENSe ] : ACQuisition : TIME : AUTO  
[ :SENSe ] : ACQuisition : TIME : AUTO?  
[ :SENSe ] : ACQuisition : TIME : PVTime  
[ :SENSe ] : ACQuisition : TIME : PVTime?  
[ :SENSe ] : ACQuisition : TIME : PVTime : AUTO  
[ :SENSe ] : ACQuisition : TIME : PVTime : AUTO?  
[ :SENSe ] : ADC : DITHer : AUTO [ :STATE ]  
[ :SENSe ] : ADC : DITHer : AUTO [ :STATE ] ?  
[ :SENSe ] : ADC : DITHer [ :STATE ]  
[ :SENSe ] : ADC : DITHer [ :STATE ] ?  
[ :SENSe ] : AVERAge : CLear  
[ :SENSe ] : AVERAge : COUNT  
[ :SENSe ] : AVERAge : COUNT?  
[ :SENSe ] : BANDwidth | BWIDth [ :RESolution ] : SElect  
[ :SENSe ] : BANDwidth | BWIDth [ :RESolution ] : SElect?  
[ :SENSe ] : BANDwidth | BWIDth [ :RESolution ] : SElect : AUTO [ :STATE ]  
[ :SENSe ] : BANDwidth | BWIDth [ :RESolution ] : SElect : AUTO [ :STATE ] ?  
[ :SENSe ] : BANDwidth | BWIDth : SHAPE  
[ :SENSe ] : BANDwidth | BWIDth : SHAPE?  
[ :SENSe ] : CORRection : BTS [ :RF ] : GAIN  
[ :SENSe ] : CORRection : BTS [ :RF ] : GAIN?

```

[:SENSe]:CORRection:BTS[:RF]:LOSS
[:SENSe]:CORRection:BTS[:RF]:LOSS?
[:SENSe]:CORRection:IMPedance[:INPut][:MAGNitude]
[:SENSe]:CORRection:IMPedance[:INPut][:MAGNitude]?
[:SENSe]:CORRection:IQ:I:GAIN
[:SENSe]:CORRection:IQ:I:GAIN?
[:SENSe]:CORRection:IQ:I|Q:ATTenuation
[:SENSe]:CORRection:IQ:I|Q:ATTenuation?
[:SENSe]:CORRection:IQ:I|Q:ATTenuation:RATio
[:SENSe]:CORRection:IQ:I|Q:ATTenuation:RATio?
[:SENSe]:CORRection:IQ[:I]:SKEW
[:SENSe]:CORRection:IQ[:I]:SKEW?
[:SENSe]:CORRection:IQ:Q:GAIN
[:SENSe]:CORRection:IQ:Q:GAIN?
[:SENSe]:CORRection:IQ:Q:GAIN:COUPlE
[:SENSe]:CORRection:IQ:Q:GAIN:COUPlE?
[:SENSe]:CORRection:IQ:Q:SKEW
[:SENSe]:CORRection:IQ:Q:SKEW?
[:SENSe]:CORRection:MS[:RF]:GAIN
[:SENSe]:CORRection:MS[:RF]:GAIN?
[:SENSe]:CORRection:MS[:RF]:LOSS
[:SENSe]:CORRection:MS[:RF]:LOSS?
[:SENSe]:CORRection:OFFSet[:MAGNitude]
[:SENSe]:CORRection:SA[:RF]:GAIN
[:SENSe]:CORRection:SA[:RF]:GAIN?
[:SENSe]:DETEctor[:FUNction]
[:SENSe]:DETEctor[:FUNction]?
[:SENSe]:DETEctor:TRACe[1]
[:SENSe]:DETEctor:TRACe[1]|2|...|6?
[:SENSe]:DETEctor:TRACe:PVTIME
[:SENSe]:DETEctor:TRACe:PVTIME?
[:SENSe]:DETEctor:TRACe:PVTIME:AUTO
[:SENSe]:DETEctor:TRACe:PVTIME:AUTO?
[:SENSe]:FEED
[:SENSe]:FEED
[:SENSe]:FEED
[:SENSe]:FEED?
[:SENSe]:FEED?
[:SENSe]:FEED:AREFERENCE
[:SENSe]:FEED:AREFERENCE?
[:SENSe]:FEED:IQ:TYPE
[:SENSe]:FEED:IQ:TYPE?
[:SENSe]:FEED:RF:PORT[:INPut]
[:SENSe]:FEED:RF:PORT[:INPut]?
[:SENSe]:FREQuency:CENTer
[:SENSe]:FREQuency:CENTer?
[:SENSe]:FREQuency:CENTer:STEP:AUTO
[:SENSe]:FREQuency:CENTer:STEP:AUTO?
[:SENSe]:FREQuency:CENTer:STEP[:INCRement]
[:SENSe]:FREQuency:CENTer:STEP[:INCRement]?
[:SENSe]:FREQuency:EMIXer:CENTer
[:SENSe]:FREQuency:EMIXer:CENTer?
[:SENSe]:FREQuency:IQ:CENTer

```

```
[ :SENSe ] : FREQuency : IQ : CENTER ?
[ :SENSe ] : FREQuency : OFFSet
[ :SENSe ] : FREQuency : OFFSet ?
[ :SENSe ] : FREQuency : RF : CENTER
[ :SENSe ] : FREQuency : RF : CENTER ?
[ :SENSe ] : FREQuency : SPAN
[ :SENSe ] : FREQuency : SPAN ?
[ :SENSe ] : FREQuency : SPAN : FULL
[ :SENSe ] : FREQuency : SPAN : PREVIOUS
[ :SENSe ] : FREQuency : START
[ :SENSe ] : FREQuency : START ?
[ :SENSe ] : FREQuency : STOP
[ :SENSe ] : FREQuency : STOP ?
[ :SENSe ] : FREQuency : SYNThesis : AUTO [ :STATe ]
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[ :SENSe ] : FREQuency : SYNThesis [ :STATe ] ?
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[ :SENSe ] : IF : GAIN : AUTO [ :STATe ] ?
[ :SENSe ] : IF : GAIN [ :STATe ]
[ :SENSe ] : IF : GAIN [ :STATe ] ?
[ :SENSe ] : MIXer : BAND
[ :SENSe ] : MIXer : BAND ?
[ :SENSe ] : MIXer : BIAS
[ :SENSe ] : MIXer : BIAS ?
[ :SENSe ] : MIXer : BIAS : STATe
[ :SENSe ] : MIXer : BIAS : STATe ?
[ :SENSe ] : MIXer : CIFLoss
[ :SENSe ] : MIXer : CIFLoss ?
[ :SENSe ] : MIXer : HARMonic
[ :SENSe ] : MIXer : HARMonic ?
[ :SENSe ] : MIXer : LODoubler
[ :SENSe ] : MIXer : LODoubler ?
[ :SENSe ] : MIXer : TTYPe
[ :SENSe ] : MIXer : TTYPe ?
[ :SENSe ] : POWer [ :RF ] : ATTenuation
[ :SENSe ] : POWer [ :RF ] : ATTenuation ?
[ :SENSe ] : POWer [ :RF ] : ATTenuation : AUTO
[ :SENSe ] : POWer [ :RF ] : ATTenuation : AUTO ?
[ :SENSe ] : POWer [ :RF ] : ATTenuation : STEP [ :INCRement ]
[ :SENSe ] : POWer [ :RF ] : ATTenuation : STEP [ :INCRement ] ?
[ :SENSe ] : POWer [ :RF ] : EATTenuation
[ :SENSe ] : POWer [ :RF ] : EATTenuation ?
[ :SENSe ] : POWer [ :RF ] : EATTenuation : STATe
[ :SENSe ] : POWer [ :RF ] : EATTenuation : STATe ?
[ :SENSe ] : POWer [ :RF ] : GAIN : BAND
[ :SENSe ] : POWer [ :RF ] : GAIN : BAND ?
[ :SENSe ] : POWer [ :RF ] : GAIN [ :STATe ]
[ :SENSe ] : POWer [ :RF ] : GAIN [ :STATe ] ?
[ :SENSe ] : POWer [ :RF ] : MIXer : RANGE [ :UPPer ]
[ :SENSe ] : POWer [ :RF ] : MIXer : RANGE [ :UPPer ] ?
[ :SENSe ] : POWer [ :RF ] : MIXer : RULEs
[ :SENSe ] : POWer [ :RF ] : MIXer : RULEs ?
```

```

[:SENSe]:POWer[:RF]:MMW:PADJust
[:SENSe]:POWer[:RF]:Mw:PADJust
[:SENSe]:POWer[:RF]:Mw:PATH
[:SENSe]:POWer[:RF]:Mw:PATH?
[:SENSe]:POWer[:RF]:Mw:PRESelector[:STATe]
[:SENSe]:POWer[:RF]:Mw:PRESelector[:STATe]?
[:SENSe]:POWer[:RF]:PADJust
[:SENSe]:POWer[:RF]:PADJust?
[:SENSe]:POWer[:RF]:PADJust:PRESelector
[:SENSe]:POWer[:RF]:PADJust:PRESelector?
[:SENSe]:POWer[:RF]:PCENter
[:SENSe]:POWer[:RF]:RFPSelector[:STATe]
[:SENSe]:POWer[:RF]:RFPSelector[:STATe]?
[:SENSe]:ROSCillator:BANDwidth
[:SENSe]:ROSCillator:BANDwidth?
[:SENSe]:ROSCillator:COUPling
[:SENSe]:ROSCillator:COUPling?
[:SENSe]:ROSCillator:EXTErnal:FREQuency
[:SENSe]:ROSCillator:EXTErnal:FREQuency?
[:SENSe]:ROSCillator:EXTErnal:FREQuency:DEFault
[:SENSe]:ROSCillator:SOURce
[:SENSe]:ROSCillator:SOURce?
[:SENSe]:ROSCillator:SOURce:TYPE
[:SENSe]:ROSCillator:SOURce:TYPE?
[:SENSe]:SIDentify:MODE
[:SENSe]:SIDentify:MODE?
[:SENSe]:SIDentify[:STATe]
[:SENSe]:SIDentify[:STATe]?
STATus:OPERation:CONDition?
STATus:OPERation:ENABle
STATus:OPERation:ENABle?
STATus:OPERation[:EVENT]?
STATus:OPERation:INSTRument:CONDition?
STATus:OPERation:INSTRument:ENABle
STATus:OPERation:INSTRument:ENABle?
STATus:OPERation:INSTRument[:EVENT]?
STATus:OPERation:INSTRument:NTRansition
STATus:OPERation:INSTRument:NTRansition?
STATus:OPERation:INSTRument:PTRansition
STATus:OPERation:INSTRument:PTRansition?
STATus:OPERation:NTRansition
STATus:OPERation:NTRansition?
STATus:OPERation:PTRansition
STATus:OPERation:PTRansition?
STATus:PRESet
STATus:QUESTionable:CALibration:CONDition?
STATus:QUESTionable:CALibration:ENABle
STATus:QUESTionable:CALibration:ENABle?
STATus:QUESTionable:CALibration[:EVENT]?
STATus:QUESTionable:CALibration:EXTended:FAILure:CONDition?
STATus:QUESTionable:CALibration:EXTended:FAILure:ENABle
STATus:QUESTionable:CALibration:EXTended:FAILure:ENABle?
STATus:QUESTionable:CALibration:EXTended:FAILure[:EVENT]?

```

STATUS:QUESTIONABLE:CALIBRATION:EXTENDED:FAILURE:NTRANSITION  
STATUS:QUESTIONABLE:CALIBRATION:EXTENDED:FAILURE:NTRANSITION?  
STATUS:QUESTIONABLE:CALIBRATION:EXTENDED:FAILURE:PTRANSITION  
STATUS:QUESTIONABLE:CALIBRATION:EXTENDED:FAILURE:PTRANSITION?  
STATUS:QUESTIONABLE:CALIBRATION:EXTENDED:NEEDED:CONDITION?  
STATUS:QUESTIONABLE:CALIBRATION:EXTENDED:NEEDED:ENABLE  
STATUS:QUESTIONABLE:CALIBRATION:EXTENDED:NEEDED:ENABLE?  
STATUS:QUESTIONABLE:CALIBRATION:EXTENDED:NEEDED[:EVENT]?  
STATUS:QUESTIONABLE:CALIBRATION:EXTENDED:NEEDED:NTRANSITION  
STATUS:QUESTIONABLE:CALIBRATION:EXTENDED:NEEDED:NTRANSITION?  
STATUS:QUESTIONABLE:CALIBRATION:EXTENDED:NEEDED:PTRANSITION  
STATUS:QUESTIONABLE:CALIBRATION:EXTENDED:NEEDED:PTRANSITION?  
STATUS:QUESTIONABLE:CALIBRATION:NTRANSITION  
STATUS:QUESTIONABLE:CALIBRATION:NTRANSITION?  
STATUS:QUESTIONABLE:CALIBRATION:PTRANSITION  
STATUS:QUESTIONABLE:CALIBRATION:PTRANSITION?  
STATUS:QUESTIONABLE:CALIBRATION:SKIPPED:CONDITION?  
STATUS:QUESTIONABLE:CALIBRATION:SKIPPED:ENABLE  
STATUS:QUESTIONABLE:CALIBRATION:SKIPPED:ENABLE?  
STATUS:QUESTIONABLE:CALIBRATION:SKIPPED[:EVENT]?  
STATUS:QUESTIONABLE:CALIBRATION:SKIPPED:NTRANSITION  
STATUS:QUESTIONABLE:CALIBRATION:SKIPPED:NTRANSITION?  
STATUS:QUESTIONABLE:CALIBRATION:SKIPPED:PTRANSITION  
STATUS:QUESTIONABLE:CALIBRATION:SKIPPED:PTRANSITION?  
STATUS:QUESTIONABLE:CONDITION?  
STATUS:QUESTIONABLE:ENABLE  
STATUS:QUESTIONABLE:ENABLE?  
STATUS:QUESTIONABLE[:EVENT]?  
STATUS:QUESTIONABLE:FREQUENCY:CONDITION?  
STATUS:QUESTIONABLE:FREQUENCY:ENABLE  
STATUS:QUESTIONABLE:FREQUENCY:ENABLE?  
STATUS:QUESTIONABLE:FREQUENCY[:EVENT]?  
STATUS:QUESTIONABLE:FREQUENCY:NTRANSITION  
STATUS:QUESTIONABLE:FREQUENCY:NTRANSITION?  
STATUS:QUESTIONABLE:FREQUENCY:PTRANSITION  
STATUS:QUESTIONABLE:FREQUENCY:PTRANSITION?  
STATUS:QUESTIONABLE:INTEGRITY:CONDITION?  
STATUS:QUESTIONABLE:INTEGRITY:ENABLE  
STATUS:QUESTIONABLE:INTEGRITY:ENABLE?  
STATUS:QUESTIONABLE:INTEGRITY[:EVENT]?  
STATUS:QUESTIONABLE:INTEGRITY:NTRANSITION  
STATUS:QUESTIONABLE:INTEGRITY:NTRANSITION?  
STATUS:QUESTIONABLE:INTEGRITY:PTRANSITION  
STATUS:QUESTIONABLE:INTEGRITY:PTRANSITION?  
STATUS:QUESTIONABLE:INTEGRITY:SIGNAL:CONDITION?  
STATUS:QUESTIONABLE:INTEGRITY:SIGNAL:ENABLE  
STATUS:QUESTIONABLE:INTEGRITY:SIGNAL:ENABLE?  
STATUS:QUESTIONABLE:INTEGRITY:SIGNAL[:EVENT]?  
STATUS:QUESTIONABLE:INTEGRITY:SIGNAL:NTRANSITION  
STATUS:QUESTIONABLE:INTEGRITY:SIGNAL:NTRANSITION?  
STATUS:QUESTIONABLE:INTEGRITY:SIGNAL:PTRANSITION  
STATUS:QUESTIONABLE:INTEGRITY:SIGNAL:PTRANSITION?  
STATUS:QUESTIONABLE:INTEGRITY:UNCALIBRATED:CONDITION?

STATus:QUESTionable:INTEgrity:UNCalibrated:ENABle  
STATus:QUESTionable:INTEgrity:UNCalibrated:ENABle?  
STATus:QUESTionable:INTEgrity:UNCalibrated[:EVENT]?  
STATus:QUESTionable:INTEgrity:UNCalibrated:NTRansition  
STATus:QUESTionable:INTEgrity:UNCalibrated:NTRansition?  
STATus:QUESTionable:INTEgrity:UNCalibrated:PTRansition  
STATus:QUESTionable:INTEgrity:UNCalibrated:PTRansition?  
STATus:QUESTionable:NTRansition  
STATus:QUESTionable:NTRansition?  
STATus:QUESTionable:POWer:CONDition?  
STATus:QUESTionable:POWer:ENABle  
STATus:QUESTionable:POWer:ENABle?  
STATus:QUESTionable:POWer[:EVENT]?  
STATus:QUESTionable:POWer:NTRansition  
STATus:QUESTionable:POWer:NTRansition?  
STATus:QUESTionable:POWer:PTRansition  
STATus:QUESTionable:POWer:PTRansition?>  
STATus:QUESTionable:PTRansition  
STATus:QUESTionable:PTRansition?  
STATus:QUESTionable:TEMPerature:CONDition?  
STATus:QUESTionable:TEMPerature:ENABle  
STATus:QUESTionable:TEMPerature:ENABle?  
STATus:QUESTionable:TEMPerature[:EVENT]?  
STATus:QUESTionable:TEMPerature:NTRansition  
STATus:QUESTionable:TEMPerature:NTRansition?  
STATus:QUESTionable:TEMPerature:PTRansition  
STATus:QUESTionable:TEMPerature:PTRansition?  
SYSTem:APPLication:CATalog[:NAME]?  
SYSTem:APPLication:CATalog[:NAME]:COUNT?  
SYSTem:APPLication:CATalog:OPTion?  
SYSTem:APPLication:CATalog:REVision?  
SYSTem:APPLication[:CURRent][:NAME]?  
SYSTem:APPLication[:CURRent]:OPTion?  
SYSTem:APPLication[:CURRent]:REVision?  
SYSTem:COMMunicate:GPIB[1][:SELF]:ADDRes  
SYSTem:COMMunicate:GPIB[1][:SELF]:ADDRes?  
SYSTem:COMMunicate:GPIB[1][:SELF]:CONTRoller[:ENABle]  
SYSTem:COMMunicate:GPIB[1][:SELF]:CONTRoller[:ENABle]?  
SYSTem:COMMunicate:LAN:SCPI:HISLip:ENABle  
SYSTem:COMMunicate:LAN:SCPI:HISLip:ENABle?  
SYSTem:COMMunicate:LAN:SCPI:SICL:ENABle  
SYSTem:COMMunicate:LAN:SCPI:SICL:ENABle?  
SYSTem:COMMunicate:LAN:SCPI:SOCKet:CONTRoll?>  
SYSTem:COMMunicate:LAN:SCPI:SOCKet:ENABle  
SYSTem:COMMunicate:LAN:SCPI:SOCKet:ENABle?  
SYSTem:COMMunicate:LAN:SCPI:TELNet:ENABle  
SYSTem:COMMunicate:LAN:SCPI:TELNet:ENABle?  
SYSTem:COMMunicate:TCPIP:CONTRoll?  
SYSTem:COMMunicate:USB:CONNEction?  
SYSTem:COMMunicate:USB:PACKets?  
SYSTem:COMMunicate:USB:STATus?  
SYSTem:CONFIgure[:SYSTem]?  
SYSTem:CSYSTem?

SYSTem:DATE  
SYSTem:DATE?  
SYSTem:DEFault  
SYSTem:DISPlay:LANGUage  
SYSTem:DISPlay:LANGUage?  
SYSTem:ERRor[:NEXT]?  
SYSTem:ERRor:OVERload[:STATe]  
SYSTem:ERRor:PUP?  
SYSTem:ERRor:VERBoSe  
SYSTem:ERRor:VERBoSe?  
SYSTem:HELP:HEADers?  
SYSTem:HID?  
SYSTem:IDN  
SYSTem:IDN?  
SYSTem:IDN:CONFIgure  
SYSTem:IDN:CONFIgure?  
SYSTem:KLOCK  
SYSTem:KLOCK?  
SYSTem:LKEY  
SYSTem:LKEY?  
SYSTem:LKEY:DELeTe  
SYSTem:LKEY:LIST?  
SYSTem:LOCK:NAME?  
SYSTem:LOCK:OWNer?  
SYSTem:LOCK:RELease  
SYSTem:LOCK:REQUest?  
SYSTem:LOFF  
SYSTem:METRics:FPANel?  
SYSTem:METRics:SCPI?  
SYSTem:METRics:STIME?  
SYSTem:MRELay:COUNT?  
SYSTem:OPTions?  
SYSTem:PDOWN  
SYSTem:PERSONa:DEFault  
SYSTem:PERSONa:DEFault?  
SYSTem:PERSONa:MANUFACTurer  
SYSTem:PERSONa:MANUFACTurer?  
SYSTem:PERSONa:MANUFACTurer:DEFault  
SYSTem:PERSONa:MANUFACTurer:DEFault?  
SYSTem:PERSONa:MODEl  
SYSTem:PERSONa:MODEl?  
SYSTem:PERSONa:MODEl:DEFault  
SYSTem:PERSONa:MODEl:DEFault?  
SYSTem:PON:APPLIcation:LLIST  
SYSTem:PON:APPLIcation:LLIST?  
SYSTem:PON:APPLIcation:VMEMory[:AVAIlable]?  
SYSTem:PON:APPLIcation:VMEMory:TOTAL?  
SYSTem:PON:APPLIcation:VMEMory:USED?  
SYSTem:PON:APPLIcation:VMEMory:USED:NAME?  
SYSTem:PON:ETIME?  
SYSTem:PON:FPGA:LOAD  
SYSTem:PON:FPGA:LOAD?  
SYSTem:PON:FPGA:PREFeRence



SYSTem:PON:FPGA:PREference?  
SYSTem:PON:MODE  
SYSTem:PON:MODE?  
SYSTem:PON:TIME?  
SYSTem:PON:TYPE  
SYSTem:PON:TYPE  
SYSTem:PON:TYPE?  
SYSTem:PRESet  
SYSTem:PRESet:TYPE  
SYSTem:PRESet:TYPE?  
SYSTem:PRESet:USER  
SYSTem:PRESet:USER:ALL  
SYSTem:PRESet:USER:SAVE  
SYSTem:PRINT:THEMe  
SYSTem:PRINT:THEMe?  
SYSTem:PUP:PROcess  
SYSTem:SECurity:USB:WPRotect[:ENABLE]  
SYSTem:SECurity:USB:WPRotect[:ENABLE]?  
SYSTem:SET  
SYSTem:SET?  
SYSTem:SHOW  
SYSTem:SHOW?  
SYSTem:TEMPerature:HEXTreme?  
SYSTem:TEMPerature:LEXTreme?  
SYSTem:TIME  
SYSTem:TIME?  
SYSTem:VERSion?

## T

TRACe:CLEar  
TRACe:CLEar  
TRACe:CLEar:ALL  
TRACe:CLEar:ALL  
TRACe:COpy  
TRACe:COpy?  
TRACe[:DATA]  
TRACe[:DATA]?  
TRACe[1]|2|...|6:DISPlay[:STATe]  
TRACe[1]|2|...|12:DISPlay[:STATe]  
TRACe[1]|2|...|12:DISPlay[:STATe]?  
TRACe[1]|2|...|6:DISPlay[:STATe]?  
TRACe:DISPlay:VIEW:SPECTrogram:POSition  
TRACe:DISPlay:VIEW:SPECTrogram:POSition?  
TRACe:DISPlay:VIEW:SPECTrogram:TIME  
TRACe:DISPlay:VIEW:SPECTrogram:TIME?  
TRACe:EXCHange  
TRACe:EXCHange?  
TRACe[1]|2|...|12:IDENTify?  
TRACe:MATH:PEAK:SORT  
TRACe:MODE  
TRACe:MODE

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TRACe:PRESet:ALL
TRACe:PRESet:ALL
TRACe[1]|2|...|12:TYPE
TRACe[1]|2|...|12:TYPE?
TRACe[1]|2|...|6:UPDate[:STATe]
TRACe[1]|2|...|12:UPDate[:STATe]
TRACe[1]|2|...|6:UPDate[:STATe]?
TRACe[1]|2|...|12:UPDate[:STATe]?
TRIGger:<measurement>[:SEQuence]:IQ:SOURce
TRIGger:<measurement>[:SEQuence]:IQ:SOURce?
TRIGger:<measurement>[:SEQuence]:RF:SOURce
TRIGger:<measurement>[:SEQuence]:RF:SOURce?
TRIGger:<measurement>[:SEQuence]:SOURce
TRIGger:<measurement>[:SEQuence]:SOURce?
TRIGger[:SEQuence]:EXTErnal:DELay
TRIGger[:SEQuence]:EXTErnal2:DELay
TRIGger[:SEQuence]:EXTErnal1:DELay
TRIGger[:SEQuence]:EXTErnal1:DELay?
TRIGger[:SEQuence]:EXTErnal2:DELay?
TRIGger[:SEQuence]:EXTErnal2:DELay:STATe
TRIGger[:SEQuence]:EXTErnal1:DELay:STATe
TRIGger[:SEQuence]:EXTErnal2:DELay:STATe?
TRIGger[:SEQuence]:EXTErnal1:DELay:STATe?
TRIGger[:SEQuence]:EXTErnal:LEVEl
TRIGger[:SEQuence]:EXTErnal1:LEVEl
TRIGger[:SEQuence]:EXTErnal2:LEVEl
TRIGger[:SEQuence]:EXTErnal1:LEVEl?
TRIGger[:SEQuence]:EXTErnal2:LEVEl?
TRIGger[:SEQuence]:EXTErnal1:SLOPe
TRIGger[:SEQuence]:EXTErnal2:SLOPe
TRIGger[:SEQuence]:EXTErnal:SLOPe
TRIGger[:SEQuence]:EXTErnal2:SLOPe?
TRIGger[:SEQuence]:EXTErnal1:SLOPe?
TRIGger[:SEQuence]:FMT:APTRigger
TRIGger[:SEQuence]:FMT:APTRigger?
TRIGger[:SEQuence]:FMT:CRITeria
TRIGger[:SEQuence]:FMT:CRITeria?
TRIGger[:SEQuence]:FMT:DELay
TRIGger[:SEQuence]:FMT:DELay?
TRIGger[:SEQuence]:FMT:DELay:STATe
TRIGger[:SEQuence]:FMT:DELay:STATe?
TRIGger[:SEQuence]:FMT:MASK
TRIGger[:SEQuence]:FMT:MASK?
TRIGger[:SEQuence]:FMT:MASK[1]|2:BUILd
TRIGger[:SEQuence]:FMT:MASK[1]|2:DATA
TRIGger[:SEQuence]:FMT:MASK[1]|2:DATA
TRIGger[:SEQuence]:FMT:MASK[1]|2:DATA?
TRIGger[:SEQuence]:FMT:MASK[1]|2:DATA?
TRIGger[:SEQuence]:FMT:MASK[1]|2:DELete
TRIGger[:SEQuence]:FMT:MASK:DELete:ALL
TRIGger[:SEQuence]:FMT:MASK:EDIT
TRIGger[:SEQuence]:FMT:MASK:EDIT?
TRIGger[:SEQuence]:FMT:MASK:HUE
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TRIGger[:SEquence]:FMT:MASK:HUE?
TRIGger[:SEquence]:FMT:MASK[1]|2:NAME
TRIGger[:SEquence]:FMT:MASK[1]|2:NAME?
TRIGger[:SEquence]:FMT:MASK[1]|2:NEW
TRIGger[:SEquence]:FMT:MASK[1]|2:OFFSet:X
TRIGger[:SEquence]:FMT:MASK[1]|2:OFFSet:X?
TRIGger[:SEquence]:FMT:MASK[1]|2:OFFSet:Y
TRIGger[:SEquence]:FMT:MASK[1]|2:OFFSet:Y?
TRIGger[:SEquence]:FMT:MASK:OPACity
TRIGger[:SEquence]:FMT:MASK:OPACity?
TRIGger[:SEquence]:FMT:MASK:OPACity:PREView
TRIGger[:SEquence]:FMT:MASK:OPACity:PREView?
TRIGger[:SEquence]:FMT:MASK:RELative:AMPLitude
TRIGger[:SEquence]:FMT:MASK:RELative:AMPLitude?
TRIGger[:SEquence]:FMT:MASK:RELative:FREQuency
TRIGger[:SEquence]:FMT:MASK:RELative:FREQuency?
TRIGger[:SEquence]:FMT:TCRieria:UPP?
TRIGger[:SEquence]:FMT:TCRiteria:LOWer
TRIGger[:SEquence]:FMT:TCRiteria:LOWer?
TRIGger[:SEquence]:FMT:TCRiteria[:TYPE]
TRIGger[:SEquence]:FMT:TCRiteria[:TYPE]?
TRIGger[:SEquence]:FMT:TCRiteria:UPPer
TRIGger[:SEquence]:FRAME:ADJust
TRIGger[:SEquence]:FRAME:DELay
TRIGger[:SEquence]:FRAME:DELay?
TRIGger[:SEquence]:FRAME:DELay:STATe
TRIGger[:SEquence]:FRAME:DELay:STATe?
TRIGger[:SEquence]:FRAME:EXTernal2:LEVel
TRIGger[:SEquence]:FRAME:EXTernal1:LEVel
TRIGger[:SEquence]:FRAME:EXTernal1:SLOPe
TRIGger[:SEquence]:FRAME:EXTernal2:SLOPe
TRIGger[:SEquence]:FRAME:OFFSet
TRIGger[:SEquence]:FRAME:OFFSet?
TRIGger[:SEquence]:FRAME:OFFSet:DISPlay:RESet
TRIGger[:SEquence]:FRAME:PERiod
TRIGger[:SEquence]:FRAME:PERiod?
TRIGger[:SEquence]:FRAME:RFBurst:LEVel:ABSolute
TRIGger[:SEquence]:FRAME:RFBurst:SLOPe
TRIGger[:SEquence]:FRAME:SYNC
TRIGger[:SEquence]:FRAME:SYNC
TRIGger[:SEquence]:FRAME:SYNC?
TRIGger[:SEquence]:HOLDoff
TRIGger[:SEquence]:HOLDoff?
TRIGger[:SEquence]:HOLDoff:STATe
TRIGger[:SEquence]:HOLDoff:STATe?
TRIGger[:SEquence]:HOLDoff:TYPE
TRIGger[:SEquence]:HOLDoff:TYPE?
TRIGger[:SEquence]:IF:LEVel
TRIGger[:SEquence]:IF:LEVel?
TRIGger[:SEquence]:LEVel:LEVel
TRIGger[:SEquence]:LEVel:LEVel?
TRIGger[:SEquence]:LEVel:TCRiteria:LOWer
TRIGger[:SEquence]:LEVel:TCRiteria:LOWer?

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TRIGger[:SEquence]:LEVel:TCRiteria[:TYPE]  
TRIGger[:SEquence]:LEVel:TCRiteria:UPPer  
TRIGger[:SEquence]:LEVel:TCRiteria:UPPer?  
TRIGger[:SEquence]:LEV:TCRiteria?  
TRIGger[:SEquence]:LINE:DELay  
TRIGger[:SEquence]:LINE:DELay?  
TRIGger[:SEquence]:LINE:DELay:STATe  
TRIGger[:SEquence]:LINE:DELay:STATe?  
TRIGger[:SEquence]:LINE:SLOPe  
TRIGger[:SEquence]:LINE:SLOPe?  
TRIGger[:SEquence]:RFBurst:DELay  
TRIGger[:SEquence]:RFBurst:DELay?  
TRIGger[:SEquence]:RFBurst:DELay:STATe  
TRIGger[:SEquence]:RFBurst:DELay:STATe?  
TRIGger[:SEquence]:RFBurst:LEVel  
TRIGger[:SEquence]:RFBurst:LEVel:ABSolute  
TRIGger[:SEquence]:RFBurst:LEVel:ABSolute?  
TRIGger[:SEquence]:RFBurst:LEVel:RELative  
TRIGger[:SEquence]:RFBurst:LEVel:RELative?  
TRIGger[:SEquence]:RFBurst:LEVel:TYPE  
TRIGger[:SEquence]:RFBurst:LEVel:TYPE?  
TRIGger[:SEquence]:RFBurst:SLOPe  
TRIGger[:SEquence]:RFBurst:SLOPe?  
TRIGger[:SEquence]:SOURce  
TRIGger[:SEquence]:SOURce  
TRIGger[:SEquence]:SOURce?  
TRIGger[:SEquence]:XRELative  
TRIGger[:SEquence]:XRELative?  
TRIGger|TRIGger1|TRIGger2[:SEquence]:OUTPut  
TRIGger|TRIGger1|TRIGger2[:SEquence]:OUTPut?  
TRIGger|TRIGger1|TRIGger2[:SEquence]:OUTPut:POLarity  
TRIGger|TRIGger1|TRIGger2[:SEquence]:OUTPut:POLarity?

## U

UNIT:POWer  
UNIT:POWer?

## W

Where

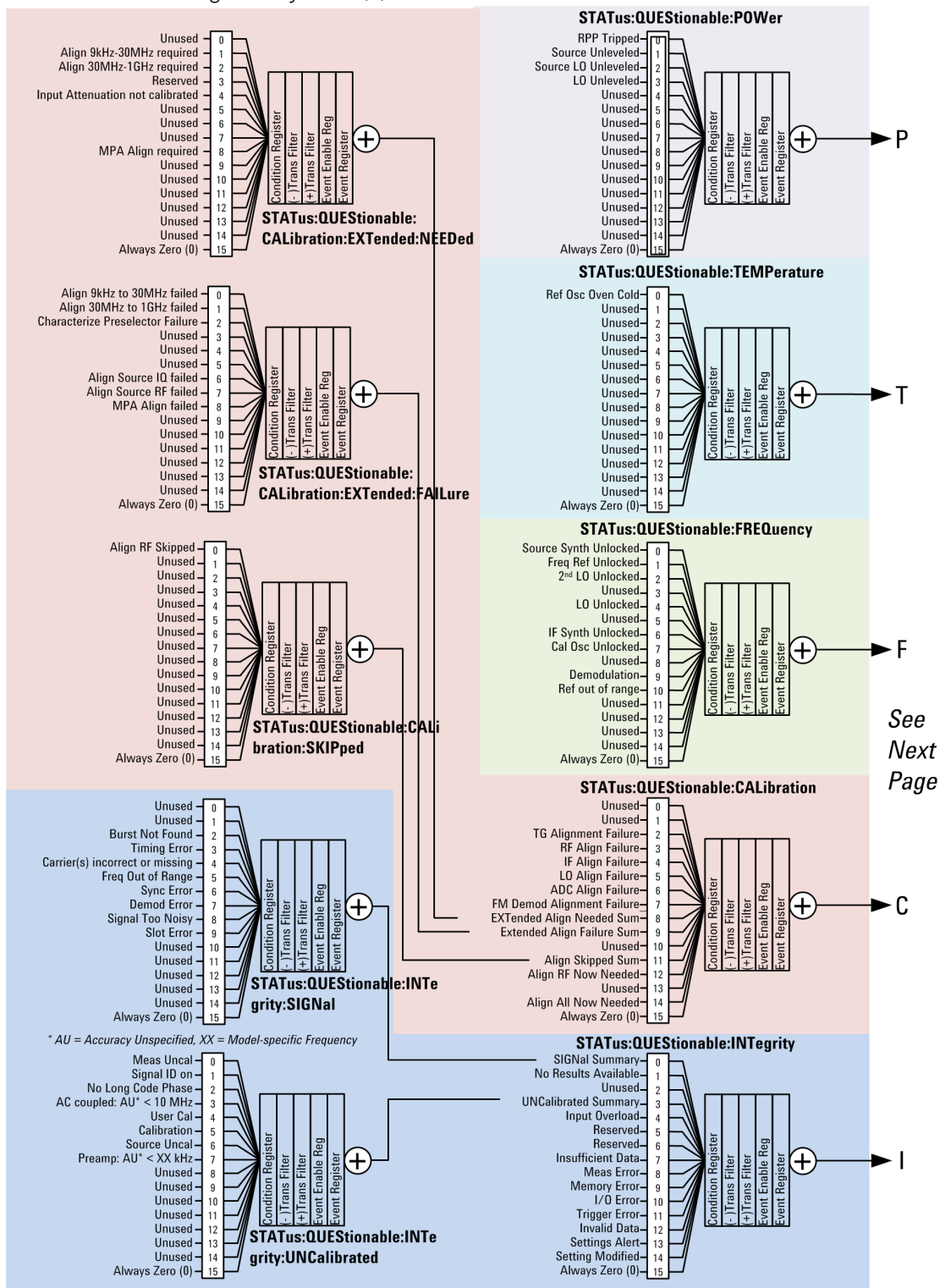
## STATus Subsystem

The following diagram provides a graphical overview of the entire X-Series Status Register System.

For readability, the diagram is split into two sections:

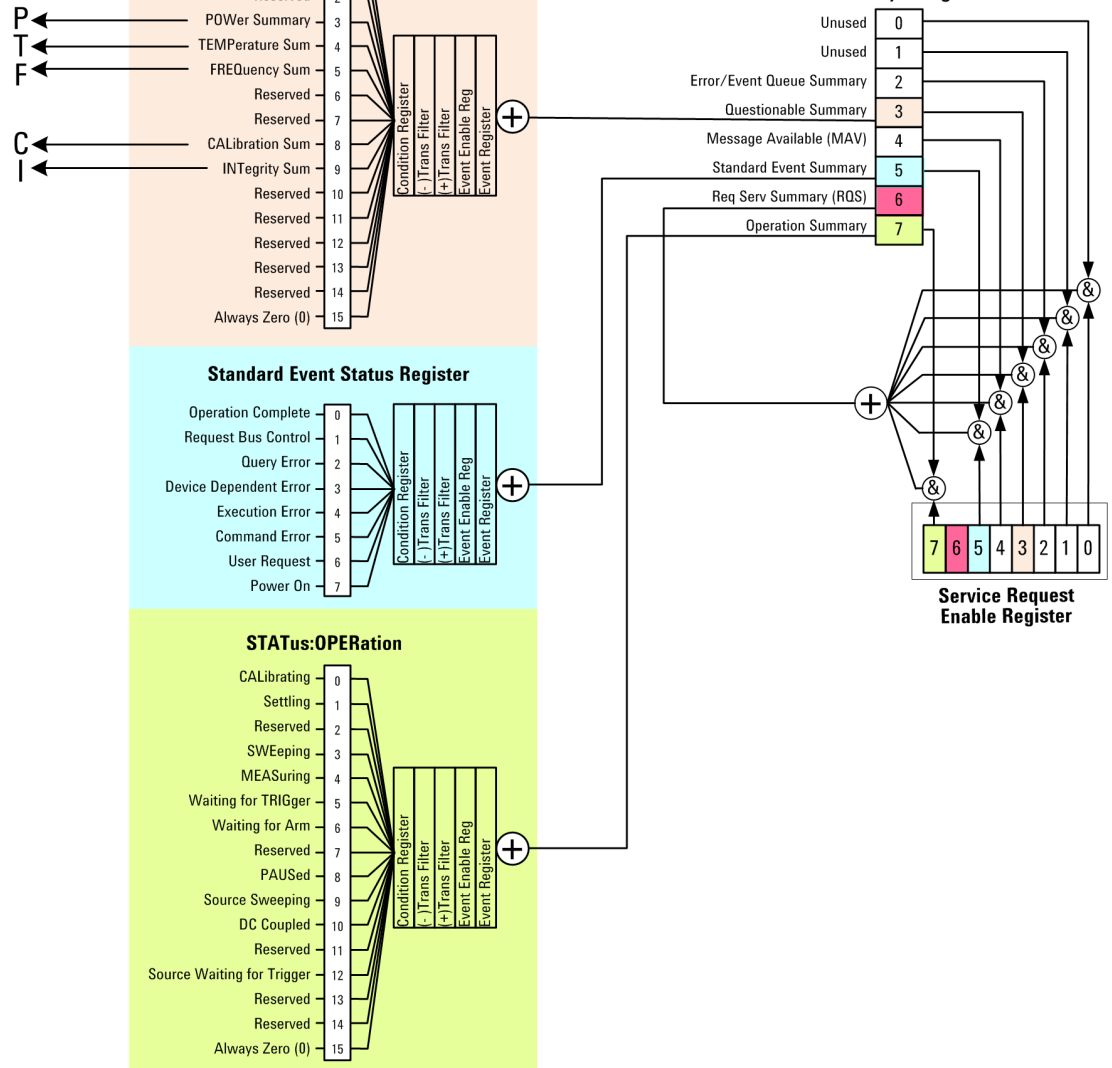
- "X-Series Status Register System (1) " on page 82
- "X-Series Status Register System (2) " on page 83

X-Series Status Register System (1)



X-Series Status Register System (2)

See  
 Previous  
 Page



Detailed Description

The STATus subsystem remote commands set and query the status hardware 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. Most commands can be started immediately and will overlap with any existing commands that are already running. This is not true of status commands. All the commands in the spectrum analyzer are assumed to be overlapped unless a command description specifically says that it is sequential.

---

## 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—It 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—It 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—It 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.

### What Are Status Register SCPI Commands

Most monitoring of the instrument conditions is done at the highest level using the IEEE common commands indicated below. Complete command descriptions are available in the IEEE commands section at the beginning of the language reference. Individual status registers can be set and queried using the commands in the STATus subsystem of the language reference.

- \*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.

### 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:
  - a. Determine which register contains the bit that reports the condition.
  - b. Send the unique SCPI query that reads that register.
  - c. Examine the bit to see if the condition has changed.

You can monitor conditions in different ways.

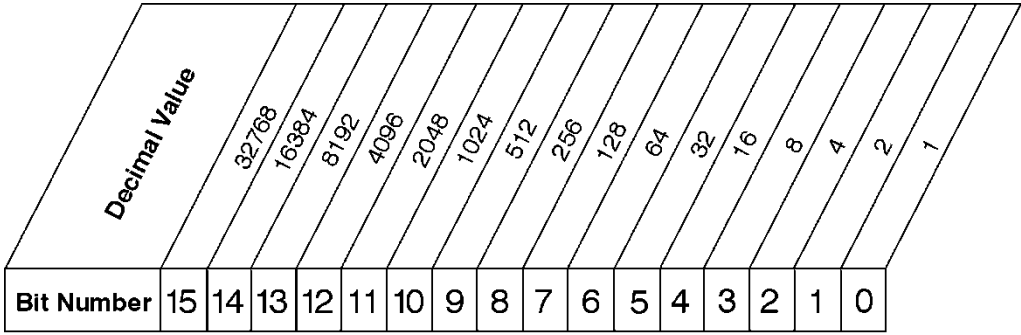
- Check the current instrument hardware and firmware status. Do this by querying the condition registers which continuously monitor status. These registers represent the current state of the instrument. Bits in a condition register are updated in real time. When the condition monitored by a particular 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 a Status Register**

Each bit in a register is represented by a numerical value based on its location. See figure below. 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.

Figure: Status Register Bit Values



```
STATus:OPERation:ENABle <num>
STATus:OPERation:ENABle?
```

**Standard Operation Event Enable Register**

ck730a

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 the command \*ESE 65 because 1 + 64 = 65.
2. The results of a query are evaluated in a similar way. If the \*STB? command 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 the STAT:QUES:INT:ENAB 1024 command 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 the STAT:QUES:INT:PTR 0 and the STAT:QUES:INT:NTR 32767.
4. So 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 the \*SRE 8 command.
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.)

### 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.

### Generating a Service Request

To use the SRQ method, you must understand how service requests are generated. 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 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 whose RQS bit is set to 1 is the device that requested service.

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.

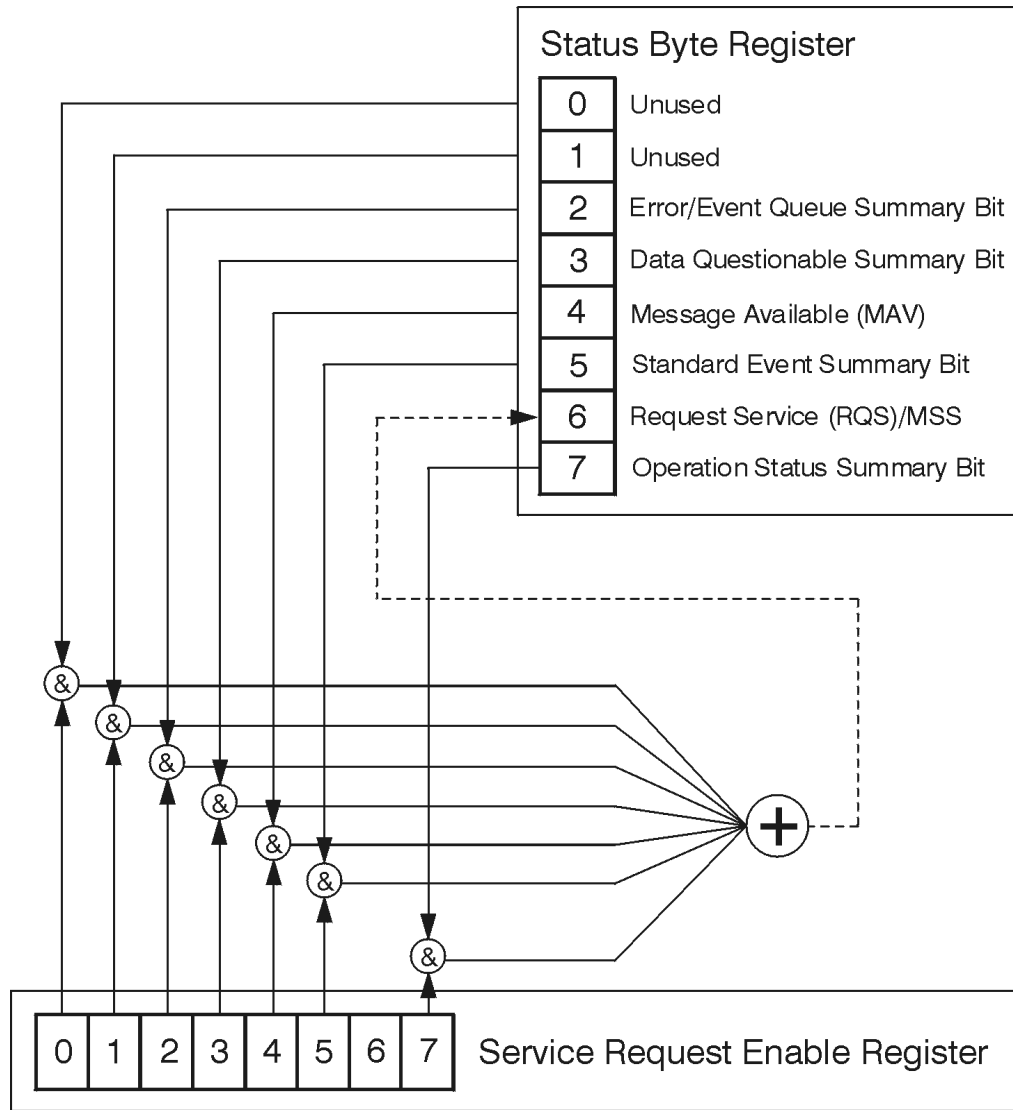
If the status register is configured to SRQ on end-of-measurement and the measurement is in continuous mode, then restarting a measurement (INIT command) can cause the measuring bit to pulse low. This causes an SRQ when you have not actually reached the "end-of-measurement" condition. To avoid this:

1. Set INITiate:CONTinuous off.
2. Set/enable the status registers.
3. Restart the measurement (send INIT).

### Status Register System

The hardware status registers are combined to form the instrument status system. Specific status bits are assigned to monitor various aspects of the instrument operation and status. See the diagram of the status system above for information about the bit assignments and status register interconnections.

### The Status Byte Register



ck776a

The RQS bit is read and reset by a serial poll. The same bit position (MSS) is read, non-destructively by the \*STB? command. 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 IEEE 488.2 standards, section 11.

Bit Number	7	6	5	4	3	2	1	0
	Standard Operation Status Summary Bit	Request Service (RQS) Summary Bit	Standard Event Status Summary Bit	Message Available (MAV)	Data Questionable Status Summary Bit	Error/Event Queue Summary Bit	Unused	Unused

\*STB?

### Status Byte Register

ck725a

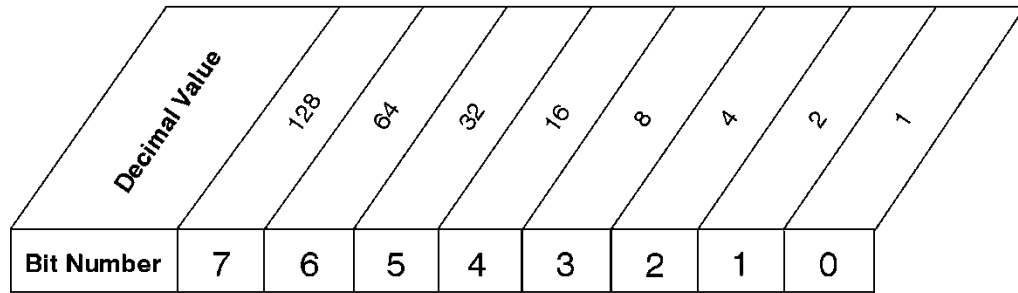
Bit	Description
0, 1	These bits are always set to 0.
2	A 1 in this bit position indicates that the SCPI error queue is not empty which means that it contains at least one error message.
3	A 1 in this bit position indicates that the data questionable summary bit has been set. The data questionable event register can then be read to determine the specific condition that caused this bit to be set.
4	A 1 in this bit position indicates that the instrument has data ready in the output queue. There are no lower status groups that provide input to this bit.
5	A 1 in this bit position indicates that the standard event summary bit has been set. The standard event status register can then be read to determine the specific event that caused this bit to be set.
6	A 1 in this bit position indicates that the instrument has at least one reason to report a status change. This bit is also called the master summary status bit (MSS).
7	A 1 in this bit position indicates that the standard operation summary bit has been set. The standard operation event register can then be read to determine the specific condition that caused this bit to be set.

To query the status byte register, send the command \*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.

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.

Send the \*SRE <integer> command 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 the command \*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. The command \*SRE? returns the decimal value of the sum of the bits previously enabled with the \*SRE <integer> command.

The service request enable register presets to zeros (0).



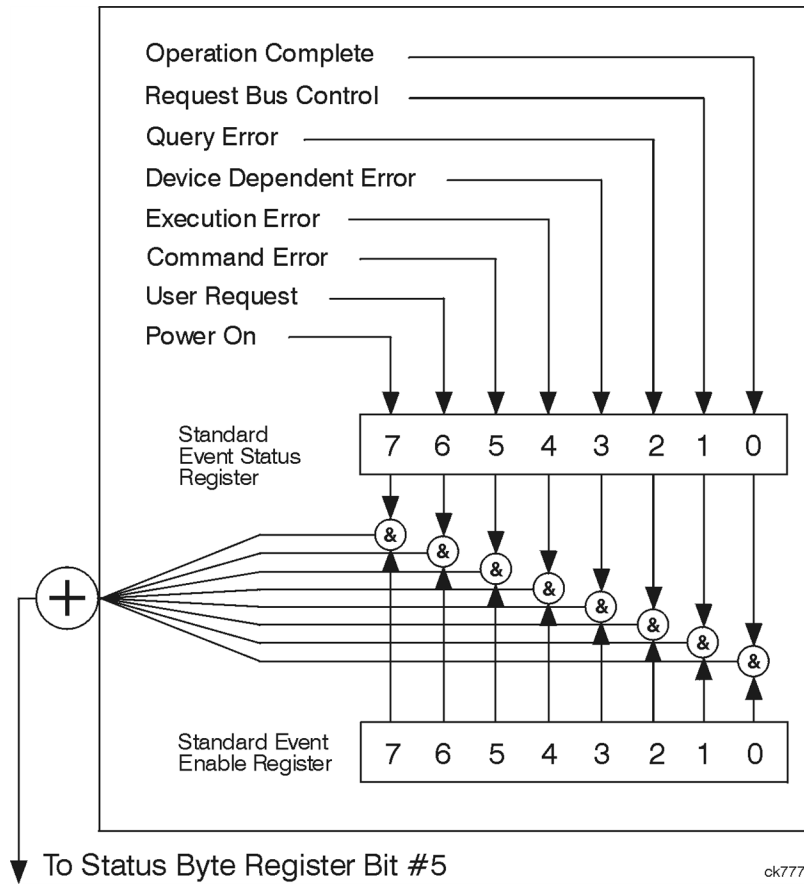
\*SRE <num>  
 \*SRE?

**Service Request Enable Register**

ck726a



### Standard Event Status Register



The standard event status register contains the following bits:

Bit Number	7	6	5	4	3	2	1	0
Description	Power On	User Request Key (Local)	Command Error	Execution Error	Device Dependent Error	Query Error	Request Control	Operation Complete

\*ESR?

### Standard Event Status Register

ok727a

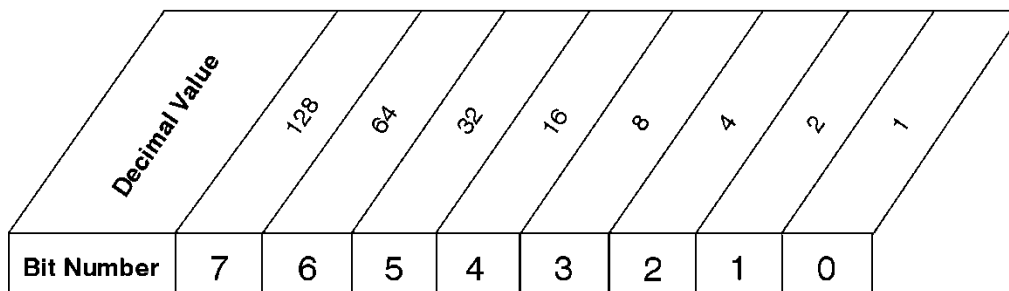
Bit	Description
0	A 1 in this bit position indicates that all pending operations were

	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 command \*ESR?. The response will be the decimal sum of the bits which 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.

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

ck728a

### Operation and Questionable Status Registers

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 in the STATus command subsystem. See the figure at the beginning of this chapter.

#### Operation Status Register

The operation status register monitors the current instrument measurement state. It checks to see if the instrument is calibrating, sweeping, or waiting for a trigger. For more information see the \*OPC? command located in the IEEE Common Commands section.

Bit	Condition	Operation
0	Calibrating	The instrument is busy executing its Align Now process
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.

#### Questionable Status Register

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.

Bit	Condition	Operation
-----	-----------	-----------

3	Power summary	The instrument hardware has detected a power unlevelled condition.
4	Temperature summary	The instrument is still warming up.
5	Frequency summary	The instrument hardware has detected an unlocked condition or a problem with the external frequency reference.
8	Calibration summary	The instrument has detected a hardware problem while doing the automatic internal alignment process.
9	Integrity summary	The instrument has detected a questionable measurement condition such as: bad timing, bad signal/data, timeout problem, signal overload, or "meas uncal".

## STATus Subsystem Command Descriptions

The STATus subsystem controls 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, 11111111111111) See the SCPI Basics information about using bit patterns for variable parameters.

### Operation Register

- "Operation Condition Query" on page 96
- "Operation Enable" on page 97
- "Operation Event Query" on page 97
- "Operation Negative Transition" on page 98
- "Operation Positive Transition" on page 98

### 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.

Mode	All
<b>Remote Command</b>	:STATus:OPERation:CONDition?
<b>Example</b>	STAT:OPER:COND?
Preset	0
Status Bits/OPC dependencies	Sequential command

---

Initial S/W Revision      Prior to A.02.00

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## 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.

---

Mode	All
<b>Remote Command</b>	:STATus:OPERation:ENABle <integer> :STATus:OPERation:ENABle?
<b>Example</b>	STAT:OPER:ENAB 1 Sets the register so that Align Now operation will be reported to the Status Byte Register.
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

---

## 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.

---

Mode	All
<b>Remote Command</b>	:STATus:OPERation[:EVENT]?
<b>Example</b>	STAT:OPER?
Preset	0
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

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### 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.

Mode	All
<b>Remote Command</b>	<b>:STATus:OPERation:NTRansition &lt;integer&gt;</b> <b>:STATus:OPERation:NTRansition?</b>
<b>Example</b>	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
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	<b>:STATus:OPERation:PTRansition &lt;integer&gt;</b> <b>:STATus:OPERation:PTRansition?</b>
<b>Example</b>	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
Initial S/W Revision	Prior to A.02.00

### Operation Instrument Register

- "Operation Instrument Condition" on page 99
- "Operation Instrument Event Enable " on page 99
- "Operation Instrument Event Query " on page 99

- "Operation Instrument Negative Transition " on page 100
- "Operation Instrument Positive Transition" on page 100
- "Preset the Status Byte " on page 101

### Operation Instrument Condition

This query returns the decimal value of the sum of the bits in the Operation Instrument Condition register.

**NOTE**

The data in this register is continuously updated and reflects the current conditions.

Mode	All
<b>Remote Command</b>	:STATus:OPERation:INSTrument:CONDition?
<b>Example</b>	STAT:OPER:INST:COND?
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	x.16.10

### Operation Instrument Event Enable

This command determines which bits in the Operation Instrument Event Register will propagate to setting the Instrument Summary bit (bit 11) in the Operation Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

Mode	All
<b>Remote Command</b>	:STATus:OPERation:INSTrument:ENABle <integer> :STATus:OPERation:INSTrument:ENABle?
<b>Example</b>	STAT:OPER:INST:ENAB 1 can be used to propagate Instrument Locked bit (bit 0) of Operation Instrument Event Register.
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	x.16.10

### Operation Instrument Event Query

This query returns the decimal value of the sum of the bits in the Operation Instrument 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.

Mode	All
<b>Remote Command</b>	:STATus:OPERation:INSTrument[:EVENT]?
<b>Example</b>	STAT:OPER:INST?
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	x.16.10

### Operation Instrument Negative Transition

This command determines which bits in the Operation Instrument Condition register will set the corresponding bit in the Operation Instrument 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.

Mode	All
<b>Remote Command</b>	:STATus:OPERation:INSTrument:NTRansition <integer> :STATus:OPERation:INSTrument:NTRansition?
<b>Example</b>	STAT:OPER:INST:NTR 1 to set event register when SCPI Lock is released.
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	x.16.10

### Operation Instrument Positive Transition

This command determines which bits in the Operation Instrument Condition register will set the corresponding bit in the Operation Instrument 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.

Mode	All
<b>Remote Command</b>	:STATus:OPERation:INSTrument:PTRansition <integer> :STATus:OPERation:INSTrument:PTRansition?
<b>Example</b>	STAT:OPER:INST:PTR 1 to set event register when SCPI Lock is required.
Preset	32767
Min	0



Max	32767
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	x.16.10

### 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, IEEE Standard Codes, Formats, Protocols, and Common Commands for Use with ANSI/IEEE Std 488.1–1987. New York, NY, 1992.

<b>Remote Command</b>	:STATus:PRESet
<b>Example</b>	STAT:PRES
Initial S/W Revision	Prior to A.02.00

### Questionable Register

- "Questionable Condition " on page 101
- "Questionable Enable" on page 102
- "Questionable Event Query " on page 102
- "Questionable Negative Transition " on page 103
- "Questionable Positive Transition" on page 103

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:CONDition?
<b>Example</b>	STAT:QUES:COND?
Preset	0
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:ENABle <integer> :STATus:QUESTionable:ENABle?
<b>Example</b>	STAT:OPER:PTR 1 Align Now operation beginning will be reported to the Status Byte Register.
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable[:EVENT]?
<b>Example</b>	STAT:QUES?
Preset	0
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

## 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:NTRansition <integer> :STATus:QUESTionable:NTRansition?
<b>Example</b>	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
Initial S/W Revision	Prior to A.02.00

## 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:PTRansition <integer> :STATus:QUESTionable:PTRansition?
<b>Example</b>	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
Initial S/W Revision	Prior to A.02.00

## Questionable Calibration Register

- "Questionable Calibration Condition " on page 104

- "Questionable Calibration Enable " on page 104
- "Questionable Calibration Event Query " on page 105
- "Questionable Calibration Negative Transition " on page 105
- "Questionable Calibration Positive Transition " on page 105

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:CALibration:CONDition?
<b>Example</b>	STAT:QUES:CAL:COND?
Preset	0
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:CALibration:ENABLE <integer> :STATus:QUESTionable:CALibration:ENABLE?
<b>Example</b>	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
Initial S/W Revision	Prior to A.02.00

## 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:CALibration[:EVENT]?
<b>Example</b>	STAT:QUES:CAL?
Preset	0
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

## 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:CALibration:NTRansition <integer> :STATus:QUESTionable:CALibration:NTRansition?
<b>Example</b>	STAT:QUES:CAL:NTR 16384 Alignment is not required.
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

## 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.

Mode	All
------	-----

<b>Remote Command</b>	<code>:STATus:QUESTionable:CALibration:PTRansition &lt;integer&gt;</code> <code>:STATus:QUESTionable:CALibration:PTRansition?</code>
<b>Example</b>	STAT:QUES:CAL:PTR 16384 Alignment is required.
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### Questionable Calibration Skipped Register

- ["Questionable Calibration Skipped Condition " on page 106](#)
- ["Questionable Calibration Skipped Enable " on page 106](#)
- ["Questionable Calibration Skipped Event Query " on page 107](#)
- ["Questionable Calibration Skipped Negative Transition " on page 107](#)
- ["Questionable Calibration Skipped Positive Transition " on page 108](#)

### 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.

Mode	All
<b>Remote Command</b>	<code>:STATus:QUESTionable:CALibration:SKIPPed:CONDition?</code>
<b>Example</b>	STAT:QUES:CAL:SKIP:COND?
Preset	0
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:CALibration:SKIPPed:ENABLE <integer> :STATus:QUESTionable:CALibration:SKIPPed:ENABLE?
<b>Example</b>	STAT:QUES:CAL:SKIP:ENAB 1 Can be used to query if an EMI alignment skipped condition is detected
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:CALibration:SKIPPed[:EVENT]?
<b>Example</b>	STAT:QUES:CAL:SKIP?
Preset	0
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:CALibration:SKIPPed:NTRansition <integer> :STATus:QUESTionable:CALibration:SKIPPed:NTRansition?
<b>Example</b>	STAT:QUES:CAL:SKIP:NTR 1 Align RF skipped is not required.

Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	<code>:STATus:QUEStionable:CALibration:SKIPped:PTRansition &lt;integer&gt;</code> <code>:STATus:QUEStionable:CALibration:SKIPped:PTRansition?</code>
<b>Example</b>	STAT:QUES:CAL:SKIP:PTR 1 Align RF skipped is required.
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### Questionable Calibration Extended Failure Register

- ["Questionable Calibration Extended Failure Condition "](#) on page 108
- ["Questionable Calibration Extended Failure Enable "](#) on page 109
- ["Questionable Calibration Extended Failure Event Query "](#) on page 109
- ["Questionable Calibration Extended Failure Negative Transition "](#) on page 110
- ["Questionable Calibration Extended Failure Positive Transition "](#) on page 110

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:CALibration:EXTended:FAILure:CONDition?
<b>Example</b>	STAT:QUES:CAL:EXT:FAIL:COND?
Preset	0
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:CALibration:EXTended:FAILure:ENABle <integer> :STATus:QUESTionable:CALibration:EXTended:FAILure:ENABle?
<b>Example</b>	STAT:QUES:CAL:EXT:FAIL:ENAB 1 Can be used to query if an EMI conducted alignment is needed.
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:CALibration:EXTended:FAILure[:EVENT]?
<b>Example</b>	STAT:QUES:CAL:EXT:FAIL?

Preset	0
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUEStionable:CALibration:EXTended:FAILure:NTRansition <integer>  :STATus:QUEStionable:CALibration:EXTended:FAILure:NTRansition?
<b>Example</b>	STAT:QUES:CAL:EXT:FAIL:NTR 1 EMI conducted align failure is not required.
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUEStionable:CALibration:EXTended:FAILure:PTRansition <integer>  :STATus:QUEStionable:CALibration:EXTended:FAILure:PTRansition?
<b>Example</b>	STAT:QUES:CAL:EXT:FAIL:PTR 1 EMI conducted align failure is required.
Preset	32767
Min	0
Max	32767
Status Bits/OPC	Sequential command

---

dependencies	
Initial S/W Revision	Prior to A.02.00

---

### Questionable Calibration Extended Needed Register

- "Questionable Calibration Extended Needed Condition " on page 111
- "Questionable Calibration Extended Needed Enable " on page 111
- "Questionable Calibration Extended Needed Event Query " on page 112
- "Questionable Calibration Extended Needed Negative Transition " on page 112
- "Questionable Calibration Extended Needed Positive Transition " on page 113

### 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.

---

Mode	All
<b>Remote Command</b>	:STATus:QUEStionable:CALibration:EXTended:NEEDed:CONDition?
<b>Example</b>	STAT:QUES:CAL:EXT:NEED:COND?
Preset	0
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

---

### 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.

---

Mode	All
<b>Remote Command</b>	:STATus:QUEStionable:CALibration:EXTended:NEEDed:ENABle <integer> :STATus:QUEStionable:CALibration:EXTended:NEEDed:ENABle?
<b>Example</b>	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
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:CALibration:EXTended:NEEDED[:EVENT]?
<b>Example</b>	STAT:QUES:CAL:EXT:NEED?
Preset	0
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:CALibration:EXTended:NEEDED:NTRansition <integer> :STATus:QUESTionable:CALibration:EXTended:NEEDED:NTRansition?
<b>Example</b>	STAT:QUES:CAL:EXT:NEED:NTR 2 Align EMI conducted is not required.
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

---

dependencies	
Initial S/W Revision	Prior to A.02.00

---

### 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.

---

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:CALibration:EXTended:NEEDed:PTRansition <integer>  :STATus:QUESTionable:CALibration:EXTended:NEEDed:PTRansition?
<b>Example</b>	STAT:QUES:CAL:EXT:NEED:PTR 2 Align EMI conducted is required.
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

---

### Questionable Frequency Register

- "Questionable Frequency Condition " on page 113
- "Questionable Frequency Enable " on page 114
- "Questionable Frequency Event Query " on page 114
- "Questionable Frequency Negative Transition " on page 115
- "Questionable Frequency Positive Transition " on page 115

### 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.

---

Mode	All
------	-----

---

<b>Remote Command</b>	<code>:STATus:QUESTionable:FREQuency:CONDition?</code>
<b>Example</b>	STAT:QUES:FREQ:COND?
Preset	0
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	<code>:STATus:QUESTionable:FREQuency:ENABle &lt;integer&gt;</code> <code>:STATus:QUESTionable:FREQuency:ENABle?</code>
<b>Example</b>	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
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	<code>:STATus:QUESTionable:FREQuency[:EVENT]?</code>
<b>Example</b>	STAT:QUES:FREQ?
Preset	0
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	<b>:STATus:QUESTionable:FREQuency:NTRansition &lt;integer&gt;</b> <b>:STATus:QUESTionable:FREQuency:NTRansition?</b>
<b>Example</b>	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
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	<b>:STATus:QUESTionable:FREQuency:PTRansition &lt;integer&gt;</b> <b>:STATus:QUESTionable:FREQuency:PTRansition?</b>
<b>Example</b>	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
Initial S/W Revision	Prior to A.02.00

### Questionable Integrity Register

– "Questionable Integrity Condition " on page 116

- "Questionable Integrity Enable " on page 116
- "Questionable Integrity Event Query " on page 117
- "Questionable Integrity Negative Transition " on page 117
- "Questionable Integrity Positive Transition " on page 117

### 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.

Mode	All
<b>Remote Command</b>	<b>:STATus:QUESTionable:INTEgrity:CONDition?</b>
<b>Example</b>	STAT:QUES:INT:COND?
Preset	0
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	<b>:STATus:QUESTionable:INTEgrity:ENABle &lt;integer&gt;</b> <b>:STATus:QUESTionable:INTEgrity:ENABle?</b>
<b>Example</b>	STAT:QUES:INT:ENAB 8 Measurement 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
Initial S/W Revision	Prior to A.02.00



## 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.

Mode	All
<b>Remote Command</b>	:STATus:QUEStionable:INTEgrity[:EVENT]?
<b>Example</b>	STAT:QUES:INT?
Preset	0
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

## 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.

Mode	All
<b>Remote Command</b>	:STATus:QUEStionable:INTEgrity:NTRansition <integer> :STATus:QUEStionable:INTEgrity:NTRansition?
<b>Example</b>	STAT:QUES:INT:NTR 8 Measurement 'regained calibration' Summary will be reported to the Integrity Summary of the Status Questionable register.
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

## 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:INTEgrity:PTRansition <integer> :STATus:QUESTionable:INTEgrity:PTRansition?
<b>Example</b>	STAT:QUES:INT:PTR 8 Measurement 'became 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
Initial S/W Revision	Prior to A.02.00

### Questionable Integrity Signal Register

- ["Questionable Integrity Signal Condition" on page 118](#)
- ["Questionable Integrity Signal Enable" on page 118](#)
- ["Questionable Integrity Signal Event Query" on page 119](#)
- ["Questionable Integrity Signal Negative Transition" on page 119](#)
- ["Questionable Integrity Signal Positive Transition" on page 120](#)

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:INTEgrity:SIGNal:CONDition?
<b>Example</b>	STAT:QUES:INT:SIGN:COND?
Preset	0
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:INTEgrity:SIGNal:ENABle <integer> :STATus:QUESTionable:INTEgrity:SIGNal:ENABle?
<b>Example</b>	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
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:INTEgrity:SIGNal[:EVENT]?
<b>Example</b>	STAT:QUES:INT:SIGN?
Preset	0
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:INTEgrity:SIGNal:NTRansition <integer> :STATus:QUESTionable:INTEgrity:SIGNal:NTRansition?

<b>Example</b>	STAT:QUES:INT:SIGN:NTR 4 Burst found will be reported to the Integrity Summary of the Status Questionable register.
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUEStionable:INTEgrity:SIGNal:PTRansition <integer> :STATus:QUEStionable:INTEgrity:SIGNal:PTRansition?
<b>Example</b>	STAT:QUES:INT:SIGN:PTR 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
Initial S/W Revision	Prior to A.02.00

### Questionable Integrity Uncalibrated Register

- ["Questionable Integrity Uncalibrated Condition "](#) on page 120
- ["Questionable Integrity Uncalibrated Enable "](#) on page 121
- ["Questionable Integrity Uncalibrated Event Query "](#) on page 121
- ["Questionable Integrity Uncalibrated Negative Transition "](#) on page 122
- ["Questionable Integrity Uncalibrated Positive Transition "](#) on page 122

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:INTEgrity:UNCalibrated:CONDition?
<b>Example</b>	STAT:QUES:INT:UNC:COND?
Preset	0
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:INTEgrity:UNCalibrated:ENABle :STATus:QUESTionable:INTEgrity:UNCalibrated:ENABle?
<b>Example</b>	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
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:INTEgrity:UNCalibrated[:EVENT]?
<b>Example</b>	STAT:QUES:INT:UNC?

Preset	0
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:INTEgrity:UNCalibrated:NTRansition <integer> :STATus:QUESTionable:INTEgrity:UNCalibrated:NTRansition?
<b>Example</b>	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
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:INTEgrity:UNCalibrated:PTRansition <integer> :STATus:QUESTionable:INTEgrity:UNCalibrated:PTRansition?
<b>Example</b>	STAT:QUES:INT:UNC:PTR 1 Oversweep (Meas Uncal) occurred will be reported to the Integrity Summary of the Status Questionable register.
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

dependencies	
Initial S/W Revision	Prior to A.02.00

### Questionable Power Register

- "Questionable Power Condition " on page 123
- "Questionable Power Enable " on page 123
- "Questionable Power Event Query " on page 124
- "Questionable Power Negative Transition " on page 124
- "Questionable Power Positive Transition " on page 125

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUEStionable:POWer:CONDition?
<b>Example</b>	STAT:QUES:POW:COND?
Preset	0
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUEStionable:POWer:ENABle <integer> :STATus:QUEStionable:POWer:ENABle?
<b>Example</b>	STAT:QUES:POW:ENAB 32 50 MHz Input Pwr too High for Cal will be reported to the Power Summary of the Status Questionable register.
Preset	32767

Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:POWer[:EVENT]?
<b>Example</b>	STAT:QUES:POW?
Preset	0
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:POWer:NTRansition <integer> :STATus:QUESTionable:POWer:NTRansition?
<b>Example</b>	STAT:QUES:POW:NTR 32 50 MHz Input Power became OK for Cal will be reported to the Power Summary of the Status Questionable register.
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00



## 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:POWer:PTRansition <integer> :STATus:QUESTionable:POWer:PTRansition?>
<b>Example</b>	STAT:QUES:POW:PTR 32 50 MHz Input Power became too high for Cal will be reported to the Power Summary of the Status Questionable register.
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

## Questionable Temperature Register

- "Questionable Temperature Condition" on page 125
- "Questionable Temperature Enable" on page 126
- "Questionable Temperature Event Query" on page 126
- "Questionable Temperature Negative Transition" on page 126
- "Questionable Temperature Positive Transition" on page 127

## 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:TEMPerature:CONDition?
<b>Example</b>	STAT:QUES:TEMP:COND?
Preset	0
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:TEMPerature:ENABle <integer> :STATus:QUESTionable:TEMPerature:ENABle?
<b>Example</b>	STAT:QUES:TEMP:ENAB 1 Reference Oscillator Oven Cold will be reported to the Temperature Summary of the Status Questionable register.
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### 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

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:TEMPerature[:EVENT]?
<b>Example</b>	STAT:QUES:TEMP?
Preset	0
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:TEMPerature:NTRansition <integer> :STATus:QUESTionable:TEMPerature:NTRansition?
<b>Example</b>	STAT:QUES:TEMP:NTR 1 Reference Oscillator Oven not cold will be reported to the Temperature Summary of the Status Questionable register.
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

### 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.

Mode	All
<b>Remote Command</b>	:STATus:QUESTionable:TEMPerature:PTRansition <integer> :STATus:QUESTionable:TEMPerature:PTRansition?
<b>Example</b>	STAT:QUES:TEMP:PTR 1 Reference Oscillator Oven became cold will be reported to the Temperature Summary of the Status Questionable register.
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command
Initial S/W Revision	Prior to A.02.00

## 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 in the detailed descriptions, some of these commands correspond directly to instrument front-panel key functionality, while others are available only as remote commands.

Command	Description
*CAL?	Align Now "All" on page 278
*CLS	"Clear Status" on page 131
*ESE	"Standard Event Status Enable " on page 131
*ESE?	
*ESR?	"Standard Event Status Register Query" on page 132
*IDN?	"Identification Query" on page 132
*OPC	"Operation Complete" on page 132
*OPC?	
*OPT?	"Query Instrument Options" on page 133
*RCL	"Recall Instrument State" on page 134
*RST	"*RST (Remote Command Only)" on page 134
*SAV	"Save Instrument State" on page 135
*SRE	"Service Request Enable" on page 135
*SRE?	
*STB?	"Status Byte Query" on page 135
*TRG	"Trigger" on page 136
*TST?	"Self Test Query" on page 136
*WAI	"Wait-to-Continue" on page 136

### All

(In MXE the key label is "**All (plus RF Presel 20 Hz – 3.6 GHz)**") Immediately executes an alignment of all subsystems.

In MXE, the Align Now All is followed by additionally aligning the RF Preselector section, so in MXE, the key label contains the parenthetical note "(plus RF Presel 20 Hz – 3.6 GHz)". 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 skipped: 50 MHz interference" or "Align skipped: 4.8 GHz interference" 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.

In the MXE, successful completion will also clear the “Align 20 Hz to 30 MHz required” Error Condition, the “Align 30 MHz to 3.6 GHz required” Error Condition, and the “Align 20 Hz to 3.6 GHz required” Error Condition, and clear bits 1 and bit 2 and clear the bit 1 in the Status Questionable Calibration Extended Needed register.

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 skipped: 50 MHz interference” and “Align skipped: 4.8 GHz interference” 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 analyzer will immediately start to update only the alignments that have expired, thus efficiently restoring the alignment process.

Key Path	<b>System, Alignments, Align Now</b>
Mode	All
<b>Remote Command</b>	:CALibration[:ALL] :CALibration[:ALL]?
<b>Example</b>	:CAL
Notes	:CALibration[:ALL]? returns 0 if successful :CALibration[:ALL]? returns 1 if failed :CALibration[:ALL]? is the same as *CAL? While Align Now, All 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 will clear bit 14 in the Status Questionable Calibration register.

	<p>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.</p> <p>An interfering user supplied signal will result in the instrument requiring an Align Now, RF with the interfering signal removed.</p>
Couplings	<p>Initializes the time for the Last Align Now, All Time.</p> <p>Records the temperature for the Last Align Now, All Temperature.</p> <p>If Align RF component succeeded, initializes the time for the Last Align Now, RF Time.</p> <p>If Align RF component succeeded, records the temperature for the Last Align Now, RF Temperature.</p>
Status Bits/OPC dependencies	Bits 11, 12, or 14 may be set in the Status Questionable Calibration register.
Initial S/W Revision	Prior to A.02.00

Mode	All
<b>Remote Command</b>	<b>*CAL?</b>
<b>Example</b>	<b>*CAL?</b>
Notes	<p>*CAL? returns 0 if successful</p> <p>*CAL? returns 1 if failed</p> <p>:CALibration[:ALL]? is the same as *CAL?</p> <p>See additional remarks described with :CALibration[:ALL]?</p> <p>Everything about :CALibration[:ALL]? is synonymous with *CAL? including all conditions, status register bits, and couplings</p>
Initial S/W Revision	Prior to A.02.00

Mode	All
<b>Remote Command</b>	<b>:CALibration[:ALL]:NPENding</b>
<b>Example</b>	<b>CAL:NPEN</b>
Notes	<p>: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 the user should use status register bits to query if the calibration is successfully completed or not.</p> <p>Typical usage is:</p> <ol style="list-style-type: none"> <li>1) :CALibration:ALL:NPENding (Start a calibration)</li> <li>2) :STATus:OPERation:CONDition? (Check if the calibration is completed or not, If bit 0 is set, then the system is doing calibration, the user should repeat this scpi query until the bit is cleared )</li> <li>3):STATus:QUESTionable:CALibration:CONDition? (Check if there are any errors/failures in previous calibration procedure</li> </ol>
Initial S/W Revision	X.14.20

## 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. The status byte register summarizes the states of the other registers. It is also responsible for generating service requests.

Key Path	No equivalent key. Related key System, Show Errors, Clear Error Queue
<b>Remote Command</b>	<b>*CLS</b>
<b>Example</b>	*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 will be backwards compatible with ESA and PSA. However, note that all conditions will generate events that go into the event log, and some will also generate status bits.
Initial S/W Revision	Prior to A.02.00

## Standard Event Status Enable

Selects the desired bits from the standard event status enable 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.

Key Path	No equivalent key. Related key System, Show Errors, Clear Error Queue
<b>Remote Command</b>	<b>*ESE &lt;integer&gt;</b> <b>*ESE?</b>
<b>Example</b>	*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
Status Bits/OPC dependencies	Event Enable Register of the Standard Event Status Register.
Initial S/W Revision	Prior to A.02.00

## Standard Event Status Register Query

Queries and clears the standard event status event register. (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.

<b>Remote Command</b>	<b>*ESR?</b>
<b>Example</b>	*ESR? Returns a 1 if there is either a query or command error, otherwise it returns a zero.
Notes	For related commands, see the <b>STATus</b> subsystem commands.
Preset	0
Min	0
Max	255
Status Bits/OPC dependencies	Standard Event Status Register (bits 0 – 7).
Initial S/W Revision	Prior to A.02.00

## 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

Key Path	No equivalent key. See related key System, Show System.
<b>Remote Command</b>	<b>*IDN?</b>
<b>Example</b>	*IDN? Returns instrument identification information, such as: Keysight Technologies, N9020A, US01020004, A.01.02
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	x.14.50

## 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.

<b>Remote Command</b>	*OPC *OPC?
<b>Example</b>	INIT:CONT 0 Selects single sweeping. INIT:IMM Initiates a sweep. *OPC? Holds off any further commands until the sweep is complete.
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. *OPC is an overlapped command, but *OPC? is sequential.
Backwards Compatibility Notes	<ol style="list-style-type: none"> <li>1. The ESA/PSA/VSA products do not meet all the requirements for the *OPC command specified by IEEE 488.2. This is corrected for X-Series. This will sometimes cause behavior that is not backward compatible, but it will work as customers expect.</li> <li>2. 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.</li> <li>3. *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).</li> </ol>
Initial S/W Revision	Prior to A.02.00

## Query Instrument Options

Returns a string of all the installed instrument options. It is a comma separated list with quotes, such as: "503,P03,PFR".

To be IEEE compliant, this command should return an arbitrary ascii variable that would not begin and end with quotes. But the quotes are needed to be backward compatible with previous SA products and software. So, the actual implementation

will use arbitrary ascii. But quotes will be sent as the first and last ascii characters that are sent with the comma-separated option list.

<b>Remote Command</b>	<b>*OPT?</b>
Initial S/W Revision	Prior to A.02.00

## 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.

<b>Remote Command</b>	<b>*RCL &lt;register #&gt;</b>
<b>Example</b>	*RCL 7 Recalls the instrument state that is currently stored in register 7.
Notes	Registers 0 through 6 are accessible from the front panel in menu keys for Recall Registers.
Min	0
Max	127
Status Bits/OPC dependencies	The command is sequential.
Initial S/W Revision	Prior to A.02.00

## \*RST (Remote Command Only)

\*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 Mode Preset remote command - :SYST:PRES, as optimal remote programming occurs with the instrument in the single measurement state.

<b>Remote Command</b>	<b>*RST</b>
<b>Example</b>	*RST
Notes	Sequential Clears all pending OPC bits and the Status Byte is set to 0.
Couplings	A *RST will cause the currently running measurement to be aborted and cause the default measurement to be active. *RST gets the mode to a consistent state with all of the default couplings set.
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.

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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.

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Initial S/W Revision      Prior to A.02.00

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## Save Instrument State

This command saves the current instrument state and mode to the specified instrument memory register.

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<b>Remote Command</b>	*SAV <register #>
<b>Example</b>	*SAV 9 Saves the instrument state in register 9.
Notes	Registers 0 through 6 are accessible from the front panel in menu keys for Save Registers.
Min	0
Max	127
Status Bits/OPC dependencies	The command is sequential.
Initial S/W Revision	Prior to A.02.00

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## Service Request Enable

This command enables the desired bits of the service request enable register.

The query returns the value of the register, indicating which bits are currently enabled.

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<b>Remote Command</b>	*SRE <integer> *SRE?
<b>Example</b>	*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).
Initial S/W Revision	Prior to A.02.00

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## Status Byte Query

Returns the value of the status byte register without erasing its contents.

---

<b>Remote Command</b>	*STB?
<b>Example</b>	*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

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	in the standard event status register is set.
Notes	See related command *CLS.
Status Bits/OPC dependencies	Status Byte Register (all bits, 0 – 7).
Initial S/W Revision	Prior to A.02.00

## Trigger

This command triggers the instrument. Use the :TRIGger[:SEquence]:SOURce command to select the trigger source.

Key Path	<b>No equivalent key. See related keys Single and Restart.</b>
<b>Remote Command</b>	<b>*TRG</b>
<b>Example</b>	*TRG Triggers the instrument to take a sweep or start a measurement, depending on the current instrument settings.
Notes	See related command :INITiate:IMMEDIATE.
Initial S/W Revision	Prior to A.02.00

## 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.

<b>Remote Command</b>	<b>*TST?</b>
<b>Example</b>	*TST? Runs the self-test routines and returns 0=passed, 1=some part failed.
Initial S/W Revision	Prior to A.02.00

## 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.

<b>Remote Command</b>	<b>*WAI</b>
<b>Example</b>	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 that the *OPC command was issued from.
Initial S/W Revision	Prior to A.02.00

## 4 Input/Output Functions

## Input/Output

The Input/Output features are common across multiple Modes and Measurements. These common features are described in this section. See the Measurement description for information on features that are unique.

The Input/Output key accesses the keys that control the Input/Output parameters of the instrument. In general, these are functions associated with external connections to the analyzer, either to the inputs or the outputs. Since these connections tend to be fairly stable within a given setup, in general, the input/output settings do not change when you Preset the analyzer.

Other functions related to the input/output connections, but which tend to change on a measurement by measurement basis, can be found under the **Trigger** and **AMPTD Y Scale** keys. In addition, some of the digital I/O bus configurations can be found under the **System** key.

**NOTE**

The functions in the Input/Output menu are "global" (common) to all Modes (applications). But individual Input/Output functions only appear in a Mode if they apply to that Mode. Functions that apply to a Mode but not to all measurements in the Mode may be grayed-out in some measurements.

["Input/Output variables - Preset behavior" on page 140](#)

The Input Port selection is the first menu under the **Input/Output** key:

Key Path	Front-panel key
<b>Remote Command</b>	[ :SENSe ] : FEED RF   AIQ   EMIXer [ :SENSe ] : FEED?
<b>Example</b>	:FEED RF :FEED?
Couplings	The [ :SENSe ] : FEED RF command turns the calibrator OFF
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
<b>Backwards Compatibility SCPI</b>	[ :SENSe ] : FEED AREFence In the PSA the calibrator was one of the inputs and selected using the AREF parameter to the same :FEED command that switched the inputs. In the X-Series it is controlled in a separate menu and overrides the input selection. For code compatibility the [ :SENSe ] : FEED AREFence command is provided, and is aliased to [ :SENSe ] : FEED : AREF REF50, which causes the input to be switched to the 50 MHz calibrator. The [ :SENSe ] : FEED RF command switches the input back to the RF port and turns the calibrator OFF, thus providing full compatibility with the PSA calibrator function. Note that after sending this, the query [ :SENSe ] : FEED? will NOT return "AREF" but instead the currently selected input.
<b>Backwards Compatibility SCPI</b>	[ :SENSe ] : FEED IQ   IONLy   QONLy [ :SENSe ] : FEED?

	<p>The parameters IQ   IONLy   QONLy are supported for backwards compatibility with the E44406A.</p> <p>[:SENSe]:FEED IQ aliases to [:SENSe]:FEED: IQ:TYPE IQ</p> <p>[:SENSe]:FEED IONLy aliases to [:SENSe]:FEED:IQ:TYPE IONLy</p> <p>[:SENSe]:FEED QONLy aliases to [:SENSe]:FEED:IQ:TYPE QONLy</p> <p>The query [:SENSe]:FEED? will always returns AIQ whatever the type of legacy parameters IQ   IONLy   QONLy has been used.</p>
Backwards Compatibility Notes	<p>Most of the settings in the X-Series Input/Output system, including External Gain, Amplitude Corrections settings and data, etc., are shared by all modes and are not changed by a mode switch. Furthermore, most variables in the Input/Output system key are not affected by Mode Preset. Both of these behaviors represent a departure from legacy behavior.</p> <p>In the X-Series. Input/Output settings are reset by using the "Restore Input/Output Defaults" function. They can also be reset to their default values through the System-&gt;Restore System Defaults-&gt; In/Out Config key or through the System -&gt;Restore System Defaults -&gt; All key (and corresponding SCPI).</p> <p>While this matches most use cases better, it does create some code compatibility issues. For example, Amplitude Corrections are no longer turned off by a Mode Preset, but instead by using the "Restore Input/Output Defaults" key/SCPI.</p> <p>Although Input/Output settings are not part of each Mode's State, they are saved in the Save State files, so that all of the instrument settings can be recalled with Recall State, as in legacy instruments.</p>
Initial S/W Revision	Prior to A.02.00
<b>Remote Command</b>	<b>:INPut:MIxer EXTernal INTernal</b> <b>:INPut:MIxer?</b>
<b>Example</b>	INP:MIX INT INP:MIX?
Notes	<p>In legacy analyzers you choose between the Internal mixer or an External Mixer. In the X-Series, the External Mixer is one of the choices for the Input and is selected using the FEED command (:SENSe:FEED EXTMixer).</p> <p>For compatibility, the INPut:MIxer EXTernal INTernal legacy command is mapped as follows:</p> <ol style="list-style-type: none"> <li>1. When INPut:MIxer EXTernal is received, SENSe:FEED EMIXer is executed.</li> <li>2. When INPut:MIxer INTernal is received, SENSe:FEED RF is executed.</li> <li>3. When INPut:MIxer? is received, the response will be INT if any input other than the external mixer is selected and EXT if the external mixer is selected</li> </ol>
Preset	INT
Backwards Compatibility Notes	<p>PSA supports the following SCPI Command :</p> <p>:INPut:MIxer:TYPE PRESelected UNPReselect</p> <p>:INPut:MIxer:TYPE?</p> <p>PXA does not support the :INPut:MIxer:TYPE command.</p>
Initial S/W Revision	A.08.01

## Input/Output variables - Preset behavior

Virtually all the input/output settings are NOT a part of mode preset. They can be set to their default value by one of the three ways:

- by using the Restore Input/Output Defaults key on the first page of the input/output menu,
- by using the System->Restore System Defaults->Input/Output Settings or,
- by using the System -> Restore System Defaults->All. Also, they survive a Preset and a Power cycle.

A very few of the Input/Output settings do respond to a 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 interest of reliability and usability, which overrides the need for absolute consistency. Exceptions are noted in the SCPI table for the excepted functions.

### RF Input

Selects the front-panel RF input port to be the analyzer signal input. If RF is already selected, pressing this key accesses the RF input setup functions.

Key Path	Input/Output
<b>Example</b>	[:SENSe]:FEED RF
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.
Readback	The RF input port, RF coupling, and current input impedance settings appear on this key as: "XX, YY, ZZ" where XX is RF, RF2, RFIO1, RFIO2, depending on what input is selected (only appears on analyzers with multiple RF inputs) YY is AC or DC ZZ is 50Ω or 75Ω
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.14.00

### 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 of ways to make 50 to 75 ohm transitions, such as impedance transformers or minimum loss pads. The choice of the solution that is best for your measurement situation requires balancing the amount of loss that you can tolerate with the amount of measurement frequency range that you need. If you are using one of these pads/adaptors with the **Input Z Corr** function, you might also want to use the **Ext Gain** key. This function is used to set a correction value to compensate for the gain (loss) through your pad. This correction factor is applied to the displayed measurement values.

Key Path	Input/Output, RF Input
Remote Command	[ :SENSe]:CORRection:IMPedance[:INPut][:MAGNitude] 50 75 [ :SENSe]:CORRection:IMPedance[:INPut][:MAGNitude]?
Example	CORR:IMP 75 sets the input impedance correction to 75 ohms. CORR:IMP?
Couplings	In the N9000A option C75, when RF Input 2 is selected, the Input Z Correction will automatically change to 75 ohms. You may then change it to whatever is desired. When the main RF Input is selected, the Input Z Correction will automatically change to 50 ohms. You may then change it to whatever is desired.
Preset	This is unaffected by a Preset but is set to 50 ohms on a "Restore Input/Output Defaults" or "Restore System Defaults->All" Some instruments/options may have 75 ohms available.
State Saved	Saved in instrument state
Readback	50 $\Omega$ or 75 $\Omega$ . Current setting reads back to the RF key.
Initial S/W Revision	Prior to A.02.00

## 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.

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 frequency below which specifications do not apply is:

X-Series Model	Lowest Freq for meeting specs when AC coupled	Lowest Freq for meeting specs when DC coupled
N9000A-	100 kHz	n/a

<b>X-Series Model</b>	<b>Lowest Freq for meeting specs when AC coupled</b>	<b>Lowest Freq for meeting specs when DC coupled</b>
503/507		
N9000A-C75 Input 2	1 MHz	n/a
N9000A-513/526	10 MHz	9 kHz
M9290A	10 MHz	9 kHz
N9010A	10 MHz	9 kHz
N9020A	10 MHz	20 Hz
N9030A	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.

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).

<b>Key Path</b>	<b>Input/Output, RF Input</b>
<b>Remote Command</b>	<b>:INPut:COUPling AC DC</b> <b>:INPut:COUPling?</b>
<b>Example</b>	INP:COUP DC
<b>Dependencies</b>	This key 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 key 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.
<b>Preset</b>	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.
<b>State Saved</b>	Saved in instrument state.
<b>Initial S/W Revision</b>	Prior to A.02.00
<b>Modified at S/W Revision</b>	A.03.00

## RF Input Port

Specifies the RF input port used. The RF Input Port key only appears on units with multiple inputs, and lets you switch between the two inputs.

Switching from the RF input port to one of the RFIO ports, on units that have them, changes the receiver performance of the instrument.

Key Path	<b>Input/Output, RF Input</b>
<b>Remote Command</b>	<code>[ :SENSe ] :FEED:RF:PORT [ :INPut ] RFIN   RFIN2   RFIO1   RFIO2   RFIO3   RFIO4   RFHD   RFFD</code> <code>[ :SENSe ] :FEED:RF:PORT [ :INPut ] ?</code>
Example	<code>:FEED:RF:PORT RFIN</code>
Dependencies	This key only appears in models that support multiple inputs. If the SCPI command is sent with unsupported parameters in any other model, an error is generated, -221.1900, "Settings conflict;option not installed"  When any input is selected in a measurement that does not support it, the "No result; Meas invalid with this input" error condition occurs, and the measurement returns invalid data when queried.  RFHD and RFFD are only available on M9420A, option "HDX" is required to enable RFHD port and option "FDX" is required to enable RFFD port.
Preset	This is unaffected by Mode Preset but is set to RF on a "Restore Input/Output Defaults" or "Restore System Defaults -> All"
State Saved	Saved in instrument state
Readback	The current RF Input Port selected is read back to this key
<b>Backwards Compatibility SCPI</b>	<code>INPut&lt;1 2&gt;:TYPE INPUT1   INPUT2</code> <code>INPut&lt;1 2&gt;:TYPE?</code>  Included for R&S ESU compatibility. In the MXE, the INPUT1 parameter is aliased to RFIN and the INPUT2 parameter is aliased to RFIN2
Initial S/W Revision	A.05.01
Modified at S/W Revision	A.14.00

## RF Input

Specifies using the main RF port for the current measurement

Key Path	<b>Input/Output, RF Input, RF Input Port</b>
Example	<code>:FEED:RF:PORT RFIN</code>
ReadBack	RF Input
Initial S/W Revision	A.05.01
Modified at S/W Revision	A.14.00

## RF Input 2

Specifies using the second RF port, if supported, for the current measurement.

See ["More Information" on page 144](#)

Key Path	<b>Input/Output, RF Input, RF Input Port</b>
Example	:FEED:RF:PORT RFIN2
Couplings	<p>When switching from Input 1 to Input 2:</p> <ul style="list-style-type: none"> <li>- If the Stop Freq is above the Max Freq, it is set to the Max Freq, otherwise it does not change.</li> <li>- If the Start Freq is above (Max Freq – Min Span), it is set to (Max Freq – Min Span), otherwise it does not change.</li> </ul> <p>When switching from Input 2 to Input 1, neither the Start Freq nor the Stop Freq change. For the Swept SA measurement, Min Span is 10 Hz. This may vary from measurement to measurement.</p>
ReadBack	RF Input 2
Initial S/W Revision	A.05.01

### More Information

In models with two inputs, the second input usually has a different maximum frequency than the first input. For your convenience, the actual “Max Freq” value is allowed to go slightly higher than the nominal Max Freq for the second input, just as is the case with the first input.

Model	Nominal Input 2 Max Freq	Absolute Input 2 Max Freq	Transition rule for switching from Input 1 to Input 2
N9038A	1 GHz	1.000025 GHz	<ul style="list-style-type: none"> <li>- If the Stop Freq is above 1.000025 GHz, it is set to 1.000025 GHz, otherwise it does not change.</li> <li>- If the Start Freq is above 1.000024990 Hz, Start Freq is set to 1.000024990 Hz and Span to 10 Hz, otherwise nothing changes.</li> </ul>
N9000A with option C75	1.5 GHz	1.58 GHz	<ul style="list-style-type: none"> <li>- If the Stop Freq is above 1.58 GHz, it is set to 1.58 GHz, otherwise it does not change.</li> <li>- If the Start Freq is above 1.579999990 GHz, Start Freq is set to 1.579999990 GHz and Span to 10 Hz, otherwise nothing changes.</li> </ul>

## RFHD

Specifies using the RFIO HD (half-duplex) port for the current measurement

Key Path	Input/Output, RF Input, RF Input Port
Example	:FEED:RF:PORT RFHD
Dependencies	RFIO HD port is exclusive for RF Input and RF Output. If HD Port is chosen as RF Output port, pressing this key or sending SCPI to set it, an error message is generated : "-221, Settings conflict;RF Input cannot be set to RFIO HD when RF Output is RFIO HD". Option "HDX" is required to enable RFHD port.
ReadBack	RFHD
Initial S/W Revision	A.16.00

## RFFD

Specifies using the RFIO FD (full duplex) port for the current measurement

Key Path	Input/Output, RF Input, RF Input Port
Example	:FEED:RF:PORT RFFD
Dependencies	Option "FDX" is required to enable RFFD port.
ReadBack	RFFD
Initial S/W Revision	A.16.00

## RF Preselector

In models that support the RF Preselector, such as MXE (N9038A), this key allows you to turn the preselector on and off.

**NOTE**

When using the RF Preselector, if your measurement starts below 3.6 GHz and finishes above 3.6 GHz, the preselector bypass switch will have to switch in and out for every measurement. When this is the case, you will hear a clicking sound from the instrument and a warning message will be displayed: "Settings Alert:Mechanical switch cycling". You are advised to avoid such setups as much as possible, to minimize switch wear. Pressing Mode Preset will reset the Stop Freq to 3.6 GHz and get you out of this state, or you can manually set the Stop Freq to be below 3.6 GHz.

Key Path	Input/Output, RF Input
Mode	All
<b>Remote Command</b>	[ :SENSe]:POWer[:RF]:RFPSelector[:STATe] 1 0 ON OFF [:SENSe]:POWer[:RF]:RFPSelector[:STATe]?
<b>Example</b>	:POW:RFPS 1
<b>Example</b>	:INP:PRES:STAT ON

Notes	[:SENSe]:POWER[:RF]:RFPreselector[:STATe] 1 ON. Sets to full compliance measurement. [:SENSe]:POWER[:RF]:RFPreselector[:STATe] 0 OFF. Sets to pre-compliance measurement.
Dependencies	The RF Preselector is not available in all measurements. The key is grayed out in measurements that do not support it, unless you are in a Mode in which no measurements support it, in that case the key does not appear at all. If the preselector is unavailable it is forced to Off. Attempting to turn it on or off in measurements that do not support it generates an error message: -221.3200, Settings conflict; Feature not supported for this measurement. The RF Preselector is not available when FFT Sweep Type is manually selected. Attempting to turn it on or off when this is the case generates an error message: “-221, Settings conflict; RF Presel unavailable when Sweep Type=Manual FFT”. This key only appears in Modes that support the RF Preselector, in other Modes, setting or querying the SCPI will generate an error. This key only appears in models that support the RF Preselector, in other models, setting or querying the SCPI will generate an error.
Preset	It is set to Off when the selected mode is SA. If the selected mode is EMI Receiver, then it will be set to On.
<b>Backwards Compatibility SCPI</b>	<b>INPut&lt;1 2&gt;:PRESelection[:STATe] ON OFF</b> <b>INPut&lt;1 2&gt;:PRESelection[:STATe]?</b> Included for R&S ESU compatibility
Initial S/W Revision	A.05.01

## External Mixer

This key 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. The External Mixer key will not appear unless option EXM is installed. The presence of the LO/IF connector alone does not indicate that you have Option EXM licensed. To verify that option EXM is installed, press **System, Show, System**.

When External Mixer is selected, the **Center Freq** key controls the setting of the Center Freq in external mixing, which is separate from the settings of Center Freq for the RF Input or BBIQ. Each input retains its unique settings for Center Freq. A unique SCPI command is provided solely for the external mixing Center Freq (see the **Center Freq** key description), which only affects the External Mixer CF, although sending the generic Center Freq command while External Mixer is selected also controls the External Mixer CF.

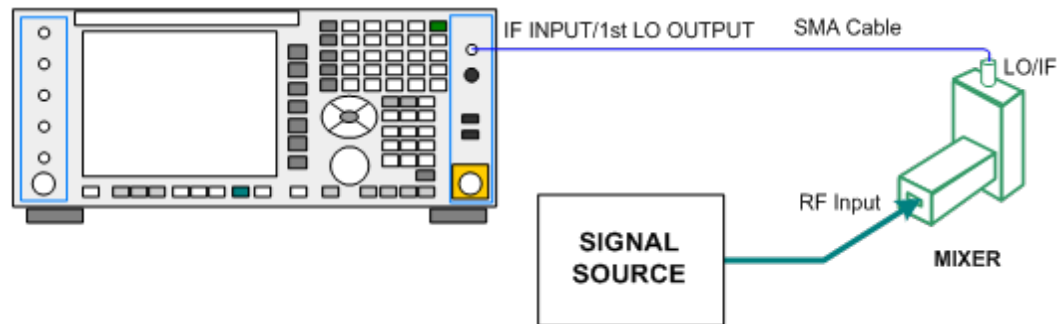
See ["More Information" on page 147](#)

Key Path	Input/Output
<b>Example</b>	:FEED EMIX
Notes	Not all measurements support the use of the External Mixer input. When External Mixer is

	selected in a measurement that does not support it, the "No result; Meas invalid with Ext Mixing" error condition occurs.
Dependencies	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.
Preset	All settings under this key are returned to their default state when <b>Restore Input/Output Defaults</b> is pressed.
State Saved	All settings under this key, and all Frequency settings, are remembered when you go out of External Mixer, so that when <b>External Mixer</b> 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).
Readback Text	The readback text on this key shows the currently selected mixer, in square brackets.
Backwards Compatibility Notes	Unlike PSA, all external mixer settings including Center Frequency are retained when you go in and out of External Mixing. Also, Preset does not take you out of External Mixing (Restore Input/Output Defaults does).
Initial S/W Revision	A.08.01

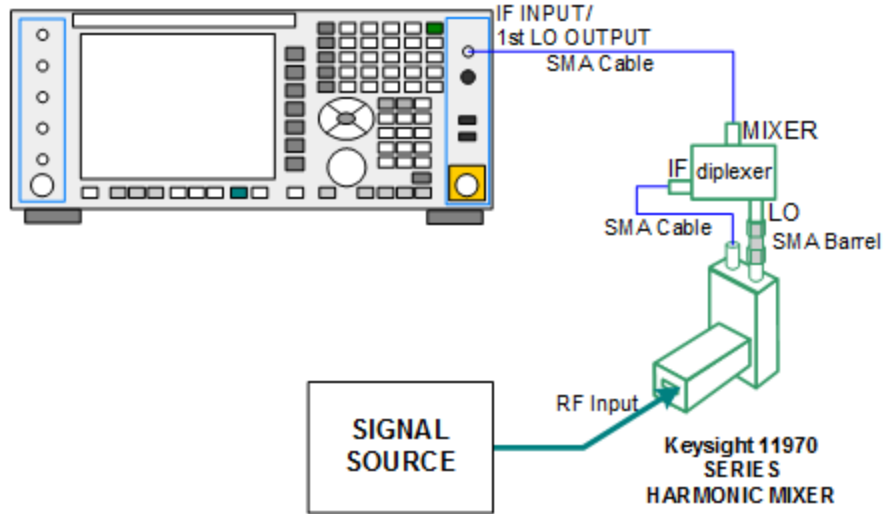
### More Information

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.



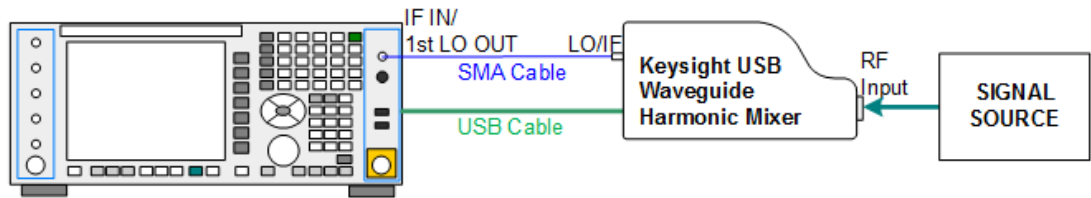
Legacy Keysight and some third party mixers have separate LO In and IF out connections. This requires you to use an external diplexer to connect these mixers. A diplexer can easily be purchased for this purpose (for example, Diplexer Model # DPL.26 or # DPL.313B from OML Inc., Morgan Hill CA)

The connection diagram for such a legacy mixer is:



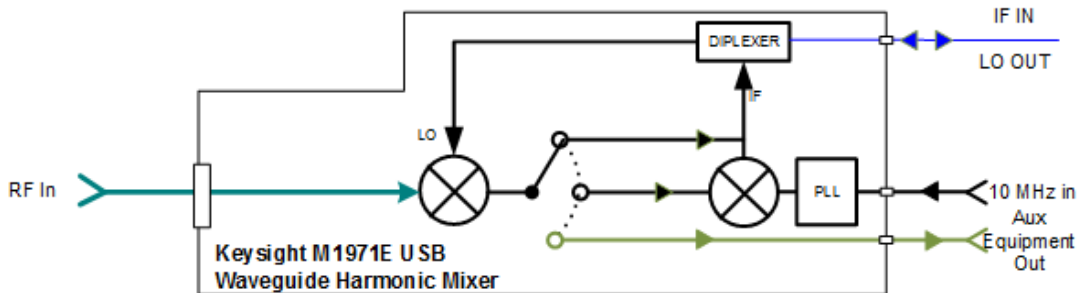
In addition, External Mixing in the X-Series supports the new Keysight M1970 series of Harmonic Mixers, which provide a USB connection for download of calibration data and additional control.

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:

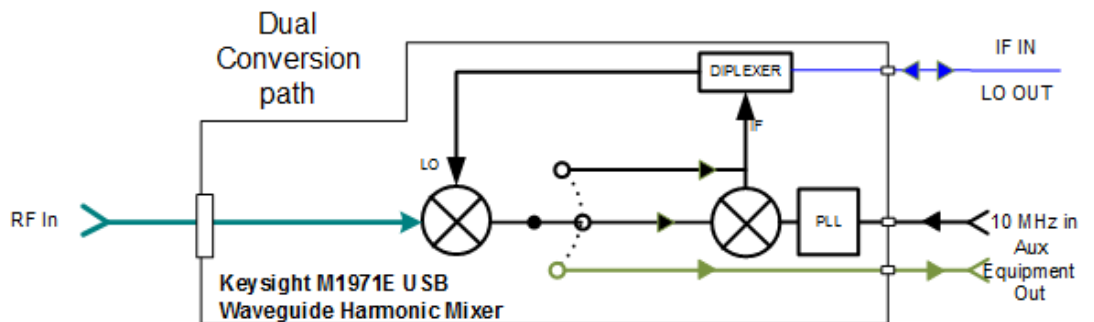
- Normal, in which the mixer functions as a classic external mixer with a single conversion:



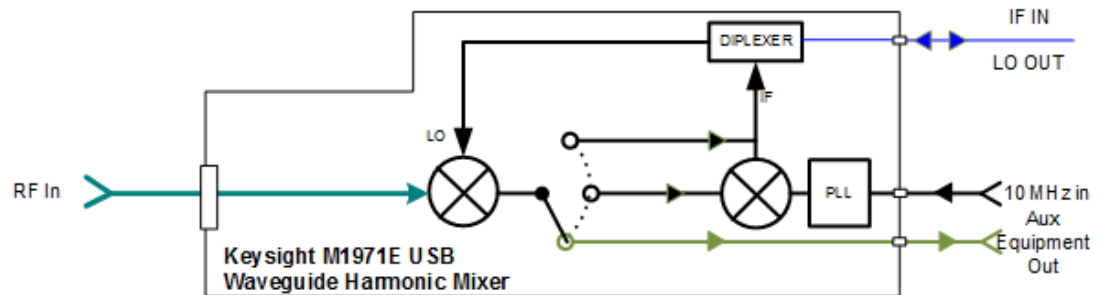
- Dual Conversion, which gives you a wider image-free range. In Dual Conversion, the first conversion is to a higher IF frequency and you provide a



10 MHz signal to which an internal PLL is locked, to effect a second downconversion:



- Aux Equipment, wherein the first mixer output drives an output connector on the mixer and the 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:

Mode	Measurements	Sig ID (Image Suppress only)
Spectrum Analyzer	Swept SA	Y*
	TOI	Y
	Harmonics	N
	Spurious Emissions	Y
	Channel Power	Y
	Occupied BW	Y
	ACP	Y
	Spectrum Emissions Mask	Y
	CCDF	N

Mode	Measurements	Sig ID (Image Suppress only)
	Burst Power	N
	List Sweep	N
Phase Noise	Monitor Spectrum	Y
	Log Plot	Y
	Spot Frequency	N
	Waveform	N
I/Q Analyzer	Complex Spectrum	N
	Waveform	N
Vector Signal Analyzer	Vector Analysis	N
	Analog Demod	N
	Digital Demod	N

\*the Swept SA measurement also supports Image Shift

### Ext Mix Setup

This menu lets you select the mixer type, and lets you configure your mixer (if necessary). While in this menu, and any of its submenus, the External Mixer Setup screen appears, showing you the current settings for the selected mixer. These settings may be dependent on which IF path is currently in use, whether a + or – harmonic is currently selected, etc.

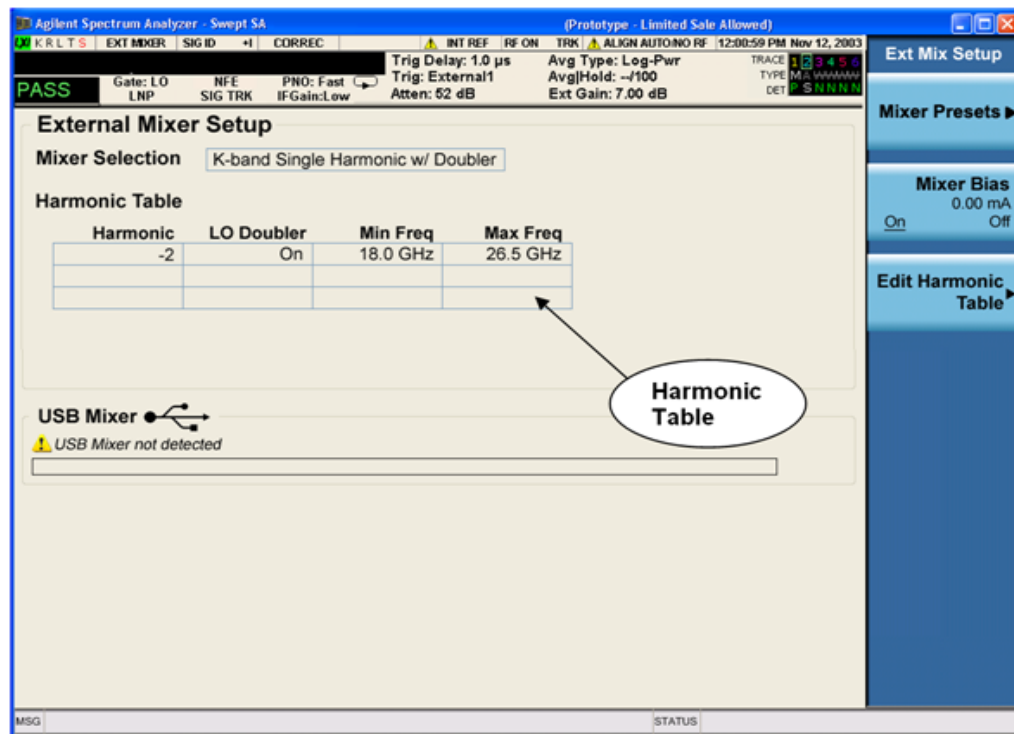
To apply any amplitude correction factors needed to correct mixer flatness, you enter values into one of the Correction tables (under Input/Output, Corrections). The correction conversion loss values can be extracted from data supplied with the mixer or from manual measurements you make to determine the conversion loss. Note that the correction applied by the Correction tables is global to the analyzer; therefore you should make sure to turn off the External Mixer corrections when you are not using the External Mixer input.

**NOTE**

The Keysight USB Mixers automatically give their flatness data to the analyzer, and the correction is applied internally. No correction needs to be entered by the user, and the correction does not appear in the user-accessible Corrections tables. The user is free to enter additional corrections into the Correction tables under Input/Output, Corrections.

Key Path	Input/Output, External Mixer
State Saved	All settings in the Mixer Setup are part of the Input/Output system, and hence are saved whenever State is saved.

Readback Text	The readback line on this key shows the currently selected mixer, in square brackets.
Initial S/W Revision	A.08.01
Modified at S/W Revision	A.08.50



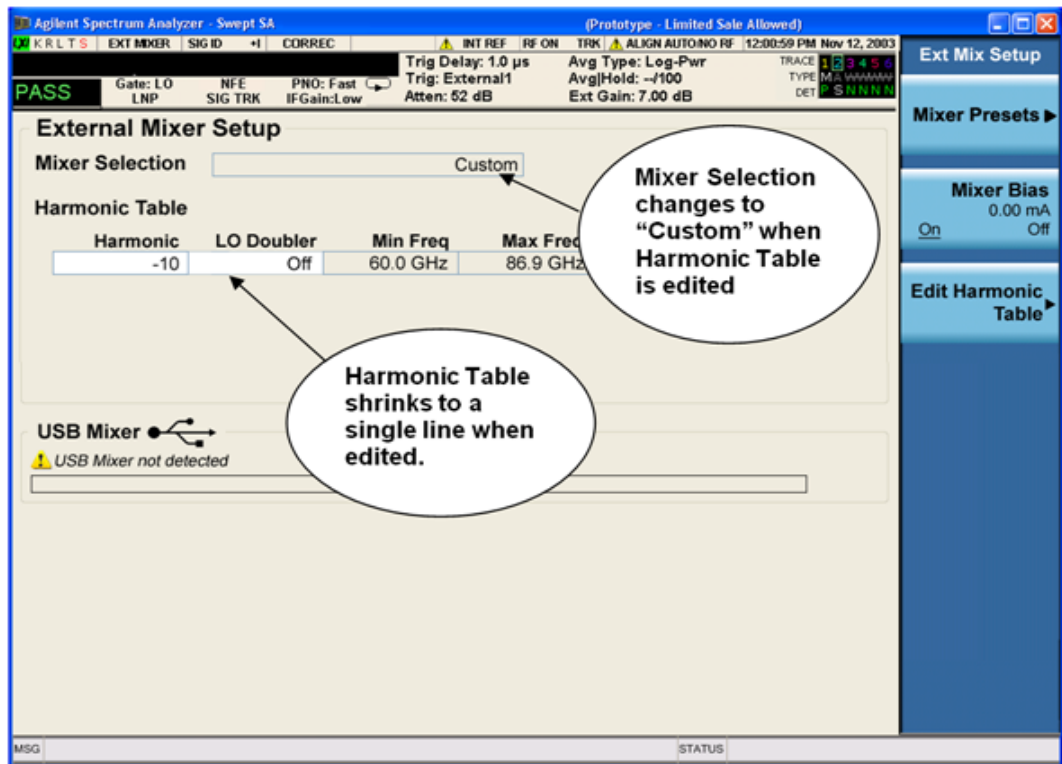
The External Mixer Setup screen looks like this

The current Mixer selection (the current or most recently connected USB Mixer, or the most recent Mixer Preset, or “Custom” if the user has modified the setup) reads out at the top of this screen.

The Harmonic Table currently being used reads out below the Mixer Selection. It shows each range being used for the current mixer. Note that a band may be made up of up to 3 ranges. Each range represents a choice of mixer harmonic and doubler state. When you select a Mixer Preset, it sets the analyzer Start and Stop frequency to the values shown in the Harmonic Table; Start Freq is set to the Min Freq for the bottom range, and Stop Freq is set to the Max Freq for the top range. In many cases you can exceed these nominal values; the absolute maximum and minimum frequency for each preset are shown in the tables that accompany the key descriptions for the Mixer Presets.

**NOTE**

If the current measurement has a limited Span available to it, and cannot achieve the Span shown in the table (Span=Stop Freq – Start Freq), the analyzer uses the maximum Span the measurement allows, and sets the Center Freq to the midpoint of the Start and Stop Freq values in the Harmonic Table.



You may customize the Harmonic Table, but when you do this the analyzer goes into “single harmonic” mode. You may enter the harmonic number and whether to use the doubler or not, but now range switching is not supported, so you can only have one harmonic.

When you edit the Harmonic Table, the Mixer Selection changes to “Custom.” To change it back you must go back into the Mixer Presets menu and select a Preset.

When you edit the Harmonic Table, the nominal Min Freq and Max Freq that are available will usually be different than the Preset you were using; and the absolute frequency limits will change as well. This may result in a change to your Start and/or Stop Freq, if the current values fall outside the new range, requiring you to retune your Center Freq to get your signal back in the center.

The analyzer supports the Keysight M1970 Series Harmonic Mixers with USB connection. While in External Mixing, if one of these mixers is plugged in to a USB port, it is automatically detected and displayed in the “USB Mixer” area of the setup screen, including its model number and serial number.

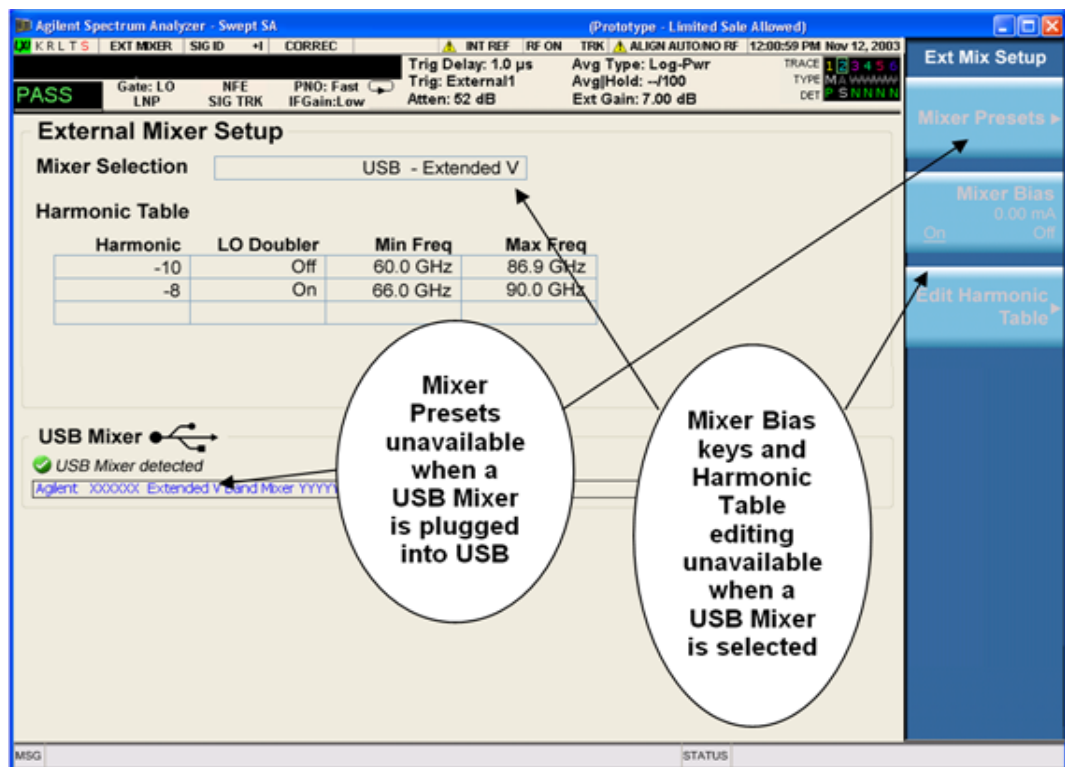
The analyzer assumes that if you plug a mixer into the USB, that is the mixer you want to use. Therefore:

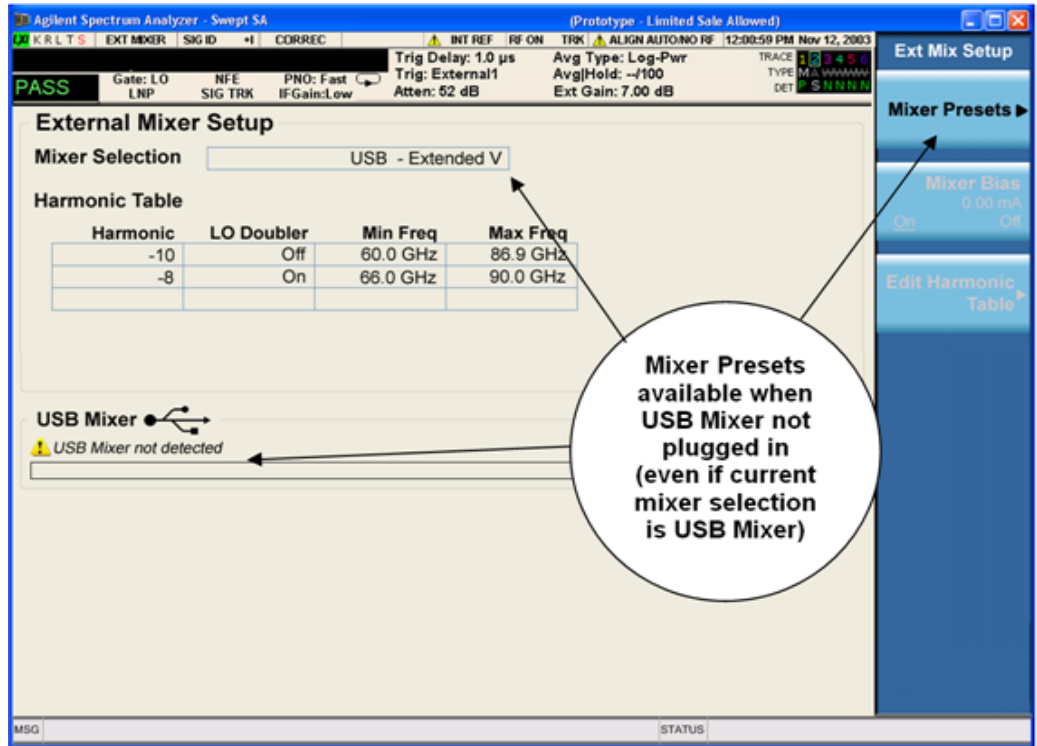
1. If a USB mixer is connected to the USB port, the Mixer Presets menu is grayed out, as none of the presets make sense with a USB Mixer connected. Note that once the analyzer has acquired the USB Mixer, the mixer selection will remain if it is subsequently unplugged from the USB, allowing you to plug it back in with

no change to your settings. However, once you unplug it, the Mixer Presets key will stop being grayed out, allowing you to preset to a different mixer.

2. When **Restore Input/Output Defaults** is performed, if an Keysight USB Mixer is plugged into the analyzer's USB port, the Mixer Selection remains unchanged.
3. When recalling an instrument state, if an Keysight USB Mixer is plugged into the analyzer's USB port, and the Mixer Selection in the recalled state is for a USB Mixer that does not match the mixer currently plugged in, you will have to unplug your mixer and then plug it back in to get the analyzer to recognize your mixer.

As long as the selection in Ext Mixer Setup shows one of the USB mixers, both the **Mixer Bias** and **Edit Harmonic Table** keys will be grayed out.





Only one USB Mixer is supported at a time. To switch to a different USB Mixer, disconnect the one that is no longer being used prior to connecting a new one.

The Mixer Selection displayed and softkey readback for the Keysight M1970 series mixers is:

Mixer Model	Mixer Selection display on Setup Screen	Readback on softkeys
Keysight M1970E: Option 001: 60 to 90 GHz Waveguide Harmonic Mixer	USB - M1970E-001 E-Band	USB Mixer E-Band
Keysight M1971E: Option 001: 60 to 90 GHz Waveguide Harmonic Mixer	USB - M1971E-001 E-Band	USB Mixer E-Band
Keysight M1971E: Option 003: 55 to 90 GHz Waveguide Harmonic Mixer	USB - M1971E-003 Extended E-Band	USB Mixer Extended E
Keysight M1971V: Option 001: 50 to 75 GHz Waveguide Harmonic Mixer	USB - M1971E-001 V-Band	USB Mixer V-Band
Keysight M1971W: Option 001: 75 to 110 GHz Waveguide Harmonic Mixer	USB - M1971E-001 W-Band	USB Mixer W-Band

<b>Mixer Model</b>	<b>Mixer Selection display on Setup Screen</b>	<b>Readback on softkeys</b>
Keysight M1970V Option 001: 50 to 75 GHz Waveguide Harmonic Mixer	USB - M1970V-001 V-Band	USB Mixer V-Band
Keysight M1970V Option 002: 50 to 80 GHz Waveguide Harmonic Mixer	USB - M1970V-002 Extended V-Band	USB Mixer Extended V
Keysight M1970W Option 001: 75 to 110 GHz Waveguide Harmonic Mixer	USB - M1970W-001 W-Band	USB Mixer W-Band

The Keysight USB mixer essentially acts as a “remote front end” and is fully calibrated over the specified frequency range, without requiring any user interaction. This is particularly useful at high mm-wave frequencies, where cable loss is typically quite large, and it is desirable to bring the front end right up to the device under test, rather than bringing the mm-wave signal to the analyzer using a lossy and uncalibrated cable or waveguide connection.

Connecting the mixer to the USB port on the analyzer switches you to External Mixing, aborts the current measurement, and initiates an alignment of the mixer. A popup message, “USB Mixer connected” appears on the display. When a USB mixer and the LO/IF cable are connected the alignment is performed. When the alignment begins, an “Aligning” popup replaces the previous message on the display. When the alignment completes, the current measurement restarts.

### Mixer Presets

This menu lets you preset the mixer setup for the particular type of mixer that you are using.

These presets are divided into four groups:

- one for Keysight legacy mixers,
- three for general purpose mixers:
  - presets that use a single harmonic and no doubling
  - presets that use a single harmonic but double the LO
  - presets that use multiple harmonics

Note that the IF/LO port provides a 3.8-14 GHz LO in two bands: 3.8-8.7 (LO fundamental), and 8.6-14 GHz (doubled LO).

In most cases, once you have executed the preset, you will not need to adjust any further settings.

Key Path	Input/Output, External Mixer, Ext Mix Setup
Remote Command	[ :SENSe]:MIXer:BAND A   Q   U   V   W   NA   ND   NE   NF   NG   NJ   NK   NQ   NU   NV   NW   NY   NEXT   DD   DF   DG   DJ   DK   DQ   DV   DW   DY   DEXT   MA   ME   MU   MCOAX   USB  [:SENSe]:MIXer:BAND?
Example	:MIX:BAND A :MIX:BAND?
Notes	<p>A Q U V W select Keysight 11970 mixer presets  NA ND NE NF NG NJ NK NQ NU NV NW NY NEXT select single harmonic, non-doubled LO presets  DD DF DG DJ DK DQ DV DW DY DEXT select single harmonic, doubled LO presets  MA ME MU MCOAX select multiple harmonic presets  All of these presets are detailed in their respective key descriptions  The query form of this command returns the most recent preset, UNLESS the harmonic table has been edited after the preset was executed. If the harmonic table has been edited it returns CUSTOM  The command USB will refresh the USB mixer connection and automatically detect the mixer band. The query form of this command returns the following if an Keysight USB Mixer is plugged into the analyzer's USB port:  USBE Keysight E-Band USB Mixer  USBV Keysight V-Band USB Mixer  USBVEXT Keysight Extended V-Band USB Mixer  USBWKeysight W-Band USB Mixer  Note that the parameters CUSTOM, USBV, USBVEXT, and USBW are query responses only, and cannot be sent TO the analyzer.  The following cross-reference matches the mixer band designators used by Keysight to the EIA waveguide designations:  EIAKeysightFreq Range  WR-28 A26.5 - 40 GHz  WR-22 Q33 - 50 GHz  WR-19 U40 - 60 GHz  WR-15 V50 - 75 GHz  WR-12 E60 - 90 GHz  WR-10 W75 - 110 GHz  WR-8 F90 - 140 GHz  WR-6 D110 - 170 GHz  WR-5 G140 - 220 GHz  WR-3 J220 - 325 GHz</p>
Preset	<p>When <b>Restore Input/Output Defaults</b> is performed, an "A" mixer preset is also issued (11970A band), unless an Keysight USB Mixer is plugged into the analyzer's USB port, in which case the Mixer Selection remains unchanged.  When using Keysight USB Mixers, if a Restore All Defaults (SCPI command SYSTem:DEFAult) has been perform, either remove and reinsert the USB cable or press the Refresh USB Mixer Connection softkey.</p>



Backwards Compatibility Notes	The [:SENSE]:MIXer:BAND command was used in PSA and ESA to select the mixer band. In the X-Series, only the legacy parameters A, Q, U, V, and W are honored, and they preset the analyzer to match the corresponding Keysight 11970 legacy mixer. Parameters D, E, F, G, J, K, Y, which were accepted in ESA and PSA, return an error if sent. If you are using a mixer in one of these bands, you should study the tables of presets and choose the appropriate preset to match your application. Also the USER parameter is no longer accepted, as the control model for mixer customization is very different in the X-Series.
Initial S/W Revision	A.08.01
Modified at S/W Revision	A.14.00

### Keysight 11970

This menu allows you to preset for one of the models in the Keysight 11970 series.

Because the X-Series has an LO range of 3.8 - 14 GHz, and older analyzers had an LO range of 3.0 - 6.8 GHz, the harmonic numbers used in the X-Series may differ from those used on older analyzers for the same mixers. Additionally, some of the 11970 mixers cannot be operated over their full range with the X-Series without switching harmonics. Consequently, you will find that some of the bands (A-Band, for example) are broken into two ranges for use with the X-Series.

See ["More Information" on page 158](#)

Key Path	Input/Output, External Mixer, Ext Mix Setup, Mixer Presets
<b>Example</b>	MIX:BAND A
Initial S/W Revision	A.08.01

## More Information

Below are the 11970A presets. The 11970U and the 11970W use a single harmonic. The other three switch harmonic mid-band. Both harmonic ranges are shown in the table. None of these mixers use LO doubling.

The 11970 K-band mixer and the 11974 preselected mixer series are not supported.

Preset	Readout in setup screen	Readback on softkeys	Range	Harm #	RF start	RF stop	RF center
A-band	Keysight 11970A	Keysight 11970A	1	-6	26.5	30.45	28.475
			2	-8	30.35	40	35.175
Q-band	Keysight 11970Q	Keysight 11970Q	1	-8	33	40.8	36.9
			2	-10	39.8	50	44.9
U-band	Keysight 11970U	Keysight 11970U	..	-10	40	60	50
V-band	Keysight 11970V	Keysight 11970V	1	-12	50	66	58
			2	-14	53	75	64
W-band	Keysight 11970W	Keysight 11970W	..	-18	75	110	92.5

## Single Harmonic

These presets choose a setup that uses a single harmonic and no doubling for the LO.

Key Path	Input/Output, External Mixer, Ext Mix Setup, Mixer Presets
<b>Example</b>	MIX:BAND NA
Initial S/W Revision	A.08.01

These are the presets for single harmonic operation with no doubler:

Mixer	Readout in setup screen	Readback on softkeys	Harm #	RF start	RF stop	RF center
K-band	K-band Single Harmonic, no doubler	Sngl harm LOx1 K-band	-4	18	26.5	22.25
A-band	A-band Single Harmonic, no doubler	Sngl harm LOx1 A-band	-6	26.5	40	33.25

Mixer	Readout in setup screen	Readback on softkeys	Harm #	RF start	RF stop	RF center
D-band	D-band Single Harmonic, no doubler	Sngl harm LOx1 D-band	-20	110	170	140
E-band	E-band Single Harmonic, no doubler	Sngl harm LOx1 E-band	-12	60	90	75
F-band	F-band Single Harmonic, no doubler	Sngl harm LOx1 F-band	-18	90	140	115
Q-band	Q-band Single Harmonic, no doubler	Sngl harm LOx1 Q-band	-6	33	50	41.5
U-band	U-band Single Harmonic, no doubler	Sngl harm LOx1 U-band	-8	40	60	50
V-band	V-band Single Harmonic, no doubler	Sngl harm LOx1 V-band	-10	50	75	62.5
W-band	W-band Single Harmonic, no doubler	Sngl harm LOx1 W-band	-14	75	110	92.5
G-band	G-band Single Harmonic, no doubler	Sngl harm LOx1 G-band	-26	140	220	180
Y-band	Y-band Single Harmonic, no doubler	Sngl harm LOx1 Y-band	-30	170	260	215
J -band	J-band Single Harmonic, no doubler	Sngl harm LOx1 J-band	-38	220	325	272.5
Extended	Extended Single Harmonic, no doubler	Sngl harm LOx1 Extended	-40	155	345	250

### Single Harmonic w/doubler

These presets choose a setup that uses a single harmonic and doubling for the LO.

Key Path	Input/Output, External Mixer, Ext Mix Setup, Mixer Presets
<b>Example</b>	MIX:BAND DW
Initial S/W Revision	A.08.01

These are the presets for single harmonic operation with LO doubling:

Mixer	Readout in setup screen	Readback on softkeys	Harm #	RF start	RF stop	RF center
D-band	D-band Single Harmonic w/doubler	Sngl harm LOx2 K-band	-14	110	170	140
F-band	F-band Single Harmonic w/doubler	Sngl harm LOx2 A-band	-10	90	140	115
G-band	G-band Single Harmonic w/doubler	Sngl harm LOx2 A-band	-16	140	220	180
J-band	J-band Single Harmonic w/doubler	Sngl harm LOx2 A-band	-24	220	325	272.5
K-band	K-band Single Harmonic w/doubler	Sngl harm LOx2 A-band	-2	18	26.5	22.25
Q-band	Q-band Single Harmonic w/doubler	Sngl harm LOx2 A-band	-4	33	50	41.5
V-band	V-band Single Harmonic w/doubler	Sngl harm LOx2 A-band	-6	50	75	62.5
W-band	W-band Single Harmonic w/doubler	Sngl harm LOx2 A-band	-8	75	110	92.5

Mixer	Readout in setup screen	Readback on softkeys	Harm #	RF start	RF stop	RF center
Y-band	Y-band Single Harmonic w/doubler	Sngl harm LOx2 A-band	-20	170	260	215
Extended	Extended Single Harmonic w/doubler	Sngl harm LOx2 A-band	-28	245	390	317.5

### Multiple Harmonics

These presets choose a setup that uses multiple harmonics and may or may not use doubling for the LO.

Key Path	Input/Output, External Mixer, Ext Mix Setup, Mixer Presets
<b>Example</b>	MIX:BAND MA
Initial S/W Revision	A.08.01

These are the presets for multiple harmonic operation:

Mixer	Readout in setup screen	Readback on softkeys	Range	Harm #	Dbl r?	RF start	RF stop	RF Center
A-band	A-band Multiple Harmonic	Multi harm A-band	1	-4	N	26.5	34.1	30.3
			2	-4	Y	33.1	40	36.55
E-band	E-band Multiple Harmonic	Multi harm E-band	1	-6	Y	60	83	71.5
			2	-8	Y	65	90	77.5
U-band	U-band Multiple Harmonic	Multi harm U-band	1	-6	N	40	51.5	45.75
			2	-6	Y	49.5	60	54.75
Coaxial	Coaxial Multiple Harmonic	Multi harm Coaxial	1	-4	N	26.5	34	30.25
			2	-4	Y	32.5	55	43.75
			3	-6	Y	50	70	60

## Mixer Bias

Adjusts an internal bias source for use with external mixers. The bias signal is present on the center conductor of the IF input connector on the front panel. The shunt current range is from -10 mA to 10 mA and it can be set whether Mixer Bias state is On or Off, but it will only be applied if it is On.

The bias remains as set if the user switches to another input (e.g., the RF Input).

Key Path	Input/Output, External Mixer, Ext Mix Setup
Remote Command	[ :SENSe]:MIXer:BIAS <real> [ :SENSe]:MIXer:BIAS? [ :SENSe]:MIXer:BIAS:STATe OFF ON 0 1 [ :SENSe]:MIXer:BIAS:STATe?
Example	:MIX:BIAS 0 :MIX:BIAS? MIX:BIAS:STAT 0 MIX:BIAS:STAT?
Preset	This is unaffected by Preset but is set to OFF and 0 on a "Restore Input/Output Defaults"
State Saved	Saved in instrument state
Min	-10 mA
Max	10 mA
Initial S/W Revision	A.08.01

## Edit Harmonic Table

This menu lets you directly configure the Harmonic number and LO Doubler state of your mixer by editing the Harmonic Table. The Harmonic Table can be configured:

- as a single row (meaning only one harmonic number is used and the LO Doubler is either on or off),
- as two rows where the harmonic number switches between the first row and the second, or
- as two rows where the LO Doubler state switches between the first row and the second

When you press the **Edit Harmonic Table** key, a dialog appears on the display informing you that when you edit the Harmonic Table you will go into Custom mixer mode, and that to undo your changes you must go to the Mixer Presets menu and choose the preset appropriate for your mixer. You may cancel out of this dialog and not enter the Edit Harmonic Table menu. If you choose to enter the menu, the Mixer Selection changes to "Custom".

In Custom mode, your maximum start and stop frequencies are strictly set by the LO range and the harmonic number you have chosen. The undoubled LO range is approximately 3.8 – 8.7 GHz, and (for LO's that support doubling) the doubled range is approximately 8.0 – 14.0 GHz. That range times the harmonic you have selected will determine your tuning range. If your frequency is currently outside that range when you edit the Harmonic Table, your frequency will be changed to fall at the edge of the range. To change it back you must go into the Mixer Presets menu and select a Preset.

Whenever you are in the **Edit Harmonic Table** menu, the editable fields in the table have a white background, indicating that they can be edited. These fields vary depending on the Table Type.

Table Type	Fields you can edit
Single Row	Harmonic and LO Doubler cells
Harmonic Switching	Harmonic and LO Doubler cells (only the first row)
Doubler Switching	Harmonics cell (only the first row)

Note that you cannot add or delete rows from the table; you can only modify the rows that are already there.

Key Path	Input/Output, External Mixer, Ext Mix Setup
Initial S/W Revision	A.08.01
Modified at S/W Revision	A.09.491

### Table Type

This parameter determines which type of configuration you want the Custom Mixer to be. You can choose Single Row, Harmonic Switching, or Doubler Switching. See detail under each of these keys.

Key Path	Input/Output, External Mixer, Ext Mix Setup, Edit Harmonic Table
<b>Remote Command</b>	[ :SENSe]:MIXer:TTYPe SINGle HARMonic DOUBler [ :SENSe]:MIXer:TTYPe?
<b>Example</b>	:MIX:TTYP SING
Couplings	When you change the Table Type, the Mixer Selection changes to "Custom"
Preset	Depends on the current Mixer Preset. This is unaffected by Mode Preset, but on a "Restore Input/Output Defaults" the Mixer is preset to 11970A, for which the Table Type is Harmonic Switching
State Saved	Saved in instrument state
Initial S/W Revision	A.09.491

## Single Row

In the Single Row type, the External Mixer always stays in the same Harmonic Number and the LO Doubler is either on or off and does not change state during a sweep. You may change the Harmonic Number and you may change the state of the Doubler.

Key Path	Input/Output, External Mixer, Ext Mix Setup, Edit Harmonic Table, Table Type
<b>Example</b>	:MIX:TTYP SING
State Saved	Saved in instrument state
Initial S/W Revision	A.09.491

## Harmonic Switching

In the Harmonic Switching type, the External Mixer switches the Harmonic Number in the middle of the sweep. The Lo Doubler may be on or off but it is the same for both Harmonic Numbers. You can set the initial Harmonic Number, and when it switches it decrements by two when the harmonic is negative and increments by two when the harmonic is positive. For example, if you set the initial number to -6, when it switches it will go to -8. If you set the harmonic number to 8 when it switches it will go to 10.

Key Path	Input/Output, External Mixer, Ext Mix Setup, Edit Harmonic Table, Table Type
<b>Example</b>	:MIX:TTYP HARM
State Saved	Saved in instrument state
Initial S/W Revision	A.09.491

## Doubler Switching

In the Doubler Switching type, the External Mixer switches the doubler from Off to On in the middle of the sweep. You can set the Harmonic Number but it stays the same for the Doubler Off state as for the Doubler On state. The LO Doubler key is grayed out in this table type.

Key Path	Input/Output, External Mixer, Ext Mix Setup, Edit Harmonic Table, Table Type
<b>Example</b>	:MIX:TTYP DOUB
State Saved	Saved in instrument state
Initial S/W Revision	A.09.491

## Harmonic

This lets you enter the Harmonic value with its associated sign (mixing mode).

The harmonic number is a signed integer, where the sign has the meaning of choosing between positive and negative mixing products. Desired mixing products



occur at an IF frequency which equals the difference between the RF frequency (fRF) and the LO frequency (NfLO). When this difference is positive, we can say  $fIF = fRF - NfLO$ . When this difference is negative, we can say  $fIF = NfLO - fRF$ . Thus, a negative harmonic means the analyzer will be tuned such that the harmonic of the LO is higher than the indicated frequency by the frequency of the first IF. A positive harmonic means the analyzer will be tuned such that the harmonic of the LO is lower than the indicated frequency by the frequency of the first IF.

Key Path	<b>Input/Output, External Mixer, Ext Mix Setup, Edit Harmonic Table</b>
<b>Remote Command</b>	<code>[ :SENSe]:MIXer:HARMonic &lt;integer&gt;</code> <code>[ :SENSe]:MIXer:HARMonic?</code>
<b>Example</b>	<code>:MIX:HARM -28</code> <code>:MIX:HARM?</code>
Notes	The query returns the harmonic value of the first row of the harmonic table.
Couplings	When you set a value for the Harmonic via SCPI, the Mixer Selection changes to "Custom"
Preset	This is unaffected by Mode Preset, but on a "Restore Input/Output Defaults" editing is turned off, the Harmonic Table returns to normal, and the Mixer is preset to 11970A, which has -6 in the first row of its Harmonic Table
State Saved	Saved in instrument state
Min	-400
Max	400
Initial S/W Revision	A.08.01
Modified at S/W Revision	A.09.491

## LO Doubler

This lets you enter the LO Doubler setting. The LO Doubler setting controls the choice of the LO doubler state for LO's that support doubled operation.

In LO's that support doubling, the fundamental band is approximately 3.8 – 8.7 GHz, and the doubled band is approximately 8.0 – 14 GHz. The higher LO frequency can result in a lower mixer harmonic and reduced mixer conversion loss.

Key Path	<b>Input/Output, External Mixer, Ext Mix Setup, Edit Harmonic Table</b>
<b>Remote Command</b>	<code>[ :SENSe]:MIXer:LODoubler ON OFF 0 1</code> <code>[ :SENSe]:MIXer:LODoubler?</code>
<b>Example</b>	<code>:MIX:LOD 0</code> <code>:MIX:LOD?</code>
Notes	The query returns the doubler value of the first row of the harmonic table.
Dependencies	This key is grayed out and set to Off when Table Type is set to Doubler Switching.
Couplings	When you set a value for the doubler setting via SCPI, the Mixer Selection changes to "Custom"
Preset	This is unaffected by Mode Preset, but on a "Restore Input/Output Defaults" editing is turned off,

	the Harmonic Table returns to normal, and the Mixer is preset to 11970A, which has the doubler Off in the first row of its Harmonic Table
State Saved	Saved in instrument state
Initial S/W Revision	A.08.01
Modified at S/W Revision	A.09.491

### Refresh USB Mixer Connection

This operation re-reads the USB devices and refreshes connection to Keysight USB mixers. This operation is the same as physically removing and reinserting the mixer's USB connection.

Key Path	<b>Input/Output, External Mixer, Ext Mix Setup</b>
<b>Example</b>	:MIX:BAND USB
Notes	When using Keysight USB Mixers, if a Restore All Defaults (SCPI command SYSTem:DEFault) has been perform, either remove and reinsert the USB cable or press the Refresh USB Mixer Connection softkey.
Initial S/W Revision	A.14.00

### Signal ID On/Off

Activates or deactivates an algorithm that aids with the identification of multiple responses

Toggles the Signal ID (signal identification) function On or Off. This function lets you identify multiple responses of a single input signal that are generated when using un-preselected external mixers. The use of mixers without pre-selecting filters offers the advantage of improved receiver sensitivity because of the absence of the filter insertion loss, but results in multiple responses due to images and undesired harmonic mixing products.

While in Signal ID, basic spectrum analyzer functions work normally (for example, you can change Span normally), but some functions are disabled (for example, some traces are unavailable).

There are two forms of Signal ID, Image Suppress and Image Shift. Choose the one most appropriate for your application. For Image Shift, an LO-shifted and an unshifted trace are taken in Trace 1 and Trace 2 and displayed together. Any peaks that are not the same in both traces are images. For Image Suppress, image cancellation is performed in the background using two hidden traces, and the result displayed in Trace 1, which shows only the valid signals.

Key Path	<b>Input/Output, External Mixer</b>
<b>Remote Command</b>	<b>[ :SENSe ] :SIDentify [ :STATe ] OFF   ON   0   1</b>

	<b>[ :SENSe]:SIDentify[ :STAtE]?</b>
<b>Example</b>	:SID 0 :SID?
Notes	Signal ID uses data from two successive sweeps. Therefore, if the analyzer is in single sweep mode, two sweep triggers are used to generate the data needed for signal identification.
Dependencies	<p>Signal ID is not available in some measurements. If the Signal ID key does not appear or is grayed out while in your measurement, then it is not available.</p> <p>Because Signal ID uses data from two successive sweeps, several trace and sweep functions are grayed out in Signal ID. See the documentation for your measurement for details on which trace keys are grayed out.</p> <p>Signal ID is not available with Signal Track so Signal ID will be grayed out if in Signal Track.</p> <p>Signal ID will be turned off when External Mixer is turned off. Signal ID cannot be turned on when using internal mixing.</p> <p>Rules for auto coupling of the Sweep and FFT keys are changed with Signal ID on. For both the dynamic range case and the speed case, swept is chosen whenever any form of Signal ID is on. If Manual FFT is selected, the Signal ID key is grayed out.</p> <p>Whenever Signal ID is on, a warning message will be generated</p> <p>If Signal ID is selected in a measurement that does not support it, a warning message is generated</p>
Couplings	The Auto Rules for detector selection select Normal for all active traces when Signal ID is turned on.
Preset	This is unaffected by Preset but is set to OFF on a "Restore Input/Output Defaults"
Initial S/W Revision	A.08.01

## Signal ID Mode

Lets you set which Signal ID mode you will use, either Image Suppress or Image Shift.

Key Path	<b>Input/Output, External Mixer</b>
<b>Remote Command</b>	<b>[ :SENSe]:SIDentify:MODE ISUPpress ISHift</b> <b>[ :SENSe]:SIDentify:MODE?</b>
<b>Example</b>	:SID:MODE ISUP :SID:MODE?
Preset	This is unaffected by Preset but is set to ISUPpress on a "Restore Input/Output Defaults"
State Saved	Saved in instrument state
Initial S/W Revision	A.08.01

## Image Suppress

The Image Suppress mode of Signal ID mathematically removes all image and multiple responses of signals present at the mixer input. Two hidden sweeps are taken in succession. The second sweep is offset in LO frequency by  $2*IF/N$ . For each point in each trace, the smaller amplitude from the two traces is taken and placed in that point in the selected Trace. Responses of each trace that lie on top of one another will remain and are valid signals, others are images and are suppressed. The action of taking the smaller of the two traces will make the average noise level lower in all points that do not have an image, thus reducing the accuracy of the measurement of noise and noise-like signals.

Key Path	Input/Output, External Mixer, Signal ID Mode
<b>Example</b>	:SID:MODE ISUP
Notes	In Image Suppress Mode, synchronization is ensured by first turning off Signal ID, initiating a single sweep, then turning on Signal ID followed by two single sweeps.
Couplings	In Image Suppress the Peak detector is auto-selected to improve the image suppression effectiveness.
Initial S/W Revision	A.08.01
Modified at S/W Revision	A.16.00

## Image Shift

Like the Image Suppress mode, Image Shift is a two sweep sequence. The data from the first sweep is placed in Trace 1 and the data from the second (LO frequency shifted by  $2*IF/N$ ) sweep is placed in Trace 2. On alternate sweeps, the alternate trace (trace 2) is placed in front of trace 1. This way, you can see a signal at the same place on alternate sweeps, showing in yellow (trace1) and blue (trace2). Signal responses of Trace 1 and Trace 2 that have the same horizontal position are considered to be in the current band and therefore can be analyzed with the amplitude and frequency measurement systems of the SA. All other responses are invalid and should be ignored.

**NOTE**

This function takes control of and uses Trace 1 and Trace 2. Any data in these traces prior to activating Image Shift will be lost.

Key Path	Input/Output, External Mixer, Signal ID Mode
<b>Example</b>	:SID:MODE ISH
Notes	To synchronize in Image Shift Mode, turn off Signal ID and then initiate a single sweep. Then turn on Signal ID and initiate two single sweeps. The results of the first sweep after Signal ID is turned on are available in Trace 1. The next sweep is shifted and the data from that sweep is available in Trace 2. The unshifted and shifted data can then be compared.
Couplings	Trace 2 is turned off when Image Shift is turned Off.
Initial S/W Revision	A.08.01

## Cable IF Loss

The loss at the IF in the IF/LO cable can be compensated for with this function, by entering the loss in dB for your cable.

The cable loss will depend on the IF frequency. The IF frequency varies depending on which IF path your measurement is using. For best accuracy, characterize your cable's loss for the IF frequency or frequencies you will be using.

IF Frequencies:

10 MHz path: 322.5 MHz

25 MHz path: 322.5 MHz

40 MHz path: 250 MHz

140 MHz path: 300 MHz

Key Path	Input/Output, External Mixer
Key Path	Input/Output, External Mixer, Calibrate Mixer
<b>Remote Command</b>	[ :SENSe]:MIXer:CIFLoss <rel_amp1> [ :SENSe]:MIXer:CIFLoss?
<b>Example</b>	:MIX:CIFL 0.23 DB :MIX:CIFL?
Preset	0.26 dB
State Saved	Saved in instrument state
Min	-100
Max	100
Initial S/W Revision	A.08.01

## I/Q

This feature is not available unless the ["Baseband I/Q \(Option BBA\)" on page 170](#) is installed.

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.

Key Path	Input/Output
Mode	BASIC, CDMA2K, EDGE GSM, TDSCDMA, VSA89601, WIMAXOFDMA, LTE, LTETDD, LTEAFDD, LTEATDD, DCTV, DTMB (CTTB), DVB-T/H with T2, CMMB, ISDBT, WCDMA, VXA, CDMA1XEV, WLAN
<b>Example</b>	FEED AIQ
Notes	Not all measurements support the use of the I/Q signal input. When I/Q is selected in a measurement that does not support it, the "No Result; Meas invalid with I/Q inputs" error

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	condition message appears. This is error 135
Initial S/W Revision	Prior to A.02.00

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### Baseband I/Q (Option BBA)

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 M $\Omega$  input passive probes as well as the Keysight 113x Series active differential probes using the Infinimax probe interface.

The Keysight 113x Series active probes can be used for both single ended and differential measurements. In either case a single connection is made for each channel (on either the I or Q input). The input is automatically configured to 50  $\Omega$  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 M $\Omega$  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.

### Baseband I/Q Remote Language Compatibility

For the Keysight E4406A VSA Series Transmitter Tester, Option B7C provided baseband I/Q inputs. Code compatibility has been provided to allow many of the commands for option B7C to function properly with the X-Series. The X-Series has hardware differences and additional capabilities (e.g., E4406A does not have independent settings of I & Q nor does it provide for probe calibrations) which make 100% compatibility impossible.

4. The following commands are supported:

:CALibration:IQ:FLATness

:INPut:IMPedance:IQ U50|B50|U1M|B1M

:INPut:IMPedance:REFerence <integer>

5. The [:SENSe]:FEED RF|IQ|IONLy|QONLy|AREFerence|IFALign command supports all parameters except IFALign. The FEED? query will return only RF|AIQ|AREF.

6. The following commands are not supported:

:CALibration:GIQ

:CALibration:IQ:CMR

:INPut:IQ:ALIGn OFF|ON|0|1

The Rohde & Schwarz FSQ-B71 also provides baseband I/Q inputs. A certain amount of code compatibility is provided in the X-Series, however hardware differences make this a somewhat limited set.

Supported:

The "<1|2>" is supported as "[1]".

INPut<1|2>:IQ:BALanced[:STATe] ON | OFF

INPut<1|2>:IQ:TYPE I | Q | IQ

INPut<1|2>:IQ:IMPedance LOW | HIGH

Not Supported:

INPut<1|2>:SElect AIQ | RF

TRACe<1|2>:IQ:DATA:FORMat COMPAtible | IQBLock | IQPair>



TRACe<1|2>:IQ:DATA:MEMory? <offset samples>, <# of samples>

TRACe<1|2>:IQ:DATA?

TRACe<1|2>:IQ:SET <filter type>, <rbw>, <sample rate>, <trigger source>, <trigger slope>, <pretrigger samples>, <# of samples>

TRACe<1|2>:IQ:SRATe 10.0kHz to 81.6MHz

TRACe<1|2>:IQ[:STATe] ON|OFF

The Rohde & Schwarz FMU has the following SCPI, which is not supported (these commands start/abort the probe calibration procedure, which is manually interactive from the front panel):

CALibration:ABORt

CALibration:PROBe[:START]

### I/Q Path

Selects which I/Q input channels are active. The LED next to each I/Q input port will be on when that port is active.

The analysis bandwidth for each channel is the same as that of the instrument. For example, the base N9020A has a bandwidth of 10 MHz. With I/Q input the I and Q channels would each have an analysis bandwidth of 10 MHz, giving 20 MHz of bandwidth when the I/Q Path is I+jQ. With option B25, the available bandwidth becomes 25 MHz, giving 25 MHz each to I and Q and 50 MHz to I+jQ.

I/Q voltage to power conversion processing is dependent on the I/Q Path selected.

- With I+jQ input we know that the input signal may not be symmetrical about 0 Hz, because it has a complex component. Therefore, above 0 Hz only the positive frequency information is displayed, and below 0 Hz only the negative frequency information is displayed.
- With all other Input Path selections, the input signal has no complex component and therefore is always symmetrical about 0 Hz. In this case, by convention, the power conversion shows the combined voltage for both the positive and negative frequencies. The information displayed below 0 Hz is the mirror of the information displayed above 0 Hz. This results in a power reading 6.02 dB higher (for both) than would be seen with only the positive frequency voltage. Note also that, in this case the real signal may have complex modulation embedded in it, but that must be recovered by further signal processing.

Key Path	Input/Output, I/Q
<b>Remote Command</b>	[ :SENSe ] : FEED : IQ : TYPE IQ   IONLY   QONLY [ :SENSe ] : FEED : IQ : TYPE ?
<b>Example</b>	Set the input to be both the I and Q channels, combined as I + j * Q.

	FEED:IQ:TYPE IQ
Preset	IQ
State Saved	Yes This is unaffected by a Preset but is set to the default value on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Range	I+jQ   I Only   Q Only
Readback Text	I+jQ   I Only   Q Only
Initial S/W Revision	Prior to A.02.00

<b>Remote Command</b>	:INPut[1]:IQ:TYPE IQ I Q :INPut[1]:IQ:TYPE?
Notes	For R&S FSQ-B71 compatibility
Preset	IQ
Initial S/W Revision	Prior to A.02.00

### I+jQ

Sets the signal input to be both the I and Q channels. The I and Q channel data will be combined as  $I + j * Q$ .

Key Path	Input/Output, I/Q, I/Q Path
<b>Example</b>	Set the input to be both the I and Q channels, combined as $I + j * Q$ . FEED:IQ:TYPE IQ
Initial S/W Revision	Prior to A.02.00

### I Only

Sets the signal input to be only the I channel. The Q channel will be ignored. The data collected is still complex. When the center frequency is 0 the imaginary part will always be zero, but for any other center frequency both the real and imaginary parts will be significant.

Key Path	Input/Output, I/Q, I/Q Path
<b>Example</b>	Set the input to be only the I channel. FEED:IQ:TYPE IONL
Initial S/W Revision	Prior to A.02.00

## Q Only

Sets the signal input to be only the Q channel. The I channel will be ignored. The Q channel will be sent to the digital receiver block as  $Q+j0$ . The receiver's output is still complex. When the center frequency is 0 the imaginary part will always be zero, but for any other center frequency both the real and imaginary parts will be significant. Note that since the receiver's real output is displayed as the "I" data, when the center frequency is 0, the Q Only input appears as the "I" data.

Key Path	Input/Output, I/Q, I/Q Path
<b>Example</b>	Set the input to be only the Q channel. FEED:IQ:TYPE QONL
Initial S/W Revision	Prior to A.02.00

## I Setup

Access the channel setup parameters for the I channel.

Key Path	Input/Output, I/Q
Initial S/W Revision	Prior to A.02.00

## I Differential Input

Selects differential input on or off for the I channel. For differential input (also called balanced input), the analyzer uses both main and complementary ports. When differential input is off (also called single-ended or unbalanced input), the analyzer uses only the main port.

Key Path	Input/Output, I/Q, I Setup
<b>Remote Command</b>	:INPut:IQ[:I]:DIFFerential OFF ON 0 1 :INPut:IQ[:I]:DIFFerential?
<b>Example</b>	Put the I channel in Differential Input mode INP:IQ:DIFF ON
Notes	When I Differential Input = On, the analyzer will check for attenuation mismatches between the I and I-bar ports. If the difference in attenuation values exceeds 0.5 dB a Settings Alert error condition, error 159 will be set.  When I Differential Input = On, and IQ Path is I+jQ, the Q Differential input must also be On. Similarly, when I Differential Input = Off, and IQ Path is I+jQ, the Q Differential input must also be Off. If the states of the two inputs do not match, an error condition message is generated, 159;Settings Alert;I/Q mismatch:Differential.
Couplings	Some active probes include built-in differential capability. When one of these probes is sensed, this key is disabled. Since the differential capability is handled in the probe, the Analyzer will use only the main port and the key will show that the Analyzer's Differential Input mode is Off (indicating that the complementary port is not in use).

	When Q Same as I is On, the value set for I will also be copied to Q.
Preset	Off
State Saved	Yes This is unaffected by a Preset but is set to the default value on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Range	Off   On
Initial S/W Revision	Prior to A.02.00

<b>Remote Command</b>	<code>:INPut[1]:IQ:BAnced[:STATe] OFF ON 0 1</code> <code>:INPut[1]:IQ:BAnced[:STATe]?</code>
Notes	For R&S FSQ-B71 compatibility, with no independent settings for the I and Q channels. Therefore, it is tied only to the I channel and does not provide an equivalent for the Q channel. For proper operation of the backwards compatibility command Q Same as I should be set to On.
Preset	OFF
Initial S/W Revision	Prior to A.02.00

## I Input Z

Selects the input impedance for the I channel. The impedance applies to both the I and I-bar ports.

The input impedance controls the hardware signal path impedance match. It is not used for converting voltage to power. The voltage to power conversion always uses the Reference Z parameter. The Reference Z parameter applies to both I and Q channels.

Key Path	Input/Output, I/Q, I Setup
<b>Remote Command</b>	<code>:INPut[1]:IQ[:I]:IMPedance LOW HIGH</code> <code>:INPut[1]:IQ[:I]:IMPedance?</code>
<b>Example</b>	Set the I channel input impedance to 1 M $\Omega$ INP:IQ:IMP HIGH
Notes	LOW = 50 $\Omega$ , HIGH = 1 M $\Omega$ When IQ Path is I+jQ, the I Input Z setting must be the same as the Q Input Z setting. If the settings of the two inputs do not match, an error condition message is generated, 159;Settings Alert;I/Q mismatch:Input Z.
Couplings	Input impedance is a built-in characteristic of a probe. Therefore, whenever a probe is sensed, this key is disabled and the value is set to match the probe. When no probe is sensed on Q and Q Same as I is On, the value set for I will also be copied to Q.
Preset	LOW
State Saved	Yes This is unaffected by a Preset but is set to the default value on a "Restore Input/Output Defaults"

	or "Restore System Defaults->All"
Range	50 $\Omega$   1 M $\Omega$
Initial S/W Revision	Prior to A.02.00

## I Skew

Sets the skew factor for the I channel. The skew will shift the channel's data in time. Use this to compensate for differences in the electrical lengths of the input paths due to cabling.

Key Path	Input/Output, I/Q, I Setup
<b>Remote Command</b>	[ :SENSe]:CORRection:IQ[:I]:SKEW <seconds> [ :SENSe]:CORRection:IQ[:I]:SKEW?
<b>Example</b>	Delay the data for the I channel by 10 ns. CORR:IQ:SKEW 10 ns
Preset	0
State Saved	Yes This is unaffected by Preset but is set to the default value on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Range	0 s to 100 ns
Min	0 s
Max	+100 ns
Initial S/W Revision	Prior to A.02.00

## I Probe

Access the probe setup parameters for the I channel. See "[I/Q Probe Setup](#)" on page 186.

Key Path	Input/Output, I/Q, I Setup
State Saved	No
Readback Text	[<I port probe id> This is reporting the type of probe sensed on the I port. There is no parameter for overriding what is sensed.
Initial S/W Revision	Prior to A.02.00

## Attenuation

The attenuation is part of the calibration data stored with the probe type and is initially the value that was returned by the last calibration. You can modify this value

and any changes will be stored with the calibration data and will survive power cycles and presets. When a probe calibration is performed the attenuation value will be overwritten by the calibration.

Key Path	Input/Output, I/Q, I Setup   Q Setup, I Probe   Q Probe
Remote Command	[ :SENSe]:CORRection:IQ:I Q:ATTenuation:RATio <real> [ :SENSe]:CORRection:IQ:I Q:ATTenuation:RATio?
Example	Set the attenuation for the current I probe to 100.00:1. CORR:IQ:I:ATT:RAT 100
Notes	Each probe type has its own attenuation setting. As probes are changed the attenuation value will reflect the new probe's setting. Changing the attenuation affects only the current probe type's setting and leaves all others unchanged.  When the IQ Path is I+jQ, the Q probe attenuation setting must match the I Probe attenuation setting within 1 dB. If this is not the case, an error condition message is generated, 159;Settings Alert;I/Q mismatch:Attenuation.
Preset	Each probe type has its own default. The default for the "Unknown" probe type is 1:1.
State Saved	Saved with probe calibration data. It survives a power cycle and is not affected by a Preset or Restore.
Range	0.001 to 10000
Min	0.001
Max	10000
Initial S/W Revision	Prior to A.02.00

This is an alternate form of the SCPI that allows input as a power instead of a ratio.

Remote Command	[ :SENSe]:CORRection:IQ:I Q:ATTenuation <rel_amp> [ :SENSe]:CORRection:IQ:I Q:ATTenuation?
Example	Set the attenuation for the current I probe type to 100.00:1. CORR:IQ:I:ATT 20 dB
Range	-60 dB to +80 dB
Min	-60 dB
Max	+80 dB
Initial S/W Revision	Prior to A.02.00

## Calibrate

Invokes the guided probe calibration. The guided probe calibration is context sensitive and depends on the channel (I or Q) and the Differential Input state. The calibration is only performed on the selected channel. When Differential Input is on, both the probe attached to the main port and the probe attached to the complementary port are calibrated. When Differential Input is off, only the probe attached to the main port is calibrated. See "[I/Q Guided Calibration](#)" on page 209.

Key Path	Input/Output, I/Q, I Setup   Q Setup, I Probe   Q Probe, Coupling
Readback Text	The last calibration date, or if no calibration exists, "(empty)". Last: <cal date> <cal time> Example: Last: 8/22/2007 1:02:49 PM
Initial S/W Revision	Prior to A.02.00

### Clear Calibration

Clears the calibration data for the current port and probe. It does not clear the data for other probe types or other ports. If the sensed probe has EEPROM identification, only the data for that specific probe is cleared. After this command has completed, the probe calibration state will be the same as if no probe calibration had ever been performed for the specified channel and probe. The probe attenuation will be the default value for that probe type and the Cable Calibration frequency response corrections will be used. This command is dependent on the Differential Input state. When Differential Input is on, both the data for the probe attached to the main port and the data for the probe attached to the complementary port are cleared. When Differential Input is off, only data for the probe attached to the main port is cleared.

Key Path	Input/Output, I/Q, I Setup   Q Setup, I Probe   Q Probe
<b>Remote Command</b>	:CALibration:IQ:PROBe:I Q:CLEar
<b>Example</b>	Clear the calibration data for the I channel and the current probe (with EEPROM identification) or probe type (without EEPROM identification). :CAL:IQ:PROBe:I:CLE
Initial S/W Revision	Prior to A.02.00

### Combined Differential/Input Z (Remote Command Only)

This is Remote Command only (no front panel) and is for backwards compatibility only. It combines the Differential Input and Input Z selections into a single SCPI command.

<b>Remote Command</b>	:INPut:IMPedance:IQ U50 B50 U1M B1M :INPut:IMPedance:IQ?
<b>Example</b>	:INPut:IMPedance:IQ U50 This is equivalent to the following two SCPI commands: :INP:IQ:DIFF OFF :INP:IQ:IMP 50
Notes	Provided for E4406A code compatibility.

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	<p>The enum values translate as follows:          U50: Differential Input = Off, Input Z = 50Ω          B50: Differential Input = On, Input Z = 50Ω          U1M: Differential Input = Off, Input Z = 1 MΩ          B1M: Differential Input = On, Input Z = 1 MΩ</p> <p>This command is for backwards compatibility. It combines the Input Z (50Ω or 1 MΩ) parameter with the Differential Input (Off = "Unbalanced", On = "Balanced") parameter into a single enumeration.</p> <p>This backwards compatibility SCPI command was for an instrument without independent settings for the I and Q channels. Therefore, it is tied only to the I channel and does not provide an equivalent for the Q channel. For proper operation of the backwards compatibility command Q Same as I should be set to On.</p> <p>Also, note the subtle difference between this SCPI command and the backwards compatibility command for Input Z. The Input Z SCPI has "IQ" before "IMP" while this command has that order reversed.</p>
Couplings	This command does not have an independent parameter, but instead is tied to the Differential Input and Input Z parameters. The coupling for those parameters apply to this command too.
Preset	U50
Initial S/W Revision	Prior to A.02.00

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## Q Setup

Access the channel setup parameters for the Q channel.

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Key Path	<b>Input/Output, I/Q</b>
Readback Text	When Q Same as I is On the readback is "Q Same as I".
Initial S/W Revision	Prior to A.02.00

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## Q Same as I

Many, but not all, usages require the I and Q channels have an identical setup. To simplify channel setup, the Q Same as I will cause the Q channel parameters to be mirrored from the I channel. That way you only need to set up one channel (the I channel). The I channel values are copied to the Q channel, so at the time Q Same as I is turned off the I and Q channel setups will be identical. This does not apply to Probe settings or to parameters that are determined by the probe.

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Key Path	<b>Input/Output, I/Q, Q Setup</b>
<b>Remote Command</b>	<b>:INPut:IQ:MIRROred OFF ON 0 1</b> <b>:INPut:IQ:MIRROred?</b>
<b>Example</b>	Turn off the mirroring of parameters from I to Q. INP:IQ:MIRR OFF

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Couplings	Only displayed for the Q channel. When Yes, the I channel values for some parameters are mirrored (copied) to the Q channel. However, when a parameter is determined by the type of probe and a probe is sensed, the probe setting is always used and the I channel setting is ignored. The following parameters are mirrored: Differential Input (when not determined by probe) Input Z (when not determined by probe)
Preset	This is unaffected by a Preset but is set to the default value (Q Same as I set to "On") on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved	Saved in instrument state
Range	On   Off
Readback Text	"Q Same as I" when On, otherwise none.
Initial S/W Revision	Prior to A.02.00

### Q Differential Input

Selects differential input on or off for the Q channel. For differential input (also called balanced input), the analyzer uses both the Q and Q-bar ports. When differential input is off (also called single-ended or unbalanced input), the analyzer uses only the Q port.

Key Path	<b>Input/Output, I/Q, Q Setup</b>
<b>Remote Command</b>	<b>:INPut:IQ:Q:DIFFerential OFF ON 0 1</b> <b>:INPut:IQ:Q:DIFFerential?</b>
<b>Example</b>	Put the Q channel in Differential Input mode INP:IQ:Q:DIFF ON
Notes	When Differential Input = On, the analyzer will check for attenuation mismatches between the Q and Q-bar ports. If the difference in attenuation values exceeds 0.5 dB a Settings Alert error condition, error 159 will be set. When Q Differential Input = On, and IQ Path is I+jQ, the I Differential input must also be On. Similarly, when Q Differential Input = Off, and IQ Path is I+jQ, the I Differential input must also be Off. If the states of the two inputs do not match, an error condition message is generated, 159;Settings Alert;I/Q mismatch:Differential.
Couplings	Some active probes include built-in differential capability. When one of these probes is sensed, this key is disabled. Since the differential capability is handled in the probe, the Analyzer will use only the main port and the key will show that the Analyzer's Differential Input mode is Off (indicating that the complementary port not in use). When a differential probe is not sensed and Q Same as I is On, the value set for I will be copied to Q. This key is disabled when Q Same as I is On.
Preset	Off
State Saved	Yes This is unaffected by a Preset but is set to the default value on a "Restore Input/Output Defaults" or "Restore System Defaults->All"

Range	Off   On
Initial S/W Revision	Prior to A.02.00

### Q Input Z

Selects the input impedance for the Q channel. The impedance applies to both the Q and Q-bar ports.

The input impedance controls the hardware signal path impedance match. It is not used for converting voltage to power. The voltage to power conversion always uses the Reference Z parameter. The Reference Z parameter applies to both I and Q channels.

Key Path	Input/Output, I/Q, Q Setup
<b>Remote Command</b>	:INPut[1]:IQ:Q:IMPedance LOW HIGH :INPut[1]:IQ:Q:IMPedance?
<b>Example</b>	Set the Q channel input impedance to 1 M $\Omega$ INP:IQ:Q:IMP HIGH
Notes	LOW = 50 $\Omega$ , HIGH = 1 M $\Omega$ When IQ Path is I+jQ, the I Input Z setting must be the same as the Q Input Z setting. If the settings of the two inputs do not match, an error condition message is generated, 159;Settings Alert;I/Q mismatch:Input Z.
Couplings	Input impedance is a built-in characteristic of a probe. Therefore, whenever a probe is sensed, this key is disabled and the value is set to match the probe. When no probe is sensed and Q Same as I is On, the value set for I will also be copied to Q. This key is disabled when Q Same as I is On.
Preset	LOW
State Saved	Yes This is unaffected by Preset but is set to the default value on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Range	50 $\Omega$   1 M $\Omega$
Initial S/W Revision	Prior to A.02.00

### Q Skew

Sets the skew factor for the Q channel. The skew will shift the channel's data in time. Use this to compensate for differences in the electrical lengths of the input paths due to cabling and probes.

Key Path	Input/Output, I/Q, Q Setup
<b>Remote Command</b>	[ :SENSe]:CORRection:IQ:Q:SKEW <seconds> [ :SENSe]:CORRection:IQ:Q:SKEW?

<b>Example</b>	Delay the data for the Q channel by 10 ns. CORR:IQ:Q:SKEW 10 ns
Preset	0
State Saved	Yes  This is unaffected by a Preset but is set to the default value on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Range	0 s to 100 ns
Min	0 s
Max	+100 ns
Initial S/W Revision	Prior to A.02.00

### Q Probe

Accesses the probe setup parameters for the Q channel. See "[I/Q Probe Setup](#)" on [page 186](#).

Key Path	Input/Output, I/Q, Q Setup
State Saved	No
Readback Text	[<Q port probe id>  This is reporting the type of probe sensed on the Q port. There is no parameter for overriding what is sensed.
Initial S/W Revision	Prior to A.02.00

### Attenuation

The attenuation is part of the calibration data stored with the probe type and is initially the value that was returned by the last calibration. You can modify this value and any changes will be stored with the calibration data and will survive power cycles and presets. When a probe calibration is performed the attenuation value will be overwritten by the calibration.

Key Path	Input/Output, I/Q, I Setup   Q Setup, I Probe   Q Probe
<b>Remote Command</b>	[ :SENSe ] :CORRection:IQ:I   Q:ATTenuation:RATio <real> [ :SENSe ] :CORRection:IQ:I   Q:ATTenuation:RATio?
<b>Example</b>	Set the attenuation for the current I probe to 100.00:1. CORR:IQ:I:ATT:RAT 100
Notes	Each probe type has its own attenuation setting. As probes are changed the attenuation value will reflect the new probe's setting. Changing the attenuation affects only the current probe type's setting and leaves all others unchanged.  When the IQ Path is I+jQ, the Q probe attenuation setting must match the I Probe attenuation setting within 1 dB. If this is not the case, an error condition message is generated, 159;Settings

	Alert;I/Q mismatch:Attenuation.
Preset	Each probe type has its own default. The default for the "Unknown" probe type is 1:1.
State Saved	Saved with probe calibration data. It survives a power cycle and is not affected by a Preset or Restore.
Range	0.001 to 10000
Min	0.001
Max	10000
Initial S/W Revision	Prior to A.02.00

This is an alternate form of the SCPI that allows input as a power instead of a ratio.

<b>Remote Command</b>	<code>[ :SENSe]:CORRection:IQ:I Q:ATTenuation &lt;rel_amp1&gt;</code> <code>[ :SENSe]:CORRection:IQ:I Q:ATTenuation?</code>
<b>Example</b>	Set the attenuation for the current I probe type to 100.00:1. CORR:IQ:I:ATT 20 dB
Range	-60 dB to +80 dB
Min	-60 dB
Max	+80 dB
Initial S/W Revision	Prior to A.02.00

## Calibrate

Invokes the guided probe calibration. The guided probe calibration is context sensitive and depends on the channel (I or Q) and the Differential Input state. The calibration is only performed on the selected channel. When Differential Input is on, both the probe attached to the main port and the probe attached to the complementary port are calibrated. When Differential Input is off, only the probe attached to the main port is calibrated. See "[I/Q Guided Calibration](#)" on page 209.

<b>Key Path</b>	<b>Input/Output, I/Q, I Setup   Q Setup, I Probe   Q Probe, Coupling</b>
<b>Readback Text</b>	The last calibration date, or if no calibration exists, "(empty)". Last: <cal date> <cal time> Example: Last: 8/22/2007 1:02:49 PM
<b>Initial S/W Revision</b>	Prior to A.02.00

## Clear Calibration

Clears the calibration data for the current port and probe. It does not clear the data for other probe types or other ports. If the sensed probe has EEPROM identification, only the data for that specific probe is cleared. After this command has completed, the probe calibration state will be the same as if no probe calibration had ever been performed for the specified channel and probe. The probe attenuation will be the default value for that probe type and the Cable Calibration frequency response corrections will be used. This command is dependent on the Differential Input state. When Differential Input is on, both the data for the probe attached to the main port and the data for the probe attached to the complementary port are cleared. When Differential Input is off, only data for the probe attached to the main port is cleared.

Key Path	Input/Output, I/Q, I Setup   Q Setup, I Probe   Q Probe
Remote Command	:CALibration:IQ:PROBe:I Q:CLEar
Example	Clear the calibration data for the I channel and the current probe (with EEPROM identification) or probe type (without EEPROM identification). :CAL:IQ:PROBe:I:CLE
Initial S/W Revision	Prior to A.02.00

## Reference Z

Sets the value of the impedance to be used in converting voltage to power for the I and Q channels. This does not change the hardware's path impedance (see "[I Input Z](#)" on page 176).

Key Path	Input/Output, I/Q
Remote Command	:INPut:IMPedance:REFeRence <integer> :INPut:IMPedance:REFeRence?
Example	Set the I/Q reference impedance to 50 $\Omega$ INP:IMP:REF 50
Preset	50 $\Omega$
State Saved	Yes This is unaffected by a Preset but is set to the default value on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Range	1 $\Omega$ to 1 M $\Omega$
Min	1 $\Omega$
Max	1 M $\Omega$
Initial S/W Revision	Prior to A.02.00

### I/Q Cable Calibrate...

The I/Q cable calibration creates correction data for each of the front panel I/Q ports. This calibration data is used whenever no probe specific calibration data is available. It is important that all ports are calibrated using the same short BNC cable so that the data is comparable from port to port.

The guided calibration (front panel only) will show connection diagrams and guide you through the isolation calibration and calibrating each port. The calibration data for each port is stored separately, so as soon as a port is calibrated that data is saved and will be used. If you press "Exit" to exit the calibration process, the data for the ports already completed will still be used. It is recommended that a calibration be completed once started, or if exited, that it be properly done before the next use of the I/Q ports. The "Next" button will perform the calibration for the current port and then proceed to the next step in the calibration procedure. The "Back" button will return to the prior port in the procedure. Both keys and dialog buttons are supplied for ease of use. The dialog buttons are for mouse use and the softkeys for front panel use.

The calibration can also be done via SCPI, but no connection diagrams will be shown. You will have to make the correct connections before issuing each port calibration command. Again, it is recommended that all ports be calibrated at the same time.

The instrument state remains as it was prior to entering the calibration procedure except while a port is actually being calibrated. Once a port is calibrated it returns to the prior state. A port calibration is in process only from the time the "Next" button is pressed until the next screen is shown. For SCPI, this corresponds to the time from issuing the CAL:IQ:FLAT:I|B|Q|QB command until the operation is complete.

For example, if the prior instrument state is Cal Out = Off, Input = I+jQ, and Differential = Off, then up until the time the "Next" button is pressed the I Input and Q Input LEDs are on and the Cal Out, I-bar Input and Q-bar Input LEDs are off. Once the "Next" button is pressed for the I port calibration, only the Cal Out and I Input LEDs will be on and the others will be off. When the screen progresses to the next step ("Next" button again enabled), the prior state is restored and only the I Input and Q Input LEDs are on (Cal Out is off again).

The last calibration date and time for each port will be displayed. Any calibrations that are more than a day older than the most recent calibration will be displayed with the color amber.

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Key Path	Input/Output, I/Q
Initial S/W Revision	Prior to A.02.00

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### I/Q Probe Setup

The set of I/Q probe setup parameters will change based on the type of probe that is sensed. All probe types have the Attenuation parameter, and all probe types can be calibrated. The remaining parameters are only available for some probe types and

will not be shown when not available. The probe type is determined by and reported for only for the I and Q ports, never the I-bar or Q-bar ports. The menu title will be "<ch>: <probe id>", where "<ch>" is either "I" or "Q" and "<probe id>" is the type of probe. For example, for the I Probe setup with an Keysight 1130A probe connected to the I port, the title will be "I: 1130A".

Probe calibration data is stored for each probe type for each channel. When no probe is sensed, the probe type "Unknown" is used, and this is also treated like a probe type with its own calibration data. When a probe is changed, the calibration data for that probe type for that port is restored. An advisory message will be displayed showing the new probe type and the calibration status. The calibration data is stored permanently (survives a power cycle) and is not affected by a Preset or any of the Restore commands. When the probe has EEPROM identification (most newer Keysight probes have this), the calibration data is stored by probe serial number and port, so if you have two probes of the same type, the correct calibration data will be used for each. For probes that do not have EEPROM identification, the calibration data is stored by probe type and port and the instrument cannot distinguish between different probes of the same type. In all cases (with or without EEPROM identification), the calibration data is port specific, so it will not follow a specific probe from port to port if the probe is moved.

The "Unknown" probe type is used whenever no probe is sensed. When no calibration data exists for "Unknown" the latest cable calibration data is used (see ["I/Q Guided Calibration " on page 209](#)).

## Attenuation

The attenuation is part of the calibration data stored with the probe type and is initially the value that was returned by the last calibration. You can modify this value and any changes will be stored with the calibration data and will survive power cycles and presets. When a probe calibration is performed the attenuation value will be overwritten by the calibration.

Key Path	Input/Output, I/Q, I Setup   Q Setup, I Probe   Q Probe
Remote Command	[ :SENSE]:CORREction:IQ:I Q:ATTenuation:RATio <real> [ :SENSE]:CORREction:IQ:I Q:ATTenuation:RATio?
Example	Set the attenuation for the current I probe to 100.00:1. CORR:IQ:I:ATT:RAT 100
Notes	Each probe type has its own attenuation setting. As probes are changed the attenuation value will reflect the new probe's setting. Changing the attenuation affects only the current probe type's setting and leaves all others unchanged.  When the IQ Path is I+jQ, the Q probe attenuation setting must match the I Probe attenuation setting within 1 dB. If this is not the case, an error condition message is generated, 159;Settings Alert;I/Q mismatch:Attenuation.
Preset	Each probe type has its own default. The default for the "Unknown" probe type is 1:1.
State Saved	Saved with probe calibration data. It survives a power cycle and is not affected by a Preset or Restore.

Range	0.001 to 10000
Min	0.001
Max	10000
Initial S/W Revision	Prior to A.02.00

This is an alternate form of the SCPI that allows input as a power instead of a ratio.

<b>Remote Command</b>	<code>[ :SENSe]:CORRection:IQ:I Q:ATTenuation &lt;rel_amp1&gt;</code> <code>[ :SENSe]:CORRection:IQ:I Q:ATTenuation?</code>
<b>Example</b>	Set the attenuation for the current I probe type to 100.00:1. <code>CORR:IQ:I:ATT 20 dB</code>
Range	-60 dB to +80 dB
Min	-60 dB
Max	+80 dB
Initial S/W Revision	Prior to A.02.00

## Offset

Some active probes have DC offset capability. When one of these probes is connected this control will be visible. The signal is adjusted for the DC offset before entering the analyzer's port. This allows for removal of a DC offset before reaching the analyzer's input port voltage limits. For example, a signal that varies 1 V peak-to-peak with a DC offset equal to the analyzer's max input voltage would exceed the input limits of the analyzer for half its cycle. Removing the DC offset allows the analyzer to correctly process the entire signal.

Key Path	<b>Input/Output, I/Q, I Setup   Q Setup, I Probe   Q Probe</b>
<b>Remote Command</b>	<code>:INPut:OFFSet:I Q &lt;voltage&gt;</code> <code>:INPut:OFFSet:I Q?</code>
<b>Example</b>	Remove a DC offset of -0.5 V from the I channel input. <code>INP:OFFS:I -0.5</code>
Notes	Only some probe types support Offset. For those that do, each probe type has its own Offset setting. As probes are changed the Offset value will reflect the new probe's setting. Changing the Offset affects only the current probe type's setting and leaves all others unchanged.
Preset	0 V
State Saved	Saved with probe calibration data. It survives power cycle and is not affected by Preset or Restore.
Range	-18 V to +18 V
Min	-18 V
Max	+18 V
Initial S/W Revision	Prior to A.02.00



## Coupling

Some probe types allow coupling to reject low frequencies. This will filter out the DC component of a signal that is composed of a DC bias plus some AC signal. This control is visible only for probe types that have this capability.

Key Path	Input/Output, I/Q, I Setup   Q Setup, I Probe   Q Probe
<b>Remote Command</b>	:INPut:COUPling:I Q DC LFR1 LFR2 :INPut:COUPling:I Q?
<b>Example</b>	Set the probe to low frequency rejection below 1.7 Hz. INP:COUP:I LFR1
Notes	Only some probe types support Coupling. For those that do, each probe type has its own Coupling setting. As probes are changed the Coupling value will reflect the new probe's setting. Changing the Coupling affects only the current probe type's setting and leaves all others unchanged.
Preset	DC
State Saved	Saved with probe calibration data. It survives a power cycle and is not affected by a Preset or Restore.
Range	DC   AC 1.7 Hz LFR1   AC 0.14 Hz LFR2
Readback Text	DC   LFR1   LFR2
Initial S/W Revision	Prior to A.02.00

## DC

Turns off low frequency rejection, allowing signals down to DC.

Key Path	Input/Output, I/Q, I Setup   Q Setup, I Probe   Q Probe, Coupling
<b>Example</b>	Turn off low frequency rejection on the I channel INP:COUP:I DC
Initial S/W Revision	Prior to A.02.00

## LFR1

Turns on low frequency rejection, rejecting signal component lower than 1.7 Hz.

Key Path	Input/Output, I/Q, I Setup   Q Setup, I Probe   Q Probe, Coupling
<b>Example</b>	Turn on low frequency rejection on the I channel for frequencies lower than 1.7 Hz INP:COUP:I LFR1
Initial S/W Revision	Prior to A.02.00

## LFR2

Turns on low frequency rejection, rejecting signal component lower than 0.14 Hz.

Key Path	Input/Output, I/Q, I Setup   Q Setup, I Probe   Q Probe, Coupling
<b>Example</b>	Turn on low frequency rejection on the I channel for frequencies lower than 0.14 Hz INP:COUP:I LFR2
Initial S/W Revision	Prior to A.02.00

## Calibrate

Invokes the guided probe calibration. The guided probe calibration is context sensitive and depends on the channel (I or Q) and the Differential Input state. The calibration is only performed on the selected channel. When Differential Input is on, both the probe attached to the main port and the probe attached to the complementary port are calibrated. When Differential Input is off, only the probe attached to the main port is calibrated. See "[I/Q Guided Calibration](#)" on page 209.

Key Path	Input/Output, I/Q, I Setup   Q Setup, I Probe   Q Probe, Coupling
Readback Text	The last calibration date, or if no calibration exists, "(empty)". Last: <cal date> <cal time> Example: Last: 8/22/2007 1:02:49 PM
Initial S/W Revision	Prior to A.02.00

## Clear Calibration

Clears the calibration data for the current port and probe. It does not clear the data for other probe types or other ports. If the sensed probe has EEPROM identification, only the data for that specific probe is cleared. After this command has completed, the probe calibration state will be the same as if no probe calibration had ever been performed for the specified channel and probe. The probe attenuation will be the default value for that probe type and the Cable Calibration frequency response corrections will be used. This command is dependent on the Differential Input state. When Differential Input is on, both the data for the probe attached to the main port and the data for the probe attached to the complementary port are cleared. When Differential Input is off, only data for the probe attached to the main port is cleared.

Key Path	Input/Output, I/Q, I Setup   Q Setup, I Probe   Q Probe
<b>Remote Command</b>	:CALibration:IQ:PROBe:I Q:CLEar
<b>Example</b>	Clear the calibration data for the I channel and the current probe (with EEPROM identification) or probe type (without EEPROM identification).

	:CAL:IQ:PROBe:I:CLE
Initial S/W Revision	Prior to A.02.00

## RF Calibrator

Lets you choose a calibrator signal to look at or turns the calibrator "off".

Key Path	<b>Input/Output</b>
<b>Remote Command</b>	[ :SENSe ] :FEED:AREFERENCE REF50 REF4800 OFF [ :SENSe ] :FEED:AREFERENCE?
<b>Example</b>	FEED:AREF REF50 selects the 50 MHz amplitude reference as the signal input. FEED:AREF REF4800 selects the 4.8 GHz amplitude reference as the signal input FEED:AREF OFF turns the calibrator "off" (switches back to the selected input – RF or I/Q)
Dependencies	Selecting an input (RF or I/Q) turns the Calibrator OFF. This is true whether the input is selected by the keys or with the [:SENSe]:FEED command.  The 4.8 GHz internal reference is only available in some models and frequency range options. If the 4.8 GHz reference is not present, the <b>4.8 GHz</b> softkey 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.
Preset	OFF
State Saved	Saved in instrument state
Readback	Off, 50 MHz, 4.8 GHz
Initial S/W Revision	Prior to A.02.00

<b>Remote Command</b>	:CALibration:SOURce:STATe OFF ON 0 1 :CALibration:SOURce:STATe?
Notes	For ESA backwards compatibility.  In the ESA the calibrator was a separate output which you connected to the input and switched on with this command.  In the X-Series, the ON parameter is aliased to the [SENSe]:FEED:AREF REF50 command and the OFF parameter is aliased to [SENSe]:FEED:AREF OFF.  When CALibration:SOURce:STATe? is received, 1 will be returned if any of the references is selected and 0 if the Calibrator is "Off"
Preset	OFF
Initial S/W Revision	Prior to A.02.00

## 50 MHz

Selects the 50 MHz internal reference as the input signal.

Key Path	<b>Input/Output, RF Calibrator</b>
<b>Example</b>	:FEED:AREF REF50
Readback	50 MHz
Initial S/W Revision	Prior to A.02.00

## 4.8 GHz

Selects the 4.8 GHz internal reference as the input signal.

Key Path	<b>Input/Output, RF Calibrator</b>
<b>Example</b>	:FEED:AREF REF4800
Dependencies	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 <b>4.8 GHz</b> softkey will be blanked, and if the REF4800 parameter is sent, the analyzer will generate an error.
Readback	4.8 GHz
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

## Off

Switches the input back to the selected input (RF or I/Q)

Key Path	<b>Input/Output, RF Calibrator</b>
<b>Example</b>	:FEED:AREF OFF
Readback	Off
Initial S/W Revision	Prior to A.02.00

## External Gain

Compensates for gain or loss in the measurement system outside the spectrum analyzer. 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 analyzer 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.

Key Path	Input/Output
Couplings	The Ext Preamp, MS, and BS keys may be grayed out depending on which measurement is currently selected. If any of the grayed out keys are pressed, or the equivalent SCPI command is sent, an advisory message is generated.
Readback	1-of-N selection   [variable]
Initial S/W Revision	Prior to A.02.00

### 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.

["More Information" on page 194](#)

Key Path	Input/Output, External Gain
<b>Remote Command</b>	[ :SENSe ] :CORRection:SA[:RF]:GAIN <rel_amp1> [ :SENSe ] :CORRection:SA[:RF]:GAIN?
<b>Example</b>	CORR:SA:GAIN 10 sets the Ext Gain value to 10 dB

	CORR:SA:GAIN -10 sets the Ext Gain value to -10 dB (that is, an attenuation of 10 dB)
Notes	Does not auto return.
Dependencies	The reference level limits are determined in part by the External Gain/Atten, Max Mixer Level, and RF Atten. This key is grayed out in Modes that do not support External Gain
Preset	This is unaffected by Preset but is set to 0 dB on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved	Saved in instrument state
Min	-120 dB
Max	120 dB
Readback	Preamp Gain, <Ext Gain value> dB
<b>Backwards Compatibility SCPI</b>	<b>[ :SENSE ] :CORRection:OFFSet [ :MAGNitude ]</b> The legacy "Ext Preamp Gain" key is now called "Ext Gain" and the sub-menu has choices of Ext Preamp   MS   BTS for backwards compatibility.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.14.00

### 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.

## MS

Sets an external gain/attenuation value for MS (Mobile Station) tests.

Key Path	<b>Input/Output, External Gain</b>
<b>Remote Command</b>	<code>[ :SENSe]:CORRection:MS[:RF]:GAIN &lt;rel_amp1&gt;</code> <code>[ :SENSe]:CORRection:MS[:RF]:GAIN?</code>
<b>Example</b>	CORR:MS:GAIN 10 sets the Ext Gain value to 10 dB CORR:MS:GAIN -10 sets the Ext Gain value to -10 dB (that is, a loss of 10 dB.)
Notes	Does not auto return.
Dependencies	The reference level limits are determined in part by the External Gain, Max Mixer Level, RF Atten This key is grayed out in modes that do not support MS.
Preset	This is unaffected by a Preset but is set to 0 dB on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved	Saved in instrument state.
Min	-100 dB
Max	100 dB
Readback	MS, <Ext Gain value> dB
Initial S/W Revision	Prior to A.02.00

<b>Remote Command</b>	<code>[ :SENSe]:CORRection:MS[:RF]:LOSS &lt;rel_amp1&gt;</code> <code>[ :SENSe]:CORRection:MS[:RF]:LOSS?</code>
<b>Example</b>	CORR:MS:LOSS 10 sets the Ext Gain value to -10 dB, and subsequently querying :LOSS will give 10 dB CORR:MS:LOSS -10 sets the Ext Gain value to 10 dB, and subsequently querying :LOSS will give -10 dB
Notes	A positive value of <rel_amp1> in the above command means a loss and a negative value indicates a gain. Anytime :LOSS is set it sets :GAIN to the negative value of the parameter sent. Anytime :LOSS is queried it gives the negative of :GAIN
Preset	This is unaffected by a Preset but is set to 0 dB on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Min	100 dB
Max	-100 dB
Initial S/W Revision	Prior to A.02.00

## BTS

Sets an external attenuation value for BTS (Base Transceiver Station) tests.

Key Path	<b>Input/Output, External Gain</b>
<b>Remote Command</b>	<code>[ :SENSe]:CORRection:BTS[:RF]:GAIN &lt;rel_amp1&gt;</code> <code>[ :SENSe]:CORRection:BTS[:RF]:GAIN?</code>
<b>Example</b>	CORR:BTS:GAIN 10 sets the Ext Gain value to 10 dB CORR:BTS:GAIN -10 sets the Ext Gain value to -10 dB (that is, a loss of 10 dB.)
Notes	Does not auto return.
Dependencies	The reference level limits are determined in part by the External Gain, Max Mixer Level, RF Atten This key is grayed out in modes that do not support BTS.
Preset	This is unaffected by a Preset but is set to 0 dB on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved	Saved in instrument state.
Min	-100 dB
Max	100 dB
Readback	BTS, <Ext Gain value> dB
Initial S/W Revision	Prior to A.02.00

<b>Remote Command</b>	<code>[ :SENSe]:CORRection:BTS[:RF]:LOSS &lt;rel_amp1&gt;</code> <code>[ :SENSe]:CORRection:BTS[:RF]:LOSS?</code>
<b>Example</b>	CORR:BTS:LOSS 10 sets the Ext Gain value to -10 dB, and subsequently querying :LOSS will give 10 dB CORR:BTS:LOSS -10 sets the Ext Gain value to 10 dB, and subsequently querying :LOSS will give -10 dB
Notes	A positive value of <rel_amp1> in the above command means a loss and a negative value indicates a gain. Anytime :LOSS is set it sets :GAIN to the negative value of the parameter sent. Anytime :LOSS is queried it gives the negative of :GAIN
Preset	This is unaffected by a Preset but is set to 0 dB on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Min	100 dB
Max	-100 dB
Initial S/W Revision	Prior to A.02.00



## I Ext Gain

This function affects the I channel input. However, when Q Gain in I+jQ is set to Same as I Gain, this value is applied to both I and Q channel inputs.

Key Path	Input/Output, External Gain
<b>Remote Command</b>	[ :SENSe]:CORRection:IQ:I:GAIN <rel_amp1> [ :SENSe]:CORRection:IQ:I:GAIN?
<b>Example</b>	Set the I Ext Gain to 10 dB CORR:IQ:I:GAIN 10 Set the I Ext Gain to -10 dB (that is, a loss of 10 dB.) CORR:IQ:I:GAIN -10
Dependencies	Not available unless option BBA is installed
Preset	0 dB This is unaffected by a Preset but is set to 0 dB on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved	Saved in instrument state.
Min	-100 dB
Max	100 dB
Readback Text	I Gain, <I Ext Gain> dB
Initial S/W Revision	Prior to A.02.00

## Q Ext Gain

This function affects the Q channel input.

Key Path	Input/Output, External Gain
<b>Remote Command</b>	[ :SENSe]:CORRection:IQ:Q:GAIN <rel_amp1> [ :SENSe]:CORRection:IQ:Q:GAIN?
<b>Example</b>	Set the Q Ext Gain to 10 dB CORR:IQ:Q:GAIN 10 Set the Q Ext Gain to -10 dB (that is, a loss of 10 dB.) CORR:IQ:Q:GAIN -10
Dependencies	Not available unless option BBA is installed.
Preset	0 dB This is unaffected by a Preset but is set to 0 dB on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved	Saved in instrument state
Min	-100 dB

Max	100 dB
Readback Text	Q Gain, <I Ext Gain> dB
Initial S/W Revision	Prior to A.02.00

### Q Gain in I+jQ

When Same as I Gain is selected, I Ext Gain value is applied to both I and Q channel input if the Input Path is I+jQ. When Independent is selected, I and Q Ext Gain values are applied to I and Q channel input independently.

Key Path	<b>Input/Output, External Gain</b>
<b>Remote Command</b>	[ :SENSe]:CORRection:IQ:Q:GAIN:COUPlE ON OFF 0 1 [ :SENSe]:CORRection:IQ:Q:GAIN:COUPlE?
<b>Example</b>	CORR:IQ:Q:GAIN:COUP ON CORR:IQ:Q:GAIN:COUP?
Preset	ON
State Saved	Saved in instrument state.
Range	Same as I Gain Independent
Initial S/W Revision	14.50

### Restore Input/Output Defaults

This selection causes the group of settings and data associated with the **Input/Output** key to be a reset to their default values. In addition, when a Source is installed, licensed and selected, Restore Input/Output defaults will initiate a Source Preset.

This level of Restore System Defaults does not affect any other system settings or mode settings and does not cause a mode switch. All the features described in this section are reset using this key, including Input Corrections and Data (described in the Corrections section).

Key Path	<b>Input/Output</b>
<b>Example</b>	:SYST:DEF INP presets all the Input/Output variables to their factory default values.
Notes	Refer to the Utility Functions for information about Restore System Defaults and the complete description of the :SYSTem:DEFAult INPut: command.
Initial S/W Revision	Prior to A.02.00

## Freq Ref In

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.

When the frequency reference is set to internal, the internal 10 MHz reference is used even if an external reference is connected.

When the frequency reference is set to external, the instrument will use the external reference. However, if there is no external signal present, or it is not within the proper amplitude range, a condition error message is generated. When the external signal becomes valid, the error is cleared.

When the frequency reference is set to Pulse, the instrument expects a 1 pulse per second signal at the EXT REF IN input. The instrument uses this signal to adjust the frequency of the internal reference.

If Sense is selected, the instrument checks whether a signal is present at the external reference connector. If it senses a signal within 5 ppm of the External Ref Freq (as set on the **External Ref Freq** softkey), it will automatically switch to the external reference. If it senses a 1 pulse per second signal, it enters Pulse mode, wherein the signal is used to adjust the internal reference. When no signal is present, it automatically switches to the internal reference. No message is generated as the reference switches between pulse, external and internal. The monitoring of the external reference occurs approximately on 1 millisecond intervals, and never occurs in the middle of a measurement acquisition, only at the end of the measurement (end of the request).

If for any reason the instrument's frequency reference is not able to obtain lock, Status bit 1 in the Questionable Frequency register will be true and a condition error message is generated. When lock is regained, Status bit 1 in the Questionable Frequency register will be cleared and the condition error will be cleared.

If an external frequency reference is being used, you must enter the frequency of the external reference if it is not exactly 10 MHz. The External Ref Freq key is provided for this purpose.

On the M9420A module, there is no internal frequency reference. To work correctly, a 100MHz external frequency reference signal is needed to connect to the front panel of the module. The default Freq Ref In setting is "External" and it cannot be set to any other types.

Key Path	Input/Output
<b>Remote Command</b>	[ :SENSe]:ROSCillator:SOURce:TYPE INTernal   EXTernal   SENSE   PULSe [ :SENSe]:ROSCillator:SOURce:TYPE?
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. On the M9420A, only the EXTernal choice is available.

Preset	This is unaffected by Mode Preset but is set to the Preset value on a "Restore Input/Output Defaults" or "Restore System Defaults->All".
State Saved	Saved in instrument state.
Status Bits/OPC dependencies	STATus:QUEStionable:FREQuency bit 1 set if unlocked.
Backwards Compatibility Notes	Freq Ref In was not saved in state in the legacy instruments. It is a part of state in the X-Series.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.14.00

<b>Remote Command</b>	<b>[ :SENSe ]:ROSCillator:SOURce?</b>
Notes	<p>The query [SENSe]:ROSCillator:SOURce? returns the current switch setting. This means:</p> <ol style="list-style-type: none"> <li>7. If it was set to SENSe but there is no external reference nor 1pps signal so the instrument is actually using the internal reference, then this query returns INTernal and not SENSe.</li> <li>8. If it was set to SENSe and there is an external reference present, the query returns EXTernal and not SENSe.</li> <li>9. If it was set to SENSe and there is a 1 pps signal present, the query returns PULSe and not SENSe.</li> <li>10. If it was set to EXTernal, then the query returns "EXTernal"</li> <li>11. If it was set to INTernal, then the query returns "INTernal".</li> <li>12. If it was set to PULSe, then the query returns "PULSe"</li> </ol>
Backwards Compatibility Notes	<p>The query [:SENSe]:ROSCillator:SOURce? was a query-only command in ESA which always returned whichever reference the instrument was using. The instrument automatically switched to the ext ref if it was present.</p> <p>In PSA (which had no sensing) the command [:SENSe]:ROSCillator:SOURce set the reference (INT or EXT), so again its query returned the actual routing.</p> <p>Thus the query form of this command is 100% backwards compatible with both instruments.</p>
Initial S/W Revision	Prior to A.02.00

<b>Remote Command</b>	<b>[ :SENSe ]:ROSCillator:SOURce INTernal EXTernal</b>
Notes	For PSA compatibility the command form is provided and is directly mapped to [:SENSe]:ROSCillator:SOURce:TYPE
Initial S/W Revision	Prior to A.02.00

## Sense

If Sense is selected, the instrument checks whether a signal is present at the external reference connector. If it senses a signal within 5 ppm of the External Ref Freq (as set on the **External Ref Freq** 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.

Key Path	<b>Input/Output, Freq Ref In</b>
<b>Example</b>	:ROSC:SOUR:TYPE SENS
Couplings	If set to SENSE and the analyzer senses a 1 pulse per second signal, it sets the System, Alignments, Timebase DAC setting to "User". This setting survives Preset and Power Cycle but is set to "Calibrated" on a System, Restore Defaults, Align or a System, Restore Defaults, All
Readback	Sense
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.14.00

## Internal

The internal reference is used. A 1 pps signal at the EXT REF IN port, or a signal there between 1 and 50 MHz, will cause a warning triangle to appear in the settings panel next to the word "INTERNAL", but will otherwise be ignored.

Key Path	<b>Input/Output, Freq Ref In</b>
<b>Example</b>	:ROSC:SOUR:TYPE INT
Readback	Internal
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.14.00

## External

The external reference is used.

Key Path	<b>Input/Output, Freq Ref In</b>
<b>Example</b>	:ROSC:SOUR:TYPE EXT
Readback	External
Initial S/W Revision	Prior to A.02.00

## Ext Ref Freq

This key tells the analyzer 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.

Key Path	Input/Output, Freq Ref In
Remote Command	[ :SENSe]:ROSCillator:EXTernal:FREQuency <freq> [ :SENSe]:ROSCillator:EXTernal:FREQuency?
Example	ROSC:EXT:FREQ 20 MHz sets the external reference frequency to 20 MHz, but does not select the external reference. ROSC:SOUR:TYPE EXT selects the external reference.
Dependencies	Still available with Internal or Pulse selected, to allow setup for when External is in use. However, the setting has no effect if the Internal Reference is in use (Freq Ref In set to Internal, Pulse, or SENSE:INT or SENSE:PULSE).
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	CXA: 10 MHz EXA: 10 MHz MXA: 1 MHz PXA: 1 MHz M9420A: 100 MHz N8973B, N8974B, N8975B, or N8976B: 10 MHz M9420A: 100 MHz
Max	CXA: 10 MHz EXA: 10 MHz EXA with option R13: 20 MHz MXA: 50 MHz PXA: 50 MHz N8973B, N8974B, N8975B, or N8976B: 10 MHz M9420A: 100 MHz
Default Unit	Hz

Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.14.00

### Default External Ref Freq

This button restores the External Ref Freq to its default of 10 MHz.

When you set an External Ref Freq value with the Ext Ref Freq control, that Frequency is persistent; is not affected by Mode Preset or Input/Output Preset, and survives shutdown and power cycle. This control allows you to reset the External Ref Freq to its default value.

#### NOTE

The persistence of the External Ref Freq is a new behavior as of firmware version A.18.00, necessitating the addition of this control. In versions before A.18.00, the frequency reset on a power cycle/restart. Thus you may need to use this command to retain backwards compatibility.

Key Path	Input/Output, Freq Ref Input
<b>Remote Command</b>	[ :SENSe ] :ROSCillator :EXTernal :FREQuency :DEFault
<b>Example</b>	ROSC:EXT:FREQ:DEF resets the external ref frequency
Notes	This is command only, there is no query
Dependencies	Grayed out if the Ext Ref Freq is already set to the default
Initial S/W Revision	A.18.00

### External Reference 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 PXA 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.

Key Path	Input/Output, Freq Ref In
----------	---------------------------

Scope	Mode Global
<b>Remote Command</b>	[ :SENSe]:ROSCillator: BANDwidth WIDE   NARROW [ :SENSe]:ROSCillator: BANDwidth?
<b>Example</b>	ROSC: BAND WIDE
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.
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.
Initial S/W Revision	A.04.00
Modified at S/W Revision	A.14.00

## External Ref Coupling

Only appears with option ERC installed and licensed.

This function lets you couple the sweep system of the analyzer to the state of the External Reference. If **Normal** is selected, data acquisition proceeds regardless of the state of the External Reference. When you select **Ext Ref Out Of Range Stops Acquisition**, the data acquisition (sweep or measurement) stops when either the "521, External ref out of range" or the "503, Frequency Reference unlocked" error message is asserted. Note that this will only take place if the **Freq Ref In** selection is **External**.

With the acquisition stopped, the data display will stop updating (even if this occurs in the middle of a sweep or measurement) and no data will be returned to a READ? or MEASure? query; that is, these queries will not complete because the analyzer will not respond to them. Furthermore, no response will be generated to a \*WAI? or \*OPC? query.

Proper SCPI sequences are shown below, which will always fail to return if the acquisition stops during the requested sweep or measurement. Note that, for predictable operation of this function, it is best to operate the analyzer in single measurement mode (INIT:CONT OFF), because if operating in continuous mode, the analyzer may respond to the above queries even after the acquisition stops, with data left over from the previous acquisition.

```
:INIT:CONT OFF
```

```
:INIT:IMM;*OPC?
```

```
--
```

```
:INIT:CONT OFF
```



:INIT:IMM;\*WAI?

--

:INIT:CONT OFF

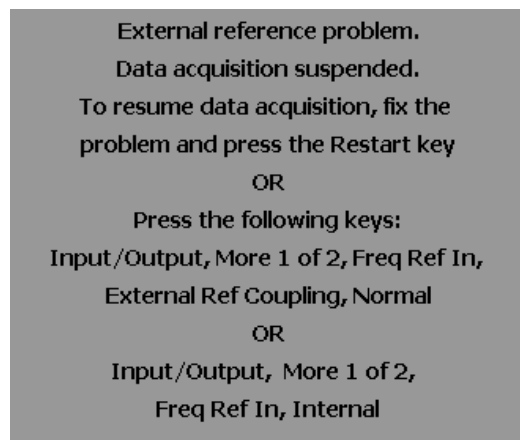
:READ?

--

:INIT:CONT OFF

:MEASure?

When the acquisition ceases, in addition to the error condition(s) described above, a popup error message will be generated informing you that the acquisition has ceased due to an invalid external reference. This message will stay on the screen while the acquisition is suspended.



If you press the Restart key this message will be taken off the screen and a new acquisition will be attempted. If the External Reference problem persists the message will re-appear. You can also remove the message by changing back to the **Normal** setting of Sweep/Ext Ref Coupling, or by pressing **Freq Ref In, Internal**, or **Freq Ref In, Sense**, or **Restore Input/Output Defaults**.

The setting of External Ref Coupling is persistent across power-cycling and is not reset with a Preset. It is reset to the default state (Normal) when **Restore Input/Output Defaults** is invoked, which will also restart normal data acquisition.

The detection of invalid external reference is under interrupt processing. If the external reference becomes invalid then returns to valid in too short a time, no error condition will be detected or reported and therefore the acquisition will not be stopped.

Key Path	Input/Output, Freq Ref In
Mode	All
<b>Remote Command</b>	<b>[ :SENSe ]:ROSCillator:COUPling NORMal   NACquisition</b> <b>[ :SENSe ]:ROSCillator:COUPling?</b>

Preset	This setting is persistent: it survives power-cycling or a Preset and is reset with Restore Input/Output defaults.
State Saved	Not saved in instrument state
Readback	Normal Stop Acq
Initial S/W Revision	A.02.00

## Output Config

Accesses keys that configure various output settings, like the frequency reference output, trigger output and analog output.

Key Path	Input/Output
Backwards Compatibility Notes	In ESA there was not a user interface to enable the Video Output (Analog Output), Trigger Output, or Gate Output. In the X-Series each of these physical connectors requires configuration, thus the user interface has been added for X-Series, along with the potential for an output you think is always on to be switched off.
Initial S/W Revision	Prior to A.02.00

## Trig Out

Select the type of output signal that will be output from the Trig 1 Out, or Trig 2 Out connectors.

Key Path	Input/Output, Output Config
<b>Remote Command</b>	:TRIGger TRIGger1 TRIGger2[:SEQuence]:OUTPut HSWP   MEASuring   MAIN   GATE   GTRigger   OEVEN   SPOint   SSweep   SSETtled   S1Marker   S2Marker   S3Marker   S4Marker   OFF  :TRIGger TRIGger1 TRIGger2[:SEQuence]:OUTPut?
<b>Example</b>	TRIG:OUTP HSWP TRIG2:OUTP GATE
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.
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
Initial S/W Revision	Prior to A.02.00

## Polarity

Sets the output to the Trig 1 Out, or Trig 2 Out, connector to trigger on either the positive or negative polarity.

Key Path	Input/Output, Output Config, Trig 1/2 Output
<b>Remote Command</b>	:TRIGger TRIGger1 TRIGger2[:SEquence]:OUTPut:POLarity POSitive   NEGative  :TRIGger TRIGger1 TRIGger2[:SEquence]:OUTPut:POLarity?
<b>Example</b>	TRIG1:OUTP:POL POS
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
Initial S/W Revision	Prior to A.02.00

## Off

Selects no signal to be output to the Trig 1 Out, or Trig 2 Out, connector.

Key Path	Input/Output, Output Config, Trig 1/2 Output
<b>Example</b>	TRIG1:OUTP OFF
Readback	Off
Initial S/W Revision	Prior to A.02.00

## Sweeping (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.

Key Path	Input/Output, Output Config, Trig 1/2 Output
<b>Example</b>	TRIG1:OUTP HSWP
Readback	Sweeping
Initial S/W Revision	Prior to A.02.00

## Measuring

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.

Key Path	<b>Input/Output, Output Config, Trig 1/2 Output</b>
<b>Example</b>	TRIG1:OUTP MEAS
Readback	Measuring
Initial S/W Revision	Prior to A.02.00

### Main Trigger

Selects the current instrument trigger signal to be output to the Trig 1 Out, or Trig 2 Out, connector.

Key Path	<b>Input/Output, Output Config, Trig 1/2 Output</b>
<b>Example</b>	TRIG1:OUTP MAIN
Readback	Main Trigger
Initial S/W Revision	Prior to A.02.00

### Gate Trigger

Selects the gate trigger 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.

Key Path	<b>Input/Output, Output Config, Trig 1/2 Output</b>
<b>Example</b>	TRIG1:OUTP GTR
Readback	Gate Trigger
Initial S/W Revision	Prior to A.02.00

### 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 time the gate is configured to pass the signal.

Key Path	<b>Input/Output, Output Config, Trig 1/2 Output</b>
<b>Example</b>	TRIG1:OUTP GATE
Readback	Gate
Initial S/W Revision	Prior to A.02.00

## Source Point Trigger

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

Key Path	Input/Output, Output Config, Trig 1/2 Output
<b>Example</b>	TRIG1:OUTP SPO
Readback	Source Point
Initial S/W Revision	Prior to A.02.00

## Odd/Even Trace Point

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.

Key Path	Input/Output, Output Config, Trig 1/2 Output
<b>Example</b>	TRIG1:OUTP OEV
Readback	Odd/Even
Initial S/W Revision	Prior to A.02.00

## I/Q Guided Calibration

Calibrating the Baseband I/Q ports requires several steps and manual connections. The Guided Calibration will interactively step you through the required steps, displaying diagrams to help with the connections. The steps will vary depending on the setup.

In the Guided Calibration windows, the date and time of the last calibration are displayed. If any of the items listed are displayed in yellow, this indicates that the calibration for that item is inconsistent with the latest calibration, and you should complete the entire calibration process before you exit the calibration.

## I/Q Isolation Calibration

The I/Q Isolation Calibration must be run before calibrating any port with either the I/Q Cable Calibration or I/Q Probe Calibration. This calibration is performed with nothing connected to any of the front panel I/Q ports. This is the first step in both the I/Q Cable Calibration and the I/Q Probe Calibration.

## Next

Perform the I/Q Isolation calibration.

Key Path	<b>Input/Output, I/Q, I/Q Cable Calibration</b>
<b>Remote Command</b>	<b>:CALibration:IQ:ISOLation</b>
<b>Example</b>	CAL:IQ:ISOL
Notes	All front panel I/Q ports must not be connected to anything.
Notes	All cables and probes should be disconnected from the I/Q ports before issuing the SCPI command.
State Saved	No.
Initial S/W Revision	Prior to A.02.00

## Exit

Exits the calibration procedure. All ports calibrated before pressing Exit will use the newly acquired calibration data.

Key Path	<b>Input/Output, I/Q, I/Q Cable Calibration</b>
Notes	Using the Exit button will not restore the calibration data to the state prior to entering the guided calibration. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration step.  When the calibration may be left in an inconsistent state, a confirmation dialog will be displayed (see <a href="#">"Exit Confirmation" on page 222</a> ).
Initial S/W Revision	Prior to A.02.00

## I/Q Isolation Calibration Time (Remote Command Only)

Returns the last date and time that the I/Q Isolation Calibration was performed. This is a remote query command only.

<b>Remote Command</b>	<b>:CALibration:IQ:ISOLation:TIME?</b>
<b>Example</b>	:CAL:IQ:ISOL:TIME?
Notes	This returns 6 integer values: year, month, day, hour, minute, second. When no calibration has been performed, all values will be 0.
Initial S/W Revision	A.02.00

## I/Q Cable Calibrate...

The I/Q cable calibration creates correction data for each of the front panel I/Q ports. This calibration data is used whenever no probe specific calibration data is available. It is important that all ports are calibrated using the same short BNC cable so that the data is comparable from port to port.

The guided calibration (front panel only) will show connection diagrams and guide you through the isolation calibration and calibrating each port. The calibration data for each port is stored separately, so as soon as a port is calibrated that data is saved and will be used. If you press "Exit" to exit the calibration process, the data for the ports already completed will still be used. It is recommended that a calibration be completed once started, or if exited, that it be properly done before the next use of the I/Q ports. The "Next" button will perform the calibration for the current port and then proceed to the next step in the calibration procedure. The "Back" button will return to the prior port in the procedure. Both keys and dialog buttons are supplied for ease of use. The dialog buttons are for mouse use and the softkeys for front panel use.

The calibration can also be done via SCPI, but no connection diagrams will be shown. You will have to make the correct connections before issuing each port calibration command. Again, it is recommended that all ports be calibrated at the same time.

The instrument state remains as it was prior to entering the calibration procedure except while a port is actually being calibrated. Once a port is calibrated it returns to the prior state. A port calibration is in process only from the time the "Next" button is pressed until the next screen is shown. For SCPI, this corresponds to the time from issuing the CAL:IQ:FLAT:|I|B|Q|QB command until the operation is complete.

For example, if the prior instrument state is Cal Out = Off, Input = I+jQ, and Differential = Off, then up until the time the "Next" button is pressed the I Input and Q Input LEDs are on and the Cal Out, I-bar Input and Q-bar Input LEDs are off. Once the "Next" button is pressed for the I port calibration, only the Cal Out and I Input LEDs will be on and the others will be off. When the screen progresses to the next step ("Next" button again enabled), the prior state is restored and only the I Input and Q Input LEDs are on (Cal Out is off again).

The last calibration date and time for each port will be displayed. Any calibrations that are more than a day older than the most recent calibration will be displayed with the color amber.

Key Path	<b>Input/Output, I/Q</b>
Initial S/W Revision	Prior to A.02.00

## I Port

The I port calibration is performed with the front panel's I port connected via a short BNC cable to the Cal Out port. The guided calibration will show a diagram of the required connections.

## Back

Return to the prior step in the calibration procedure.

Key Path	<b>Input/Output, I/Q, Q Setup, Q Probe, Calibrate</b>
Initial S/W Revision	Prior to A.02.00

## Next

Perform the I port calibration.

Key Path	Input/Output, I/Q, I/Q Cable Calibrate...
<b>Remote Command</b>	:CALibration:IQ:FLATness:I
<b>Example</b>	CAL:IQ:FLAT:I
Notes	The recommended procedure is to use the same BNC cable to calibrate all I/Q ports. All I/Q ports should be calibrated sequentially during the procedure. The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands.
Notes	The I port must be connected to the Cal Out port before issuing the SCPI command.
State Saved	No.
Initial S/W Revision	Prior to A.02.00

## Exit

Exit the calibration procedure. All ports calibrated before pressing Exit will use the newly acquired calibration data.

Key Path	Input/Output, I/Q, I/Q Cable Calibrate...
Notes	Using the Exit button will not restore the calibration data to the state prior to entering the guided calibration. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration step. When the calibration may be left in an inconsistent state, a confirmation dialog will be displayed (see " <a href="#">Exit Confirmation</a> " on page 222 ).
Initial S/W Revision	Prior to A.02.00

## I-bar Port

The I-bar port calibration is performed with the front panel's I-bar port connected via a short BNC cable to the Cal Out port. The guided calibration will show a diagram of the required connections.

## Back

Return to the prior step in the calibration procedure.

Key Path	Input/Output, I/Q, I/Q Cable Calibration
Notes	Using the Back button will not restore the calibration data to a prior state. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration step. The Back button allows the user to go back to a prior step to redo that calibration step.
Initial S/W Revision	Prior to A.02.00



## Next

Perform the I-bar port calibration.

Key Path	Input/Output, I/Q, I/Q Cable Calibrate...
<b>Remote Command</b>	:CALibration:IQ:FLATness:IBAR
<b>Example</b>	CAL:IQ:FLAT:IBAR
Notes	The recommended procedure is to use the same BNC cable to calibrate all I/Q ports. All I/Q ports should be calibrated sequentially during the procedure. The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands.
Notes	The I-bar port must be connected to the Cal Out port before issuing the SCPI command.
State Saved	No
Initial S/W Revision	Prior to A.02.00

## Exit

Exit the calibration procedure. All ports calibrated before pressing Exit will use the newly acquired calibration data.

Key Path	Input/Output, I/Q, I/Q Cable Calibrate...
Notes	Using the Exit button will not restore the calibration data to the state prior to entering the guided calibration. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration step. When the calibration may be left in an inconsistent state, a confirmation dialog will be displayed (see " <a href="#">Exit Confirmation</a> " on page 222 ).
Initial S/W Revision	Prior to A.02.00

## Q Port

The Q port calibration is performed with the front panel's Q port connected via a short BNC cable to the Cal Out port. The guided calibration will show a diagram of the required connections.

## Back

Return to the prior step in the calibration procedure.

Key Path	Input/Output, I/Q, I/Q Cable Calibrate...
Notes	Using the Back button will not restore the calibration data to a prior state. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration step. The Back button allows the user to go back to a prior step to redo that calibration step.
Initial S/W Revision	Prior to A.02.00

## Next

Perform the Q port calibration.

---

Key Path	Input/Output, I/Q, I/Q Cable Calibrate...
<b>Remote Command</b>	:CALibration:IQ:FLATness:Q
<b>Example</b>	CAL:IQ:FLAT:Q
Notes	The recommended procedure is to use the same BNC cable to calibrate all I/Q ports. All I/Q ports should be calibrated sequentially during the procedure. The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands.
Notes	The Q port must be connected to the Cal Out port before issuing the SCPI command.
State Saved	No
Initial S/W Revision	Prior to A.02.00

---

## Exit

Exit the calibration procedure. All ports calibrated before pressing Exit will use the newly acquired calibration data.

---

Key Path	Input/Output, I/Q, I/Q Cable Calibrate...
Notes	Using the Exit button will not restore the calibration data to the state prior to entering the guided calibration. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration step. When the calibration may be left in an inconsistent state, a confirmation dialog will be displayed (see " <a href="#">Exit Confirmation</a> " on page 222 ).
Initial S/W Revision	Prior to A.02.00

---

## Q-bar Port

The Q-bar port calibration is performed with the front panel's Q-bar port connected via a short BNC cable to the Cal Out port. The guided calibration will show a diagram of the required connections.

## Back

Return to the prior step in the calibration procedure.

---

Key Path	Input/Output, I/Q, I/Q Cable Calibrate...
Notes	Using the Back button will not restore the calibration data to a prior state. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration step. The Back button allows the user to go back to a prior step to redo that calibration step.
Initial S/W Revision	Prior to A.02.00

---

## Next

Perform the Q-bar port calibration.

Key Path	Input/Output, I/Q, I/Q Cable Calibrate...
<b>Remote Command</b>	:CALibration:IQ:FLATness:QBAR
<b>Example</b>	CAL:IQ:FLAT:QBAR
Notes	The recommended procedure is to use the same BNC cable to calibrate all I/Q ports. All I/Q ports should be calibrated sequentially during the procedure. The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands.
Notes	The Q-bar port must be connected to the Cal Out port before issuing the SCPI command.
State Saved	No
Initial S/W Revision	Prior to A.02.00

## Exit

Exit the calibration procedure. All ports calibrated before pressing Exit will use the newly acquired calibration data.

Key Path	Input/Output, I/Q, I/Q Cable Calibrate...
Notes	Using the Exit button will not restore the calibration data to the state prior to entering the guided calibration. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration step. When the calibration may be left in an inconsistent state, a confirmation dialog will be displayed (see " <a href="#">Exit Confirmation</a> " on page 222).
Initial S/W Revision	Prior to A.02.00

## I/Q Cable Calibration Time (Remote Command Only)

Returns the last date and time that the I/Q Cable Calibration was performed for a specific port. This is a remote query command only.

<b>Remote Command</b>	:CALibration:IQ:FLATness:I IBAR Q QBAR:TIME?
<b>Example</b>	:CAL:IQ:FLAT:I:TIME?
Notes	This returns 6 integer values: year, month, day, hour, minute, second. When no calibration has been performed, all values will be 0.
Initial S/W Revision	A.02.00

## I/Q Probe Calibration

The I/Q probe calibration creates correction data for one of the front panel I/Q channels. When the probe has EEPROM identification, the data is unique to that specific probe. When the probe does not have EEPROM identification, the data will be used for all probes of the same type. The data is also unique to the channel, so calibration data for the I channel will not be used for the Q channel and vice versa.

The guided calibration (front panel only) will show connection diagrams and guide the user through the I/Q Isolation Calibration and through calibrating each port. The calibration data for each port is stored separately, so as soon as a port is calibrated that data is saved and will be used. If a user presses "Exit" to exit the calibration process, the data for the port already completed will still be used. It is recommended that a calibration be completed once started, or if exited, that it be properly done before the next use of the probe. The "Next" button will perform the calibration for the current port and then proceed to the next step in the calibration procedure. The "Back" button will return to the prior port in the procedure. Both softkeys and dialog buttons are supplied for ease of use. The dialog buttons are for mouse use and the softkeys for front panel use.

The calibration can also be done via SCPI, but no connection diagrams will be shown. The user will have to make the correct connections before issuing each port calibration command. Again, it is recommended that all ports be calibrated at the same time.

For Active probes or when Differential is Off, only the main port is calibrated, otherwise both the main and complementary ports are calibrated.

The instrument state remains as it was prior to entering the calibration procedure except while a port is actually being calibrated. Once a port is calibrated it returns to the prior state. A port calibration is in process only from the time the "Next" button is pressed until the next screen is shown. For SCPI, this corresponds to the time from issuing the CAL:IQ:PROB:I|B|Q|QB command until the operation is complete.

For example, if the prior instrument state is Cal Out = Off, Input = I+jQ, and Differential = Off, then up until the time the "Next" button is pressed the I Input and Q Input LEDs are on and the Cal Out, I-bar Input and Q-bar Input LEDs are off. Once the "Next" button is pressed for the I port calibration, only the Cal Out and I Input LEDs will be on and the others will be off. When the screen progresses to the next step ("Next" button again enabled), the prior state is restored and only the I Input and Q Input LEDs are on (Cal Out is off again).

The last calibration date and time for each relevant port will be displayed. For passive probes with Differential On, any calibration that is more than a day older than the most recent calibration will be displayed with the color amber.

## I Port

The I port calibration is performed with the probe body attached to the front panel's I port and the probe tip connected via an adapter to the Cal Out port. The guided calibration will show a diagram of the required connections.

## Show Adapter

Show a connection diagram and instructions for the probe and adapter. See ["Show Adapter Screen" on page 221](#).

Key Path	<b>Input/Output, I/Q, I Setup, I Probe, Calibrate</b>
Notes	Either a passive or an active probe adapter diagram will be shown, depending on the type of probe attached.
Initial S/W Revision	Prior to A.02.00

## Back

Return to the prior step in the calibration procedure.

Key Path	<b>Input/Output, I/Q, Q Setup, Q Probe, Calibrate</b>
Initial S/W Revision	Prior to A.02.00

## Next

Perform the I port calibration.

Key Path	<b>Input/Output, I/Q, I Setup, I Probe, Calibrate</b>
<b>Remote Command</b>	<b>:CALibration:IQ:PROBE:I</b>
<b>Example</b>	CAL:IQ:PROB:I
Notes	The I port must be connected to the Cal Out port before issuing the SCPI command. The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands.
State Saved	No
Initial S/W Revision	Prior to A.02.00

## Exit

Exit the calibration procedure. All ports calibrated before pressing Exit will use the newly acquired calibration data.

Key Path	<b>Input/Output, I/Q, I Setup, I Probe, Calibrate</b>
Notes	Using the Exit button will not restore the calibration data to the state prior to entering the guided calibration. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration step. When the calibration may be left in an inconsistent state, a confirmation dialog will be displayed (see <a href="#">"Exit Confirmation" on page 222</a> ).
Initial S/W Revision	Prior to A.02.00

## I-bar Port

The I-bar port calibration is performed with the probe body attached to the front panel's I-bar port and the probe tip connected via an adapter to the Cal Out port. The I-bar probe calibration is only available for passive probes with Differential On. The guided calibration will show a diagram of the required connections.

### Show Adapter

Show a connection diagram and instructions for the probe and adapter. See ["Show Adapter Screen" on page 221](#).

Key Path	<b>Input/Output, I/Q, I Setup, I Probe, Calibrate</b>
Notes	Either a passive or an active probe adapter diagram will be shown, depending on the type of probe attached.
Initial S/W Revision	Prior to A.02.00

### Back

Return to the prior step in the calibration procedure.

Key Path	<b>Input/Output, I/Q, I Setup, I Probe, Calibrate</b>
Notes	Using the Back button will not restore the calibration data to a prior state. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration step. The Back button allows the user to go back to a prior step to redo that calibration step.
Initial S/W Revision	Prior to A.02.00

### Next

Perform the I-bar port calibration.

Key Path	<b>Input/Output, I/Q, I Setup, I Probe, Calibrate</b>
<b>Remote Command</b>	<b>:CALibration:IQ:PROBE:IBar</b>
<b>Example</b>	CAL:IQ:PROB:IB
Notes	The I-bar port must be connected to the Cal Out port before issuing the SCPI command. The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands.
State Saved	No
Initial S/W Revision	Prior to A.02.00

## Exit

Exit the calibration procedure. All ports calibrated before pressing Exit will use the newly acquired calibration data.

Key Path	<b>Input/Output, I/Q, I Setup, I Probe, Calibrate</b>
Notes	Using the Exit button will not restore the calibration data to the state prior to entering the guided calibration. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration step.  When the calibration may be left in an inconsistent state, a confirmation dialog will be displayed (see " <a href="#">Exit Confirmation</a> " on page 222).
Initial S/W Revision	Prior to A.02.00

## Q Port

The Q port calibration is performed with the probe body attached to the front panel's Q port and the probe tip connected via an adapter to the Cal Out port. The guided calibration will show a diagram of the required connections.

### Show Adapter

Show a connection diagram and instructions for the probe and adapter. See "[Show Adapter Screen](#)" on page 221.

Key Path	<b>Input/Output, I/Q, Q Setup, Q Probe, Calibrate</b>
Notes	Either a passive or an active probe adapter diagram will be shown, depending on the type of probe attached.
Initial S/W Revision	Prior to A.02.00

## Back

Return to the prior step in the calibration procedure.

Key Path	<b>Input/Output, I/Q, Q Setup, Q Probe, Calibrate</b>
Initial S/W Revision	Prior to A.02.00

## Next

Perform the Q port calibration.

Key Path	<b>Input/Output, I/Q, Q Setup, Q Probe, Calibrate</b>
<b>Remote Command</b>	<b>:CALibration:IQ:PROBE:Q</b>
<b>Example</b>	CAL:IQ:PROB:Q

---

Notes	The Q port must be connected to the Cal Out port before issuing the SCPI command. The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands.
State Saved	No
Initial S/W Revision	Prior to A.02.00

---

## Exit

Exit the calibration procedure. All ports calibrated before pressing Exit will use the newly acquired calibration data.

---

Key Path	<b>Input/Output, I/Q, Q Setup, Q Probe, Calibrate</b>
Notes	Using the Exit button will not restore the calibration data to the state prior to entering the guided calibration. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration step. When the calibration may be left in an inconsistent state, a confirmation dialog will be displayed (see " <a href="#">Exit Confirmation</a> " on page 222 ).
Initial S/W Revision	Prior to A.02.00

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## Q-bar Port

The Q-bar port calibration is performed with the probe body attached to the front panel's Q-bar port and the probe tip connected via an adapter to the Cal Out port. The Q-bar probe calibration is only available for passive probes with Differential On. The guided calibration will show a diagram of the required connections.

## Show Adapter

Show a connection diagram and instructions for the probe and adapter. See "[Show Adapter Screen](#)" on page 221.

---

Key Path	<b>Input/Output, I/Q, Q Setup, Q Probe, Calibrate</b>
Notes	Either a passive or an active probe adapter diagram will be shown, depending on the type of probe attached.
Initial S/W Revision	Prior to A.02.00

---

## Back

Return to the prior step in the calibration procedure.

---

Key Path	<b>Input/Output, I/Q, Q Setup, Q Probe, Calibrate</b>
Notes	Using the Back button will not restore the calibration data to a prior state. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration

---



---

step. The Back button allows the user to go back to a prior step to redo that calibration step.

---

Initial S/W Revision      Prior to A.02.00

---

### Next

Perform the Q-bar port calibration.

---

Key Path	Input/Output, I/Q, Q Setup, Q Probe, Calibrate
<b>Remote Command</b>	:CALibration:IQ:PROBe:QBar
<b>Example</b>	CAL:IQ:PROB:QB
Notes	The Q-bar port must be connected to the Cal Out port before issuing the SCPI command. The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands.
State Saved	No
Initial S/W Revision	Prior to A.02.00

---

### Exit

Exit the calibration procedure. All ports calibrated before pressing Exit will use the newly acquired calibration data.

---

Key Path	Input/Output, I/Q, Q Setup, Q Probe, Calibrate
Notes	Using the Exit button will not restore the calibration data to the state prior to entering the guided calibration. Once a port is calibrated the data is stored immediately and the only way to change it is to redo the calibration step. When the calibration may be left in an inconsistent state, a confirmation dialog will be displayed (see " <a href="#">Exit Confirmation</a> " on page 222).
Initial S/W Revision	Prior to A.02.00

---

### Show Adapter Screen

When one of the Probe Calibration Show Adapter buttons is pressed, a diagram of the probe with its adapter will be shown. Depending on the type of probe attached, either the Passive Probe Adapter or the Active Probe Adapter diagram will be shown.

### I/Q Probe Calibration Time (Remote Command Only)

Return the last date and time that the I/Q Probe Calibration was performed for a specific port. This is a remote query command only.

---

<b>Remote Command</b>	:CALibration:IQ:PROBe:I IBAR Q QBAR:TIME?
-----------------------	---

---

---

<b>Example</b>	:CAL:IQ:PROB:I:TIME?
Notes	This returns 6 integer values: year, month, day, hour, minute, second. When no calibration has been performed, all values will be 0. The value is specific to both the port and probe, so the value will change as probes are connected or disconnected.
Initial S/W Revision	A.02.00

---

### Exit Confirmation

When Exit is pressed during one of the calibration routines, the calibration may be in an inconsistent state with some of the ports having newly measured calibration data and others with old data. If this is the case, a dialog box will appear to confirm that the user really wants to exit. A "Yes" answer will exit the calibration procedure, leaving potentially inconsistent calibration data in place. A "No" answer will return to the calibration procedure.

## 5 Mode Functions

## Mode

The Mode key allows you to select the available measurement applications or “Modes”. Modes are a collection of measurement capabilities packaged together to provide an instrument personality that is specific to your measurement needs. Each application software product is ordered separately by Model Number and must be licensed to be available. Once an instrument mode is selected, only the commands that are valid for that mode can be executed.

**NOTE**

Key operation can be different between modes. The information displayed in Help is about the current mode.

To access Help for a different Mode you must first exit Help (by pressing the Cancel (Esc) key). Then select the desired mode and re-access Help.

For more information on Modes, preloading Modes, and memory requirements for Modes,

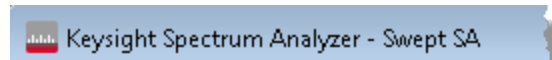
see ["More Information" on page 226](#)

Key Path	Front-panel key
<b>Remote Command</b>	:INSTRUMENT[:SElect] SA   RTSA   SEQAN   EMI   BASIC   WCDMA   EDGE GSM   WIMAXOFDMA   VSA   PNOISE   NFIGure   ADEMOM   BTooth   TDSCDMA   CDMA2K   CDMA1XEV   LTE   LTETDD   LTEAFDD   LTEATDD   MSR   DVB   DTMB   DCTV   ISDBT   CM MB   WLAN   CWLAN   CWIMAXOFDM   WIMAXFIXED   IDEN   RLC   SCPILC   VSA89601 :INSTRUMENT[:SElect]?
<b>Example</b>	:INST SA
Notes	The available parameters are dependent upon installed and licensed applications resident in the instrument. Parameters given here are an example, specific parameters are in the individual Application. A list of the valid mode choices is returned with the INST:CAT? Query.
Preset	This is unaffected by a Preset but is set on a “Restore System Defaults->All” to: For N9038A: EMI For N8973B, N8974B, N8975B, or N8976B: NFIG For all other models: SA
State Saved	Saved in instrument state
<b>Backwards Compatibility SCPI</b>	:INSTRUMENT[:SElect] GSM provided for backwards compatibility. Mapped to EDGE GSM.
<b>Backwards Compatibility SCPI</b>	:INSTRUMENT[:SElect] SANalyzer provided for ESU compatibility. When this command is received, the analyzer aliases it to the following: INST:SEL SCPI LC

	This results in the analyzer being placed in SCPI Language Compatibility Mode, in order to emulate the ESU Spectrum Analyzer Mode.
<b>Backwards Compatibility SCPI</b>	<p><b>:INSTrument[:SElect] RECeiver</b></p> <p>provided for ESU compatibility. When this command is received, the analyzer aliases it to the following:</p> <p><b>:INST:SEL EMI</b></p> <p><b>:CONF FSC</b></p> <p>This results in the analyzer being placed in the EMI Receiver Mode, running the Frequency Scan measurement, in order to emulate the ESU Receiver Mode.</p>
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.13.00
Control Type	SCPI only
<b>Remote Command</b>	<p><b>:INSTrument:CONFigure:&lt;mode&gt;:&lt;meas&gt;</b></p> <p>Where &lt;mode&gt; is a valid parameter for the INST:SEL command and &lt;meas&gt; is a valid parameter for the CONF command in the Mode specified by &lt;mode&gt;</p>
<b>Example</b>	<p>:INST:CONF:SA:SAN selects the Spectrum Analyzer mode and the Swept SA measurement</p> <p>:INST:CONF:WCDMA:RHO selects the WCDMA mode and the Mod Accuracy measurement</p>
Notes	<p>The available parameters for &lt;mode&gt; are dependent upon installed and licensed applications resident in the instrument. The available parameters for &lt;meas&gt; are dependent on the &lt;mode&gt; parameter and the valid measurements available for that mode, which can depend on model numbers and installed options.</p> <p>In general this command will execute more quickly than sending the equivalent separate INST:SEL and :CONF commands.</p>
Initial S/W Revision	A.17.50
<b>Example</b>	:INST 'SA'
Notes	<p><b>NOTE</b> The query is not a quoted string. It is an enumeration as indicated in the Instrument Select table above.</p> <p>The command must be sequential: i.e. continued parsing of commands cannot proceed until the instrument select is complete and the resultant SCPI trees are available.</p>
<b>Backwards Compatibility SCPI</b>	<b>:INSTrument[:SElect] 'SA'   'PNOISE'   'EDGE'   'GSM'   'BASIC'</b>
Initial S/W Revision	Prior to A.02.00

## More Information

The Mode name appears on the banner after the word “Keysight” followed by the Measurement Title. For example, for the Spectrum Analyzer mode with the Swept SA measurement running:



It is possible to specify the order in which the Modes appear in the Mode menu, using the Configure Applications utility (**System, Power On, Configure Applications**). 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 significantly decrease the startup time of the analyzer. During runtime, if an application that is not loaded into memory is selected (by either pressing that applications Mode key or sending that applications :INST:SEL command over SCPI), there will be a pause while the Application is loaded. During this pause a message box that says “Loading application, please wait...” is displayed.

Each application (Mode) that runs in the X-Series signal analyzers consumes virtual memory. The various applications consume varying amounts of virtual memory, and as more applications run, the memory consumption increases. Once an application is run, some of its memory remains allocated even when it is not running, and is not released until the analyzer program (xSA.exe) is shut down.

Keysight characterizes each Mode and assigns a memory usage quantity based on a conservative estimate. There is a limited amount of virtual memory available to applications (note that this is virtual memory and is independent of how much physical RAM is in the instrument). The instrument keeps track of how much memory is being used by all loaded applications – which includes those that preloaded at startup, and all of those that have been run since startup.

When you request a Mode that is not currently loaded, the instrument looks up the memory estimate for that Mode, and adds it to the residual total for all currently loaded Modes. If there is not enough virtual memory to load the Mode, a dialog box and menu will appear that gives you four options:

1. Close and restart the analyzer program without changing your configured preloads. This may free up enough memory to load the requested Mode, depending on your configured preloads
2. Clear out all preloads and close and restart the analyzer program with only the requested application preloaded, and with that application running. This choice is guaranteed to allow you to run the requested application; but you will lose your previously configured preloads. In addition, there may be little or no room for other applications, depending on the size of the requested application.
3. Bring up the Configure Applications utility in order to reconfigure the preloaded apps to make room for the applications you want to run (this will

then require restarting the analyzer program with your new configuration). This is the recommended choice because it gives you full flexibility to select exactly what you want.

- Exit the dialog box without doing anything, which means you will be unable to load the application you requested.

In each case except 4, this will cause the analyzer software to close, and you will lose all unsaved traces and results.

If you attempt to load a mode via SCPI that will exceed memory capacity, the Mode does not load and an error message is returned:

**-225, "Out of memory;Insufficient resources to load Mode (mode name)"**

where "mode name" is the SCPI parameter for the Mode in question, for example, SA for Spectrum Analyzer Mode.

### Application Mode Number Selection (Remote Command Only)

Select the measurement mode by its mode number. The actual available choices depend upon which applications are installed in your instrument. The modes appear in this table in the same order they appear in the Mode menu (if the order is not changed by the Configure Applications utility found in the **System, Power On** menu). See ["Detailed List of Modes" on page 232](#) for Mode details.

The Mode Number is the parameter for use with the :INSTRument:NSElect command. The Mode Parameter is the parameter for use with the :INSTRument[:SElect] command.

Mode	Mode Number	Mode Parameter
Spectrum Analyzer	1	SA
Real Time Spectrum Analyzer	2	RTSA
Sequence Analyzer	123	SEQAN
EMI Receiver	141	EMI
I/Q Analyzer (Basic)	8	BASIC
WCDMA with HSPA+	9	WCDMA
GSM/EDGE/EDGE Evo	13	EDGE GSM
802.16 OFDMA (WiMAX/WiBro)	75	WIMAX OFDMA
Vector Signal Analyzer (VXA)	100	VSA
Phase Noise	14	PNOISE
Noise Figure	219	NFIGure
Analog Demod	234	ADEMODO
Bluetooth	228	BT00th

Mode	Mode Number	Mode Parameter
TD-SCDMA with HSPA/8PSK	211	TDSCDMA
cdma2000	10	CDMA2K
1xEV-DO	15	CDMA1XEV
LTE	102	LTE
LTE TDD	105	LTETDD
LTE-Advanced FDD	107	LTEAFDD
LTE-Advanced TDD	108	LTEATDD
MSR	106	MSR
DVB-T/H with T2	235	DVB
DTMB (CTTB)	236	DTMB
Digital Cable TV	238	DCTV
ISDB-T	239	ISDBT
CMMB	240	CMMB
WLAN	217	WLAN
Combined WLAN	19	CWLAN
Combined Fixed WiMAX	81	CWIMAXOFDM
802.16 OFDM (Fixed WiMAX)	104	WIMAXFIXED
iDEN/WiDEN/MotoTalk	103	IDEN
Remote Language Compatibility	266	RLC
SCPI Language Compatibility	270	SCPILC
89601 VSA	101	VSA89601
Electronic Toll Collection	61	ETC

<b>Remote Command</b>	:INSTRument:NSElect <integer> :INSTRument:NSElect?
<b>Example</b>	:INST:NSEL 1
Notes	SA mode is 1 The command must be sequential: i.e. continued parsing of commands cannot proceed until the instrument select is complete and the resultant SCPI trees are available.
Preset	Not affected by Preset. Set to default mode (1 for SA mode) following Restore System Defaults.
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00



## 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.

<b>Remote Command</b>	:INSTrument:CATalog?
<b>Example</b>	:INST:CAT?
<b>Notes</b>	Query returns a quoted string of the installed and licensed modes separated with a comma. Example: "SA,PNOISE,WCDMA"
<b>Backwards Compatibility Notes</b>	VSA (E4406A) :INSTrument:CATalog? returned a list of installed INSTrument:SELECT items as a comma separated list of string values: "BASIC","GSM","EDGE GSM","CDMA","NADC","PDC","WCDMA","CDMA2K","CDMA1XEV","IDEN","WIDEN","WLAN","SERVICE" X-Series uses the ESA/PSA compatible query of a string contain comma separated values: "SA,PNOISE,NFIGURE,BASIC,CDMA,CDMA2K,WCDMA,CDMA1XEV,EDGE GSM,GSM,NADC,PDC,TDSCDMA,DMODULATION,WLAN"
<b>Initial S/W Revision</b>	Prior to A.02.00

## Application Identification (Remote Commands Only)

Each entry in the Mode Menu will have a Model Number and associated information: Version, and Options.

This information is displayed in the Show System screen. The corresponding SCPI remote commands are defined here.

["Current Application Model " on page 229](#)

["Current Application Revision" on page 230](#)

["Current Application Options" on page 230](#)

### Current Application Model

Returns a string that is the Model Number of the currently selected application (mode).

<b>Remote Command</b>	:SYSTem:APPLication[:CURRent][:NAME]?
<b>Example</b>	:SYST:APPL?
<b>Notes</b>	Query returns a quoted string that is the Model Number of the currently selected application (Mode). Example: "N9060A" String length is 6 characters.

Preset	Not affected by Preset
State Saved	Not saved in state, the value will be the selected application when a Save is done.
Initial S/W Revision	Prior to A.02.00

### Current Application Revision

Returns a string that is the Revision of the currently selected application (mode).

<b>Remote Command</b>	<b>:SYSTem:APPLication[:CURRent]:REVision?</b>
<b>Example</b>	: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)
Preset	Not affected by a Preset
State Saved	Not saved in state, the value will be the selected application when a Save is done.
Initial S/W Revision	Prior to A.02.00

### Current Application Options

Returns a string that is the Options list of the currently selected application (Mode).

<b>Remote Command</b>	<b>:SYSTem:APPLication[:CURRent]:OPTion?</b>
<b>Example</b>	: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.
Initial S/W Revision	Prior to A.02.00

### Application Identification Catalog (Remote Commands Only)

A catalog of the installed and licensed applications (Modes) can be queried for their identification.

"Application Catalog Number of Entries" on page 231

"Application Catalog Model Numbers" on page 231

"Application Catalog Revision" on page 231

"Application Catalog Options" on page 232

### Application Catalog Number of Entries

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

<b>Remote Command</b>	:SYSTem:APPLication:CATalog[:NAME]:COUNT?
<b>Example</b>	:SYST:APPL:CAT:COUNT?
Preset	Not affected by Preset
State Saved	Not saved in instrument state.
Initial S/W Revision	Prior to A.02.00

### Application Catalog Model Numbers

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

<b>Remote Command</b>	:SYSTem:APPLication:CATalog[:NAME]?
<b>Example</b>	: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 is COUNT * 7 - 1. (7 = 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.
Initial S/W Revision	Prior to A.02.00

### Application Catalog Revision

Returns the Revision of the provided Model Number.

<b>Remote Command</b>	:SYSTem:APPLication:CATalog:REvision? <model>
<b>Example</b>	: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 and licensed. Example, if SAMS is installed and licensed: "1.0.0.0"
Preset	Not affected by a Preset.
State Saved	Not saved in instrument state.
Initial S/W Revision	Prior to A.02.00

## Application Catalog Options

Returns a list of Options for the provided Model Number

<b>Remote Command</b>	:SYSTem:APPLication:CATalog:OPTion? <model>
<b>Example</b>	: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.
Initial S/W Revision	Prior to A.02.00

### Detailed List of Modes

This section contains an alphabetical list of Modes available in the X-Series, along with a brief description of each Mode.

Note that with the exception of the 89601 VSA, only licensed applications appear in the Mode menu. The 89601 will always appear, because it's licensing is handled differently.

#### 1xEV-DO

Selects the 1xEV-DO mode for general purpose measurements of signals following this standard. There are several measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	Mode
<b>Example</b>	INST:SEL CDMA1XEV INST:NSEL 15
Initial S/W Revision	Prior to A.02.00

#### 802.16 OFDMA (WiMAX/WiBro)

Selects the OFDMA mode for general purpose measurements of WiMAX signals. There are several measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	Mode
<b>Example</b>	INST:SEL WIMAXOFDMA INST:NSEL 75
Initial S/W Revision	Prior to A.02.00

### 802.16 OFDM (Fixed WiMAX)

Selects the 802.16 OFDM (Fixed WiMAX) mode. This mode allows modulation quality measurements of signals that comply with IEEE 802.16a-2003 and IEEE 802.16-2004 standards, with flexibility to measure nonstandard OFDM formats. Along with the typical digital demodulation measurement results, several additional 802.16 OFDM unique trace data formats and numeric error data results provide enhanced data analysis.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	Mode
<b>Example</b>	INST:SEL WIMAXFIXED INST:NSEL 104
Initial S/W Revision	A.02.00

### 89601 VSA

Selecting the 89601 VSA mode will start 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. Reach deeper into signals, gather more data on signal problems, and gain greater insight.

- 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](http://www.keysight.com/find/89600vsa)

To learn more about how to use the 89600 VSA running in the X-Series, after the 89600 VSA software is running, open the 89600 VSA Help and open the "About Keysight X-Series Signal Analyzer with 89600 VSA Software" help topic.

Key Path	Mode
<b>Example</b>	INST:SEL VSA89601 INST:NSEL 101
Initial S/W Revision	Prior to A.02.00

### Analog Demod

Selects the Analog Demod mode for making measurements of AM, FM and phase modulated signals.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	Mode
<b>Example</b>	INST:SEL ADEMODO INST:NSEL 234
Initial S/W Revision	Prior to A.02.00

## Bluetooth

Selects the Bluetooth mode for Bluetooth specific measurements. There are several measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	Mode
<b>Example</b>	INST:SEL BT INST:NSEL 228
Initial S/W Revision	A.06.01

## cdma2000

Selects the cdma2000 mode for general purpose measurements of signals following this standard. There are several measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	Mode
<b>Example</b>	INST:SEL CDMA2K INST:NSEL 10
Initial S/W Revision	Prior to A.02.00

## CMMB

Selects the CMMB mode for measurements of digital video signals using this format. There are several power and demod measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	Mode
<b>Example</b>	INST:SEL CMMB INST:NSEL 240
Initial S/W Revision	A.03.00

### Combined WLAN

Selects the CWLAN mode for general purpose measurements of signals following this standard. There are several measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	Mode
<b>Example</b>	INST:SEL CWLAN INST:NSEL 19
Initial S/W Revision	A.02.00

### Combined Fixed WiMAX

Selects the Combined Fixed WiMAX mode for general purpose measurements of signals following this standard. There are several measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	Mode
<b>Example</b>	INST:SEL CWIMAXOFDM INST:NSEL 81
Initial S/W Revision	A.02.00

### Digital Cable TV

Selects the Digital Cable TV mode for measurements of digital cable television systems. There are several power and demod measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	Mode
<b>Example</b>	INST:SEL DCTV INST:NSEL 238
Initial S/W Revision	A.07.00



## DTMB (CTTB)

Selects the DTMB (CTTB) mode for measurements of digital video signals using this format. There are several power and demod measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	Mode
<b>Example</b>	INST:SEL DTMB INST:NSEL 236
Initial S/W Revision	A.02.00

## DVB-T/H with T2

Selects the DVB-T/H mode for measurements of digital video signals using this format. There are several power and demod measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	Mode
<b>Example</b>	INST:SEL DVB INST:NSEL 235
Initial S/W Revision	A.02.00
Modified at S/W Revision	A.07.00

## EMI Receiver

The EMI Receiver Mode makes EMC measurements. Several measurements are provided to aid the user in characterizing EMC performance of their systems, including looking at signals with CISPR-16 compliant detectors, performing scans for interfering signals, and determining and charting interfering signals over time.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	Mode
<b>Example</b>	INST:SEL EMI INST:NSEL 141
Initial S/W Revision	A.07.01

### GSM/EDGE/EDGE Evo

Selects the GSM with EDGE mode for general purpose measurements of signals following this standard. There are several measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	Mode
<b>Example</b>	INST:SEL EDGEGSM INST:NSEL 13
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

### iDEN/WiDEN/MOTOTalk

Selects the iDEN/WiDEN/MOTOTalk mode for general purpose measurements of iDEN and iDEN-related signals. There are several measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	Mode
<b>Example</b>	INST:SEL IDEN INST:NSEL 103
Initial S/W Revision	A.02.00

### IQ Analyzer (Basic)

The IQ Analyzer Mode makes general purpose frequency domain and time domain measurements. These measurements often use alternate hardware signal paths when compared with a similar measurement in the Signal Analysis Mode using the Swept SA measurement. These frequency domain and time domain measurements can be used to output I/Q data results when measuring complex modulated digital signals.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	Mode
<b>Example</b>	INST:SEL BASIC INST:NSEL 8

---

Initial S/W Revision	Prior to A.02.00
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---

### ISDB-T

Selects the ISDB-T mode for measurements of digital video signals using this format. There are several power and demod measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

---

Key Path	Mode
<b>Example</b>	INST:SEL ISDBT INST:NSEL 239
Initial S/W Revision	A.03.00

---

### LTE

Selects the LTE mode for general purpose measurements of signals following the LTE FDD standard. There are several measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

---

Key Path	Mode
<b>Example</b>	INST:SEL LTE INST:NSEL 102
Initial S/W Revision	Prior to A.02.00

---

### LTE TDD

Selects the LTE TDD mode for general purpose measurements of signals following the LTE TDD standard. There are several measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

---

Key Path	Mode
<b>Example</b>	INST:SEL LTETDD INST:NSEL 105
Initial S/W Revision	A.03.00

---

### LTE-Advanced FDD

As LTE-Advanced FDD and LTE modes are converged into one single application, the single softkey under Mode menu is designed to select the converged mode. The display mode of the LTE and LTE-Advanced FDD are distinguished by the licenses.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	Mode
<b>Example</b>	INST:SEL LTEAFDD INST:NSEL 107
Notes	When the N9080A/80B-1FP exists, the display mode name is LTE. When the N9080A/80B-1FP and N9080B-2FP all exist, the display mode name is LTE FDD & LTE-A FDD.
<b>Backwards Compatibility SCPI</b>	INST:SEL LTE INST:NSEL 102
Initial S/W Revision	A.14.00
Modified at S/W Revision	A.14.50

### LTE-Advanced TDD

As LTE-Advanced TDD and LTE TDD modes are converged into one single application, the single softkey under Mode menu is designed to select the converged mode. The display mode of the LTE TDD and LTE-Advanced TDD are distinguished by the licenses.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	Mode
<b>Example</b>	INST:SEL LTEATDD INST:NSEL 108
Notes	When the N9082A/82B-1FP exists, the display mode name is LTE TDD. When the N9082A/82B-1FP and N9082B-2FP all exist, the display mode name is LTE TDD & LTE-A TDD.
<b>Backwards Compatibility SCPI</b>	INST:SEL LTETDD INST:NSEL 105
Initial S/W Revision	A.14.00
Modified at S/W Revision	A.14.50

## MSR

Selects the MSR mode. The MSR mode makes several measurements for Cellular Communication devices that can be configured with multiple radio formats simultaneously following the 3GPP standard of Multi-Standard Radio, including GSM/EDGE, WCDMA/HSPA+ and LTE.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	Mode
<b>Example</b>	INST:SEL MSR INST:NSEL 106
Initial S/W Revision	A.09.491

## Noise Figure

The Noise Figure mode provides pre-configured measurements for making general purpose measurements of device noise figure.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	Mode
<b>Example</b>	INST:SEL NFIGURE INST:NSEL 219
Initial S/W Revision	Prior to A.02.00

## Phase Noise

The Phase Noise mode provides pre-configured measurements for making general purpose measurements of device phase noise.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	Mode
<b>Example</b>	INST:SEL PNOISE or INST:NSEL 14
Initial S/W Revision	Prior to A.02.00

## Real Time Spectrum Analyzer

The Real Time Spectrum Analyzer (RTSA) mode provides real-time signal analysis, very high probability-of-intercept for intermittent signals with appropriate triggers.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

---

Key Path	Mode
<b>Example</b>	INST:SEL RTSA or INST:NSEL 2
Initial S/W Revision	A.13.00

---

## Remote Language Compatibility

The Remote Language Compatibility (RLC) mode provides remote command backwards compatibility for the 8560 series of spectrum analyzers, known as legacy spectrum analyzers.

**NOTE**

**After changing into or out of this mode, allow a 1 second delay before sending any subsequent commands.**

---

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

---

Key Path	Mode
<b>Example</b>	INST:SEL RLC Or INST:NSEL 266
Initial S/W Revision	Prior to A.02.00

---

## SCPI Language Compatibility

The SCPI Language Compatibility mode provides remote language compatibility for SCPI-based instruments, such as the Rohde and Schwartz FSP and related series of spectrum analyzers.

**NOTE**

**After changing into or out of this mode, allow a 1 second delay before sending any subsequent commands.**

---

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	Mode
<b>Example</b>	INST:SEL SCPILC Or INST:NSEL 270
Initial S/W Revision	A.06.00

## Spectrum Analyzer

Selects the Spectrum Analyzer mode for general purpose measurements. There are several measurements available in this mode. General spectrum analysis measurements, in swept and zero span, can be done using the first key in the Meas menu, labeled Swept SA. Other measurements in the Meas Menu are designed to perform specialized measurement tasks, including power and demod measurements.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	Mode
<b>Example</b>	INST:SEL SA INST:NSEL 1
Initial S/W Revision	Prior to A.02.00

## TD-SCDMA with HSPA/8PSK

Selects the TD-SCDMA mode for general purpose measurements of signals following this standard. There are several measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	Mode
<b>Example</b>	INST:SEL TDSCDMA INST:NSEL 211
Initial S/W Revision	Prior to A.02.00

## Vector Signal Analyzer (VXA)

The N9064A (formerly 89601X) VXA Vector signal and WLAN modulation analysis application provides solutions for basic vector signal analysis, analog demodulation, and digital demodulation. The digital demodulation portion of N9064A allows you to

perform measurements on standard-based formats such as cellular, wireless networking and digital video as well as general purpose flexible modulation analysis for wide range of digital formats, FSK to 1024QAM, with easy-to-use measurements and display tools such as constellation and eye diagram, EVM traces and up to four simultaneous displays. Analog baseband analysis is available using the MXA and PXA with option BBA. Option 3FP WLAN has been discontinued.

N9064A honors existing 89601X licenses with all features and functionalities found on X-Series software versions prior to A.06.00. Specifically:

N9064A-1 is equivalent to 89601X-205

N9064A-2 is equivalent to 89601X-AYA

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	Mode
<b>Example</b>	INST:SEL VSA INST:NSEL 100
Initial S/W Revision	Prior to A.02.00

### W-CDMA with HSPA+

Selects the W-CDMA with HSPA+ mode for general purpose measurements of signals following this standard. There are several measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.

Key Path	Mode
<b>Example</b>	INST:SEL WCDMA INST:NSEL 9
Initial S/W Revision	Prior to A.02.00

### WLAN

Selects the WLAN mode for general purpose measurements of signals following this standard. There are several measurements available in this mode.

If you are using the Help feature, this mode must be currently active to access its detailed information. If it is not active, exit the Help feature (Esc key), select the mode, and re-access Help.



Key Path	Mode
<b>Example</b>	INST:SEL WLAN INST:NSEL 217
Initial S/W Revision	A.09.491

## 6 System Functions

## File

Opens a menu that enables you to access various standard and custom Windows functions. Press any other front-panel key to exit

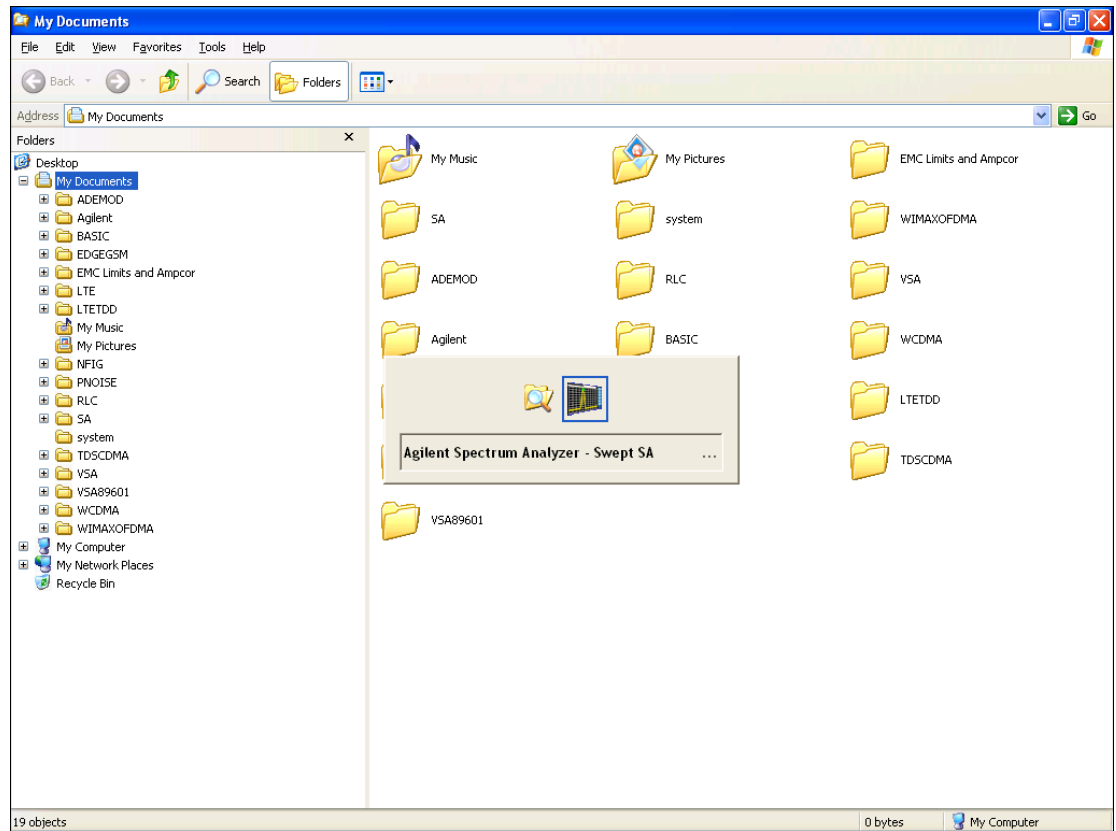
Key Path	<b>Front-panel key</b>
Initial S/W Revision	Prior to A.02.00

## File Explorer

Opens the standard Windows File Explorer. The File Explorer opens in the My Documents directory for the current user.

The File Explorer is a separate Windows application, so to return to the analyzer once you are in the File Explorer, you may either:

Exit the File Explorer by clicking on the red X in the upper right corner, with a mouse



Or use Alt-Tab: press and hold the Alt key and press and release the Tab key until the Analyzer logo is showing in the window in the center of the screen, as shown above, then release the Alt key.

The ability to access File Explorer is not available if Option SF1 is installed.

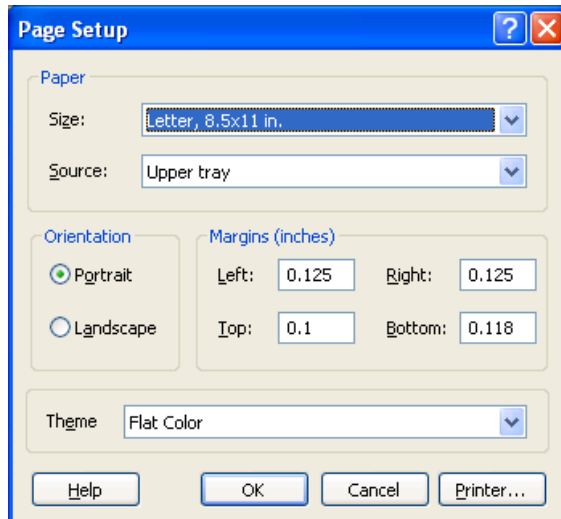
Key Path	File
Initial S/W Revision	Prior to A.02.00

## Page Setup

The Page Setup key brings up a Windows Page Setup dialog that allows you to control aspects of the pages sent to the printer when the PRINT hardkey is pressed.

Key Path	File
Initial S/W Revision	Prior to A.02.00

Paper size, the printer paper source, the page orientation and the margins are all settable. Just like any standard Windows dialog, you may navigate the dialog using the front-panel keys, or a mouse. There are no SCPI commands for controlling these parameters.



Also contained in this dialog is a drop-down control that lets you select the Theme to use when printing. For more on Themes, see information under View/Display, Display, System Display Settings, Theme. The Theme control has a corresponding SCPI command.

Parameter Name	Print Themes
Parameter Type	Enum
Mode	All
<b>Remote Command</b>	:SYSTem:PRINT:THEMe TDCoLor   TDMonochrome   FCOLor   FMONochrome :SYSTem:PRINT:THEMe?
<b>Example</b>	:SYST:PRIN:THEM FCOL
Setup	:SYSTem:DEFault MISC
Preset	FCOL; 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
Initial S/W Revision	Prior to A.02.00

---

## Restore Down

This key allows you to Restore Down the Instrument Application and reverses the action taken by Maximize. This key is only visible when the application has been maximized, and after the Restore Down action has been completed this key is replaced by the Maximize key.

---

Key Path	<b>File</b>
Mode	<b>All</b>
Notes	No equivalent remote command for this key.
State Saved	No
Initial S/W Revision	A.05.01

---

## Minimize

The Minimize key causes the analyzer display to disappear down into the task bar, allowing you to see the Windows Desktop. You can use Alt-Tab (press and hold the

Alt  key and press and release the Tab key) to restore the analyzer display.

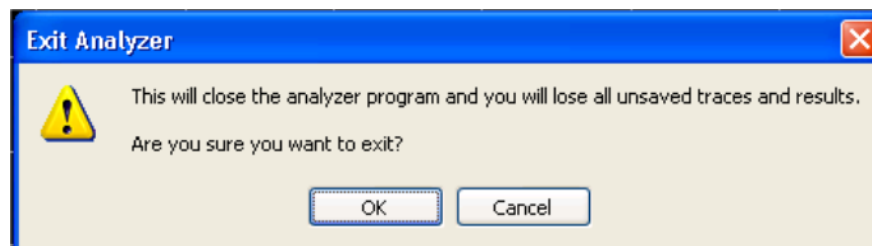
---

Key Path	<b>File</b>
Mode	<b>All</b>
Notes	No equivalent remote command for this key.
State Saved	No
Initial S/W Revision	A.05.01

---

## Exit

This key, when pressed, will exit the Instrument Application. A dialog box is used to confirm that you intended to exit the application:



---

Key Path	<b>File</b>
Mode	All
Notes	The Instrument Application will close. No further SCPI commands can be sent. Use with caution!
Initial S/W Revision	Prior to A.02.00

---

## Print

The Print key opens a Print dialog for configured printing (for example, to the printer of your choice). Refer to your Microsoft Windows Operating System manual for more information.

## Maximize/Restore Down

These keys allow the Instrument Application to be maximized and then restored to its prior state. Only one of the two keys is visible at a time. When not already maximized the Maximize Application key is visible, and when maximized, the Restore Down Application key is visible and replaces the Maximize Application key.

### Maximize

This key allows you to Maximize the Instrument Application, which causes the analyzer display to fill the screen. Once the application is maximized, this key is replaced by the Restore Down key.

Key Path	<b>File</b>
Mode	<b>All</b>
Notes	No equivalent remote command for this key.
State Saved	No
Initial S/W Revision	A.05.01

### Restore Down

This key allows you to Restore Down the Instrument Application and reverses the action taken by Maximize. This key is only visible when the application has been maximized, and after the Restore Down action has been completed this key is replaced by the Maximize key.

Key Path	<b>File</b>
Mode	<b>All</b>
Notes	No equivalent remote command for this key.
State Saved	No
Initial S/W Revision	A.05.01

## Print

This front-panel key is equivalent to performing a File, Print, OK. It immediately performs the currently configured Print to the Default printer.

The :HCOPY command is equivalent to pressing the PRINT key. The :HCOPY:ABORT command can be used to abort a print which is already in progress. Sending :HCOPY:ABORT will cause the analyzer 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 the user sent the ABORT command.

---

Key Path	Front-panel key
<b>Remote Command</b>	:HCOPY[:IMMEDIATE]
Initial S/W Revision	Prior to A.02.00

---

---

Key Path	SCPI command only
<b>Remote Command</b>	:HCOPY:ABORT
Initial S/W Revision	Prior to A.02.00

---

## System

Opens a menu of keys that access various configuration menus and dialogs.

Key Path	<b>Front-panel key</b>
Notes	No remote command for this key specifically.
Initial S/W Revision	Prior to A.02.00

## Show

Accesses a menu of choices that enable you to select the information window you want to view.

Key Path	<b>System</b>
Mode	All
<b>Remote Command</b>	:SYSTem:SHOW OFF   ERRor   SYSTem   HARDware   LXI   HWSTatistics   ALIGNment   SOFTware   CAPPllication :SYSTem:SHOW?
<b>Example</b>	: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 CAPPllication
Initial S/W Revision	Prior to A.02.00

## Errors

There are two modes for the Errors selection, History and Status.

The list of errors displayed in the Errors screen does not automatically refresh. You must press the Refresh key or leave the screen and return to it to refresh it.

History brings up a screen displaying the event log in chronological order, with the newest event at the top. The history queue can hold up to 100 messages (if a message has a repeat count greater than 1 it only counts once against this number of 100). Note that this count bears no relation to the size of the SCPI queue. If the queue extends onto a second page, a scroll bar appears to allow scrolling with a mouse. Time is displayed to the second.

Status brings up a screen summarizing the status conditions currently in effect. Note that the time is displayed to the second.

The fields on the Errors display are:

Type (unlabeled) - Displays the icon identifying the event or condition as an error or warning.

ID - Displays the error number.



Message - Displays the message text.

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

If the value of Repeat is 1 the field does not display. If the value of Repeat is >1, the time and date shown are those of the most recent occurrence. If the value of repeat reaches 999,999 it stops there.

Time - Shows the most recent time (including the date) at which the event occurred.

Key Path	<b>System, Show</b>
Mode	All
<b>Remote Command</b>	<b>:SYSTem:ERRor[:NEXT]?</b>
<b>Example</b>	:SYST:ERR?
Notes	The return string has the format: “<Error Number>,<Error>” Where <Error Number> and <Error> are those shown on the Show Errors screen
Backwards Compatibility Notes	In some legacy analyzers, the Repeat field shows the number of times the message has repeated since the last time the error queue was cleared. In the X-Series, the Repeat field shows the number of times the error has repeated since the last intervening error. So the count may very well be different than in the past even for identical signal conditions  Unlike previous analyzers, in the X-Series all errors are reported through the Message or Status lines and are logged to the event queue. They never appear as text in the graticule area (as they sometimes do in previous analyzers) and they are never displayed in the settings panel at the top of the screen (as they sometimes do, by changing color, in previous analyzers).  As a consequence of the above, the user can only see one status condition (the most recently generated) without looking at the queue. In the past, at least in the Spectrum Analyzer, multiple status conditions might display on the right side of the graticule.  In general, there is no backwards compatibility specified or guaranteed between the error numbers in the X-Series and those of earlier products. Error, event, and status processing code in customers' software will probably need to be rewritten to work with X-Series.  In the legacy analyzers, some conditions report as errors and others simply turn on status bits. Conditions that report as errors often report over and over as long as the condition exists. In the X-series, all conditions report as start and stop events. Consequently, software that repeatedly queries for a condition error until it stops reporting will have to be rewritten for the X-series.
Initial S/W Revision	Prior to A.02.00

### Previous Page

See ["Next Page" on page 254.](#)

Key Path	<b>System, Show, Errors</b>
Initial S/W Revision	Prior to A.02.00

## Next Page

Next Page and Previous Page menu keys move you between pages of the log, if it fills more than one page. These keys are grayed out in some cases:

- If on the last page of the log, the Next Page key is grayed-out
- If on the first page of the log, the Previous Page key is grayed-out.
- If there is only one page, both keys are grayed out.

---

Key Path	<b>System, Show, Errors</b>
Initial S/W Revision	Prior to A.02.00

---

## History

The History and Status keys select the Errors view. The Status key has a second line that shows a number in [square brackets]. This is the number of currently open status items.

---

Key Path	<b>System, Show, Errors</b>
Initial S/W Revision	Prior to A.02.00

---

## Status

See ["History" on page 254](#).

## Verbose SCPI On/Off

When you turn Verbose SCPI on, additional information is returned when you send the :SYSTem:ERRor? query. The additional information consists of the characters that stimulated the error. This can aid you in debugging your test programs by indicating where in the parsing of a SCPI command the instrument encountered an invalid command or query.

Specifically, with Verbose SCPI on, the SYSTem:ERRor? query is expanded to show the SCPI data received, with the indicator <Err> at the point in the stream that the error occurred.

Verbose SCPI has no effect on the Show Errors screen or front panel Message Line; it only changes the response to the :SYST:ERR? query.

See the example below, where the invalid command "SENS:BOGUS" is sent:

Normal response to :SYST:ERR (using the Telnet window):

```
SCPI> SENS:BOGUS
```

```
SCPI> SYST:ERR?
```

```
-113,"Undefined header"
```

Now after turning on Verbose SCPI:

```
SCPI> SYST:BOGUS
```

```
SCPI> SYST:ERR?
-113,"Undefined header;SYST:BOGUS<Err>"
```

Key Path	<b>System, Show, Errors</b>
Mode	All
<b>Remote Command</b>	:SYSTem:ERRor:VERBoSe OFF ON 0 1 :SYSTem:ERRor:VERBoSe?
<b>Example</b>	:SYST:ERR:VERB ON
Preset	This is unaffected by Preset but is set to OFF on a "Restore System Defaults->Misc"
State Saved	No
Range	On   Off
Initial S/W Revision	Prior to A.02.00

### Refresh

When pressed, refreshes the Show Errors display.

Key Path	<b>System, Show, Errors</b>
Initial S/W Revision	Prior to A.02.00

### Clear Error Queue

This clears all errors in all error queues.

Note the following:

- Clear Error Queue does not affect the current status conditions.
- Mode Preset does not clear the error queue.
- Restore System Defaults will clear all error queues.
- \*CLS only clears the queue if it is sent remotely and \*RST does not affect any error queue.
- Switching modes does not affect any error queues.

Key Path	<b>System, Show, Errors</b>
Initial S/W Revision	Prior to A.02.00

### Input Overload Enable (Remote Command Only)

Input Overload errors are reported using the Input Overload status bit (bit 12 in the Measurement Integrity status register). Input Overloads (for example, ADC Overload errors) can come and go with great frequency, generating many error events (for example, for signals just on the verge of overload), and so are not put into the SCPI error queue by default. Normally the status bit is the only way for detecting these errors remotely.

It is possible to enable Input Overload reporting to the SCPI queue, by issuing the :SYSTEM:ERROR:OVERload ON command. To return to the default state, issue the :SYSTEM:ERROR:OVERload OFF command. In either case, Input Overloads always set the status bit.

**NOTE**

For versions of firmware before A.10.01, the Input Overload was only a Warning and so was never available in the SCPI queue, although it did set the status bit. For A.10.01 and later, the Input Overload is an error and can be enabled to the SCPI queue using this command.

Key Path	SCPI only
<b>Remote Command</b>	:SYSTem:ERRor:OVERload[:STATe] 0 1 OFF ON
<b>Example</b>	:SYST:ERR:OVER 1 Enable overload errors
Preset	Set to OFF by Restore Misc Defaults (no Overload errors go to SCPI)
State Saved	Saved in instrument state.
Initial S/W Revision	A.10.01

### Power Up (Remote Command Only)

This serves to show the errors encountered during the application boot-up, such as: mismatch FW-FPGA, missing Calibration data, missing hardware and construction errors.

<b>Remote Command</b>	:SYSTem:ERRor:PUP?
Notes	<p>If no error occurs, the return value will be: "No Power Up Errors."  Return Value: &lt;list of error strings&gt;.  &lt;List of error strings&gt; is an &lt;IEEE488 Block&gt; format.  Return Value Example:  "Power up errors, see details in Windows Event Log"  "Unmatched FPGA Version(s), See details in Windows Event Log"</p>
Initial S/W Revision	E.14.30

### System

The System screen is formatted into three groupings: product descriptive information, options tied to the hardware, and software products:

```

<Product Name> <Product Description>
Product Number: N9020A
Serial Number: US46220924
Firmware Revision: A.01.01
Computer Name: <hostname>
Host ID: N9020A,US44220924

N9020A-503      Frequency Range to 3.6 GHz
N9020A-PFR     Precison Frequency Reference
N9020A-P03     Preamp 3.6 GHz

N9060A-2FP     Spectrum Analysis Measurement Suite  1.0.0.0
N9073A-1FP     WCDMA                               1.0.0.0
N9073A-2FP     WCDMA with HSDPA                     1.0.0.0
    
```

The Previous Page is grayed-out if the first page of information is presently displayed. The Next Page menu key is grayed-out if the last page is information is presently displayed.

Key Path	<b>System, Show</b>
Mode	All
<b>Example</b>	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.
Initial S/W Revision	Prior to A.02.00

### Show System contents (Remote Command Only)

A remote command is available to obtain the contents of the Show System screen (the entire contents, not just the currently displayed page).

<b>Remote Command</b>	<b>:SYSTem:CONFIgure[:SYSTem]?</b>
<b>Example</b>	:SYST:CONF?
Notes	The output is an IEEE Block format of the Show System contents. Each line is separated with a new-line character.
Initial S/W Revision	Prior to A.02.00

### Computer System description (Remote Command Only)

A remote command is available to obtain the Computer System description. The Computer System is the operating system and patch level as reported by operating system.

<b>Remote Command</b>	<b>:SYSTem:CSYSTem?</b>
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## LXI

This key shows you the product number, serial number, firmware revision, computer name, IP address, Host ID, LXI Class, LXI Version, MAC Address, and the Auto-MDIX Capability.

Key Path	<b>System, Show</b>
Initial S/W Revision	Prior to A.02.00

## Power On

Enables you to select how the instrument should power on. The options are: Mode and Input/Output Defaults, User Preset and Last State.

Key Path	<b>System</b>
Mode	All
<b>Remote Command</b>	:SYSTem:PON:TYPE MODE USER LAST :SYSTem:PON:TYPE?
<b>Example</b>	:SYST:PON:TYPE MODE
Preset	This is unaffected by a Preset but is set to Mode on a “Restore System Defaults->All”
State Saved	No
<b>Backwards Compatibility SCPI</b>	:SYSTem:PON:TYPE PRESet the “PRESet” parameter is supported for backward compatibility only and behaves the same as MODE.
Backwards Compatibility Notes	The <b>Preset Type</b> key in legacy analyzers has been removed, and the <b>Power On</b> toggle key has been replaced by this 1-of-N key in the <b>System</b> menu.
Initial S/W Revision	Prior to A.02.00

## Mode and Input/Output Defaults

When the analyzer 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.

Key Path	<b>System, Power On</b>
Mode	All
<b>Example</b>	SYST:PON:TYPE MODE
Readback Text	Defaults
Initial S/W Revision	Prior to A.02.00

## User Preset

Sets **Power On** to **User Preset**. When the analyzer is powered on in User Preset, it will User Preset each mode and switch to the power-on mode. Power On User Preset will not affect any settings beyond what a normal User Preset affects.

**NOTE**

An instrument could never power up for the first time in User Preset.

Key Path	<b>System, Power On</b>
Mode	All
<b>Example</b>	SYST:PON:TYPE USER
Readback Text	User Preset
Backwards Compatibility Notes	Power On User Preset will cause the instrument to power up in the power-on mode, not the last mode the instrument was in prior to shut down. Also, Power On User Preset will User Preset all modes. This does not exactly match legacy behavior.
Initial S/W Revision	Prior to A.02.00

## Last State

Sets **Power On** to **Last**. When the analyzer is powered on, it will put all modes in the last state they were in prior to when the analyzer was put into Power Standby and it will wake 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 by using the front panel power **Standby** key or by using the remote command **SYSTem:PDOWn**. The non-active modes are saved as they are deactivated and recalled by Power On Last State.

**NOTE**

An instrument can never power up for the first time in Last.

If line power to the analyzer 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 you shutting down the instrument using the Standby key or the **SYSTem:PDOWn** SCPI command. This will ensure the last state of each mode is saved and can be recalled during a power up.

Key Path	<b>System, Power On</b>
Mode	All
<b>Example</b>	SYST:PON:TYPE LAST
Notes	Power on Last State only works if you have done a controlled shutdown prior to powering on in Last. If a controlled shutdown is not done 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 the <b>:SYSTem:PDOWn</b> command.
Readback Text	Last State
Backwards Compatibility Notes	It is no longer possible to power-up the analyzer in the last mode the analyzer was running with that mode in the preset state. (ESA/PSA SYST:PRESET:TYPE MODE with SYST:PON:PRESET) You can power-on the analyzer 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>).
Initial S/W Revision	Prior to A.02.00
<b>Power On Application</b>	
<p>Accesses a menu that lists the available Modes and lets you select which Mode is to be the power-on application.</p> <p>This application is used for Power On Type “Mode and Input/Output Defaults” and Restore System Defaults All.</p>	
Key Path	<b>System, Power On</b>
Mode	All
<b>Remote Command</b>	<p>:SYSTem: PON: MODE &lt;mode&gt;</p> <p>where &lt;mode&gt; is the identical list from the :INSTrument[:SElect] command</p> <p>:SYSTem: PON: MODE?</p>
<b>Example</b>	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	<p>This is unaffected by a Preset but is set on a “Restore System Defaults-&gt;All” to:</p> <p>For N9038A: EMI</p> <p>For N8973B, N8974B, N8975B, or N8976B: NFIG</p> <p>For all other models: SA</p>
State Saved	No
Initial S/W Revision	Prior to A.02.00

## Configure Applications

The Configure Applications 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.

This 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.

For more information, see the following topics:

["Preloading Applications" on page 262](#)

["Access to Configure Applications utility" on page 262](#)

"Virtual memory usage" on page 262

Key Path	System, Power On
<b>Example</b>	:SYST:SHOW CAPP Displays the Config Applications screen
Initial S/W Revision	A.02.00

## Preloading Applications

During runtime, if a Mode that is not preloaded is selected using the Mode menu or 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 will cause it to be loaded into the analyzer'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 your memory.

## Access to Configure Applications utility

A version of the utility runs the first time you power up the analyzer 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.

You may, at any time, manually call up the Configure Applications utility by pressing System, Power On, Configure Applications, to find a configuration that works best for you, and then restart the analyzer program.

The utility may also be called if, during operation of the analyzer, you attempt to load more applications than can fit in memory at once.

## 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 memory in question here is Virtual memory and is a limitation imposed by the operating system, not by the amount of physical memory you have in your analyzer). 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 analyzer's memory. You must deselect applications until the fuel bar turns yellow.

**YELLOW:** the applications you have selected can all fit into the analyzer'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 analyzer 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 analyzer's memory with room to spare. You will likely be able to load one or more other applications without running out of memory.

### 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.

---

Key Path	<b>System, Power On, Configure Applications</b>
Initial S/W Revision	A.02.00

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### 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.

---

Key Path	<b>System, Power On, Configure Applications</b>
Initial S/W Revision	A.02.00

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### Move Up

The application list is the order that applications appear in the Mode Menu. This key enables you to shift the selected application up in the list, thus moving the selected application earlier in the Mode Menu.

---

Key Path	<b>System, Power On, Configure Applications</b>
Initial S/W Revision	A.02.00

---

### Move Down

The application list is the order that applications appear in the Mode Menu. This key enables you to shift the selected application down in the list, thus moving the

selected application later in the Mode Menu.

Key Path	System, Power On, Configure Applications
Initial S/W Revision	A.02.00

### Select/Deselect

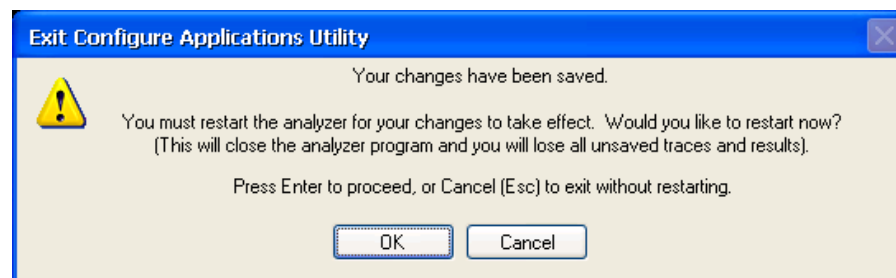
Toggles the currently highlighted application in the list.

Key Path	System, Power On, Configure Applications
Initial S/W Revision	A.02.00

### Save Changes and Exit

Applies the configuration of the applications list. The marked applications will be pre-loaded in memory the next time the instrument application is started, and the order of the applications in the list will be the order of the applications in the Mode Menu.

After saving your changes, the analyzer asks you if you would like it to restart so that your changes can take effect (see dialog box, below). If you choose not to restart, the changes will not take affect until the next time you shut down and restart the analyzer.



Key Path	System, Power On, Configure Applications
<b>Remote Command</b>	:SYSTem:PUP:PROcEss
<b>Example</b>	:SYST:PUP:PROC This is the SCPI command for restarting the analyzer. You must Wait after this command for the instrument application to restart
Notes	The softkey will be grayed-out when the virtual memory of the selected applications exceeds 100% of the limit.
Notes	You cannot use *WAI or *OPC? to synchronize operation after a restart. This command stops and restarts the instrument application, thus the SCPI operation is terminated and restarted. A remote program must use fixed wait time to resume sending commands to the instrument. The wait time will be dependent upon which applications are pre-loaded.
Initial S/W Revision	A.02.00
Modified at S/W Revision	A.04.00

## Exit Without Saving

Pressing this key will exit the Configure Applications utility without saving your changes.

Key Path	<b>System, Power On, Configure Applications</b>
Initial S/W Revision	A.02.00
Modified at S/W Revision	A.04.00

## FPGA Configuration

Available only when the EMC Application, TDS and FS2 are all licensed.

When installing new firmware, this setting is used to select the preferred FPGA version if more than one version is available. It also allows you to be prompted at each startup to select which version of the FPGA is wanted at that time.

- TDS - Load the Time Domain Scan version of the FPGA
- FS2 - Load the Enhanced Sweep Speed version of the FPGA
- PROMpt - Initiate a prompt at each startup and show the FPGA Configuration dialog. You can choose to continue with the currently loaded FPGA version, or load a different version.

See ["Time Domain Scan" on page 265](#) and ["Prompt at Startup" on page 266](#).

The readback text on the key is “[<preference>, <currently loaded>]”.

Control Path	System, Power On
<b>Remote Command</b>	<b>SYSTem: PON: FPGA: PREFerence TDS   FS2   PROMpt</b> <b>SYSTem: PON: FPGA: PREFerence?</b>
<b>Example</b>	SYST: PON: FPGA: PREF TDS SYST: PON: FPGA: PREF?
Preset	PROMpt Not affected by Mode Preset but set to PROMpt by “Restore System Default” -> “All” or “Power On”
Notes	The 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 from NA results in the error -224, “Illegal parameter value”.
Initial S/W Revision	A.18.20

## Time Domain Scan

This function is available only when the EMC Application, TDS and FS2 are all licensed.

Selects the Time Domain Scan version of the FPGA, for use by the EMC application.

If this version is not currently loaded, then it will be loaded when the "Load FPGA" on page 268 key is pressed, or when new firmware is loaded.

Note that load time for this version may be longer than for the previous version.

Key Path	<b>System, Power On, FPGA Configuration</b>
<b>Example</b>	SYST:PON:FPGA:PREF TDS
Initial S/W Revision	A.18.20

### Enhanced Sweep Speed

This function is available only when the EMC Application, TDS and FS2 are all licensed.

Selects the Enhanced Sweep Speed version of the FPGA. This implements fast sweep capability in the FPGA for swept measurements.

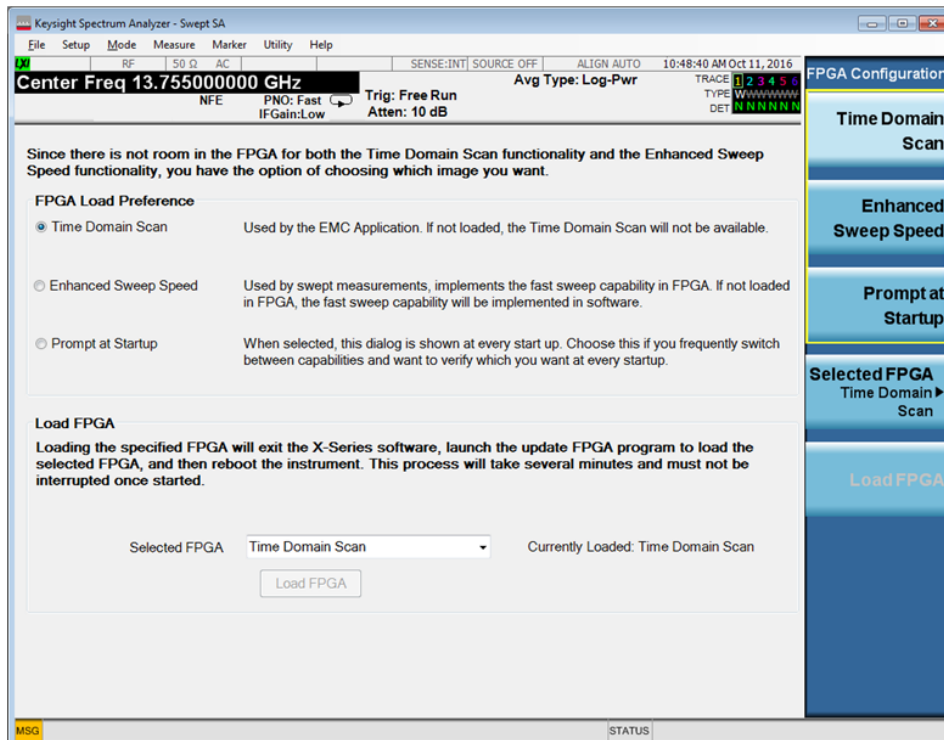
If this version is not currently loaded, then it will be loaded when the "Load FPGA" on page 268 key is pressed, or when new firmware is loaded.

Key Path	<b>System, Power On, FPGA Configuration</b>
<b>Example</b>	SYST:PON:FPGA:PREF FS2
Initial S/W Revision	A.18.20

### Prompt at Startup

This function is available only when the EMC Application, TDS and FS2 are all licensed.

When multiple capabilities are licensed and this key is pressed, the following dialog displays at startup:



This can be useful if you frequently switch between capabilities.

Key Path	System, Power On, FPGA Configuration
Example	SYST:PON:FPGA:PREF PROMpt
Initial S/W Revision	A.18.20

### Selected FPGA

This function is available only when the EMC Application, TDS and FS2 are all licensed.

Accesses a menu that enables you to select the desired FPGA version.

Key Path	System, Power On, FPGA Configuration
Initial S/W Revision	A.18.20

### Time Domain Scan

This function is available only when the EMC Application, TDS and FS2 are all licensed.

Selects the Time Domain Scan version of the FPGA, for use by the EMC application.

If this version is not currently loaded, then it will be loaded when the "Load FPGA" on page 268 key is pressed, or when new firmware is loaded.

Note that load time for this version may be longer than for the previous version.

Key Path	System, Power On, FPGA Configuration, Selected FPGA
Initial S/W Revision	A.18.20

### Enhanced Sweep Speed

This function is available only when the EMC Application, TDS and FS2 are all licensed.

Selects the Enhanced Sweep Speed version of the FPGA. This implements fast sweep capability in the FPGA for swept measurements.

If this version is not currently loaded, then it will be loaded when the **"Load FPGA"** on [page 268](#) key is pressed, or when new firmware is loaded.

Key Path	System, Power On, FPGA Configuration, Selected FPGA
Initial S/W Revision	A.18.20

### Load FPGA

This function is available only when the EMC Application, TDS and FS2 are all licensed.

Pressing this key loads the selected FPGA version. This key is grayed out if the selected version is already loaded.

#### CAUTION

Loading the specified FPGA exits the X-Series software, launches the Update FPGA program to load the selected FPGA, then reboots the instrument. This process will take several minutes and must not be interrupted once started.

See ["Restore Power On Defaults" on page 269](#)

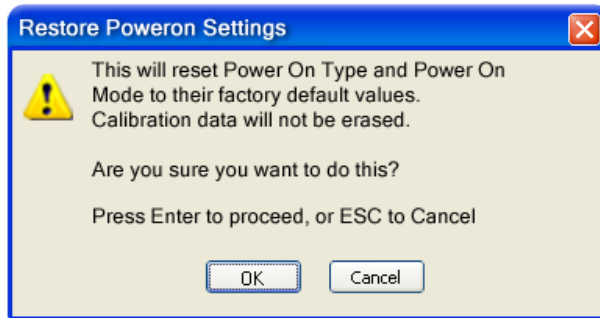
Key Path	System, Power On, FPGA Configuration
<b>Remote Command</b>	SYSTem: PON: FPGA: LOAD TDS   FS2 SYSTem: PON: FPGA: LOAD?
<b>Example</b>	SYST: PON: FPGA: LOAD TDS SYST: PON: FPGA: Load?
Notes	The command has no effect if the specified FPGA version is the one already loaded. The SCPI is always available, 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; <option> is not licensed"
Dependencies	Available only when there are multiple versions of the FPGA that could be loaded. The selection is limited to licensed features: <ul style="list-style-type: none"> <li>- TDS selection requires the EMC Application and the TDS hardware option</li> <li>- FS2 requires the FS2 hardware option</li> </ul>



Preset	None. Not affected by Mode Preset or any Restore Defaults.
Initial S/W Revision	A.18.20

### Restore Power On Defaults

This selection causes the Power On Type and Power On Application settings to be a reset to their default values. This level of Restore System Defaults does not affect any other system settings, mode settings and does not cause a mode switch. The Power On key, under the Restore System Defaults menu, causes the same action.



If you press any key other than OK or Enter, it is construed as a Cancel, because the only path that will actually cause the reset to be executed is through OK or Enter.

Key Path	<b>System, Power On</b>
<b>Example</b>	:SYST:DEF PON
Initial S/W Revision	Prior to A.02.00

### Configure Applications - Instrument boot-up

At start-up of the analyzer program a dialog box similar to the one under the **System, Power On, Configure Applications** key will be displayed allowing you to choose which licensed applications are to be loaded. This dialog will only be displayed if the memory required to pre-load all of the licensed applications exceeds the Virtual Memory available.

### Configure Applications - Windows desktop

The Configure Applications Utility may be run from the Windows Desktop. The utility



is launched by double-clicking the icon on the desktop, which brings-up a dialog box similar to the one under the **System, Power On, Configure Applications** key, allowing you to choose which licensed applications are to be loaded when the analyzer program starts up. This dialog box has mouse buttons on it that do the job the softkeys normally do in the **System, Power On, Configure Applications** menu.

## Configure Applications - Remote Commands

The following topics provide details on using remote commands to configure the list of applications you want to load into the instrument memory or query the Virtual Memory utilization for your applications.

- "Configuration list (Remote Command Only)" on page 270
- "Configuration Memory Available (Remote Command Only)" on page 270
- "Configuration Memory Total (Remote Command Only)" on page 270
- "Configuration Memory Used (Remote Command Only)" on page 271
- "Configuration Application Memory (Remote Command Only)" on page 271

### Configuration list (Remote Command Only)

This remote command is used to set or query the list of applications to be loaded in-memory.

<b>Remote Command</b>	<code>:SYSTem:PON:APPLication:LLISt &lt;string of INSTRument:SElect names&gt;</code> <code>:SYSTem:PON:APPLication:LLISt?</code>
<b>Example</b>	<code>:SYST:PON:APPL:LLIS "SA,BASIC,WCDMA"</code>
Notes	<string of INSTRument:SElect names> are from the enums of the :INSTRument:SElect command. The order of the <INSTRument:SElect names> is the order that the applications are loaded into memory, and the order that they appear in the Mode Menu. Error message -225 "Out of Memory" is reported when more applications are listed than can reside in Virtual Memory. When this occurs, the existing applications load list is unchanged.
Preset	Not affected by Preset
State Saved	Not saved in instrument state
Initial S/W Revision	A.02.00

### Configuration Memory Available (Remote Command Only)

This remote command is used to query the amount of Virtual Memory remaining.

<b>Remote Command</b>	<code>:SYSTem:PON:APPLication:VMEMory[:AVAilable]?</code>
<b>Example</b>	<code>:SYST:PON:APPL:VMEM?</code>
Preset	Not affected by Preset
Initial S/W Revision	A.02.00

### Configuration Memory Total (Remote Command Only)

This remote command is used to query the limit of Virtual Memory allowed for applications.

<b>Remote Command</b>	<code>:SYSTem:PON:APPLication:VMEMory:TOTal?</code>
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<b>Example</b>	:SYST:PON:APPL:VMEM:TOT?
Preset	Not affected by Preset
Initial S/W Revision	A.02.00

### Configuration Memory Used (Remote Command Only)

This remote command is a query of the amount of Virtual Memory used by all measurement applications.

<b>Remote Command</b>	:SYSTem:PON:APPLication:VMEMemory:USED?
<b>Example</b>	:SYST:PON:APPL:VMEM:USED?
Preset	Not affected by Preset
Initial S/W Revision	A.02.00

### Configuration Application Memory (Remote Command Only)

This remote command is used to query the amount of Virtual Memory a particular application consumes.

<b>Remote Command</b>	:SYSTem:PON:APPLication:VMEMemory:USED:NAME? <INSTrument:SELEct name>
<b>Example</b>	:SYST:PON:APPL:VMEM:USED:NAME? CDMA2K
Notes	<INSTrument:SELEct name> is from the enums of the :INSTrument:SELEct command Value returned will be 0 (zero) if the name provided is invalid.
Preset	Not affected by Preset
Initial S/W Revision	Prior to A.02.00

## Alignments

The Alignments Menu controls and displays the automatic alignment of the instrument, and provides the ability to restore the default alignment values.

The current setting of the alignment system is displayed in the system Settings Panel along the top of the display, including a warning icon for conditions that may cause specifications to be impacted.



Key Path	System
Initial S/W Revision	Prior to A.02.00

### Auto Align

Configures the method for which the automatic background alignment is run.

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.

An Auto Align execution cannot be aborted with the Cancel (ESC) key. To interrupt an Auto Align execution, select **Auto Align Off**.

Key Path	<b>System, Alignments</b>
Mode	All
<b>Remote Command</b>	<b>:CALibration:AUTO ON LIGHT PARTial OFF</b> <b>:CALibration:AUTO?</b>
<b>Example</b>	: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 upon a “Restore System Defaults->Align”.
State Saved	No
Status Bits/OPC dependencies	When Auto Align is executing, bit 0 in the Status Operational register is set.
<b>Backwards Compatibility SCPI</b>	<b>:CALibration:AUTO ALERt</b> Parameter ALERt is for backward compatibility only and is mapped to PARTial
Backwards Compatibility Notes	<ol style="list-style-type: none"> <li>1. ESA SCPI for Auto Align is :CALibration:AUTO &lt;Boolean&gt;. The command for X-Series is an enumeration. Thus the parameters of “0” and “1” are not possible in X-Series.</li> <li>2. Similarly, the ESA SCPI for :CALibration:AUTO? returned the Boolean value 1 or 0, in X-Series it is an Enumeration (string). Thus, queries by customer applications into numeric variables will result in an error</li> <li>3. In PSA Auto Align OFF was not completely off, it is equivalent to PARTial in X-Series. In X-Series, OFF will be fully OFF. This means users of PSA SCPI who choose OFF may see degraded performance and should migrate their software to use PARTial.</li> </ol>
Initial S/W Revision	Prior to A.02.00

## Normal

Auto Align, Normal turns on the automatic alignment of all measurement systems. The Auto Align, Normal selection maintains the instrument in warranted operation across varying temperature and over time.

If the condition “Align Now, All required” is set, transition to Auto Align, Normal will perform the required alignments and clear the “Align Now, All required” condition and then continue 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.

When **Auto Align, Normal** is selected the Settings Panel indicates ALIGN AUTO.

Key Path	<b>System, Alignments, Auto Align</b>
Mode	All
<b>Example</b>	:CAL:AUTO ON

Notes	Alignment processing as a result of the transition to Normal will be executed sequentially. Thus, *OPC? or *WAI following CAL:AUTO ON will return when the alignment processing is complete.  The presence of an external signal may interfere with the RF portion of the alignment. If so, the Error Condition message "Align skipped: 50 MHz interference" or "Align skipped: 4.8 GHz interference" is reported, and bit 11 is set in the Status Questionable Calibration register. After the interfering signal is removed, subsequent alignment of the RF will clear the condition, and clear bit 11 in the Status Questionable Calibration register.
Readback Text	Normal
Status Bits/OPC dependencies	An interfering user signal may prevent automatic alignment of the RF subsystem. If this occurs, the Error Condition message "Align skipped: 50 MHz interference" or "Align skipped: 4.8 GHz interference" 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.
Initial S/W Revision	Prior to A.02.00

### Partial

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.

When **Auto Align, Partial** is selected the Settings Panel indicates ALIGN PARTIAL with a warning icon. The warning icon is to inform the operator that they are responsible for maintaining the warranted operation of the instrument

Key Path	<b>System, Alignments, Auto Align</b>
Mode	All
<b>Example</b>	:CAL:AUTO PART
Notes	Auto Align Partial begins the elapsed time counter for Auto Align Off time.
Readback Text	Partial
Initial S/W Revision	Prior to A.02.00

## 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 like 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.

When **Auto Align, Off** is selected the Settings Panel indicates ALIGN OFF with a warning icon. The warning icon is to inform the operator that they are responsible for maintaining the warranted operation of the instrument:

Key Path	<b>System, Alignments, Auto Align</b>
Mode	All
<b>Example</b>	:CAL:AUTO OFF
Notes	Auto Align Off begins the elapsed time counter for Auto Align Off time.
Couplings	Auto Align is set to Off if Restore Align Data is invoked.
Readback Text	Off
Initial S/W Revision	Prior to A.02.00

## All but RF

Auto Align, 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 Auto Align, All but RF ON is selected, the operator is responsible for performing an Align Now, RF when RF-related alignments expire. The Auto Align, Alert mechanism will notify the operator to perform an Align Now, All when the combination of time and temperature variation is exceeded.

When Auto Align, All but RF ON is selected the Settings Panel indicates ALIGN AUTO/NO RF with a warning icon (warning icon is intended to inform the operator they are responsible for the maintaining the RF alignment of the instrument):

Key Path	<b>System, Alignments, Auto Align</b>
Mode	All

<b>Remote Command</b>	:CALibration:AUTO:MODE ALL NRF :CALibration:AUTO:MODE?
<b>Example</b>	:CAL:AUTO:MODE NRF
Preset	This is unaffected by Preset but is set to ALL on a "Restore System Defaults->Align".
State Saved	No
Readback Text	RF or NRF
Initial S/W Revision	Prior to A.02.00

### Alert

The instrument will signal an Alert when conditions exist such that you will need to perform a full alignment (for example, Align Now, All). The Alert can be configured in one of four settings; Time & Temperature, 24 hours, 7 days, or None. A confirmation is required when a selection other than Time & Temperature is chosen. This prevents accidental deactivation of alerts.

With Auto Align set to Normal, the configuration of Alert is not relevant because the instrument's software maintains the instrument in warranted operation.

Key Path	<b>System, Alignments, Auto Align</b>
Mode	All
<b>Remote Command</b>	:CALibration:AUTO:ALERT TTEMperature DAY WEEK NONE :CALibration:AUTO:ALERT?
<b>Example</b>	:CAL:AUTO:ALERTTEM
Notes	The alert that alignment is needed is the setting of bit 14 in the Status Questionable Calibration register.
Preset	This is unaffected by Preset but is set to TTEMperature on a "Restore System Defaults->Align".
State Saved	No
Status Bits/OPC dependencies	The alert is the Error Condition message "Align Now, All required" and bit 14 is set in the Status Questionable Calibration register.
Initial S/W Revision	Prior to A.02.00

### Time & Temperature

With Auto Align Alert set to Time & Temperature the instrument will signal 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 analyzer alignment is sufficiently up-to-date to maintain warranted accuracy.

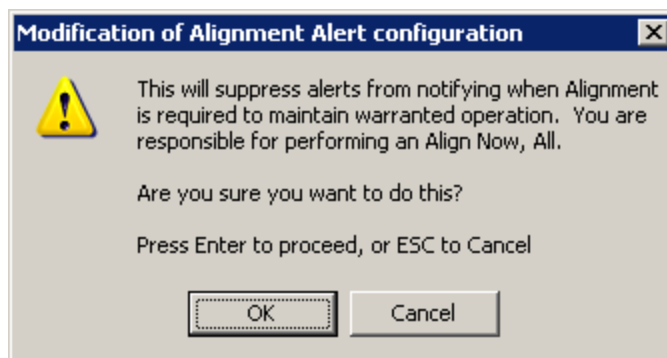
Key Path	<b>System, Alignments, Auto Align, Alert</b>
Mode	All
<b>Example</b>	:CAL:AUTO:ALERTTEM
Readback Text	Time & Temp

Status Bits/OPC dependencies	Bit 14 is set in the Status Questionable Calibration register.
Initial S/W Revision	Prior to A.02.00

## 24 hours

With Auto Align Alert set to 24 Hours the instrument will signal 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 choose this selection 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”.

For front-panel operation, confirmation is required to transition into this setting of Alert. The confirmation dialog is:



No confirmation is required when Alert is configured through a remote command.

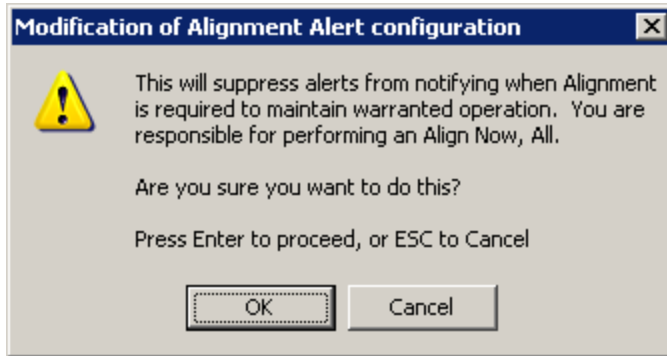
Key Path	<b>System, Alignments, Auto Align, Alert</b>
Mode	All
<b>Example</b>	:CAL:AUTO:ALER DAY
Readback Text	24 hours
Status Bits/OPC dependencies	Bit 14 is set in the Status Questionable Calibration register.
Initial S/W Revision	Prior to A.02.00

## 7 days

With Auto Align Alert is set to 7 days the instrument will signal 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 choose this selection 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”.



For front panel operation, confirmation is required for the customer to transition into this setting of Alert. The confirmation dialog is:



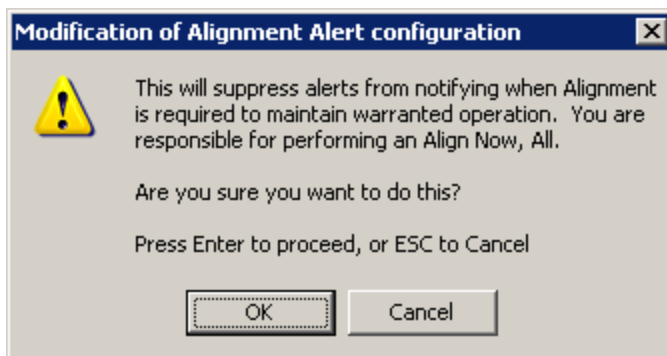
No confirmation is required when Alert is configured through a remote command.

Key Path	<b>System, Alignments, Auto Align, Alert</b>
Mode	All
<b>Example</b>	:CAL:AUTO:ALER WEEK
Readback Text	7 days
Status Bits/OPC dependencies	Bit 14 is set in the Status Questionable Calibration register.
Initial S/W Revision	Prior to A.02.00

### None

With Auto Align Alert set to None the instrument will not signal an alert. This is provided for rare occasions where you are making a long measurement which 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.

For front panel operation, confirmation is required to transition into this setting of Alert. The confirmation dialog is:



No confirmation is required when Alert is configured through a remote command.

Key Path	<b>System, Alignments, Auto Align, Alert</b>
Mode	All
<b>Example</b>	:CAL:AUTO:ALER NONE
Initial S/W Revision	Prior to A.02.00

### Execute Expired Alignments (Remote Command Only)

Alignments can be expired in the situation where Auto Align is in the state of Partial or Off. This feature runs the alignments that have expired. This is different than performing an Align All, Now operation. Align All, Now performs an alignment of all subsystems regardless of whether they are needed or not, with Execute Expired Alignments, only the individual subsystems that have become due are aligned.

Mode	All
<b>Remote Command</b>	:CALibration:EXPIred?
<b>Example</b>	:CAL:EXP?
Notes	:CALibration:EXPIred? returns 0 if successful :CALibration:EXPIred? returns 1 if failed
Initial S/W Revision	Prior to A.02.00

### Align Now

Accesses alignment processes that are immediate action operations. They perform complete operations and run until they are complete.

Key Path	<b>System, Alignments</b>
Initial S/W Revision	Prior to A.02.00

### All

(In MXE the key label is “**All (plus RF Presel 20 Hz – 3.6 GHz)**”) Immediately executes an alignment of all subsystems.

In MXE, the Align Now All is followed by additionally aligning the RF Preselector section, so in MXE, the key label contains the parenthetical note “(plus RF Presel 20 Hz – 3.6 GHz)”. 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 skipped: 50 MHz interference” or “Align skipped: 4.8 GHz interference” 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.

In the MXE, successful completion will also clear the “Align 20 Hz to 30 MHz required” Error Condition, the “Align 30 MHz to 3.6 GHz required” Error Condition, and the “Align 20 Hz to 3.6 GHz required” Error Condition, and clear bits 1 and bit 2 and clear the bit 1 in the Status Questionable Calibration Extended Needed register.

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 skipped: 50 MHz interference” and “Align skipped: 4.8 GHz interference” 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 analyzer will immediately start to update only the alignments that have expired, thus efficiently restoring the alignment process.

Key Path	<b>System, Alignments, Align Now</b>
Mode	All
<b>Remote Command</b>	:CALibration[:ALL] :CALibration[:ALL]?
<b>Example</b>	:CAL
Notes	:CALibration[:ALL]? returns 0 if successful :CALibration[:ALL]? returns 1 if failed :CALibration[:ALL]? is the same as *CAL? While Align Now, All 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 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.
Initial S/W Revision	Prior to A.02.00

Mode	All
<b>Remote Command</b>	<b>*CAL?</b>
<b>Example</b>	<b>*CAL?</b>
Notes	*CAL? returns 0 if successful *CAL? returns 1 if failed :CALibration[:ALL]? is the same as *CAL? See additional remarks described with :CALibration[:ALL]? Everything about :CALibration[:ALL]? is synonymous with *CAL? including all conditions, status register bits, and couplings
Initial S/W Revision	Prior to A.02.00

Mode	All
<b>Remote Command</b>	<b>:CALibration[:ALL]:NPENding</b>
<b>Example</b>	<b>CAL:NPEN</b>
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 the user should use status register bits to query if 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, the user 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
Initial S/W Revision	X.14.20

### All but RF

(In MXE the key label is “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 analyzer input.

The query form of the remote commands (:CALibration:NRF?) will invoke the alignment and return a success or failure value.

Successful completion of Align Now, All but RF will clear the “Align Now, All required” Error Condition, and clear bit 14 in the Status Questionable Calibration register. If “Align Now, All required” was in effect prior to executing the 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.

In models with the RF Preselector, such as the N9038A, the “All but RF” alignment will execute an alignment of all subsystems except the RF subsystem of the Spectrum Analyzer, as well as the system gain of the RF Preselector.

Key Path	<b>System, Alignments, Align Now</b>
Mode	All
<b>Remote Command</b>	<b>:CALibration:NRF</b> <b>:CALibration:NRF?</b>
<b>Example</b>	:CAL:NRF
Notes	:CALibration:NRF? returns 0 if successful :CALibration:NRF? returns 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 will clear bit 14 in the Status Questionable Calibration register and set 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	Bits 12 or 14 may be set in the Status Questionable Calibration register.

dependencies	
Initial S/W Revision	Prior to A.02.00
Mode	
Mode	All
<b>Remote Command</b>	<b>:CALibration:NRF:NPENding</b>
<b>Example</b>	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 the user should use status register bits to query if 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, the user 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)
Initial S/W Revision	X.14.20

## RF

(In MXE the key label is “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 skipped: 50 MHz interference” or “Align skipped: 4.8 GHz interference”, 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?) will invoke the alignment of the RF subsystem and return a success or failure value. An interfering user signal is grounds for failure.

Successful completion of Align Now, RF will begin 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.

In models with the RF Preselector, such as the N9038A, the RF alignment will execute an alignment of the RF subsystem of the Spectrum Analyzer, as well as the RF subsystem on RF Preselector path.

Key Path	<b>System, Alignments, Align Now</b>
Mode	All
<b>Remote Command</b>	<b>:CALibration:RF</b> <b>:CALibration:RF?</b>
<b>Example</b>	:CAL:RF
Notes	:CALibration:RF? returns 0 if successful :CALibration:RF? returns 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, 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 the Error Conditions "Align skipped: 50 MHz interference" and "Align skipped: 4800 MHz interference" 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 will generate the Error Condition message "Align RF failed" and set bit 3 in the Status Questionable Calibration register. An interfering user signal will result in bits 11 and 12 to be 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, 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.
Initial S/W Revision	Prior to A.02.00
Mode	All
<b>Remote Command</b>	<b>:CALibration:RF:NPENDING</b>
<b>Example</b>	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 the user should use status register bits to query if 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, the user 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)
Initial S/W Revision	X.14.20

## 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 form of the remote commands (:CALibration:EMIXer?) will invoke the alignment of the External Mixer and return a success or failure value.

Key Path	<b>System, Alignments, Align Now</b>
Mode	All
<b>Remote Command</b>	<b>:CALibration:EMIXer</b> <b>:CALibration:EMIXer?</b>
<b>Example</b>	:CAL:EMIX
Notes	:CAL:EMIX? returns 0 if successful :CAL:EMIX? returns 1 if failed While Align Now, Ext Mix 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. A failure encountered during alignment will generate the Error Condition message "Align LO failed" and set bit 5 in the Status Questionable Calibration register. Successful completion will clear the "Align LO failed" message and bit 5 in the Status Questionable Calibration register.
Dependencies	This key 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.
Initial S/W Revision	A.08.00

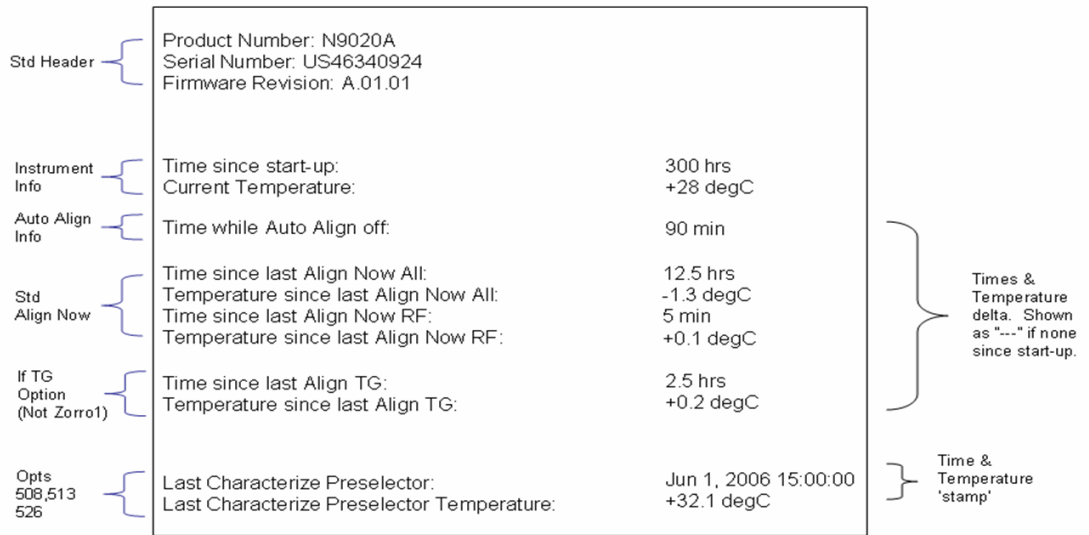
## Show Alignment Statistics

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.

An example of the Show Alignment Statistics screen would be similar to:





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.

Key Path	<b>System, Alignments</b>
Mode	All
Notes	The values displayed on the screen are only updated upon entry to the screen and not updated while the screen is being displayed.
Initial S/W Revision	Prior to A.02.00

Key Path	<b>Visual annotation in the Show Alignment Statistics screen</b>
Mode	All
<b>Remote Command</b>	<b>:SYSTem:PON:TIME?</b>
<b>Example</b>	<b>:SYST:PON:TIME?</b>
Notes	Value is the time since the most recent start-up in seconds.
State Saved	No
Initial S/W Revision	Prior to A.02.00

Key Path	<b>Visual annotation in the Show Alignment Statistics screen</b>
Mode	All
<b>Remote Command</b>	<b>:CALibration:TEMPerature:CURRent?</b>
<b>Example</b>	<b>:CAL:TEMP:CURR?</b>

Notes	Value is in degrees Centigrade. Value is invalid if using default alignment data (Align Now, All required)
State Saved	No
Initial S/W Revision	Prior to A.02.00

Key Path	<b>Visual annotation in the Show Alignment Statistics screen</b>
Mode	All
<b>Remote Command</b>	<b>:CALibration:TIME:LALL?</b>
<b>Example</b>	:CAL:TIME:LALL?
Notes	Value is the elapsed time, in seconds, since the last successful Align Now, All or Align Now, All but RF was executed.
State Saved	No
Initial S/W Revision	Prior to A.02.00

Key Path	<b>Visual annotation in the Show Alignment Statistics screen</b>
Mode	All
<b>Remote Command</b>	<b>:CALibration:TEMPerature:LALL?</b>
<b>Example</b>	:CAL:TEMP:LALL?
Notes	Value is in degrees Centigrade at which the last successful Align Now, All or Align Now, All but RF was executed.
State Saved	No
Initial S/W Revision	Prior to A.02.00

Key Path	<b>Visual annotation in the Show Alignment Statistics screen</b>
Mode	All
<b>Remote Command</b>	<b>:CALibration:TIME:LRF?</b>
<b>Example</b>	:CAL:TIME:LRF?
Notes	Value is the elapsed time, in seconds, since the last successful Align Now, RF was executed, either individually or as a component of Align Now, All.
State Saved	No
Initial S/W Revision	Prior to A.02.00

Key Path	<b>Visual annotation in the Show Alignment Statistics screen</b>
Mode	All

<b>Remote Command</b>	:CALibration:TEMPerature:LRF?
<b>Example</b>	:CAL:TEMP:LRF?
Notes	Value is in degrees Centigrade at which the last successful Align Now, RF was executed, either individually or as a component of Align Now, All.
State Saved	No
Initial S/W Revision	Prior to A.02.00

Key Path	<b>Visual annotation in the Show Alignment Statistics screen</b>
Mode	All
<b>Remote Command</b>	:CALibration:TIME:LPReselector?
<b>Example</b>	:CAL:TIME:LPR?
Notes	Value is the date and time the last successful Characterize Preselector was executed. The date is separated from the time by a space character. Returns "" if no Characterize Preselector has ever been performed on the instrument.
Dependencies	In models that do not include preselectors, this command is not enabled and any attempt to set or query will yield an error.
State Saved	No
Initial S/W Revision	Prior to A.02.00

Key Path	<b>Visual annotation in the Show Alignment Statistics screen</b>
Mode	All
<b>Remote Command</b>	:CALibration:TEMPerature:LPReselector?
<b>Example</b>	:CAL:TEMP:LPR?
Notes	Value is in degrees Centigrade at which the last successful Characterize Preselector was executed.
Dependencies	In models that do not include preselectors, this command is not enabled and any attempt to set or query will yield an error.
State Saved	No
Initial S/W Revision	Prior to A.02.00

Key Path	<b>Visual annotation in the Show Alignment Statistics screen</b>
Mode	All
<b>Remote Command</b>	:CALibration:AUTO:TIME:OFF?
<b>Example</b>	:CAL:AUTO:TIME:OFF?
Notes	Value is the elapsed time, in seconds, since Auto Align has been set to Off or Off with Alert. The value is 0 if Auto Align is ALL or NORF.

State Saved	No
Initial S/W Revision	Prior to A.02.00

Key Path	<b>Visual annotation in the Show Alignment Statistics screen</b>
Mode	All (N9038A only)
<b>Remote Command</b>	<b>:CALibration:TIME:RFPSelector:LCONducted?</b>
<b>Example</b>	:CAL:TIME:RFPS:LCON?
Notes	Values are the date and time the last successful Align Now, 20 Hz – 30 MHz was executed. The date is separated from the time by a semi-colon character.
State Saved	No

Key Path	<b>Visual annotation in the Show Alignment Statistics screen</b>
Mode	All (N9038A only)
<b>Remote Command</b>	<b>:CALibration:TEMPerature:RFPSelector:LCONducted?</b>
<b>Example</b>	:CAL:TEMP:RFPS:LCON?
Notes	Value is in degrees Centigrade at which the last successful Align Now, 20 Hz – 30 MHz was executed.
State Saved	No

Key Path	<b>Visual annotation in the Show Alignment Statistics screen</b>
Mode	All (N9038A only)
<b>Remote Command</b>	<b>:CALibration:TIME:RFPSelector:LRADiated?</b>
<b>Example</b>	:CAL:TIME:RFPS:LRAD?
Notes	Value is the date and time the last successful Align Now, 30 MHz – 3.6 GHz was executed. The date is separated from the time by a semi-colon character.
State Saved	No

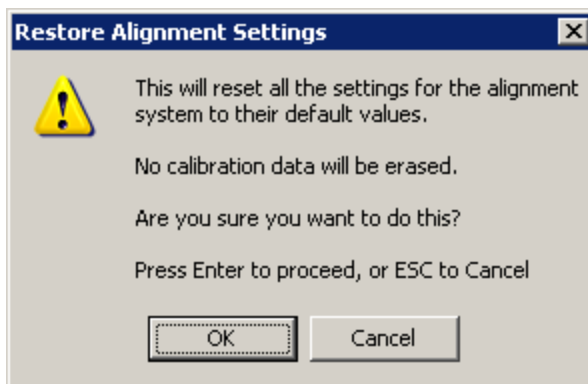
Key Path	<b>Visual annotation in the Show Alignment Statistics screen</b>
Mode	All (N9038A only)
<b>Remote Command</b>	<b>:CALibration:TEMPerature:RFPSelector:LRADiated?</b>
<b>Example</b>	:CAL:TEMP:RFPS:LRAD?
Notes	Value is in degrees Centigrade at which the last successful Align Now, 30 MHz – 3.6 GHz was executed.
State Saved	No

Key Path	Visual annotation in the Show Alignment Statistics screen
Mode	All (N9038A only)
<b>Remote Command</b>	<b>:CALibration:RFPSelector:Scheduler:TIME:NEXT?</b> This query returns data using the following format "YYYY/MM/DD; HH:MM:SS"
<b>Example</b>	:CAL:RFPS:SCH:TIME:NEXT?
Notes	For model N9038A only. The next run time will be updated based on the start date/time and recurrence set by the users. "date" is representation of the date the task will run in the form of "YYYY/MM/DD" where: <ul style="list-style-type: none"> <li>- YYYY is the four digit representation of year. (for example, 2009)</li> <li>- MM is the two digit representation of month. (for example, 01 to 12)</li> <li>- DD is the two digit representation of the day. (for example, 01 to 28, 29, 30 or 31 depending on the month and year)</li> </ul> "Time" is a representation of the time of day the task will run in the form of "HH:MM:SS" where: <ul style="list-style-type: none"> <li>- HH is the two digit representation of the hour in 24 hour format</li> <li>- MM is the two digit representation of minute</li> <li>- SS is the two digit representation of seconds</li> </ul>
State Saved	No

### Restore Align Defaults

Initializes the alignment user interface settings, not alignment data, to the factory default values. Align Now, All must be executed if the value of the Timebase DAC results in a change.

For front panel operation, you are prompted to confirm action before setting the alignment parameters to factory defaults:



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

Key Path	<b>System, Alignments</b>
Mode	All
<b>Example</b>	:SYST:DEF ALIG
Notes	Alignment processing that results as the transition to Auto Alignment Normal will be executed sequentially; thus *OPC? or *WAI will wait until the alignment processing is complete.
Initial S/W Revision	Prior to A.02.00

### Backup or Restore Align Data...

Opens the utility for backing-up or restoring the alignment data.

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 the operator to navigate to any location of the Windows file system. It is intended that the operator use a USB memory device or Mapped Network Drive to back up the alignment data to storage outside of the instrument.**

The PC6 and PC7 CPUs contain a removable SD memory card. With one of these CPU's installed the Backup and Restore Alignment Data wizard will default 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 SSD. In such situations, before the application is loaded the operator will be given the opportunity to restore the data from the backup. If the operator responds "Yes", the Backup and Restore Alignment Data wizard will be invoked to perform the restore.

Key Path	<b>System, Alignments</b>
Initial S/W Revision	A.02.00

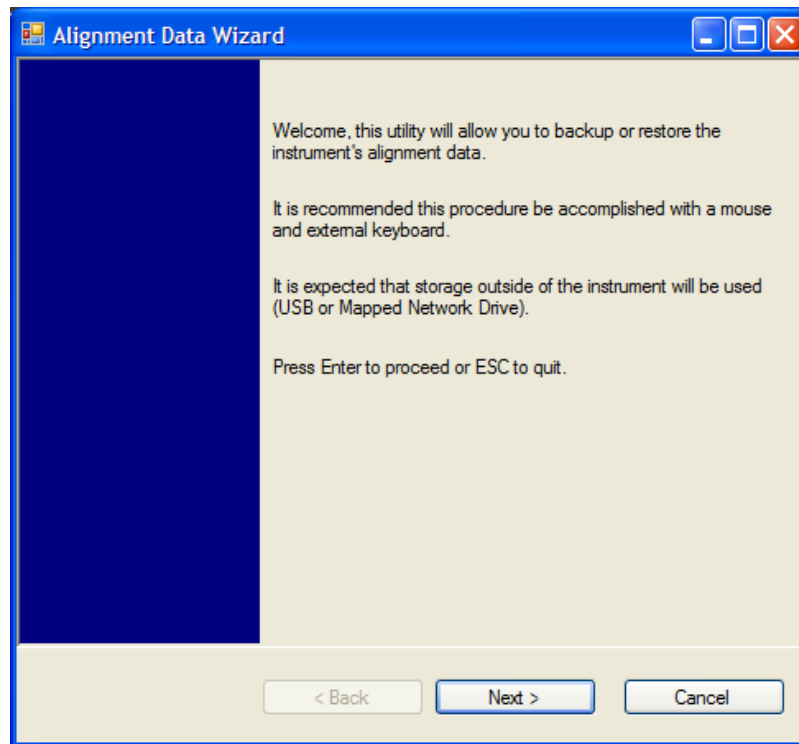
Key Path	<b>System, Alignments</b>
----------	---------------------------

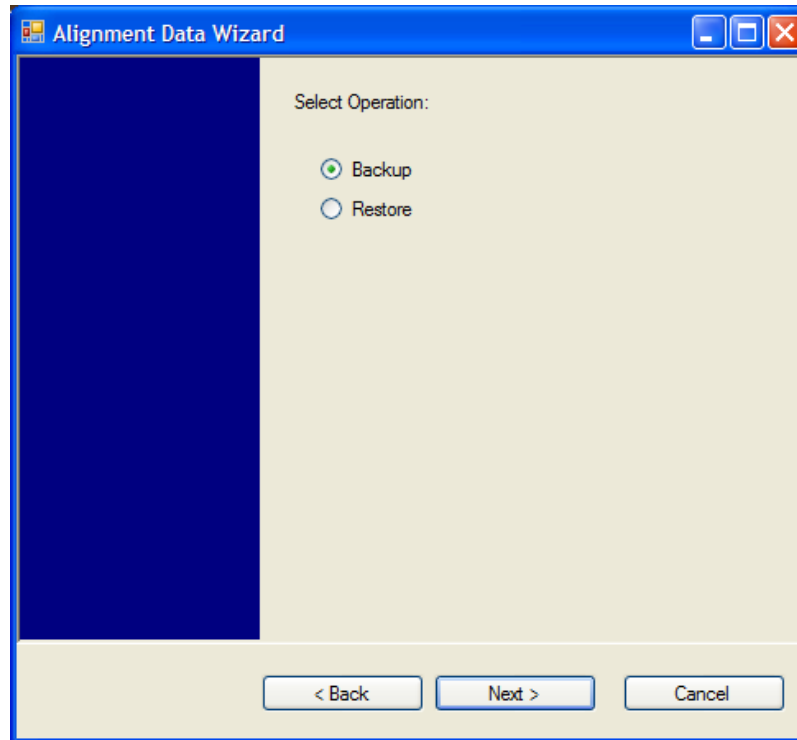
Mode	All
<b>Remote Command</b>	<b>:CALibration:DATA:DEFault</b>
<b>Example</b>	:CAL:DATA:DEF
Couplings	Sets Auto Align to Off. Sets bit 14 in the Status Questionable Calibration register. The Error Condition message "Align Now, All required" is generated.
Initial S/W Revision	Prior to A.02.00

### Alignment Data Wizard

The Backup or Restore Alignment Data wizard guides you through the operation of backing-up or restoring the alignment data.

The following dialog boxes operate without a mouse or external keyboard when you use the default file names.



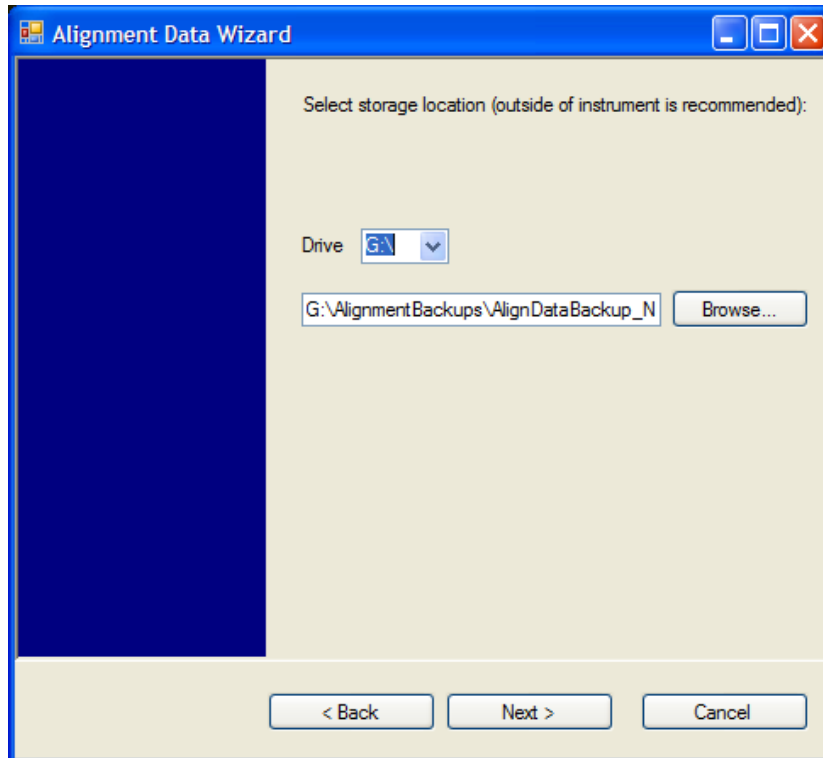


The backup screen indicates the approximate amount of space required to contain the backup file.

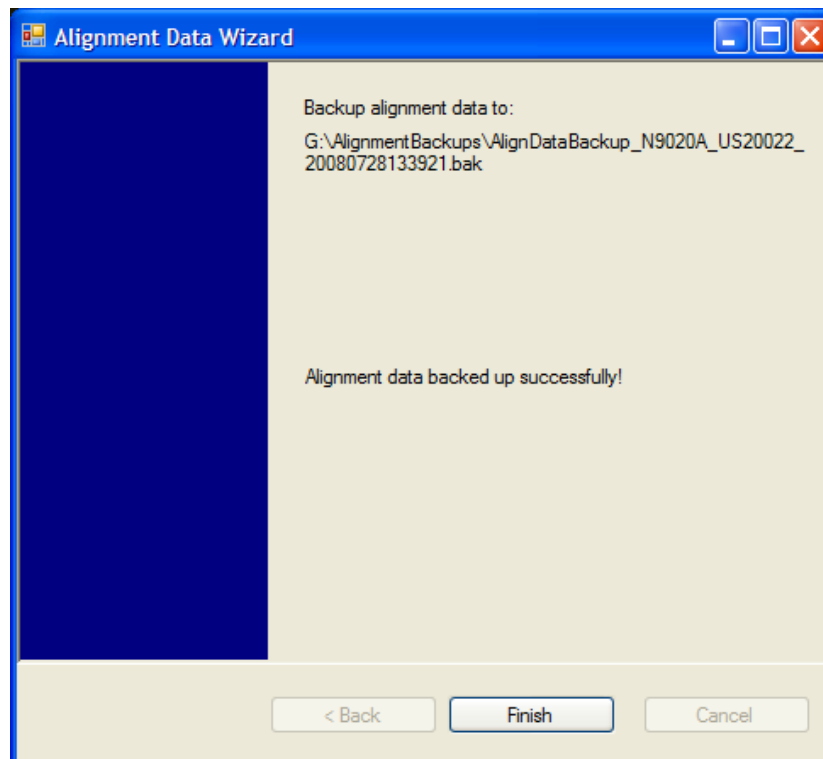
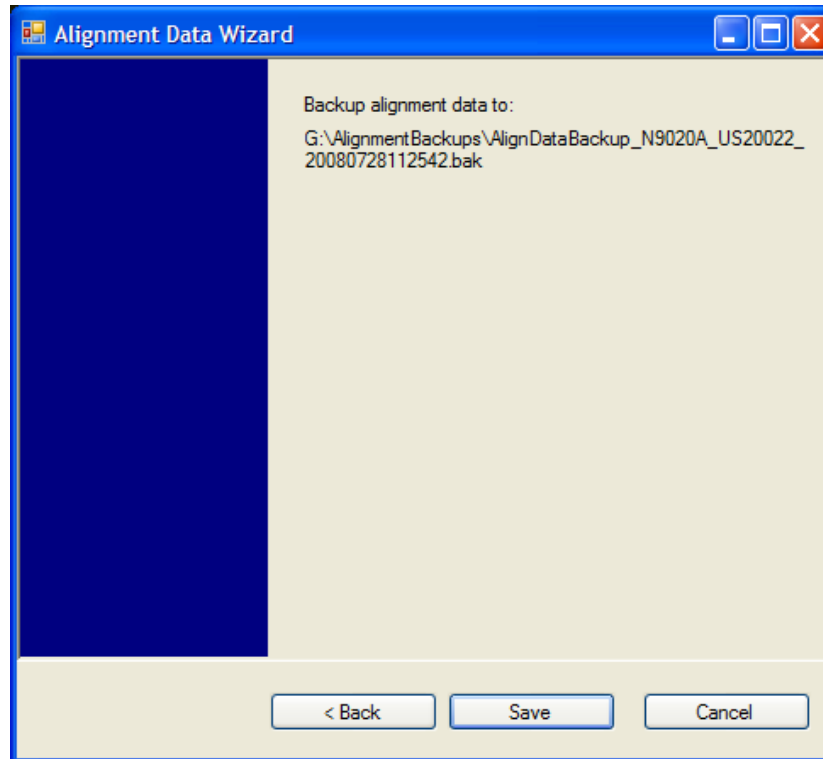
The default file name will be AlignDataBackup\_<model number>\_<serial number>\_<date in YYYYMMDDHHMMSS>.bak.

The default backup location will be first drive identified as an external drive (USB or LAN) if such is available; if not, the internal D: partition will be selected.



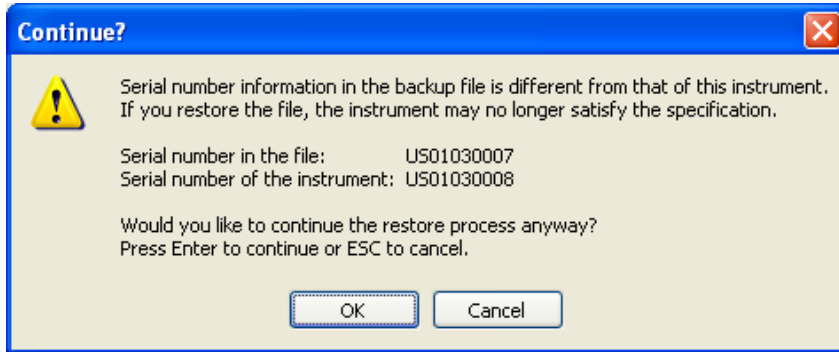


Changing the drive letter will also modify the path displayed in the box below. When this step is first loaded, the drive drop-down menu is populated with connected drives, which provide the user with write access. If there are many unreachable network drives connected to the instrument, this step can take a few seconds. 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 of AlignDataBackup\_<model>\_<serial number>\_<date><time>. When the "Next >" button is pressed, you will be prompted to create a new folder if the chosen path does not yet exist.

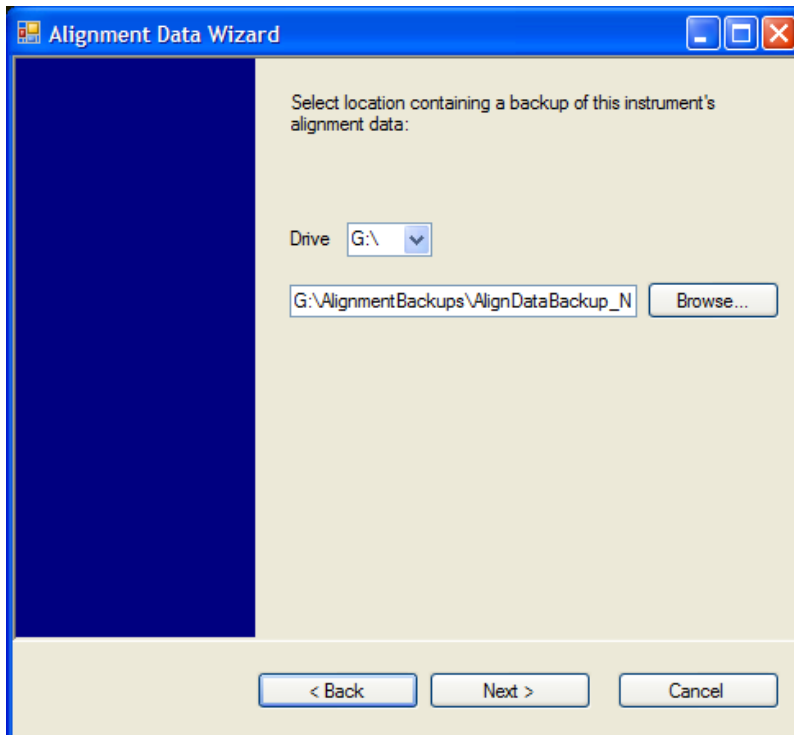


The restore operation checks the validity of the restore file using the database's built-in file validation. If the restore file is corrupt, the existing alignment data will remain in use.

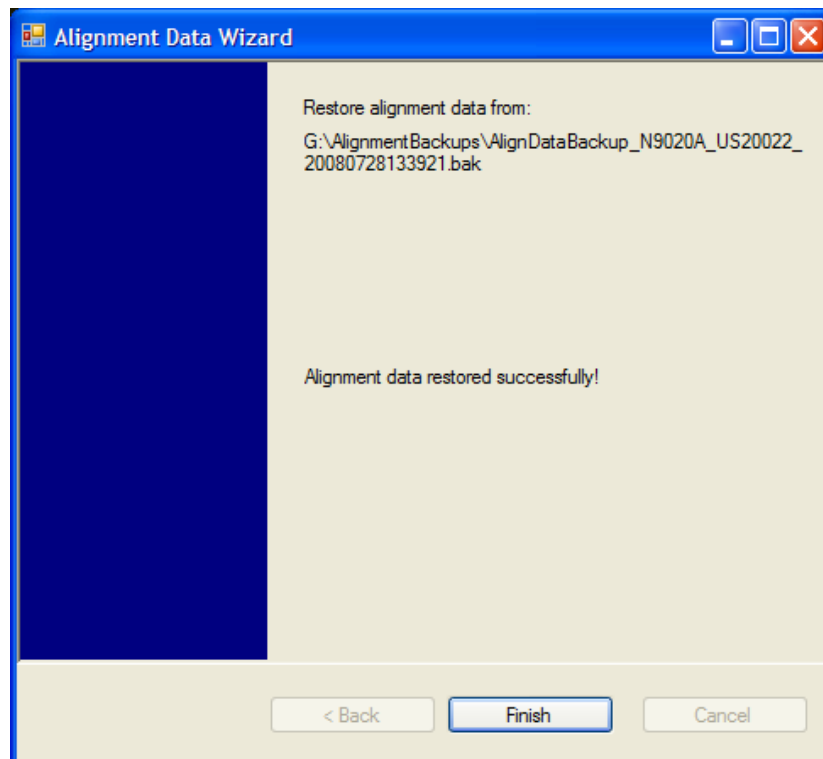
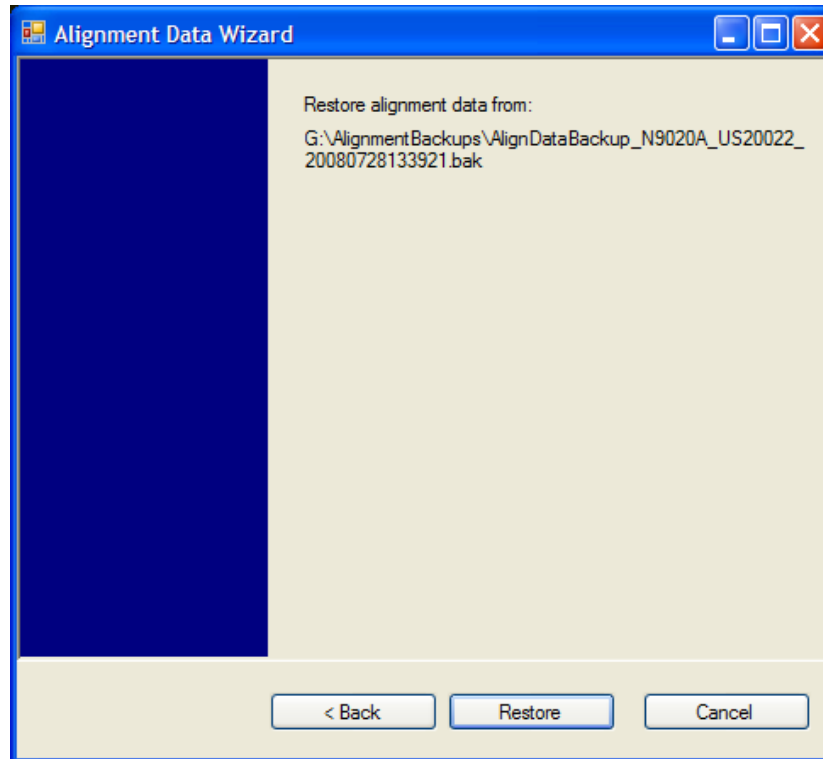
If the serial number information in the backup file being restored is different from that of the instrument, the following message appears (the serial number shown are examples):



The default restore location will be first drive identified as an external drive (USB or LAN) if such is available; if not, the internal D: partition will be selected. The default restore file will be the most recent file that matches the default backup file name format: AlignDataBackup\_<model number>\_<serial number>\_<date>.bak



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 \*.bak file in the folder will also be selected by default.



### Perform Backup (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).

<b>Remote Command</b>	:CALibration:DATA:BACKup <filename>
<b>Example</b>	:CAL:DATA:BACK "F:\AlignDataBackup_N9020A_US00000001_2008140100.bak"
Initial S/W Revision	A.02.00

### Perform Restore (Remote Command Only)

Invokes an alignment data restore operation from the provided filename.

<b>Remote Command</b>	:CALibration:DATA:RESTore <filename>
<b>Example</b>	:CAL:DATA:REST "F:\AlignDataBackup_N9020A_US00000001_2008140100.bak "
Initial S/W Revision	A.02.00

### 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

Key Path	System, Alignments
Initial S/W Revision	Prior to A.02.00

### 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 form of the remote commands (:CALibration:YTF?) will invoke the alignment of the YTF subsystem and return a success or failure value.

A failure encountered during alignment will generate the Error Condition message "Characterize Preselector failure" and set bit 3 in the STATus:QUESTionable:CALibration:EXTended:FAILure status register. Successful

completion of Characterize Preselector will clear this Condition. It will also begin the elapsed time counter for Last Characterize Preselector Time, and capture 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.

Key Path	System, Alignments, Advanced
Mode	All
<b>Remote Command</b>	:CALibration:YTF :CALibration:YTF?
<b>Example</b>	:CAL:YTF
Notes	:CALibration:YTF? returns 0 if successful :CALibration:YTF? returns 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, 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 9 in the Status Questionable Calibration register. A failure encountered during alignment will generate the Error Condition message "Characterize Preselector failed" and set bit 9 in the Status Questionable Calibration register. For Options that support frequencies > 3.6 GHz only.
Dependencies	This key 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.
Initial S/W Revision	Prior to A.02.00

Mode	All
<b>Remote Command</b>	:CALibration:YTF:NPending
<b>Example</b>	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 the user 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, the user should repeat this scpi query until the bit is cleared )  
 3) :STATus:QUESTionable:CALibration:EXTended:FAILure:CONDition? (Check if bit 2 is set or not. If this bit is set, that means there are some errors in previous internal source calibration)

Initial S/W Revision X.14.20

### Characterize Reference Clock

Characterizing the reference clock is calibrating 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 300

Key Path	System, Alignments, Advanced
Mode	All
<b>Remote Command</b>	:CALibration:REference:CLOCK?
<b>Example</b>	:CAL:REF:CLOC:INIT? //connect cable :CAL:REF:CLOC? //disconnect cable :CAL:REF:CLOC:END?
Notes	:CALibration:REference:CLOCK? returns 0 if successful :CALibration:REference:CLOCK? returns 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.
Initial S/W Revision	A.13.00

Parameter Name	Characterize Reference Clock Initialization
Mode	All
<b>Remote Command</b>	:CALibration:REference:CLOCK:INITialize?
<b>Example</b>	:CAL:REF:CLOC:INIT?
Notes	:CALibration:REference:CLOCK:INIT? returns 0 if successful :CALibration:REference:CLOCK:INIT? returns 1 if failed

Dependencies	Option DP2 or B40
Couplings	Expected to be run before sending the :CAL:REF:CLOC? command. This will stop the current measurement when it has completed (does not abort the current data acquisition), and it will prepare the instrument for the expected cabling.
Force Restart	Yes
Initial S/W Revision	A.12.00

Parameter Name	Characterize Reference Clock End
Mode	All
<b>Remote Command</b>	<b>:CALibration:REference:CLOCK:END?</b>
<b>Example</b>	:CAL:REF:CLOC:END?
Notes	:CALibration:REference:CLOCK:END? returns 0 if successful :CALibration:REference:CLOCK:END? returns 1 if failed
Dependencies	Option DP2 or B40
Couplings	Expected to be run after sending the :CAL:REF:CLOC? command, and after removing the cable used in that Characterize Reference Clock step. This will resume any queued measurements, and it concludes the reference clock characterization.
Force Restart	Yes
Initial S/W Revision	A.12.00

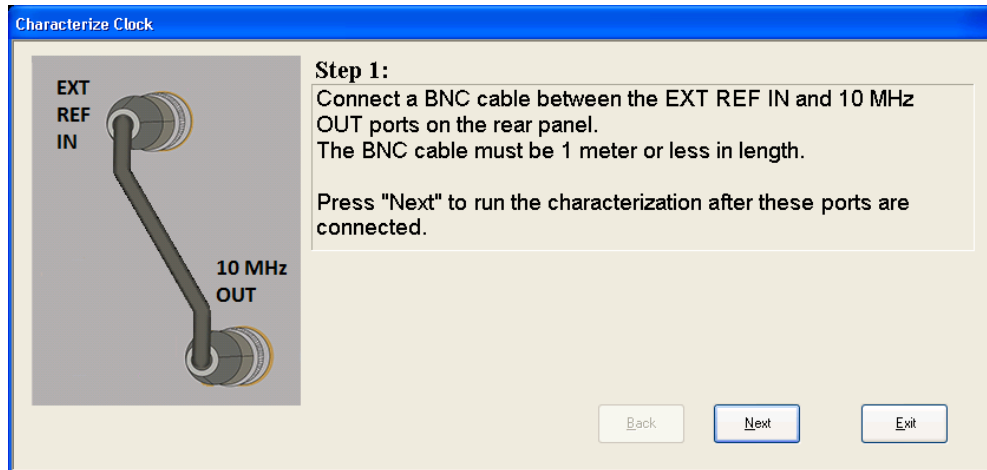
Parameter Name	Last Characterize Reference Clock
Key Path	<b>Visual annotation in the Show Alignment Statistics screen</b>
Parameter Type	String
Mode	All
<b>Remote Command</b>	<b>:CALibration:TIME:REference:CLOCK?</b>
<b>Example</b>	:CAL:TIME:REference:CLOCK?
Notes	Value is the date and time the last 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
Initial S/W Revision	A.12.00

### Front panel guided calibration sequence

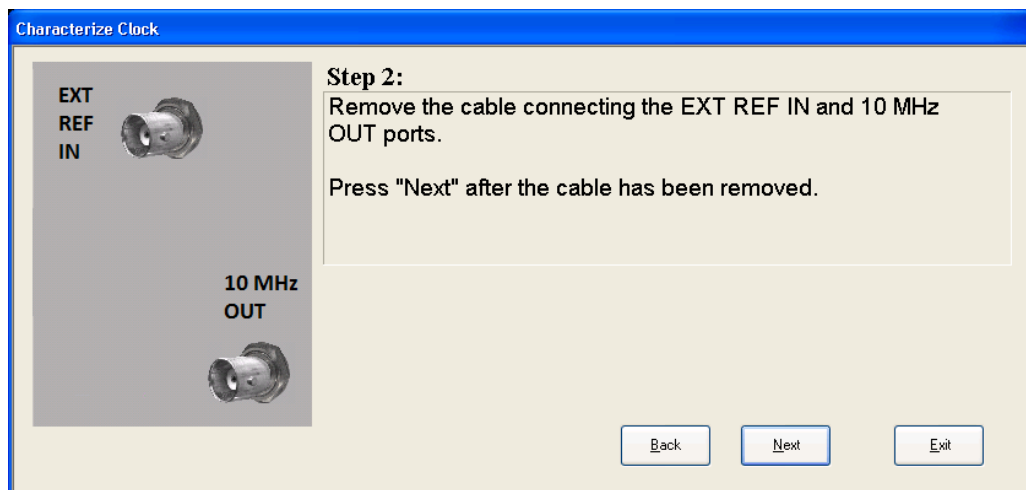
When selecting "Characterize Reference Clock" through the front panel, the following form will be shown.

Step 1 of the guided calibration sequence:

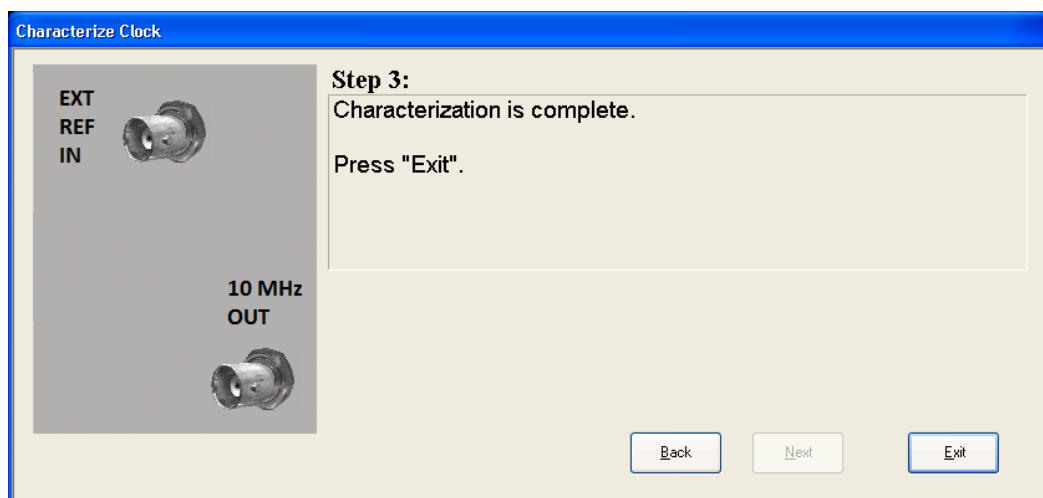




Step 2 of the guided calibration sequence:



Step 3 of the guided calibration sequence:



## 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 the **Characterize Noise Floor** key. When you press this key, the instrument stops any measurement currently underway, and a dialog appears with an OK and Cancel button which 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 analyzer 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 NFE 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 analyzer 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 analyzer will display a “Characterize Noise Floor required” message and set bit 12 in the Status Questionable Calibration register (STATus:QUEStionable:CALibration:EXTended:NEEDed).

Key Path	System, Alignments, Advanced
Mode	All
<b>Remote Command</b>	:CALibration:NFLoor :CALibration:NFLoor?
<b>Example</b>	:CAL:NFL
Notes	:CALibration:NFLoor? returns 0 if successful :CALibration:NFLoor? returns 1 if failed (including interfering user signal) While Characterize Noise Floor is performing the alignment, bit ? in the Status Operation register is set. Completion, or termination, will clear bit ? in the Status Operation register. This command is sequential; it must complete before further SCPI commands are processed.

	<p>Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the :ABORt command.</p> <p>A failure encountered during characterization will generate the Error Condition message "Characterize Noise Floor failed" message and set bit ? in the Status Questionable Calibration register. Successful completion will clear bit ? in the Status Questionable Calibration register.</p>
Dependencies	This key does not appear in models that do not contain NFE. In these models the SCPI command is accepted without error but no action is taken.
Couplings	Successful completion of Characterize Noise Floor will begin the elapsed time counter or the Last Characterize Noise Floor Time.
Initial S/W Revision	A.14.00

Key Path	<b>Visual annotation in the Show Alignment Statistics screen</b>
Mode	All
<b>Remote Command</b>	<b>:CALibration:TIME:NFLoor?</b>
<b>Example</b>	: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 NFE, this command is not enabled and any attempt to set or query will yield an error.
State Saved	No
Initial S/W Revision	A.14.00

Key Path	<b>Visual annotation in the Show Alignment Statistics screen</b>
Mode	All
<b>Remote Command</b>	<b>:CALibration:TEMPerature:NFLoor?</b>
<b>Example</b>	: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 NFE, this command is not enabled and any attempt to set or query will yield an error.
State Saved	No
Initial S/W Revision	A.14.00

Key Path	<b>Visual annotation in the Show Alignment Statistics screen</b>
Mode	All
<b>Remote Command</b>	<b>:CALibration:TIME:ELAPsed:NFLoor?</b>

<b>Example</b>	: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 NFE, this command is not enabled and any attempt to set or query will yield an error.
State Saved	No
Initial S/W Revision	A.14.00

### Timebase DAC

Allows control of the internal 10 MHz reference oscillator timebase. This may be used to adjust for minor frequency alignment between the signal 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 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.

Key Path	<b>System, Alignments</b>
Mode	All
<b>Remote Command</b>	:CALibration:FREquency:REference:MODE CALibrated USER :CALibration:FREquency:REference:MODE?
<b>Example</b>	:CAL:FREQ:REF:MODE CAL
Notes	If the value of the timebase is changed the alignment system automatically performs an alignment or alerts that an alignment is due. 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 CALibrated on a "Restore System Defaults->Align".
State Saved	No
Initial S/W Revision	Prior to A.02.00

### Calibrated

Sets the Timebase DAC to the value established during factory or field calibration. The value displayed on the menu key is the calibrated value.

Key Path	<b>System, Alignments, Timebase DAC</b>
Mode	All
<b>Example</b>	:CAL:FREQ:REF:MODE CAL
Readback Text	[xxx] < where xxx is the calibrated value
Initial S/W Revision	Prior to A.02.00

## User

Allows setting the Timebase DAC to a value other than the value established during the factory or field calibration. The value displayed on the menu key is the calibrated value.

Key Path	<b>System, Alignments, Timebase DAC</b>
Mode	All
<b>Example</b>	:CAL:FREQ:REF:MODE USER
Readback Text	xxx < where xxx is the Timebase DAC setting
Initial S/W Revision	Prior to A.02.00

Key Path	<b>System, Alignments, Timebase DAC</b>
Mode	All
<b>Remote Command</b>	:CALibration:FREQuency:REFerence:FINE <integer> :CALibration:FREQuency:REFerence:FINE?
<b>Example</b>	:CAL:FREQ:REF:FINE 8191
Notes	If the value of the timebase is changed the alignment system automatically performs an alignment or alerts that an alignment is due.
Couplings	Setting :CAL:FREQ:REF:FINE sets :CAL:FREQ:REF:MODE USER
Preset	This is unaffected by Preset but is set to the factory setting on a "Restore System Defaults->Align".
State Saved	No
Min	0
Max	16383
<b>Backwards Compatibility SCPI</b>	:CALibration:FREQuency:REFerence:COARse ESA hardware contained two DAC controls for the Timebase. In X-Series the command :CALibration:FREQuency:REFerence:FINE is the method for adjusting the timebase. The :COARse command is provided as an alias to :FINE.
Initial S/W Revision	Prior to A.02.00

<b>Remote Command</b>	:CALibration:FREQuency:REFerence:COARse <integer> :CALibration:FREQuency:REFerence:COARse?
<b>Example</b>	:CAL:FREQ:REF:COAR 8191
Notes	This is an alias for CAL:FREQ:REF:FINE any change to COARse is reflected in FINE and vice-versa. See CAL:FREQ:REF:FINE for description of functionality.
Couplings	Setting :CAL:FREQ:REF:COAR sets :CAL:FREQ:REF:MODE USER
Initial S/W Revision	Prior to A.02.00

## RF Preselector

This menu and all of its submenus are only available in models with the RF Preselector, such as the N9038A.

See ["Align Now, 20 Hz to 30 MHz" on page 306](#)

See ["Align Now, 30 MHz to 3.6 GHz" on page 307](#)

See ["Align Now, 20 Hz to 3.6 GHz" on page 308](#)

See ["Alert" on page 309](#)

Key Path	System, Alignments
Initial S/W Revision	Prior to A.08..00

### Align Now, 20 Hz to 30 MHz

Immediately executes an alignment of the receiver subsystem. The receiver will stop any measurement currently underway, perform an Align Now All, then perform the RF Preselector alignment, and then restart the measurement from the beginning (similar to pressing the Restart key).

The query form of the remote commands (:CALibration:RFPSelector:CONDUCTed?) will invoke the alignment of the RF Preselector on Conducted Band and return a success or failure value. Successful completion will clear the "Align 20 Hz to 30 MHz required" Error Condition, and clear the bit 1 in the Status Questionable Calibration Extended Needed register. The elapsed time counter will begin for Last Align Now, Conducted Time, and the temperature is captured for the Last Align Now, Conducted Temperature. The alignment can be interrupted by pressing the Cancel (ESC) front-panel key or remotely with Device Clear followed by the :ABORT SCPI command. When this occurs, the Error Condition "Align 20 Hz to 30 MHz required" is set because new alignment data may be employed for an individual subsystem, but not a cohesive set of data for all subsystems.

The "Align 20 Hz to 30 MHz required" Error Condition will appear when this alignment has expired. User is now responsible to perform the Align Now, 20 Hz to 30 MHz in order to keep the receiver in warranted operation. This alignment can only be performed by user as it is not part of the Auto Align process.

Key Path	System, Alignments, RF Preselector, Align Now
Mode	All
<b>Remote Command</b>	:CALibration:RFPSelector:CONDUCTed :CALibration:RFPSelector:CONDUCTed?
<b>Example</b>	:CAL:RFPS:COND
Notes	For model N9038A only. :CALibration:RFPSelector:CONDUCTed? Return 0 if successful :CALibration:RFPSelector:CONDUCTed? Return 1 if failed When Align 20 Hz to 30 MHz 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.

	<p>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 1 in the Status Questionable Calibration Extended Needed register and bit 0 in Status Questionable Calibration Extended Failure register.</p> <p>A failure encountered during alignment will set the Error Condition “20 Hz to 30 MHz Alignment Failure” and set both bit 1 in the Status Questionable Calibration Extended Needed register and bit 9 in Status Questionable Calibration register.</p>
Dependencies	This key does not appear in other than N9038A models, setting or querying the SCPI will generate an error.
Couplings	<p>Initializes the time for the Last Align Conducted Now, Conducted Time.</p> <p>Records the temperature for the Last Align Conducted Now, Conducted Temperature.</p>
Status Bits/OPC Dependencies	<p>Bit 8 or 9 may be set in the Status Questionable Calibration register.</p> <p>Bit 1 may be set in the Status Questionable Calibration Extended Needed register.</p> <p>Bit 0 may be set in the Status Questionable Calibration Extended Failure register.</p>
Initial S/W Revision	A.08.00

### Align Now, 30 MHz to 3.6 GHz

Immediately executes an alignment of the receiver subsystem. The receiver will stop any measurement currently underway, perform an Align Now All, then perform the RF Preselector alignment, and then restart the measurement from the beginning (similar to pressing the Restart key).

The query form of the remote commands (:CALibration:RFPSelector:RADiated?) will invoke the alignment of the RF Preselector on Radiated Band and return a success or failure value. Successful completion will clear the “Align 30 MHz to 3.6 GHz required” Error Condition, and clear the bit 2 in the Status Questionable Calibration Extended Needed register. The elapsed time counter will begin for Last Align Now, Radiated Time, and the temperature is captured for the Last Align Now, Radiated Temperature. The alignment can be interrupted by pressing the Cancel (ESC) front-panel key or remotely with Device Clear followed by the :ABORt SCPI command. When this occurs, the Error Condition “Align 30 MHz to 3.6 GHz required” is set because new alignment data may be employed for an individual subsystem, but not a cohesive set of data for all subsystems.

The “Align 30 MHz to 3.6 GHz required” Error Condition will appear when this alignment has expired. User is now responsible to perform the Align Now, 30 MHz to 3.6 GHz in order to keep the receiver in warranted operation. This alignment can only be performed by user as it is not part of the Auto Align process.

Key Path	<b>System, Alignments, RF Preselector, Align Now</b>
Mode	All
<b>Remote Command</b>	<p><b>:CALibration:RFPSelector:RADiated</b></p> <p><b>:CALibration:RFPSelector:RADiated?</b></p>
<b>Example</b>	<b>:CAL:RFPS:RAD</b>

Notes	<p>For model N9038A only.</p> <p>:CALibration:RFPSelector:RADiated? Return 0 if successful</p> <p>:CALibration:RFPSelector:RADiated? Return 1 if failed</p> <p>When Align 30 MHz to 3.6 GHz is performing the alignment, bit 0 in the Status Operation register is set. Completion, or termination, will clear bit 0 in the Status Operation register.</p> <p>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 2 in the Status Questionable Calibration Extended Needed register and bit 1 in Status Questionable Calibration Extended Failure register.</p> <p>A failure encountered during alignment will set the Error Condition “30 MHz to 3.6 GHz Alignment Failure” and set both bit 2 in the Status Questionable Calibration Extended Needed register and bit 9 in Status Questionable Calibration register.</p>
Dependencies	This key does not appear in other than N9038A models, setting or querying the SCPI will generate an error.
Couplings	<p>Initializes the time for the Last Align Radiated Now, Radiated Time.</p> <p>Records the temperature for the Last Align Radiated Now, Radiated Temperature.</p>
Status Bits/OPC Dependencies	<p>Bit 8 or 9 may be set in the Status Questionable Calibration register.</p> <p>Bit 2 may be set in the Status Questionable Calibration Extended Needed register.</p> <p>Bit 1 may be set in the Status Questionable Calibration Extended Failure register.</p>
Initial S/W Revision	A.08.00

### Align Now, 20 Hz to 3.6 GHz

Immediately executes an alignment of the receiver subsystem. The receiver will stop any measurement currently underway, perform an Align Now All, then perform the RF Preselector alignment, and then restart the measurement from the beginning (similar to pressing the Restart key).

The query form of the remote commands (:CALibration:RFPSelector:FULL?) will invoke the alignment of the RF Preselector on both Conducted and Radiated Band and return a success or failure value. Successful completion will clear the “Align 20 Hz to 3.6 GHz required” Error Condition, and clear the bit 1 and bit 2 in the Status Questionable Calibration Extended Needed register. The elapsed time counter will begin for Last Align Now, Conducted Time and Last Align Now Radiated Time and the temperature is captured for Last Align Now, Conducted Temperature and Last Align Now, Radiated Temperature. The alignment can be interrupted by pressing the Cancel (ESC) front-panel key or remotely with Device Clear followed by the :ABORT SCPI command. When this occurs, the Error Condition “Align 20 Hz to 3.6 GHz required” is set because new alignment data may be employed for an individual subsystem, but not a cohesive set of data for all subsystems.

The “Align 20 Hz to 3.6 GHz required” Error Condition will appear when this alignment has expired. It is now your responsibility to perform the Align Now, 20 Hz to 3.6 GHz to keep the receiver in warranted operation. This alignment can only be performed by the user as it is not part of the Auto Align process.



Key Path	<b>System, Alignments, RF Preselector, Align Now</b>
Mode	All
<b>Remote Command</b>	<b>:CALibration:RFPSelector:FULL</b> <b>:CALibration:RFPSelector:FULL?</b>
<b>Example</b>	:CAL:RFPS:FULL
Notes	For model N9038A only. :CALibration:RFPSelector:FULL? Return 0 if successful :CALibration:RFPSelector:FULL? Return 1 if failed When Align 20 Hz to 3.6 GHz is performing the alignment, bit 0 in the Status Operation register is set. Completion, or termination, will clear bit 0 in the Status Operation register. This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the :ABORT command. Successful completion will clear bit 1, bit 2 in the Status Questionable Calibration Extended Needed register and bit 0, bit 1 in Status Questionable Calibration Extended Failure register. A failure encountered during alignment will set the Error Condition "20 Hz to 3.6 GHz Alignment Failure" and set bit1, bit 2 in the Status Questionable Calibration Extended Needed register and bit 9 in Status Questionable Calibration register.
Dependencies	This key only appears in N9038A models, setting or querying the SCPI in other models will generate an error.
Couplings	Initializes the time for the Last Align Conducted Now, Conducted Time. Initializes the time for the Last Align Radiated Now, Radiated Time. Records the temperature for the Last Align Conducted Now, Conducted Temperature. Records the temperature for the Last Align Radiated Now, Radiated Temperature.
Status Bits/OPC Dependencies	Bit 8 or 9 may be set in the Status Questionable Calibration register. Bit 1 and 2 may be set in the Status Questionable Calibration Extended Needed register. Bit 0 and 1 may be set in the Status Questionable Calibration Extended Failure register.
Initial S/W Revision	A.08.00

### Alert

Setting Alert to ON/OFF will enable/disable the display of RF Preselector alignment required message on the status line. The instrument will power up with Alert On mode.

Key Path	<b>System, Alignments, RF Preselector</b>
Mode	All
<b>Remote Command</b>	<b>:CALibration:RFPSelector:ALERT ON OFF 0 1</b> <b>:CALibration:RFPSelector:ALERT?</b>
<b>Example</b>	:CAL:RFPS:ALER OFF
Notes	For model N9038A only. Error Condition will be generated when the alert is On and any of the RF Preselector alignments

	has expired.
Preset	This is unaffected by Preset, but is set to ON on a "Restore System Defaults->Align".
State Saved	No
Initial S/W Revision	A.08.00

### Schedule Setup

Enables you to schedule a task to run automatically at the background based on the recurrence and time set in the scheduler. Make sure that the Instrument's local time is accurate as the Scheduler relies on this information to execute the task.

Key Path	<b>System, Alignments, RF Preselector</b>
Initial S/W Revision	A.08.00

### Task

There are 3 tasks that can be selected for the scheduler to run.

Task 1 is the 20 Hz to 30 MHz alignment

Task 2 is the 30 MHz to 3.6 GHz alignment

Task 3 is the 20 Hz to 3.6 GHz alignment.

Key Path	<b>System, Alignments, RF Preselector, Schedule Setup</b>
Mode	All
<b>Remote Command</b>	<b>:CALibration:RFPSelector:SCHeduler:TASK T1 T2 T3</b> <b>:CALibration:RFPSelector:SCHeduler:TASK?</b>
<b>Example</b>	:CAL:RFPS:SCH:TASK T1
Notes	Changing the task will not reset the Scheduler time and the alignment is based on the current scheduled configuration to occur. For model N9038A only.
Preset	This is unaffected by Preset but is set to T3 on a "Restore System Defaults->Align".
State Saved	No
Range	Task 1   Task 2   Task 3
Initial S/W Revision	A.08.00

### Date/Time

Enables you to configure the scheduler to run a task starting from this date and time. The date and time rely on the instrument's local time to execute a scheduled task. The date is based on the format "YYYY/MM/DD" and the time is based on a 24 hour clock.

Key Path	<b>System, Alignments, RF Preselector, Schedule Setup</b>
----------	---

Mode	All
<b>Remote Command</b>	:CALibration:RFPSelector:Scheduler:TIME:START "date","time" :CALibration:RFPSelector:Scheduler:TIME:START?
	This query returns data using the following format "YYYY/MM/DD; HH:MM:SS"
<b>Example</b>	:CAL:RFPS:SCH:TIME:STAR "2009/8/20", "12:00:00"
Notes	<p>"date" is representation of the date the task will run in the form of "YYYY/MM/DD" where:</p> <ul style="list-style-type: none"> <li>- YYYY is the four digit representation of year. (for example, 2009)</li> <li>- MM is the two digit representation of month. (for example, 01 to 12)</li> <li>- DD is the two digit representation of the day. (for example, 01 to 28, 29, 30 or 31 depending on the month and year)</li> </ul> <p>"time" is a representation of the time of day the task will run in the form of "HH:MM:SS" where:</p> <ul style="list-style-type: none"> <li>- HH is the two digit representation of the hour in 24 hour format</li> <li>- MM is the two digit representation of minute</li> <li>- SS is the two digit representation of seconds</li> </ul> <p>For model N9038A only.</p>
Preset	This is unaffected by Preset but is set to Current date and 00:00:00 on a "Restore System Defaults->Align".
State Saved	No
Initial S/W Revision	A.08.00

### **Date**

Enables you to configure the date of the scheduled task. The SCPI command to configure the date and time parameters of the scheduler is the same; however, they each have their own front-panel control.

Key Path	<b>System, Alignments, RF Preselector, Schedule Setup, Date/Time</b>
Notes	See " <a href="#">Date/Time</a> " on page 310. For model N9038A only.
Preset	This is unaffected by Preset but is set to Current date and 00:00:00 on a "Restore System Defaults->Align".
State Saved	No
Initial S/W Revision	A.08.00

### **Time**

Enables you to configure the time of the scheduled task. The SCPI command to configure the date and time parameters of the scheduler is the same; however, they each have their own front panel-control.

Key Path	System, Alignments, RF Preselector, Schedule Setup, Date/Time
Notes	See "Date/Time " on page 310 . For model N9038A only.
Preset	This is unaffected by Preset but is set to Current date and 00:00:00 on a "Restore System Defaults->Align".
State Saved	No
Initial S/W Revision	A.08.00

### ***Recurrence***

Enables you to configure the scheduler to run the task recurrently on a scheduled date and time. You can schedule it to run daily, weekly or alternate weeks.

Key Path	System, Alignments, RF Preselector, Schedule Setup
Mode	All
<b>Remote Command</b>	:CALibration:RFPSelector:SCHeduler:REcurrence DAY WEEK OFF :CALibration:RFPSelector:SCHeduler:REcurrence?
<b>Example</b>	:CAL:RFPS:SCH:REC DAY
Notes	For model N9038A only.
Preset	This is unaffected by Preset but is set to OFF on a "Restore System Defaults->Align".
State Saved	No
Range	DAY WEEK OFF
Initial S/W Revision	A.08.00

### ***Every N Weeks***

Enables you to configure the scheduler to run the task on a day in every number of week's duration.

Key Path	System, Alignments, RF Preselector, Schedule Setup, Recurrence
Initial S/W Revision	A.08.00

### ***N of Weeks***

Enables you to set the number of weeks that the scheduler will wait to trigger a task.

Key Path	System, Alignments, RF Preselector, Schedule Setup, Recurrence, Every N Weeks
Mode	All
<b>Remote Command</b>	:CALibration:RFPSelector:SCHeduler:REcurrence:WEEK <integer> :CALibration:RFPSelector:SCHeduler:REcurrence:WEEK?
<b>Example</b>	:CAL:RFPS:SCH:REC:WEEK 2
Notes	New scheduled date to run the alignment task will get updated when this parameter is changed.

	For model N9038A only.
Preset	This is unaffected by Preset but is set to 1 on a "Restore System Defaults->Align".
State Saved	No
Range	1-52
Min	1
Max	52
Initial S/W Revision	A.08.00

### Day

Enables you to set the Day of the Week the scheduler will run a scheduled task.

Key Path	<b>System, Alignments, RF Preselector, Schedule Setup, Recurrence, Every N Weeks</b>
Mode	All
<b>Remote Command</b>	<b>:CALibration:RFPreselector:Scheduler:REcurrence:DAY SUN   MON   TUE   WED   THU   FRI   SAT</b> <b>:CALibration:RFPreselector:Scheduler:REcurrence:DAY?</b>
<b>Example</b>	:CAL:RFPS:SCH:REC:DAY SUN
Notes	For model N9038A only.
Preset	This is unaffected by Preset but is set to SUN on a "Restore System Defaults->Align".
State Saved	No
Range	Sunday Monday Tuesday Wednesday Thursday Friday Saturday
Initial S/W Revision	A.08.00

### Scheduler

Setting the Scheduler to ON will trigger the execution of the scheduled task based on the recurrence and time set in the scheduler since the last successful of the specific alignment. A warning condition of "RF Preselector alignment scheduler is ON" will be appeared when the scheduler is set to ON. OFF will turn off the Scheduler from running any scheduled task.

Key Path	<b>System, Alignments, RF Preselector</b>
Mode	All
<b>Remote Command</b>	<b>:CALibration:RFPreselector:Scheduler:STATe ON OFF 0 1</b> <b>:CALibration:RFPreselector:Scheduler:STATe?</b>
<b>Example</b>	:CAL:RFPS:SCH:STAT OFF
Notes	For model N9038A only.
Preset	This is unaffected by Preset but is set to OFF on a "Restore System Defaults->Align".
State Saved	No
Initial S/W Revision	A.08.00

## I/O Config

Activates a menu for identifying and changing the I/O configuration for remote control.

Key Path	<b>System</b>
Initial S/W Revision	Prior to A.02.00

### GPIB

Activates a menu for configuring the GPIB I/O port.

Key Path	<b>System, I/O Config</b>
Initial S/W Revision	A.02.00

### GPIB Address

Select the GPIB remote address.

Key Path	<b>System, I/O Config, GPIB</b>
Mode	All
<b>Remote Command</b>	<code>:SYSTem:COMMunicate:GPIB[1][:SELF]:ADDRess &lt;integer&gt;</code> <code>:SYSTem:COMMunicate:GPIB[1][:SELF]:ADDRess?</code>
<b>Example</b>	<code>:SYST:COMM:GPIB:ADDR 17</code>
Notes	Changing the Address on the GPIB port requires all further communication to use the new address.
Preset	This is unaffected by Preset but is set to 18 on a "Restore System Defaults->Misc"
State Saved	No
Range	0 to 30
Min	0
Max	30
Initial S/W Revision	Prior to A.02.00

### GPIB Controller

Sets the GPIB port into controller or device mode. In the normal state, GPIB controller is disabled, which allows the analyzer 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 analyzer 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.

Key Path	<b>System, I/O Config, GPIB</b>
Mode	All
Scope	Mode Global
<b>Remote Command</b>	:SYSTem:COMMunicate:GPIB[1][:SELF]:CONTroller[:ENABle] ON   OFF   0   1 :SYSTem:COMMunicate:GPIB[1][:SELF]:CONTroller[:ENABle]?
<b>Example</b>	:SYST:COMM:GPIB:CONT ON Will set GPIB port to Controller
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).
Preset	This is unaffected by Preset but is set to OFF on a "Restore System Defaults->Misc"
State Saved	No
Range	Disabled Enabled
Initial S/W Revision	A.02.00

### Disabled

Disables the GPIB Controller capability, this is the default (or normal) setting.

Key Path	<b>System, I/O Config, GPIB, GPIB Controller</b>
<b>Example</b>	:SYST:COMM:GPIB:CONT OFF Will set GPIB port to Device
Initial S/W Revision	A.02.00

### Enabled

Enables the GPIB Controller capability.

Key Path	<b>System, I/O Config, GPIB, GPIB Controller</b>
<b>Example</b>	:SYST:COMM:GPIB:CONT ON Will set GPIB port to Controller
Initial S/W Revision	A.02.00

### 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 keys limit that somewhat by disabling the telnet, socket, and/or SICL capability.

Key Path	<b>System, I/O Config</b>
Initial S/W Revision	Prior to A.02.00

## SCPI Telnet

Turns the SCPI LAN telnet capability On or Off allowing you to limit SCPI access over LAN through telnet.

Key Path	System, I/O Config, SCPI LAN
Mode	All
<b>Remote Command</b>	:SYSTem:COMMunicate:LAN:SCPI:TELNet:ENABle OFF ON 0 1 :SYSTem:COMMunicate:LAN:SCPI:TELNet:ENABle?
<b>Example</b>	:SYST:COMM:LAN:SCPI:TELN:ENAB OFF
Preset	This is unaffected by Preset but is set to ON with a "Restore System Defaults->Misc"
State Saved	No
Range	On   Off
Initial S/W Revision	Prior to A.02.00

## SCPI Socket

Turns the capability of establishing Socket LAN sessions On or Off. This allows you to limit SCPI access over LAN through socket sessions.

Key Path	System, I/O Config, SCPI LAN
Mode	All
<b>Remote Command</b>	:SYSTem:COMMunicate:LAN:SCPI:SOCKet:ENABle OFF ON 0 1 :SYSTem:COMMunicate:LAN:SCPI:SOCKet:ENABle?
<b>Example</b>	:SYST:COMM:LAN:SCPI:SOCK:ENAB OFF
Preset	This is unaffected by a Preset but is set to ON with a "Restore System Defaults->Misc"
State Saved	No
Range	On   Off
Initial S/W Revision	Prior to A.02.00

## SICL Server

Turns the SICL server capability On or Off, enabling you 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 analyzer	inst0
Instrument Logical Unit	The unique integer assigned to your analyzer when using SICL LAN	8
Emulated GPIB Name	The name (same as the remote SICL address) of the device used when communicating with your	gpib7



analyzer		
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

Key Path	<b>System, I/O Config, SCPI LAN</b>
Mode	All
<b>Remote Command</b>	<b>:SYSTem:COMMunicate:LAN:SCPI:SICL:ENABle OFF ON 0 1</b> <b>:SYSTem:COMMunicate:LAN:SCPI:SICL:ENABle?</b>
<b>Example</b>	:SYST:COMM:LAN:SCPI:SICL:ENAB OFF
Preset	This is unaffected by Preset, but is set to ON with a “Restore System Defaults->Misc”
State Saved	No
Range	On   Off
Initial S/W Revision	Prior to A.02.00

### HiSLIP Server

Turns the HiSLIP server capability On or Off, enabling you 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.

Here is an 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 their HiSLIP VISA Address strings. Your HiSLIP device name may be different depending on your VISA settings.

Key Path	<b>System, I/O Config, SCPI LAN</b>
Mode	All
<b>Remote Command</b>	<b>:SYSTem:COMMunicate:LAN:SCPI:HISLip:ENABle OFF ON 0 1</b> <b>:SYSTem:COMMunicate:LAN:SCPI:HISLip:ENABle?</b>
<b>Example</b>	:SYST:COMM:LAN:SCPI:HISL:ENAB OFF
Preset	This is unaffected by Preset, but is set to ON with a “Restore System Defaults->Misc”
State Saved	No
Range	On   Off
Initial S/W Revision	A.11.00

## SCPI Socket Control Port (Remote Command Only)

Returns the TCP/IP port number of the control socket associated with the SCPI socket session. This query enables you to obtain the unique port number to open when a device clear is to be sent to the instrument. Every time a connection is made to the SCPI socket, the instrument creates a peer control socket. The port number for this socket is random. The user must use this command to obtain the port number of the control socket. To force a device clear on this socket, open the port and send the string “DCL” to the instrument.

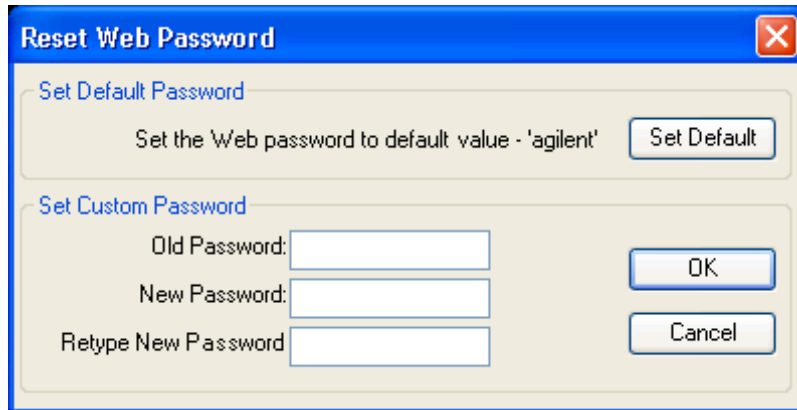
If this SCPI command is sent to a non SCPI Socket interface, then 0 is returned.

Mode	All
<b>Remote Command</b>	<b>:SYSTem:COMMunicate:LAN:SCPI:SOCKet:CONTRol?</b>
<b>Example</b>	:SYST:COMM:LAN:SCPI:SOCK:CONT?
Preset	This is unaffected by Preset or “Restore System Defaults->Misc”.
State Saved	No
Range	0 to 65534
Min	0
Max	65534
<b>Backwards Compatibility SCPI</b>	<b>SYSTem:COMMunicate:TCPIp:CONTRol?</b>
Initial S/W Revision	Prior to A.02.00

## Reset Web Password

The embedded web server contains certain capabilities which 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 for software versions less than A.14.49 is ‘agilent’ (without the quotes), for software versions greater than A.14.50 the password is ‘measure4u’ (without the quotes). The control provided here is the means to set the web password as the user desires, or to reset the password to the factory default.

Selecting Reset web password brings up a control for resetting the password as the user desires, or to the factory default. An external keyboard is required to change the password from the factory default. The control is:



If this control is entered without an external keyboard or mouse connected, you can cancel the control by pressing the Cancel (ESC) front-panel key.

Key Path	System, I/O Config
Mode	All
Initial S/W Revision	Prior to A.02.00

### LXI

Opens a menu that allows you to access the various LXI configuration properties.


Key Path	System, I/O Config
Initial S/W Revision	Prior to A.02.00

### LAN Reset

Resets the LAN connection.

Key Path	System, I/O Config, LXI
Initial S/W Revision	Prior to A.02.00

### Device Identification (Remote Command Only)

Enabling the LXI device identification will place the LXI Status Indicator to the 'Identify' state. Disabling the LXI device identification will place the LXI Status Indicator to the 'No Fault' state. The LXI Status indicator is in the upper left region of the instrument's graphical user interface (.

Mode	All
<b>Remote Command</b>	:LXI:IDENtify[:STATe] OFF ON 0 1 :LXI:IDENtify[:STATe]?
<b>Example</b>	:LXI:IDEN ON
Preset	Not part of Preset, but reset to OFF on Restore System Defaults All
State Saved	No

Range	On   Off
Initial S/W Revision	A.12.50

### System IDN Response

This key allows you to specify a response to the \*IDN? query, or to return the analyzer to the Factory response if you have changed it.

To choose the factory-set response, press the **Factory** key.

To specify your own response, press the **User** key, and enter your desired response.

If your test software is expecting the response to indicate Agilent Technologies as the Manufacturer, you can conveniently configure the response by pressing the Agilent key.

Key Path	<b>System, I/O Config</b>
Mode	All
<b>Remote Command</b>	<b>:SYSTem:IDN:CONFigure FACTory AGILent USER</b> <b>:SYSTem:IDN:CONFigure?</b>
Notes	<ul style="list-style-type: none"> <li>- This affects the response given in all Modes of the Analyzer, 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..</li> <li>- It survives shutdown and restart of the software and therefore survives a power cycle</li> </ul>
Preset	This is unaffected by Preset but is set to Factory on a "Restore System Defaults->Misc"
State Saved	No
Initial S/W Revision	A.06.00
Modified at S/W Revision	x.14.50

### Factory

This key selects the factory setting, for example:

"Agilent Technologies,N9020A,MY00012345,A.05.01"

where the fields are manufacturer, model number, serial number, firmware revision.

Key Path	<b>System, I/O Config, IDN Response</b>
<b>Example</b>	<b>:SYST:IDN:CONF FACT</b>
Initial S/W Revision	A.06.0

### User

This key 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.

When you press this key, the active function becomes the current User string with the cursor at the end. This makes it easy to edit the existing string.

If you enter a null string (for example, by clearing the User String while editing and then pressing **Done**) the analyzer automatically reverts to the Factory setting.

Key Path	<b>System, I/O Config, IDN Response</b>
<b>Example</b>	:SYST:IDN:CONF USER
Initial S/W Revision	A.06.00

### SYSTem:IDN Response setting (Remote command)

This SCPI command is used to set or clear the User SYSTem:IDN response.

<b>Remote Command</b>	:SYSTem:IDN <string> :SYSTem:IDN?
Notes	<ul style="list-style-type: none"> <li>- The format of the &lt;string&gt; must be four fields each separated by a comma, example: :SYST:IDN "XYZ Corp,Model 12,012345,A.01.01"</li> <li>- The four fields are &lt;manufacturer&gt;, &lt;model number&gt;, &lt;serial number&gt;, &lt;firmware revision&gt;. Thus, the text within a field cannot contain a comma.</li> <li>- This affects the response given in all Modes of the Analyzer, 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..</li> <li>- It survives shutdown and restart of the software and therefore survives a power cycle</li> <li>- Null string as parameter restores the Factory setting, example: :SYST:IDN ""</li> </ul>
Preset	This is unaffected by Preset but is set to the original factory setting on a "Restore System Defaults->Misc"
Initial S/W Revision	A.06.00

### SYSTem:PERSONa:DEFault

This command will reset the \*IDN response to the instrument default.

<b>Remote Command</b>	SYSTem:PERSONa:DEFault SYSTem:PERSONa:DEFault?
Notes	<p>The query SYST:PERSONa:DEF? returns the default value of *IDN? even if the current setting of *IDN? is the non-default value. The return value of SYST:PERSONa:DEF? is a &lt;string&gt;.</p> <p>SYST:PERSONa:DEF is equivalent to: SYSTem:IDN "" SYSTem:IDN:CONF DEF</p>
Initial S/W Revision	x.17.00

## SYSTem:PERSONa:MANUFACTURer

This command will set the Manufacturer field of the \*IDN? response. The Manufacturer field is the first field of the \*IDN? response.

<b>Remote Command</b>	<code>SYSTem:PERSONa:MANUFACTURer &lt;string&gt;</code> <code>SYSTem:PERSONa:MANUFACTURer?</code>
Notes	When setting the manufacturer field, the current IDN response string is modified to replace the manufacturer field with the string specified by the command. If the resulting IDN response matches one of the predefined responses (SYSTem:IDN:CONFIgure FACT   AGIL), then the SYSTem:IDN:CONFIgure is set to the corresponding value. If the IDN response with the new manufacturer field is not one of the predefined values, then SYSTem:IDN:CONFIgure will be set to USER and SYSTem:IDN will be set to the new IDN response string. The query SYST:PERs:MAN? returns the current value of the *IDN? Manufacturer field.
Initial S/W Revision	x.17.00

## SYSTem:PERSONa:MANUFACTURer:DEFault

This command will reset the Manufacturer field of the \*IDN? response to the default value.

<b>Remote Command</b>	<code>SYSTem:PERSONa:MANUFACTURer:DEFault</code> <code>SYSTem:PERSONa:MANUFACTURer:DEFault?</code>
Notes	The query SYST:PERs:MAN:DEF? returns the default Manufacturer Field value of *IDN? even if the current setting of *IDN? is the non-default value. The return value of SYST:PERs:MAN:DEF? is a <string>.
Initial S/W Revision	x.17.00

## SYSTem:PERSONa:MODEl

This command will set the Model field of the \*IDN? response. The Model field is the second field of the \*IDN? response.

<b>Remote Command</b>	<code>SYSTem:PERSONa:MODEl &lt;string&gt;</code> <code>SYSTem:PERSONa:MODEl?</code>
Notes	When setting the model field, the current IDN response string is modified to replace the model field with the string specified by the command. If the resulting IDN response matches one of the predefined responses (SYSTem:IDN:CONFIgure FACT   AGIL), then the SYSTem:IDN:CONFIgure is set to the corresponding value. If the IDN response with the new model field is not one of the predefined values, then SYSTem:IDN:CONFIgure will be set to USER and SYSTem:IDN will be set to the new IDN response string. The query SYST:PERs:MOD? returns the current value of the *IDN? Model field.
Initial S/W Revision	x.17.00

## SYSTem:PERSONa:MODEl:DEFault

This command will reset the Model field of the \*IDN? response to the default value.

<b>Remote Command</b>	SYSTem:PERSONa:MODEl:DEFault SYSTem:PERSONa:MODEl:DEFault?
Notes	The query SYST:PERS:MOD:DEF? returns the default Model Field value of *IDN? even if the current setting of *IDN? is the non-default value. The return value of SYST:PERS:MOD:DEF? is a <string>.
Initial S/W Revision	x.17.00

### Query USB Connection (Remote Command Only)

Enables you to determine the speed of the USB connection.

Mode	All
<b>Remote Command</b>	:SYSTem:COMMunicate:USB:CONNecTion?
<b>Example</b>	:SYST:COMM:USB:CONN?
Notes	NONE – Indicates no USB connection has been made. LSPeed – Indicates a USB low speed connection (1.5 Mbps). HSPeed – Indicates that a USB high speed connection (480 Mbps) has been negotiated. FSPeed – Indicates that a USB full speed connection (12 Mbps) has been negotiated.
State Saved	No
Range	NONE LSPeed HSPeed FSPeed
Initial S/W Revision	Prior to A.02.00

### USB Connection Status (Remote Command Only)

Enables you to determine the current status of the USB connection.

Mode	All
<b>Remote Command</b>	:SYSTem:COMMunicate:USB:STATus?
<b>Example</b>	:SYST:COMM:USB:STAT?
Notes	SUSPended – Indicates that the USB bus is currently in its suspended state. The bus is in the suspended state when: <ul style="list-style-type: none"> <li>– The bus is not connected to any controller</li> <li>– The controller is currently powered off</li> <li>– The controller has explicitly placed the USB device into the suspended state.</li> </ul> <p>When in the suspended state, no USB activity, including start of frame packets are received.</p> <p>ACTIVE – Indicates that the USB device is in the active state. When the device is in the active state, it is receiving periodic start of frames but it isn't necessarily receiving or transmitting data.</p>
State Saved	No
Range	SUSPended ACTIVE
Initial S/W Revision	Prior to A.02.00

## USB Packet Count (Remote Command Only)

Enables you to determine the number of packets received and transmitted on the USB bus.

Mode	All
<b>Remote Command</b>	<b>:SYSTem:COMMunicate:USB:PACKets?</b>
<b>Example</b>	:SYST:COMM:USB:PACK?
Notes	Two integers are returned. The first is the number of packets received since application invocation, the second is the number of packets transmitted since application invocation. If no packets have been received or transmitted the response is 0,0.  The packet count is initialized to 0,0 when the instrument application is started.
State Saved	No
Initial S/W Revision	Prior to A.02.00

## Lock Remote I/O Session (Remote Command only)

You can lock the SCPI control of the instrument to the I/O Interface and Session by performing a SYSTem:LOCK:REQuest? Query. This permits cooperative sharing of the instrument between multiple computers, or multiple sessions from the same computer.

**NOTE**

Use of cooperative sharing (locking) must take into account the properties of an interface, interfaces are either single session or multiple session:

Interface	Single Session	Multiple Session
GPIB	✓	
USB-488	✓	
LAN VXI-11 (SICL)	✓	
LAN Socket		✓
LAN HiSLIP		✓
LAN Telnet		✓

**NOTE**

It is inappropriate to control the instrument from multiple computers (or multiple processes or threads of a single computer) when using single session interfaces. In particular, care must be taken when using LAN VXI-11 (SICL) interface that only a single computer (or single process or single thread) is controlling the instrument; if multiple computers are controlling the instrument responses may not result in expected operation.



It is not recommend to use VXI-11 with SCPI locking as multiple clients can simultaneously connect to the instrument. If VXI-11 is required then VISA locking must be used in addition to SCPI locking.

The recommended interface is LAN HiSLIP. Since HiSLIP is a multiple session interface, the controlling computer can send lock requests from multiple applications (or multiple threads of a single application) to permit cooperative sharing of the instrument.

<b>Remote Command</b>	<b>SYSTem:LOCK:REQuest?</b>
<b>Example</b>	SYST:LOCK:REQ?
Notes	<p>The command returns a 1 if the lock request is granted, 0 is returned if the request is denied. Single Session interfaces will always return 1 once the same interface has already received a lock request.</p> <p>Lock requests on an individual interface and session can be nested and each request will increase an internal lock count by 1. For every granted request, you will need to perform a SYSTem:LOCK:RELease to decrement the internal lock count to fully relinquish the lock.</p> <p>When the instrument is locked bit 0 is set in the Operation Instrument status register.</p> <p>Disconnecting the individual interface and session will release the lock if the lock is granted to the interface and session.</p> <p>A Device Clear over any interface and session will release the lock, regardless of the interface and session which obtained the lock.</p> <p>The following queries are permitted over any interface and session even if an interface has the instrument locked:</p> <p>*IDN? *OPT? *STB? *ESR?</p> <p>:SYSTem:DATE? :SYSTem:TIME? :SYSTem:PON:TIME?</p> <p>Queries in the :STATus subsystem Queries in the :SYSTem:ERRor subsystem Queries in the :SYSTem:LKEY subsystem Queries in the :SYSTem:LOCK subsystem Queries in the :SYSTem:METRics subsystem Queries in the :SYSTem:MODule subsystem</p> <p>All other commands and queries will result in the error: -203,"Command protected; Instrument locked by another I/O session"</p>
State Saved	Not part of Save/Recall
Initial S/W Revision	x.16.10

### Unlock Remote I/O Session (Remote Command only)

You can unlock the SCPI control of an I/O Interface and Session performing a SYSTem:LOCK:RELease command. Lock requests on an individual interface and

session can be nested and each request will increase an internal lock count by 1. For every granted request, you will need to perform a release. The lock is not relinquished until the internal lock count is at 0.

<b>Remote Command</b>	<code>SYSTem:LOCK:RELease</code>
<b>Example</b>	<code>SYST:LOCK:REL</code>
Notes	When the instrument is unlocked bit 0 is cleared in the Operation Instrument status register.
Initial S/W Revision	x.16.10

### Remote I/O Session Lock Name (Remote Command only)

You can determine the I/O Interface and Session name of the currently running program with the query `SYSTem:LOCK:NAME?`.

<b>Remote Command</b>	<code>SYSTem:LOCK:NAME?</code>
<b>Example</b>	<code>SYST:LOCK:NAME?</code>
Notes	The information returned is a string of the format: “<I/O Interface>[/<IP address>/<Session ID>]” Where IP address and Session ID are only provided for interfaces that provide multiple sessions. Single Session interfaces (GPIB, USB-488, and LAN VXI-11) only list interface name. The Session ID is an internally generated identifier, it is not guaranteed to be consistent across instrument software versions (the identifier is free to change when the software of the instrument is updated). The absolute value of the Session ID is not significant, the identifier will be consistent for a given software version and can be relied upon for lock owner logic comparisons.
Initial S/W Revision	x.16.10

### Remote I/O Session Lock Owner (Remote Command only)

You can determine which I/O Interface and Session has the SCPI locked with the query `SYSTem:LOCK:OWNer?`. If no interface and session has the SCPI locked “NONE” is returned.

<b>Remote Command</b>	<code>SYSTem:LOCK:OWNer?</code>
<b>Example</b>	<code>SYST:LOCK:OWN?</code>
Notes	The information returned is a string of the format: “<I/O Interface>[/<IP address>/<Session ID>]” Where IP address and Session ID are only provided for interfaces that provide multiple sessions. Single Session interfaces (GPIB, USB-488, and LAN VXI-11) only list interface name. The Session ID is an internally generated identifier, it is not guaranteed to be consistent across instrument software versions (the identifier is free to change when the software of the instrument is updated). The absolute value of the Session ID is not significant, the identifier will be consistent for a given software version and can be relied upon for lock owner logic comparisons. If no interface and session have the SCPI locked the return value is “NONE”.
Initial S/W Revision	x.16.10

## Restore Defaults

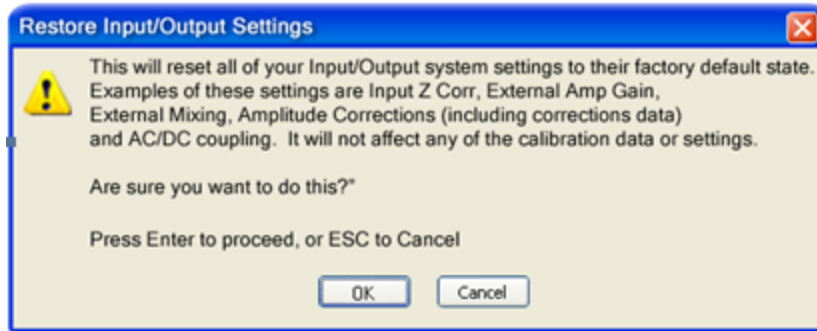
Provides incremental initialization of the system setting groups along with supporting a comprehensive reset of the entire instrument back to a factory default state. The menu selections are the groups of system settings and when one is selected, that particular group of system settings is reset back to their default values.

Key Path	<b>System</b>
Mode	All
<b>Remote Command</b>	<b>:SYSTem:DEFau1t [ALL]   ALIGn   INPut   MISC   MODes   PON</b>
<b>Example</b>	SYST:DEF
State Saved	No
Initial S/W Revision	Prior to A.02.00

### Restore Input/Output Defaults

Causes the group of settings and data associated with Input/Output front-panel key to be a reset to their default values. This level of Restore System Defaults does not affect any other system settings, mode settings and does not cause a mode switch.

Confirmation is required to restore the Input/Output setting. The confirmation dialog is:

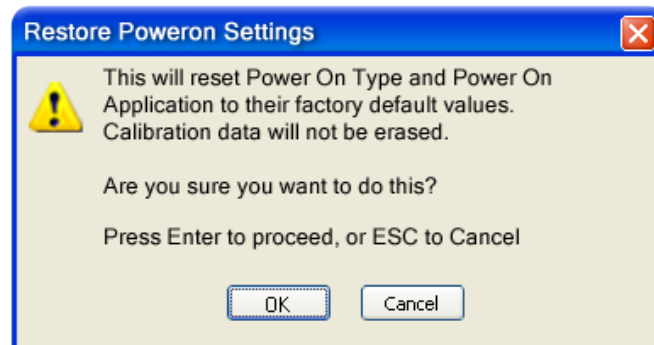


Key Path	<b>System, Restore System Defaults</b>
<b>Example</b>	<b>:SYST:DEF INP</b>
Initial S/W Revision	Prior to A.02.00

### Restore Power On Defaults

This selection causes the Power On settings to be a reset to their default value. This level of Restore System Defaults does not affect any other system settings, mode settings and does not cause a mode switch. The Power On settings and their default values are Power On Type reset to Mode and Input/Output Defaults and Power On Application reset to whatever the factory set as its default value.

Confirmation is required to restore the factory default values. The confirmation dialog is:



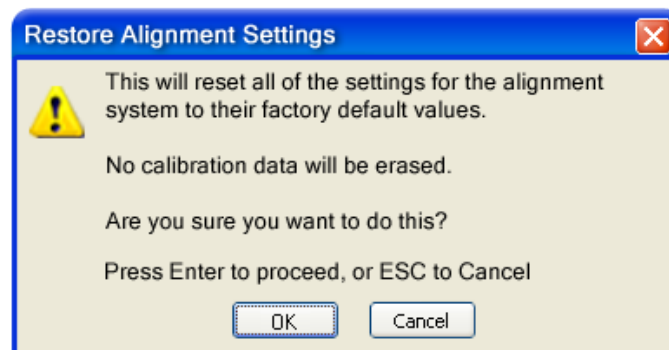
Key Path	System, Restore System Defaults
<b>Example</b>	:SYST:DEF PON
Initial S/W Revision	Prior to A.02.00

### Restore Align Defaults

This selection causes the Alignment system settings to be a reset to their default values. This does not affect any Alignment data stored in the system. This level of Restore System Defaults does not affect any other system settings, mode settings and does not cause a mode switch.

After performing this function, it may impact the auto-alignment time of the instrument until a new alignment baseline has been established.

Confirmation is required to restore the factory default values. The confirmation dialog is:



Key Path	System, Restore System Defaults
<b>Example</b>	:SYST:DEF ALIG
Initial S/W Revision	Prior to A.02.00

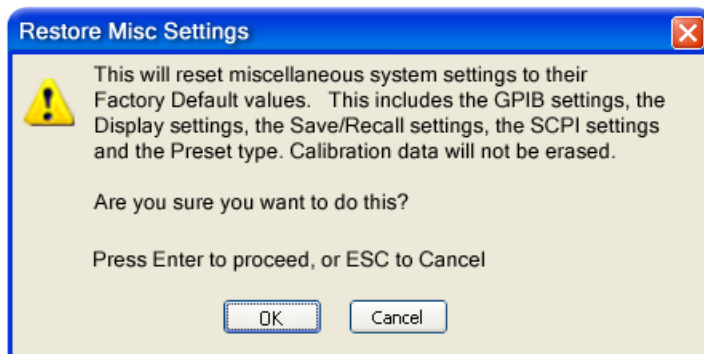
### Restore Misc Defaults

This selection causes miscellaneous system settings to be reset to their default values. With this reset, you lose the GPIB address and it is reset to 18, so this should be used with caution. This level of Restore System Defaults does not affect any

other system settings, mode settings and does not cause a mode switch. This miscellaneous group contains the rest of the settings that have not been part of the other Restore System Defaults groups. The following table is a complete list of settings associated with this group:

Miscellaneous Setting	Default Value
Verbose SCPI	Off
The SYST:PRES:TYPE	MODE
Auto File Name Number	000
Save Type	State
State Save To	Register 1
Screen Save To	SCREEN000.png
DISP:ENABLE	ON
Full Screen	Off
SCPI Telnet	ON
SCPI Socket	ON
SICL Server	ON
Softkey Language	English
System Annotation	ON
Display Theme	TDColor
System IDN Response	Factory result of *IDN?
System IDN Response selection	Factory
Display Intensity	100
Display Backlight	ON
GPIB Address	18

Confirmation is required to restore the factory default values. The confirmation dialog is:

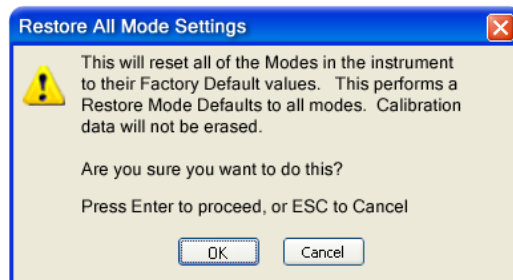


Key Path	System, Restore System Defaults
<b>Example</b>	:SYST:DEF MISC
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	x.14.50

### Restore Mode Defaults (All Modes)

This selection resets all of the modes in the instrument back to their default state just as a Restore Mode Defaults does and it switches the instrument to the power-on mode and causes the default measurement for the power-on mode to be active. This level of Restore System Defaults does not affect any system settings, but it does affect the state of all modes and does cause a mode switch unless the instrument was already in the power-on mode.

Confirmation is required to restore the factory default values. The confirmation dialog is:

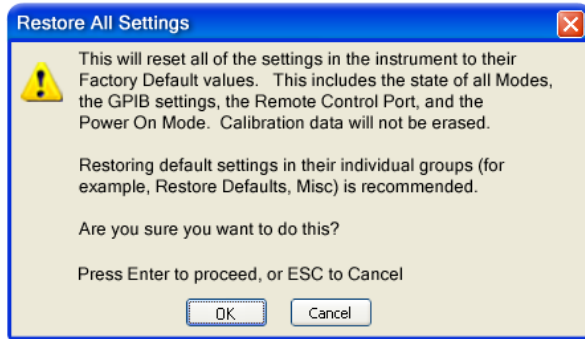


Key Path	System, Restore System Defaults
<b>Example</b>	:SYST:DEF MOD
Couplings	An All Mode will cause the currently running measurement to be aborted, mode switch to the power-on mode and activate the default measurement for the power-on mode.. It gets the mode to a consistent state with all of the default couplings set.
Initial S/W Revision	Prior to A.02.00

### All

This performs a comprehensive reset of ALL analyzer settings to their factory default values. It resets all of the system setting groups, causes a 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.

Confirmation is required to restore the factory default values. The confirmation dialog is:



**NOTE**

If you are using an Keysight USB External Mixer, then you will need to perform a Refresh USB Mixer Connection after Restoring All Defaults.

Key Path	System, Restore System Defaults
<b>Example</b>	:SYST:DEF ALL
Notes	If using Keysight USB External Mixer, perform a Refresh USB Mixer Connection (SCPI command :MIX:BAND USB) following a Restore All Defaults.
Couplings	An All will cause the currently running measurement to be aborted and get all modes to a consistent state, so it is unnecessary to couple any settings.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.14.00

### Control Panel...

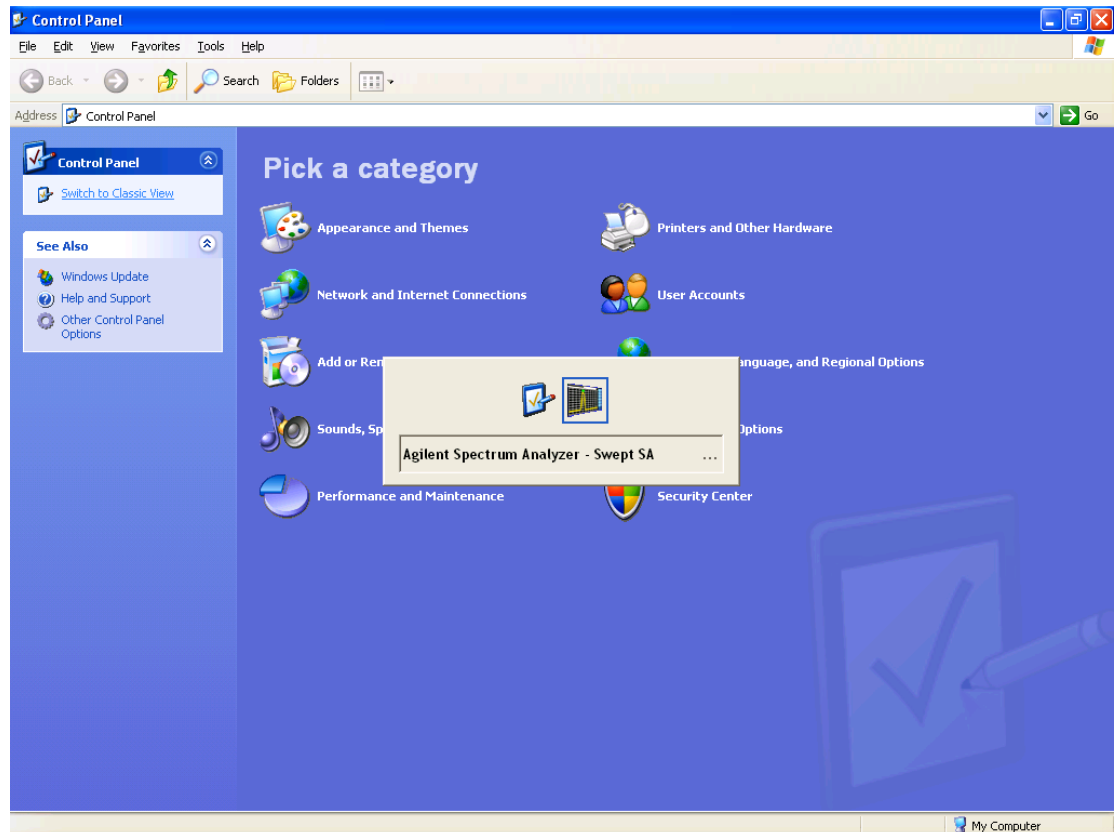
Opens the Windows Control Panel. The Control Panel is used to configure certain elements of Windows that are not configured through the hardkey/softkey System menus.

**NOTE**

**This feature is not available if option SF1 is installed.**

The Control Panel is a separate Windows application, so to return to the analyzer once you are in the Control Panel, you may either:

Exit the Control Panel by clicking on the red X in the upper right hand corner, with a mouse



Or use Alt-Tab: press and hold the Alt key and press and release the Tab key until the Analyzer logo is showing in the window in the center of the screen, as above, then release the Alt key.

Key Path	<b>System</b>
Notes	No remote command for this key.
Initial S/W Revision	Prior to A.02.00

### Licensing...

Opens the license explorer.

**NOTE**

**This feature is not available if option SF1 is installed.**

For Help on this key, select Help in the menu bar at the top of the license explorer window.

Key Path	<b>System</b>
Notes	No equivalent remote command for this key.
Backwards Compatibility Notes	In ESA the SCPI command for displaying the Show Licenses screen is: <b>:SYSTem:CONFIgure:LKEY:STATe OFF ON 0 1:SYSTem:CONFIgure:LKEY:STATe?</b> There are no equivalent SCPI commands in the X-Series for displaying the License Explorer.



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Initial S/W Revision	Prior to A.02.00
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**Remote Command** :SYSTem:LKEY <"OptionInfo">, <"LicenseInfo">

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**Example** SYST:LKEY "N9073A-1FP",  
"027253AD27F83CDA5673A9BA5F427FDA5E4F25AEB1017638211AC9F60D9C639FE539735909C551DE0A91"

---

**Notes** The <"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.

The <"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.

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Initial S/W Revision	Prior to A.02.00
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**Remote Command** :SYSTem:LKEY:DELeTe <"OptionInfo">,<"LicenseInfo">

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**Example** SYST:LKEY:DEL 'N9073A-1FP',  
"027253AD27F83CDA5673A9BA5F427FDA5E4F25AEB1017638211AC9F60D9C639FE539735909C551DE0A91"

---

**Notes** The <"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.

The <"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.

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Initial S/W Revision	Prior to A.02.00
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**Remote Command** :SYSTem:LKEY:LIST?

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**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

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	<p>&lt;arbitrary block data&gt; is: #NMMM&lt;data&gt; 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. &lt;data&gt; ASCII contents of the data</p>
Initial S/W Revision	Prior to A.02.00

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<b>Remote Command</b>	<b>:SYSTem:LKEY? &lt;"OptionInfo"&gt;</b>
<b>Example</b>	SYST:LKEY? "N9073A-1FP"
Notes	<p>The &lt;"OptionInfo"&gt; 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: &lt;"LicenseInfo"&gt; if the license is valid, null otherwise. &lt;"LicenseInfo"&gt; contains the signature, the expiration date, and serial number if transportable. Return Value Example: "B043920A51CA"</p>
Initial S/W Revision	Prior to A.02.00

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<b>Remote Command</b>	<b>:SYSTem:HID?</b>
Notes	Return value is the host ID as a string
Initial S/W Revision	Prior to A.02.00

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## Security

Accesses capabilities for operating the instrument in a security controlled environment.

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Key Path	<b>System</b>
Initial S/W Revision	A.04.00

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## USB

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. This user interface is a convenient way for the customer to disable write access to USB.

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Key Path	<b>System, Security</b>
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Mode	All
Scope	Mode Global
<b>Remote Command</b>	<b>:SYSTem:SECurity:USB:WPRotect[:ENABle] ON OFF 0 1</b> <b>:SYSTem:SECurity:USB:WPRotect[:ENABle]?</b>
<b>Example</b>	:SYST:SEC:USB:WPR ON Will set USB ports to Read-only
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 key is grayed-out unless the current user has administrator privileges.
Preset	This is unaffected by Preset or any Restore System Defaults. An Agilent Recovery will set the USB to write protect OFF
State Saved	No
Range	Read-Write Read only
Initial S/W Revision	A.04.00

### Read-Write

Selection for allowing full read-write access to the USB ports.

Key Path	<b>System, Security, USB</b>
<b>Example</b>	:SYST:SEC:USB:WPR OFF Sets USB ports to Read-Write
Initial S/W Revision	A.04.00

### Read only

Selection for disabling write access to the USB ports.

Key Path	<b>System, Security, USB</b>
<b>Example</b>	:SYST:SEC:USB:WPR ON Sets USB ports to Read only
Initial S/W Revision	A.04.00

### Diagnostics

The Diagnostics key in the System menu gives you access to basic diagnostic capabilities of the instrument.

Key Path	<b>System</b>
Initial S/W Revision	Prior to A.02.00

### Show Hardware Statistics

Provides a display of various hardware statistics. The statistics include the following:

- Mechanical relay cycles

- 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.

Hardware Statistical Information	
Agilent MXA Signal Analyzer	
Product Number: N9020A	
Serial Number: US00061145	
Instrument S/W Revision: A.12.00	
Revision Date: 7/11/2012 12:11:10 PM	
Component Name	Value
MechAtten #1 Count Total	457304
Calibrator Switch Cycles	105953
AC/DC Switch Cycles	114240
2 dB #1 Mechanical Atten Cycles	112655
2 dB #2 Mechanical Atten Cycles	124456
MechAtten #2 Count Total	472265
6 dB Mechanical Atten Cycles	115302
10 dB Mechanical Atten Cycles	93602
20 dB Mechanical Atten Cycles	144781
30 dB Mechanical Atten Cycles	118580
Low Noise Path Switch	45668
Preselector Bypass Cycles	31133
High temperature operating extreme	45.75
Low temperature operating extreme	-23.9375
Elapsed Time (On-Time)(hours)	134164

In some CXA models this field is called "Fixed Aten"

Some CXA models omit these fields

Only shown if LNP installed

Only shown if MPB installed

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 the Show Hardware Statistics menu key is pressed, it will not be updated while the screen is displayed.

The tabular data should be directly printable.

Key Path	<b>System, Diagnostics</b>
Mode	All
Notes	The values displayed on the screen are only updated upon entry to the screen and not updated while the screen is being displayed.
Initial S/W Revision	Prior to A.02.00

## SCPI for Show Hardware Statistics ( Remote Commands Only)

Each of the hardware statistic items can be queried via SCPI.

- "Query the Mechanical Relay Cycle Count" on page 337
- "Query the Operating Temperature Extremes" on page 337
- "Query the Elapsed Time since 1st power on" on page 338

### Query the Mechanical Relay Cycle Count

Return the count of mechanical relay cycles.

For N9038A model, there are additional 2 Mechanical Relays which are <N9038A Input2>, <N9038A Bypass>.

<b>Remote Command</b>	:SYSTem:MRELay:COUNT?
<b>Example</b>	:SYST:MREL:COUN?
Notes	<p>Query Only</p> <p>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:            "&lt;Cal Signal&gt;,&lt;AC/DC&gt;,&lt;2dB #1 Atten&gt;,&lt;2dB #2 Atten&gt;,&lt;6dB Atten&gt;,&lt;10dB Atten&gt;,&lt;20dB Atten&gt;,&lt;30dB Atten&gt;,&lt;Fixed Atten&gt;,&lt;Low Noise Path Switch&gt;,&lt;Presel Bypass&gt;,&lt;N9038A Input2&gt;,&lt;N9038A Bypass&gt;"</p> <p>Items in the list not pertaining to your particular hardware configuration will return as -999 for those items.</p>
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.08.00

### Query the Operating Temperature Extremes

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.

Mode	All
<b>Remote Command</b>	:SYSTem:TEMPerature:LEXTreme?
<b>Example</b>	: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
Initial S/W Revision	Prior to A.02.00

Mode	All
<b>Remote Command</b>	:SYSTem:TEMPerature:HEXTreme?

<b>Example</b>	: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
Initial S/W Revision	Prior to A.02.00

### Query the Elapsed Time since 1<sup>st</sup> power on

Returns the elapsed on-time in minutes since 1st power-on.

<b>Remote Command</b>	:SYSTem:PON:ETIME?
<b>Example</b>	:SYST:PON:ETIM?
Notes	Query Only
Initial S/W Revision	Prior to A.02.00

### Advanced

Accesses advanced diagnostic capabilities performed in the factory or under instructions from repair procedures. This menu key is only visible when the logged-in user is "saservice".

#### NOTE

This feature is not available if option SF1 is installed.

The first access to the Advanced Diagnostic Menu after invoking the instrument application will require an authentication, which is to enter the Service Code. Subsequent accesses to the Advanced Diagnostic Menu are unimpeded. The Authentication dialog looks like:

"OK" is the default key thus the Enter key is used to complete the entry. If invalid Service Code is entered authentication is not granted and you are provided the following dialog:

Key Path	<b>System, Diagnostics</b>
Notes	Password is required to access this menu.
Initial S/W Revision	Prior to A.02.00

	Keysight Converged	PSA
IP Address	SYSTem:COMMunicate:LAN:ADDRes <string> SYSTem:COMMunicate:LAN:ADDRes?	:SYSTem:COMMunicate:LAN[:SELF]:IP <string> :SYSTem:COMMunicate:LAN[:SELF]:IP?
Gateway	SYSTem:COMMunicate:LAN:DGATeway <string> SYSTem:COMMunicate:LAN:DGATeway?	:SYSTem:COMMunicate:LAN [:SELF]:GATEWay <string> :SYSTem:COMMunicate:LAN [:SELF]:GATEWay?
Subnet Mask	SYSTem:COMMunicate:LAN:SMASK <string> SYSTem:COMMunicate:LAN:SMASK?	:SYSTem:COMMunicate:LAN [:SELF]:SUBNetmask <string> :SYSTem:COMMunicate:LAN [:SELF]:SUBNetmask?

## 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.

Key Path	<b>System</b>
Initial S/W Revision	Prior to A.02.00

## Softkey Language

Accesses the selection of language displayed on the Softkeys and Softkey Menus. English is the default language. The selection of language is available when the instrument is licensed with a language option.

All Measurement Applications that share common softkeys will display the localized softkey.

The description on the key labels is bounded by the softkey size, any given language will have labels in that language which are shorter or longer than the equivalent label in English. Any localized text on the softkeys that does not fit the label size, will remain in English. Thus for any given menu, keys may be displayed in English and the selected language. Also, labels that are acronyms, engineering, or technology specific terms may remain in English.

All Application and Measurement names will remain in English.

All data in exported files will remain in English.

The Diagnostic and Service menus in the System Subsystem will 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 presented to the user that any external keyboards must remain English.

Other aspects of the Graphical User Interface remain in the English language. The Remote User Interface, SCPI, remains in English.

Key Path	<b>System</b>
Mode	All
<b>Remote Command</b>	<b>SYSTem:DISPlay:LANGUage ENGLISH RUSSian</b> <b>SYSTem:DISPlay:LANGUage?</b>
Preset	This is unaffected by a Preset but is set to ENGLISH on a "Restore Misc Defaults" or "Restore System Defaults->All".
Readback	1-of-N selection
Initial S/W Revision	A.13.00

## English

Displays English on the softkey labels.

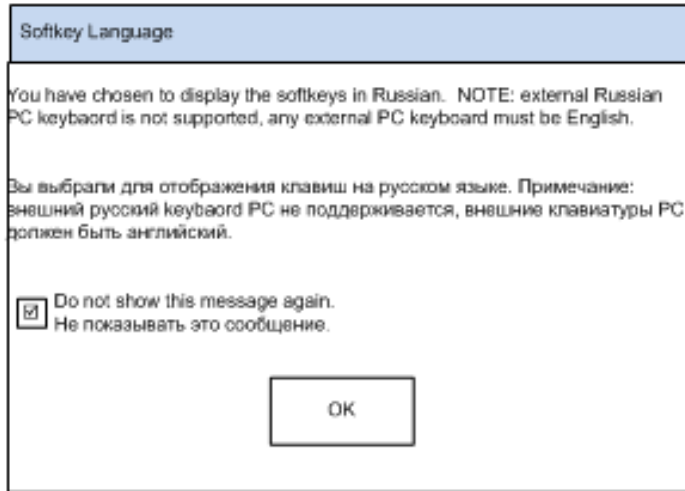
Key Path	<b>System, Language</b>
<b>Example</b>	SYST:DISP:LANG ENGL
Readback	English
Initial S/W Revision	A.13.00

## Russian

If option AKT is installed, Russian (**русский**) language is displayed on the softkey labels.

When the operator selects this language choice from the softkey, the following message is presented (the message is not presented if Russian is selected from SCPI):





Key Path	System, Language
<b>Example</b>	SYST:DISP:LANG RUSS
Readback	русский
Initial S/W Revision	A.13.00

### Internet Explorer...

This key launches Microsoft Internet Explorer. A mouse and external keyboard are highly desired for using Internet Explorer. When Internet Explorer is running, 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.

Key Path	System
Mode	All
Notes	No equivalent remote command for this key.
Initial S/W Revision	A.05.01

### System Remote Commands (Remote Commands Only)

The commands in this section have no front-panel key equivalent.

- "System Powerdown (Remote Command Only)" on page 342
- "System Log Off (Remote Command Only)" on page 342
- "List installed Options (Remote Command Only)" on page 342
- "Lock the Front-panel keys (Remote Command Only)" on page 343
- "Front Panel activity history (Remote Command only)" on page 343

- "SCPI activity history (Remote Command only)" on page 344
- "Instrument start time (Remote Command only)" on page 344
- "SCPI Version Query (Remote Command Only)" on page 345
- "Date (Remote Command Only)" on page 345
- "Time (Remote Command Only)" on page 345

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Initial S/W Revision      Prior to A.02.00

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### System Powerdown (Remote Command Only)

<b>Remote Command</b>	<code>SYSTem:PDOWn [NORMa1   FORCe]</code>
Notes	Shuts down the instrument in the normal way (NORMal) or forced way (FORCe). In case there is another application with modified data pending for saving, the application prompt the user. The system waits until the user responds in the normal mode. It will go off after 20 seconds of wait in the force mode and all data will be lost.

### System Log Off (Remote Command Only)

This SCPI command provides a means to terminate all open Windows applications and log off the current user. This is equivalent to performing the Windows command "shutdown -l -f -t0".

<b>Remote Command</b>	<code>SYSTem:LOFF</code>
<b>Example</b>	<code>SYST:LOFF</code>
Notes	Initiates an immediate log off of the current user. This exits the instrument application, thus any unsaved measurement result will be lost. You cannot use *WAI or *OPC? to synchronize operation. In addition to the instrument application, all other Windows programs will be terminated without the opportunity to save any work in progress. The instrument will require human interaction to perform a Log In to regain instrument operation.

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Initial S/W Revision      A.14.50

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### List installed Options (Remote Command Only)

Lists the installed options that pertain to the instrument (signal analyzer). .

Mode	All
<b>Remote Command</b>	<code>:SYSTem:OPTions?</code>
<b>Example</b>	<code>:SYST:OPT?</code>
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
Initial S/W Revision	Prior to A.02.00

### Lock the Front-panel keys (Remote Command Only)

Disables the instrument keyboard to prevent local input when the instrument is controlled remotely. Annunciation showing a “K” for ‘Klock” (keyboard lock) alerts the local user that the keyboard is locked. Klock is similar to the GPIB Local Lockout function; namely that no front-panel keys are active with the exception of the Power Standby key. (The instrument is allowed to be turned-off if Klock is ON.) The Klock command is used in remote control situations where Local Lockout cannot be used.

Although primary intent of Klock is to lock-out the front panel, it will lock-out externally connected keyboards through USB. Klock has no effect on externally connected pointing devices (mice).

The front panel ‘Local’ key (Cancel/Esc) has no effect if Klock is ON.

Mode	All
<b>Remote Command</b>	:SYSTem:KLOCK OFF ON 0 1 :SYSTem:KLOCK?
<b>Example</b>	:SYST:KLOC ON
Notes	Keyboard lock remains in effect until turned-off or the instrument is power-cycled
Preset	Initialized to OFF at startup, unaffected by Preset
State Saved	No
Initial S/W Revision	Prior to A.02.00

### Front Panel activity history (Remote Command only)

Instrument front panel usage can be monitored with the query :SYSTem:METRics:FPANel?. The monitoring occurs for front panel Hardkey or Softkey operation (not mouse or touch operation on instruments with Multi-Touch User Interface). The information of the usage pertains to the activity since the instrument application was started; the information does not persist after the application is terminated, or the instrument has been rebooted.

To prevent the front panel from being placed into Remote the monitoring must occur via an I/O protocol such as LAN Socket, or the remote program performing the monitoring must explicitly place the instrument into Local after the query has been performed.

<b>Remote Command</b>	:SYSTem:METRics:FPANel?
<b>Example</b>	SYST:METR:FPAN?
Notes	The return value is a string with the format “YYYY-MM-DD<space>HH:MM:SS”, in instrument local time.  If no front panel activity has occurred since the instrument was booted (instrument application started), the return value will be the time the instrument application started. The instrument application start time can be obtained with the query SYSTem:METRics:STIME?
Initial S/W Revision	x.16.10

### SCPI activity history (Remote Command only)

Instrument remote operation usage via SCPI can be monitored with the query :SYSTem:METRics:SCPI?. The monitoring occurs for SCPI control from any I/O channel (GPIB, USB, or LAN). The information of the usage pertains to the activity since the instrument application was started; the information does not persist after the application is terminated, or the instrument has been rebooted.

<b>Remote Command</b>	:SYSTem:METRics:SCPI?
<b>Example</b>	:SYST:METR:SCPI?
Notes	<p>The return value is a string with the format "YYYY-MM-DD&lt;space&gt;HH:MM:SS", in instrument local time.</p> <p>The following commands are excluded from the history accounting:</p> <ul style="list-style-type: none"> <li>*IDN?</li> <li>*OPT?</li> <li>:SYSTem:DATE?</li> <li>:SYSTem:TIME?</li> <li>:SYSTem:PON:TIME?</li> </ul> <p>Queries in the :SYSTem:ERRor subsystem            Queries in the :SYSTem:LKEY subsystem            Queries in the :SYSTem:METRics subsystem            Queries in the :SYSTem:MODule subsystem</p> <p>If no SCPI activity has occurred since the instrument was booted (instrument application started), the return value will be the time the instrument application started. The instrument application start time can be obtained with the query SYSTem:METRics:STIME?</p>
Initial S/W Revision	x.16.10

### Instrument start time (Remote Command only)

To determine if instrument activity has occurred the SCPI query :SYSTem:METRics:STIME? can be used to determine the instrument application start time.

<b>Remote Command</b>	:SYSTem:METRics:STIME?
<b>Example</b>	:SYST:METR:STIM?
Notes	The return value is a string with the format "YYYY-MM-DD<space>HH:MM:SS", in instrument local time.
Initial S/W Revision	x.16.10

### List SCPI Commands (Remote Command Only)

Outputs a list of the valid SCPI commands for the currently selected Mode.

<b>Remote Command</b>	:SYSTem:HELP:HEADers?
<b>Example</b>	:SYST:HELP:HEAD?
Notes	The output is an IEEE Block format with each command separated with the New-Line character

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	(hex 0x0A)
Initial S/W Revision	Prior to A.02.00

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### SCPI Version Query (Remote Command Only)

Returns the SCPI version number with which the instrument complies. The SCPI industry standard changes regularly. This command indicates the version used when the instrument SCPI commands were defined.

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<b>Remote Command</b>	:SYSTem:VERSion?
<b>Example</b>	:SYST:VERS?
Initial S/W Revision	Prior to A.02.00

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### Date (Remote Command Only)

The recommended access to the Date, Time, and Time zone of the instrument is through the Windows native control (Control Panel or accessing the Task Bar). You may also access this information remotely, as shown in this command and Time (below).

Sets or queries the date in the instrument.

---

Mode	All
<b>Remote Command</b>	:SYSTem:DATE "<year>, <month>, <day>" :SYSTem:DATE?
<b>Example</b>	:SYST:DATE "2006,05,26"
Notes	<year> is the four digit representation of year. (for example, 2006) <month> is the two digit representation of year. (for example. 01 to 12) <day> is the two digit representation of day. (for example, 01 to 28, 29, 30, or 31) depending on the month and year Unless the current account has Power User or Administrator privileges, an error will be generated by this command and no action will be taken.
Initial S/W Revision	Prior to A.02.00

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### Time (Remote Command Only)

Sets or queries the time in the instrument.

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Mode	All
<b>Remote Command</b>	:SYSTem:TIME "<hour>, <minute>, <second>" :SYSTem:TIME?
<b>Example</b>	:SYST:TIME "13,05,26"
Notes	<hour> is the two digit representation of the hour in 24 hour format <minute> is the two digit representation of minute <second> is the two digit representation of second Unless the current account has Power User or Administrator privileges, an error will be

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generated by this command and no action will be taken.

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Initial S/W Revision      Prior to A.02.00

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## 7 Trigger Functions

## Trigger

Accesses a menu of keys to control the selection of the trigger source and the setup of each of the trigger sources. The analyzer is designed to allow triggering from a number of different sources, for example, Free Run, Video, External, RF Burst, and so forth.

The TRIG:SOURCe command (below) will specify the trigger source for the currently selected 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. You can directly set the trigger source for each input using the TRIGger:RF:SOURce and TRIGger:IQ:SOURce commands (later in this section). When in External Mixing, the analyzer uses the RF trigger source.

Note the inclusion of the <measurement> parameter in the command below. Because each measurement remembers its own Trigger Source, the command must be qualified with the measurement name. Note that for the Swept SA measurement this is not the case; for backwards compatibility, no <measurement> parameter is used when setting the Trigger Source for the Swept SA measurement.

See ["Trigger Source Presets" on page 349](#)

See ["RF Trigger Source" on page 353](#)

See ["I/Q Trigger Source" on page 354](#)

See ["More Information" on page 355](#)

Key Path	Front-panel key
<b>Remote Command</b>	<pre>:TRIGger:&lt;measurement&gt;[:SEquence]:SOURce EXTerna11   EXTerna12   IMMediate   LINE   FRAMe   RFBurst   VIDeo   IF   ALARm   LAN   IQMag   IDEMod   QDEMod   IINPut   QINPut   AIQMag   TV   PRTChandet   PRTFrame   PXI   INTerna1</pre> <pre>:TRIGger:&lt;measurement&gt;[:SEquence]:SOURce?</pre> <p>where &lt;measurement&gt; is the measurement for which you wish to set the Source (blank for the Swept SA measurement)</p>
<b>Example</b>	<pre>TRIG:ACP:SOUR EXT1</pre> <p>Selects the external 1 trigger input for the ACP measurement and the selected input</p> <pre>TRIG:SOUR VID</pre> <p>Selects video triggering for the Swept SA (SANAlyzer) measurement in the Spectrum Analyzer mode. For SAN, do not use the &lt;measurement&gt; keyword. Only send this form in the Spectrum Analyzer mode or you will get an Undefined Header error</p>
<b>Notes</b>	<p>Not all measurements have all the trigger sources available to them. Check the trigger source documentation for your specific measurement to see what sources are available.</p> <p>Not all trigger sources are available for each input. See the <a href="#">"RF Trigger Source" on page 353</a> and <a href="#">"I/Q Trigger Source" on page 354</a> commands for detailed information on which trigger sources are available for each input.</p> <p>Other trigger-related commands are found in the INITiate and ABORt SCPI command subsystems.</p> <p>*OPC should be used after requesting data. This will hold off any subsequent changes to the selected trigger source, until after the sweep is completed and the data is returned.</p>



	Available ranges and presets can vary from mode to mode.
Dependencies	In some models, there is no second External input. In these models, the External 2 key is blanked and the EXTernal2 parameter will generate a "Hardware missing; Not available for this model number" message.  INTernal trigger is only available on the M9420A. It triggers on the internal source signal PRTChandet and PRTFrame are only available in the E7515A.  PXI trigger is only supported in PXI (modular) instruments.
Preset	See table 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.
<b>Backwards Compatibility SCPI</b>	<b>:TRIGger[:SEquence]:SOURCE EXTernal1</b> For backward compatibility, the parameter EXTernal is mapped to EXTernal1
<b>Backwards Compatibility SCPI</b>	<b>[:SENSe]:&lt;measurement&gt;:TRIGger:SOURce</b> This backwards compatibility alias command is provided for ESA/PSA compatibility This backwards compatibility command does not apply to the Swept SA measurement, for that just use :TRIGger:SOURCe This backwards compatibility command does not apply to the monitor spectrum, log plot and spot frequency measurements
<b>Backwards Compatibility SCPI</b>	<b>[:SENSe]:&lt;measurement&gt;:TRIGger:SOURce IF</b> In earlier instruments, the parameter IF was used by apps for the video trigger, so using the IF parameter selects VIDeo triggering. Sending IF in the command causes VID to be returned to a query.
<b>Backwards Compatibility SCPI</b>	<b>[:SENSe]:ACPR:TRIGger:SOURce</b> This backwards Compatibility SCPI command is provided to support the same functionality as [:SENSe]:ACPr:TRIGger:SOURce (PSA W-CDMA, PSA cdma2000 and PSA 1xEVDO) due to the fact that the ACPr node conflicts with the ACPower node.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

## Trigger Source Presets

Here are the Trigger Source Presets for the various measurements:

Meas	Mode	Preset for RF	Preset for IQ	Notes
Swept SA	SA	IMM	IQ not supported	
CHP	SA, WCDMA, C2K, WIMAX	IMM	IQ not supported	

Meas	Mode	Preset for RF	Preset for IQ	Notes
	OFDMA, 1xEVDO, DVB-T/H, DTMB, LTE, LTETDD, CMMB, ISDB-T, Digital Cable TV, MSR			
OBW	SA, WCDMA, C2K, WIMAX OFDMA, TD-SCDMA, 1xEVDO, LTE, LTETDD, CMMB, ISDB-T, MSR	1xEVDO: EXT1 others: IMM	IQ not supported	For 1xEVDO mode, the trigger source is coupled with the gate state, as well as the gate source. When the trigger source changes to RFBurst, External1 or External2, the gate state is set to on, and the gate source is set identically with the trigger source. When the trigger source changes to IMMEDIATE, VIDEO, LINE, FRAME or IF, the gate state is set to off.
CCDF	SA, WCDMA, C2K, WIMAX OFDMA, TD-SCDMA, 1xEV-DO, DVB-T/H, DTMB, LTE, LTETDD, CMMB, ISDB-T, Digital Cable TV, MSR	WIMAX OFDMA: RFBurst LTETDD: BTS: External 1 MS: Periodic Timer TD-SCDMA and 1xEV-DO: BTS: External 1 MS: RFBurst SA, WCDMA, C2K, LTE, CMMB, ISDB-T, DVB-T/H, DTMB, Digital Cable TV, MSR: IMMEDIATE	TD-SCDMA and 1xEV-DO: BTS: External 1 MS: IQMag LTETDD: BTS: External 1 MS: Periodic Timer Others: IMM	For TD-SCDMA: Trigger source is coupled with radio device. When radio device changes to BTS, trigger source will be changed to EXTERNAL1. When radio device changes to MS, trigger source will be set as RFBurst for RF or IQ Mag for BBIQ. When TriggerSource is RFBurst or IQ Mag, Measure Interval is grayed out.
ACP	SA, WCDMA, C2K, WIMAX OFDMA, TD-SCDMA, 1xEVDO, DVB-T/H, DTMB, LTE, LTETDD, CMMB, ISDB-T,	IMM	IQ not supported	

Meas	Mode	Preset for RF	Preset for IQ	Notes
	Digital Cable TV, MSR			
Tx Power	SA, GSM, TD-SCDMA	SA, GSM: RFBurst TD-SCDMA: EXTERNAL	IMM	TD-SCDMA doesn't support the Line and Periodic Timer parameters. When the mode is TD-SCDMA, if the Radio Device is switched to BTS, the value will be changed to External 1 and if the Radio device is switched to MS, the value will be changed to RFBurst
SPUR	SA, WCDMA, C2K, WIMAX OFDMA, TD-SCDMA, 1xEV-DO, DVB-T/H, LTE, LTETDD, MSR	IMM	IQ not supported	
SEM	SA, WCDMA, C2K, WIMAX OFDMA, TD-SCDMA, 1xEVDO, DVB-T/H, DTMB, LTE, LTETDD, CMMB, ISDB-T, Digital Cable TV, MSR	1xEVDO(BTS): EXTERNAL1 All others: IMMEDIATE	IQ not supported	
CDP	WCDMA	IMM	IMM	
RHO	WCDMA	IMM	IMM	
PCON	WCDMA	IMM	IMM	
QPSK	WCDMA, C2K, 1xEVDO	All except CDMA1xEVDO: IMMEDIATE CDMA1xEVDO: EXT1	IMM	
MON	All except SA and BASIC	IMM	IQ not supported	
WAV		LTETDD: BTS: External 1 MS: Periodic Timer	LTETDD: BTS: External 1 MS:	

Meas	Mode	Preset for RF	Preset for IQ	Notes
		GSM/EDGE: RFBurst All others: IMMediate	Periodic Timer GSM/EDGE: IQMag All others: IMMediate	
PVT	WIMAXOFDMA	RFB	IMM	
EVM	WIMAXOFDMA, DVB-T/H, DTMB, LTE, LTETDD, CMMB, ISDB-T, Digital Cable TV	All but CMMB: IMM CMMB: Periodic Timer	All but CMMB: IMM CMMB: External 1	LTE, LTETDD supports Free Run, Video and External 1 only.
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	IQMag	
GMSK ORFS	EDGE/GSM	RF Burst	IQ not supported	
EDGE PVT	EDGE/GSM	RFB	IMM	
EDGE EVM	EDGE/GSM	RFB	IQMag	
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	LTETDD: BTS: External 1 MS: Periodic Timer	LTETDD: BTS: External 1 MS: Periodic Timer	
Transmit Analysis	BLUETOOTH	RFB	IQ not supported	

Meas	Mode	Preset for RF	Preset for IQ	Notes
Adjacent Channel Power	BLUETOOTH	IMM	IQ not supported	
LE In-band Emissions	BLUETOOTH	IMM	IQ not supported	
EDR In-band Spurious Emissions	BLUETOOTH	Periodic Timer	IQ not supported	
Conformance EVM	LTE, LTETDD, MSR	IMM	IMM	

## RF Trigger Source

The **RF Trigger Source** command selects the trigger to be used for the specified measurement when RF is the selected input. The RF trigger source can be queried and changed even while another input is selected, but it is inactive until RF becomes the selected input.

Note the inclusion of the <measurement> parameter in the command below. Because each measurement remembers its own Trigger Source, the command must be qualified with the measurement name. Note that for the Swept SA measurement this is not the case; for backwards compatibility, no <measurement> parameter is used when setting the Trigger Source for the Swept SA measurement.

<b>Remote Command</b>	<pre> :TRIGger:&lt;measurement&gt;[:SEquence]:RF:SOURce EXTerna1   EXTerna12   IMMediate   LINE   FRAMe   RFBurst   VIDeo   IF   ALARm   LAN   TV   PRTChandet   PRTFrame   PXI   INTerna1 :TRIGger:&lt;measurement&gt;[:SEquence]:RF:SOURce? </pre>
<b>Example</b>	<pre> TRIG:ACP:RF:SOUR EXT1 </pre> <p>Selects the external 1 trigger input for the ACP measurement and the RF input</p> <pre> TRIG:RF:SOUR VID </pre> <p>Selects video triggering for the SANalyzer measurement and the RF input. For SAN, do not use the &lt;measurement&gt; keyword.</p>
Notes	*OPC should be used after requesting data. This will hold off any subsequent changes to the selected trigger source, until after the sweep is completed and the data is returned.
Dependencies	<p>Presets and available ranges can vary from mode to mode.</p> <p>Not all measurements have all the trigger sources available to them. Check the trigger source documentation for your specific measurement to see what sources are available.</p> <p>Not all trigger sources are available for each input. For the <b>RF Trigger Source</b>, the following trigger sources are available:</p> <ul style="list-style-type: none"> <li>- IMMEDIATE - free run triggering</li> <li>- VIDeo - triggers on the video signal level</li> </ul>

- 
- LINE - triggers on the power line signal
  - EXTERNAL1 (or EXTERNAL) - triggers on an externally connected trigger source marked "Trigger 1 In" on the rear panel
  - EXTERNAL2 - triggers on an externally connected trigger source marked "Trigger 2 In" on the front panel. In some models, there is no second External input. In these models, the External 2 key is blanked and the EXTERNAL2 parameter will generate a "Hardware missing; Not available for this model number" message
  - RFBURST - triggers on the bursted frame
  - FRAME - triggers on the periodic timer
  - IF (video) - same as video, for backwards compatibility only

INTERNAL trigger is only available on the M9420A. It triggers on the internal source signal PRTCHANDET and PRTFRAME are only available in the E7515A.  
PXI trigger is only supported in PXI (modular) instruments.

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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.
Initial S/W Revision	Prior to A.02.00

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## I/Q Trigger Source

**NOTE**

This command is available only when Option BBA is installed.

This command selects the trigger to be used for the specified measurement when I/Q is the selected input. The I/Q trigger source can be queried and changed even while another input is selected, but it is inactive until I/Q becomes the selected input.

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<b>Remote Command</b>	<code>:TRIGger:&lt;measurement&gt;[:SEQUENCE]:IQ:SOURce EXTERNAL1   EXTERNAL2   IMMEDIATE   IQMag   IDEMod   QDEMod   IINPut   QINPut   AIQMag</code> <code>:TRIGger:&lt;measurement&gt;[:SEQUENCE]:IQ:SOURce?</code>
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<b>Example</b>	TRIG:WAVEform:SOUR IQM Selects I/Q magnitude triggering for the IQ Waveform measurement and the I/Q input
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Notes	Not all measurements have all the trigger sources available to them. Check the trigger source documentation for your specific measurement to see what sources are available. Not all trigger sources are available for each input. For the <b>I/Q Trigger Source</b> , the following trigger sources are available:
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- IMMEDIATE - free run triggering
  - EXTERNAL1 (or EXTERNAL) - triggers on an externally connected trigger source on the rear panel
  - EXTERNAL2 - triggers on an externally connected trigger source on the front panel
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- IQMag - triggers on the magnitude of the I/Q signal
  - IDEMod - triggers on the I/Q signal's demodulated I voltage
  - QDEMod - triggers on the I/Q signal's demodulated Q voltage
  - IINPut - triggers on the I channel's ADC voltage
  - QINPut - triggers on the Q channel's ADC voltage
  - AIQMag - triggers on the magnitude of the auxiliary receiver channel I/Q signal

\*OPC should be used after requesting data. This will hold off any subsequent changes to the selected trigger source, until after the sweep is completed and the data is returned.

Available ranges, and from mode to mode presets can vary

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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.
Initial S/W Revision	Prior to A.02.00

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## 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 analyzer will begin a sweep or measurement only with 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 do 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 **Sync Source** menu that is part of the **Periodic Timer Trigger Setup** 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 **Sync Source** menus. For these reasons the trigger settings commands are not qualified with the measurement name, the way the trigger source commands are.

The settings setup menu can be accessed by pressing the key for the current trigger source a second time. For example, one press of Video selects the Video trigger as the source. The Video key becomes highlighted and the hollow arrow on the key

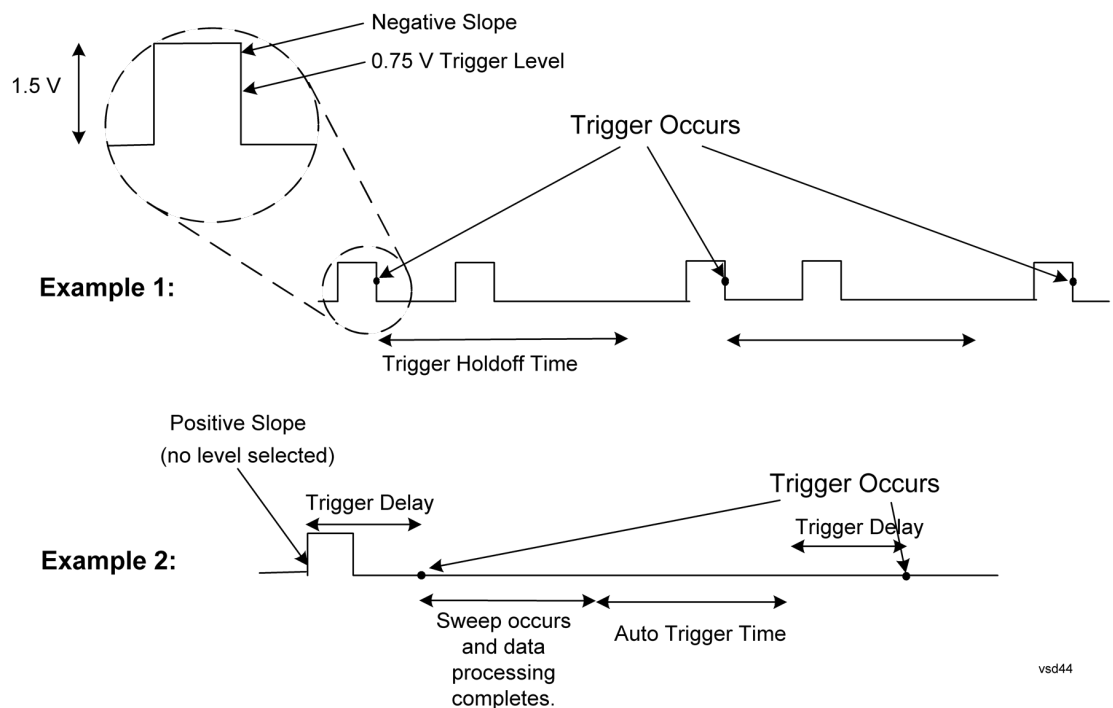
turns black. Now a second press of the key takes you into the Video Trigger Setup menu.

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.



## Free Run

Pressing this key, when it is not selected, selects free-run triggering. Free run triggering occurs immediately after the sweep/measurement is initiated.

Key Path	Trigger
<b>Example</b>	TRIG:SOUR IMM Swept SA measurement TRIG:<meas>:SOUR IMM Measurements other than Swept SA
State Saved	Saved in instrument state
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.
Initial S/W Revision	Prior to A.02.00



## Trigger Level

Sets a level for the signal trigger. This level is displayed as a horizontal line. When the signal crosses this level, the trigger occurs.

Key Path	<b>Trigger, Level (Time Domain)</b>
<b>Remote Command</b>	:TRIGger[:SEquence]:LEVe1:LEVe1 <amp1> :TRIGger[:SEquence]:LEVe1:LEVe1?
<b>Example</b>	TRIG:LEV:LEV -40 dBm
Notes	The Level trigger uses the amplitude envelope in a bandwidth wider than the FFT width as a trigger source. External Gain and Ref Level Offset, modify the actual trace data as it is taken and are taken into account by Trig Level.
Preset	Sets the Trigger Level -25 dBm on Preset. When the Trigger Level becomes the active function, if the value is off screen, set it to either the top or bottom of screen, depending on which direction off screen it was.
State Saved	Saved in instrument state
Min	-170 dBm
Max	+30 dBm
Default Unit	Depends on the current selected Y axis unit
<b>Backwards Compatibility SCPI</b>	:TRIGger[:SEquence]:IF:LEVe1 :TRIGger[:SEquence]:IF:LEVe1?
Backwards Compatibility Notes	This alias is provided for backward compatibility with VSA/PSA comms apps.
Initial S/W Revision	A.13.00

## Line

Pressing this key, when it is not selected, selects the line signal as the trigger. A new sweep/measurement will start synchronized with the next cycle of the line voltage. Pressing this key, when it is already selected, access the line trigger setup menu.

Key Path	<b>Trigger</b>
<b>Example</b>	TRIG:SOUR LINE Swept SA measurement TRIG:<meas>:SOUR LINE Measurements other than Swept SA
Dependencies	Line trigger is not available when operating from a "dc power source", for example, when the instrument is powered from batteries.
State Saved	Saved in instrument state
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.

Initial S/W Revision      Prior to A.02.00

### Trig Slope

Controls the trigger polarity. It is set positive to trigger on a rising edge and negative to trigger on a falling edge.

Key Path	Trigger, Line
<b>Remote Command</b>	:TRIGger[:SEquence]:LINE:SLOPe POSitive NEGative :TRIGger[:SEquence]:LINE:SLOPe?
<b>Example</b>	TRIG:LINE:SLOP NEG
Preset	POSitive
State Saved	Saved in instrument state
Backwards Compatibility Notes	The legacy :TRIGger[:SEquence]:SLOPe command affects the slopes for the VID, LINE, EXT1, EXT2, and RFB triggers.
Initial S/W Revision	Prior to A.02.00

### Trig Delay

Controls a time delay during which the analyzer will wait to begin a sweep after meeting the trigger criteria. You can use negative delay to pre-trigger the instrument in time domain or FFT, but not in swept spans.

Key Path	Trigger, Line
<b>Remote Command</b>	:TRIGger[:SEquence]:LINE:DELAy <time> :TRIGger[:SEquence]:LINE:DELAy? :TRIGger[:SEquence]:LINE:DELAy:STATE OFF ON 0 1 :TRIGger[:SEquence]:LINE:DELAy:STATE?
<b>Example</b>	TRIG:LINE:DEL:STAT ON TRIG:LINE:DEL 100 ms
Notes	Video trigger delay may be set to negative values, in time domain, FFT and even swept. It 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. 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.
Preset	Off, 1.000 us
State Saved	Saved in instrument state
Min	-150 ms
Max	500 ms
Default Unit	S
Backwards Compatibility Notes	The legacy :TRIGger[:SEquence]:DELAy command affects the delay for the VID, LINE, EXT1, EXT2, and RFB triggers.

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The legacy :TRIGger[:SEQuence]:OFFSet command is supported for the VIDEO, LINE, EXT1, and EXT2 triggers.

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Initial S/W Revision      Prior to A.02.00

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## 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.

The switch is grayed out and Off unless the measurement is a time domain measurement; thus, in Swept SA it is grayed out unless in Zero Span.

Key Path	Trigger, Trigger
Remote Command	:TRIGger[:SEQuence]:XRELative ON OFF 1 0 :TRIGger[:SEQuence]:XRELative?
Example	TRIG:XREL ON
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. Non-forceful grayout, no error if SCPI sent while grayed out.
Preset	Off
State Saved	Saved in instrument state.
Initial S/W Revision	Prior to A.18.00
Control Type	Toggle

## External 1

Pressing this key, when it is not selected, selects an external input signal as the trigger. A new sweep/measurement will start when the external trigger condition is met using the external 1 input connector on the rear panel.

Pressing this key, when it is already selected, accesses the external 1 trigger setup menu.

Key Path	<b>Trigger</b>
<b>Example</b>	TRIG:SOUR EXT1 Swept SA measurement TRIG:<meas>:SOUR EXT1 Measurements other than Swept SA
Dependencies	Grayed out if in use by Point Trigger in the Source Setup menu. Forced to Free Run if already selected and Point Trigger is set to External 1.
State Saved	Saved in instrument state
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.
Initial S/W Revision	Prior to A.02.00

### Trigger Level

Sets the value where the external 1 trigger input will trigger a new sweep/measurement.

Key Path	<b>Trigger, External 1</b>
<b>Remote Command</b>	:TRIGger[:SEquence]:EXTernal1:LEVel <level> :TRIGger[:SEquence]:EXTernal1:LEVel?
<b>Example</b>	TRIG:EXT1:LEV 0.4 V
Couplings	This same level is used for the Ext1 trigger source in the Trigger menu, for the Ext1 selection in the Periodic Timer sync source (in the Trigger menu and in the Gate Source menu), and also for the Ext1 selection in the Gate Source menu.
Preset	1.2 V
State Saved	Saved in instrument state
Min	-5 V
Max	5 V
Default Unit	V
<b>Backwards Compatibility SCPI</b>	:TRIGger[:SEquence]:EXTernal:LEVel
	For backward compatibility, the parameter EXTernal is mapped to EXTernal1
<b>Backwards Compatibility SCPI</b>	:TRIGger[:SEquence]:FRAMe:EXTernal1:LEVel
Initial S/W Revision	Prior to A.02.00

### Trig Slope

Controls the trigger polarity. It is set positive to trigger on a rising edge and negative to trigger on a falling edge.

Key Path	<b>Trigger, External 1</b>
<b>Remote Command</b>	:TRIGger[:SEquence]:EXTernal1:SLOPe POSitive NEGative

	<code>:TRIGger[:SEquence]:EXTeRnal1:SLOPe?</code>
<b>Example</b>	TRIG:EXT1:SLOP NEG
Couplings	This same slope is used in the Ext1 selection for the trigger source in the Trigger menu and for the period timer sync source (in the Trigger menu and in the Gate Source menu).
Preset	POSitive
State Saved	Saved in instrument state
<b>Backwards Compatibility SCPI</b>	<code>:TRIGger[:SEquence]:EXTeRnal:SLOPe</code> For backward compatibility, the parameter EXTeRnal is mapped to EXTeRnal1
<b>Backwards Compatibility SCPI</b>	<code>:TRIGger[:SEquence]:FRAMe:EXTeRnal1:SLOPe</code>
Backwards Compatibility Notes	The legacy <code>:TRIGger[:SEquence]:SLOPe</code> command affects the slopes for the VID, LINE, EXT1, EXT2, and RFB triggers.
Initial S/W Revision	Prior to A.02.00

### Trig Delay

Controls a time delay during which the analyzer will wait to begin a sweep after meeting the trigger criteria. You can use negative delay to pre-trigger the instrument in time domain or FFT, but not in swept spans.

Key Path	Trigger, External 1
<b>Remote Command</b>	<code>:TRIGger[:SEquence]:EXTeRnal1:DELAy &lt;time&gt;</code> <code>:TRIGger[:SEquence]:EXTeRnal1:DELAy?</code> <code>:TRIGger[:SEquence]:EXTeRnal1:DELAy:STATe OFF ON 0 1</code> <code>:TRIGger[:SEquence]:EXTeRnal1:DELAy:STATe?</code>
<b>Example</b>	TRIG:EXT1:DEL:STAT ON TRIG:EXT1:DEL 100 ms
Notes	Video trigger delay may be set to negative values, in time domain, FFT and even swept. It 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. 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.
Preset	Off, 1.000 us
State Saved	Saved in instrument state
Min	-150 ms
Max	+500 ms
Default Unit	s
<b>Backwards Compatibility SCPI</b>	<code>:TRIGger[:SEquence]:EXTeRnal:DELAy</code> For backward compatibility, the parameter EXTeRnal is mapped to EXTeRnal1
Backwards Compatibility Notes	The legacy <code>:TRIGger[:SEquence]:DELAy</code> command affects the delay for the VID, LINE, EXT1, EXT2, and RFB triggers. The legacy <code>:TRIGger[:SEquence]:OFFSet</code> command is supported for the VIDeO, LINE, EXT1, and

	EXT2 triggers.
Initial S/W Revision	Prior to A.02.00

### 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.

The switch is grayed out and Off unless the measurement is a time domain measurement; thus, in Swept SA it is grayed out unless in Zero Span.

Key Path	<b>Trigger, Trigger</b>
<b>Remote Command</b>	<b>:TRIGger[:SEquence]:XRElative ON OFF 1 0</b> <b>:TRIGger[:SEquence]:XRElative?</b>
<b>Example</b>	TRIG:XREL ON
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. Non-forceful grayout, no error if SCPI sent while grayed out.
Preset	Off
State Saved	Saved in instrument state.
Initial S/W Revision	Prior to A.18.00
Control Type	Toggle

### External 2

Pressing this key, when it is not selected, selects an external input signal as the trigger. A new sweep/measurement will start when the external trigger condition is met using the external 2 input connector. The external trigger 2 input connector is on the rear panel.

Pressing this key, when it is already selected, accesses the external 2 trigger setup menu.

Key Path	<b>Trigger</b>
<b>Example</b>	TRIG:SOUR EXT2 Swept SA measurement TRIG:<meas>:SOUR EXT2 Measurements other than Swept SA
Dependencies	In some models, there is no second External input. In these models, the External 2 key is blanked and the EXTernal2 parameter will generate a "Hardware missing; Not available for this model number" message.  Grayed out if in use by Point Trigger in the Source Setup menu.  Forced to Free Run if already selected and Point Trigger is set to External 2.
State Saved	Saved in instrument state
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.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

### Trigger Level

Sets the value where the external 2 trigger input will trigger a new sweep/measurement.

Key Path	<b>Trigger, External 2</b>
<b>Remote Command</b>	:TRIGger[:SEquence]:EXTernal2:LEVel :TRIGger[:SEquence]:EXTernal2:LEVel?
<b>Example</b>	TRIG:EXT2:LEV 1.1 V
Couplings	This same level is used for the Ext2 trigger source in the Trigger menu, for the Ext2 selection in the Periodic Timer sync source (in the Trigger menu and in the Gate Source menu), and also for the Ext2 selection in the Gate Source menu.
Preset	1.2 V
State Saved	Saved in instrument state
Min	-5 V
Max	5 V
Default Unit	V
<b>Backwards Compatibility SCPI</b>	:TRIGger[:SEquence]:FRAME:EXTernal2:LEVel
Initial S/W Revision	Prior to A.02.00

### Trig Slope

Controls the trigger polarity. It is set positive to trigger on a rising edge and negative to trigger on a falling edge.

Key Path	Trigger, External 2
Remote Command	:TRIGger[:SEquence]:EXTerna12:SLOPe POSitive NEGative :TRIGger[:SEquence]:EXTerna12:SLOPe?
Example	TRIG:EXT2:SLOP NEG
Couplings	This same slope is used in the Ext2 selection for the trigger source in the Trigger menu and for the period timer sync source (in the Trigger menu and in the Gate Source menu).
Preset	POSitive
State Saved	Saved in instrument state
Backwards Compatibility SCPI	:TRIGger[:SEquence]:FRAME:EXTerna12:SLOPe
Backwards Compatibility Notes	The legacy :TRIGger[:SEquence]:SLOPe command affects the slopes for the VID, LINE, EXT1, EXT2, and RFB triggers.
Initial S/W Revision	Prior to A.02.00

### Trig Delay

Controls a time delay during which the analyzer will wait to begin a sweep after meeting the trigger criteria. You can use negative delay to pre-trigger the instrument in time domain or FFT, but not in swept spans.

Key Path	Trigger, External 2
Remote Command	:TRIGger[:SEquence]:EXTerna12:DELay <time> :TRIGger[:SEquence]:EXTerna12:DELay? :TRIGger[:SEquence]:EXTerna12:DELay:STATe OFF ON 0 1 :TRIGger[:SEquence]:EXTerna12:DELay:STATe?
Example	TRIG:EXT2:DEL:STAT ON TRIG:EXT2:DEL 100 ms
Notes	Video trigger delay may be set to negative values, in time domain, FFT and even swept. It 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. 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.
Preset	Off, 1.000 us
State Saved	Saved in instrument state
Min	-150 ms
Max	500 ms
Default Unit	s
Backwards Compatibility Notes	The legacy :TRIGger[:SEquence]:DELay command affects the delay for the VID, LINE, EXT1, EXT2, and RFB triggers. The legacy :TRIGger[:SEquence]:OFFSet command is supported for the VIDeO, LINE, EXT1, and EXT2 triggers.
Initial S/W Revision	Prior to A.02.00



## 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.

The switch is grayed out and Off unless the measurement is a time domain measurement; thus, in Swept SA it is grayed out unless in Zero Span.

Key Path	Trigger, Trigger
Remote Command	:TRIGger[:SEquence]:XRELative ON OFF 1 0 :TRIGger[:SEquence]:XRELative?
Example	TRIG:XREL ON
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. Non-forceful grayout, no error if SCPI sent while grayed out.
Preset	Off
State Saved	Saved in instrument state.
Initial S/W Revision	Prior to A.18.00
Control Type	Toggle

## RF Burst

Pressing this key, when it is not selected, selects the RF Burst as the trigger. A new sweep/measurement will start when an RF burst envelope signal is identified from the signal at the RF Input connector. Pressing this key, when it is already selected, accesses the RF Burst trigger setup menu.

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.

Key Path	Trigger
Example	TRIG:SOUR RFB Swept SA measurement

	TRIG:<meas>:SOUR RFB Measurements other than Swept SA
State Saved	Saved in instrument state
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.
Backwards Compatibility Notes	The legacy command: :TRIGger[:SEQuence]:RFBurst:FSElectivity[:STATe] OFF ON 0 1 is not supported in the X-Series, as the hardware to do Frequency Selective burst triggers does not exist in X-Series.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.04.00

### Absolute Trigger Level

Sets the absolute trigger level for the RF burst envelope.

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.

Key Path	<b>Trigger, RF Burst</b>
Scope	Meas Global
<b>Remote Command</b>	:TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute <ampl> :TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute?
<b>Example</b>	TRIG:RFB:LEV:ABS 10 dBm sets the trigger level of the RF burst envelope signal to the absolute level of 10 dBm
Notes	Sending this command does not switch the setting from relative to absolute; to switch it you need to send the :TRIGger[:SEQuence]:RFBurst:LEVel:TYPE command, below.  Amplitude Corrections are not taken into account by the Absolute Trigger Level. For example, if you have given yourself effective gain with an amplitude correction factor, the Absolute Trigger will not fire until you have set the trigger level that far below the displayed signal level, rather than simply to the displayed signal level. This is only true for Amplitude Corrections, not External Gain or Ref Level Offset functions.  If mode is Bluetooth, the default value is -50 dBm.
Couplings	This same level is used for the RF Burst trigger source in the Trigger menu, for the RF Burst selection in the Periodic Timer sync source (in the Trigger menu and in the Gate Source menu), and also for the RF Burst selection in the Gate Source menu
Preset	-20 dBm
State Saved	Saved in instrument state
Min	-200 dBm
Max	100 dBm
Default Unit	depends on the current selected Y-Axis unit

<b>Backwards Compatibility SCPI</b>	<b>:TRIGger[:SEquence]:FRAMe:RFBurst:LEVe1:ABSolute</b>
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.04.00
<b>Key Path</b>	<b>Trigger, RF Burst</b>
<b>Remote Command</b>	<b>:TRIGger[:SEquence]:RFBurst:LEVe1:TYPE ABSolute RELative</b> <b>:TRIGger[:SEquence]:RFBurst:LEVe1:TYPE?</b>
<b>Example</b>	TRIG:RFB:LEV:TYPE REL sets the trigger level type of the RF burst trigger to Relative.
Preset	ABSolute
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.04.00

### 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:

5. 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.
6. Now, 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:
7. absolute RF Burst level = peak level of the previous acquisition + relative RF Burst level
8. 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.

Key Path	Trigger, RF Burst
Scope	Meas Global
<b>Remote Command</b>	:TRIGger[:SEquence]:RFBurst:LEVel:RELative <rel_amp1> :TRIGger[:SEquence]:RFBurst:LEVel:RELative?
<b>Example</b>	TRIG:RFB:LEV:REL -10 dB sets the trigger level of the RF burst envelope signal to the relative level of -10 dB
Notes	Sending this command does not switch the setting from absolute to relative; to switch it you need to send the :TRIGger[:SEquence]:RFBurst:LEVel:TYPE command, above. The relative trigger level is not available in some measurements. In those measurements the RELative parameter, and the :TRIGger[:SEquence]:RFBurst:LEVel:TYPE command (above), will generate an error if sent.
Dependencies	This key is grayed out and Absolute Trigger Level selected if the required hardware is not present in your analyzer and the current measurement does not support Relative triggering.
Preset	-6 dB GSM: -25 dB
State Saved	Saved in instrument state
Min	-45 dB
Max	0 dB
Default Unit	dB or dBc
<b>Backwards Compatibility SCPI</b>	:TRIGger[:SEquence]:RFBurst:LEVel This legacy command is aliased to :TRIGger[:SEquence]:RFBurst:LEVel:RELative because the PSA had ONLY relative burst triggering
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.04.00

## Trigger Slope

It is set positive to trigger on a rising edge and negative to trigger on a falling edge.

Key Path	Trigger, RF Burst
<b>Remote Command</b>	:TRIGger[:SEquence]:RFBurst:SLOPe POSitive NEGative :TRIGger[:SEquence]:RFBurst:SLOPe?
<b>Example</b>	TRIG:RFB:SLOP NEG
Couplings	This same slope is used in the RF Burst selection for the trigger source in the Trigger menu and for the period timer sync source (in the Trigger menu and in the Gate Source menu).
Preset	POSitive
State Saved	Saved in instrument state
<b>Backwards</b>	:TRIGger[:SEquence]:FRAME:RFBurst:SLOPe

**Compatibility SCPI**

Backwards Compatibility Notes	The legacy :TRIGger[:SEquence]:SLOPe command affects the slopes for the VID, LINE, EXT1, EXT2, and RFB triggers.
Initial S/W Revision	Prior to A.02.00

**Trig Delay**

Controls a time delay during which the analyzer will wait to begin a sweep after meeting the trigger criteria. You can use negative delay to pre-trigger the instrument in time domain or FFT, but not in swept spans.

Key Path	Trigger, RF Burst
<b>Remote Command</b>	:TRIGger[:SEquence]:RFBurst:DElay <time> :TRIGger[:SEquence]:RFBurst:DElay? :TRIGger[:SEquence]:RFBurst:DElay:STATe OFF ON 0 1 :TRIGger[:SEquence]:RFBurst:DElay:STATe?
<b>Example</b>	TRIG:RFB:DEL:STAT ON TRIG:RFB:DEL 100 ms
Notes	Video trigger delay may be set to negative values, in time domain, FFT and even swept. It 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. 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.
Preset	Off, 1.000 us
State Saved	Saved in instrument state
Min	-150 ms
Max	500 ms
Default Unit	s
Backwards Compatibility Notes	The legacy :TRIGger[:SEquence]:DElay command affects the delay for the VID, LINE, EXT1, EXT2, and RFB triggers.
Initial S/W Revision	Prior to A.02.00

**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.

The switch is grayed out and Off unless the measurement is a time domain measurement; thus, in Swept SA it is grayed out unless in Zero Span.

Key Path	<b>Trigger, Trigger</b>
<b>Remote Command</b>	<b>:TRIGger[:SEquence]:XRELative ON OFF 1 0</b> <b>:TRIGger[:SEquence]:XRELative?</b>
<b>Example</b>	TRIG:XREL ON
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. Non-forceful grayout, no error if SCPI sent while grayed out.
Preset	Off
State Saved	Saved in instrument state.
Initial S/W Revision	Prior to A.18.00
Control Type	Toggle

### Periodic Timer (Frame Trigger)

Pressing this key, when it is not selected, selects the internal periodic timer signal as the trigger. Triggering occurrences are set by the **Period** parameter, which is modified by the **Sync Source** and **Offset**. Pressing this key, when it is already selected, accesses the periodic timer trigger setup functions.

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.

Key Path	<b>Trigger</b>
<b>Example</b>	TRIG:SOUR FRAM Swept SA measurement TRIG:<meas>:SOUR FRAM Measurements other than Swept SA
State Saved	Saved in instrument state
Readback	[Sync: <value of Sync Source>], for example, [Sync: External 1]
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.
Initial S/W Revision	Prior to A.02.00

Periodic Timer Triggering:

This feature selects the internal periodic timer signal as the trigger. Trigger occurrences are set by the **Periodic Timer** parameter, which is modified by the **Sync Source** and **Offset**.

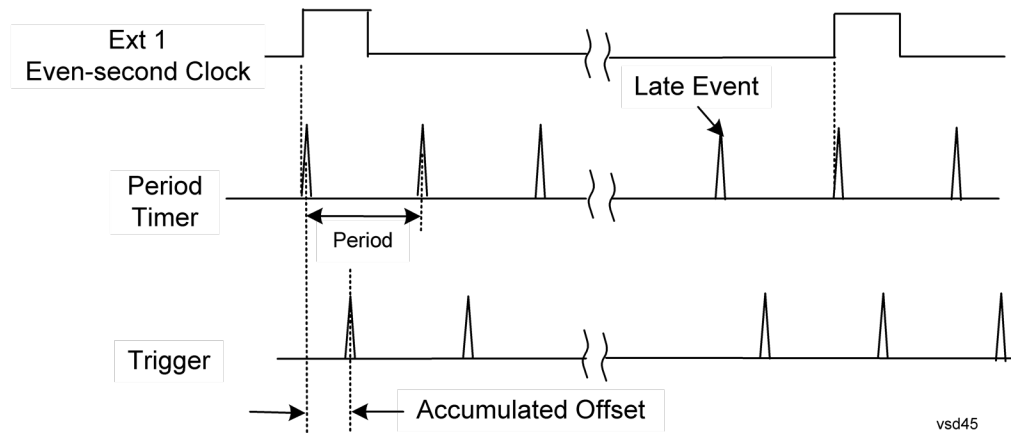
The figure below shows the action of the periodic timer trigger. Before reviewing the figure, we'll explain some uses for the periodic trigger.

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.)



### 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.

Key Path	Trigger, Periodic Timer
Remote Command	:TRIGger[:SEquence]:FRAME:PERiod <time> :TRIGger[:SEquence]:FRAME:PERiod?
Example	TRIG:FRAM:PER 100 ms
Dependencies	The invalid data indicator turns on when the period is changed, until the next sweep/measurement completes.
Couplings	The same period is used in the Gate Source selection of the period timer.
Preset	20 ms GSM: 4.615383
State Saved	Saved in instrument state
Min	100.000 ns
Max	559.0000 ms
Default Unit	S
Initial S/W Revision	Prior to A.02.00

### Offset

Adjusts the accumulated offset between the periodic timer events and the trigger event. Adjusting the accumulated offset is different than setting an offset, and requires explanation.

The periodic timer is usually not synchronized with any external events, so the timing of its output events has no absolute meaning. Since the timing relative to external events (RF signals) is important, you need to be able to adjust (offset) it. However, you have no direct way to see when the periodic timer events occur. All that you can see is the trigger timing. When you want to adjust the trigger timing, you will be



changing the internal offset between the periodic timer events and the trigger event. Because the absolute value of that internal offset is unknown, we will just call that the accumulated offset. Whenever the Offset parameter is changed, you are changing that accumulated offset. You can reset the displayed offset using Reset Offset Display. Changing the display does not change the value of the accumulated offset, and you can still make additional changes to accumulated offset.

To avoid ambiguity, we define that an increase in the "offset" parameter, either from the knob or the SCPI adjust command, serves to delay the timing of the trigger event.

Key Path	Trigger, Periodic Timer
Remote Command	:TRIGger[:SEquence]:FRAMe:OFFSet <time> :TRIGger[:SEquence]:FRAMe:OFFSet?
Example	TRIG:FRAM:OFFS 1.2 ms
Notes	<p>The front panel interface (for example, the knob), and this command, adjust the accumulated offset, which is shown on the active function display. 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).</p> <p>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 section "<a href="#">Trig Delay</a>" on page 381.</p> <p>An increase in the "offset" parameter, either from the knob or the SCPI adjust command, serves to delay the timing of the trigger event.</p>
Notes	<p>When the SCPI command is sent the value shown on the key (and the Active Function, if this happens to be the active function) is updated with the new value. However, the actual amount sent to the hardware is the delta value, that is, the current accumulated offset value minus the previous accumulated offset value.</p> <p>The SCPI query simply returns the value currently showing on the key.</p>
Dependencies	The invalid data indicator turns on when the offset is changed, until the next sweep/measurement completes.
Couplings	The same offset is used in the Gate Source selection of the period timer.
Preset	0 s
State Saved	Saved in instrument state
Min	-10.000 s
Max	10.000 s
Default Unit	S
Initial S/W Revision	Prior to A.02.00

### Offset Adjust (Remote Command Only)

This remote command does not work at all like the related front panel keys. This command lets you advance the phase of the frame trigger by the amount you specify.

It does not change the period of the trigger waveform. If the command is sent multiple times, it advances the phase of the frame trigger an additional amount each time it is sent. Negative numbers are permitted.

<b>Remote Command</b>	<b>:TRIGger[:SEquence]:FRAMe:ADJust &lt;time&gt;</b>
<b>Example</b>	TRIG:FRAM:ADJ 1.2 ms
Notes	Note also that Offset is used only when the sync source is set to OFF, otherwise delay is used, see section " <a href="#">Trig Delay</a> " on page 381 An increase in the "offset" parameter, either from the knob or the SCPI adjust command, serves to delay the timing of the trigger event.
Notes	The front panel interface (for example, the knob) and the :TRIG:FRAM:OFFS command adjust the accumulated offset, which is shown on the active function display. However, the actual amount sent to the hardware is the delta value, that is, the current offset value minus the previous offset value. When the SCPI command is sent the value shown on the key (and the Active Function, if this happens to be the active function) is updated by increasing it (or decreasing it if the value sent is negative) by the amount specified in the SCPI command. This is a "command only" SCPI command, with no query.
Dependencies	The invalid data indicator turns on when the offset is changed, until the next sweep/measurement completes.
Couplings	The same offset is used in the Gate Source selection of the period timer.
Preset	0 s
State Saved	Saved in instrument state
Min	-10.000 s
Max	10.000 s
Default Unit	S
Initial S/W Revision	Prior to A.02.00

### 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 key redefines the currently displayed trigger location as the new trigger point that is 0.0 s offset. The **Offset** key can then be used to add offset relative to this new timing.

Key Path	<b>Trigger, Periodic Timer</b>
<b>Remote Command</b>	<b>:TRIGger[:SEquence]:FRAMe:OFFSet:DISPlay:RESet</b>
<b>Example</b>	TRIG:FRAM:OFFS:DISP:RES
Initial S/W Revision	Prior to A.02.00

### 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.

For convenience you may adjust the level and slope of the selected sync source in a conditional branch setup menu accessed from the Sync Source menu. 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.

Key Path	<b>Trigger, Periodic Timer</b>
<b>Remote Command</b>	:TRIGger[:SEquence]:FRAMe:SYNC EXTerna11   EXTerna12   RFBurst   PXI   OFF  :TRIGger[:SEquence]:FRAMe:SYNC?
<b>Example</b>	TRIG:FRAM:SYNC EXT2
Dependencies	In some models, there is no second External input. In these models, the External 2 key is blanked and the EXTerna12 parameter will generate a "Hardware missing; Not available for this model number" message.  PXI trigger is only supported in PXI (modular) instruments.
Preset	Off  GSM/EDGE, MSR,LTE,LTETDD: RFBurst
State Saved	Saved in instrument state
Readback	The current setting is read back to this key and it is also Readback to the previous <b>Periodic Timer</b> trigger key.
<b>Backwards Compatibility SCPI</b>	:TRIGger[:SEquence]:FRAMe:SYNC EXTerna1  For backward compatibility, the parameter EXTerna1 is mapped to EXTerna1
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00, A.14.00

## Off

Turns off the sync source for your periodic trigger. With the sync source off, the timing will drift unless the signal source frequency is locked to the analyzer frequency reference.

Key Path	<b>Trigger, Periodic Timer, Sync Source</b>
<b>Example</b>	TRIG:FRAM:SYNC OFF
Readback	Off
Initial S/W Revision	Prior to A.02.00

## External 1

Pressing this key, when it is not selected, selects an external input signal as the trigger. A new sweep/measurement will start when the external trigger condition is met using the external 1 input connector on the rear panel.

Pressing this key, when it is already selected, accesses the external 1 trigger setup menu.

Key Path	<b>Trigger</b>
<b>Example</b>	TRIG:SOUR EXT1 Swept SA measurement TRIG:<meas>:SOUR EXT1 Measurements other than Swept SA
Dependencies	Grayed out if in use by Point Trigger in the Source Setup menu. Forced to Free Run if already selected and Point Trigger is set to External 1.
State Saved	Saved in instrument state
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.
Initial S/W Revision	Prior to A.02.00

### Trigger Level

Sets the value where the external 1 trigger input will trigger a new sweep/measurement.

Key Path	<b>Trigger, External 1</b>
<b>Remote Command</b>	:TRIGger[:SEquence]:EXTernal1:LEVel <level> :TRIGger[:SEquence]:EXTernal1:LEVel?
<b>Example</b>	TRIG:EXT1:LEV 0.4 V
Couplings	This same level is used for the Ext1 trigger source in the Trigger menu, for the Ext1 selection in the Periodic Timer sync source (in the Trigger menu and in the Gate Source menu), and also for the Ext1 selection in the Gate Source menu.
Preset	1.2 V
State Saved	Saved in instrument state
Min	-5 V
Max	5 V
Default Unit	V
<b>Backwards Compatibility SCPI</b>	:TRIGger[:SEquence]:EXTernal:LEVel
	For backward compatibility, the parameter EXTernal is mapped to EXTernal1
<b>Backwards Compatibility SCPI</b>	:TRIGger[:SEquence]:FRAMe:EXTernal1:LEVel
Initial S/W Revision	Prior to A.02.00

### Trig Slope

Controls the trigger polarity. It is set positive to trigger on a rising edge and negative to trigger on a falling edge.

Key Path	<b>Trigger, External 1</b>
<b>Remote Command</b>	:TRIGger[:SEquence]:EXTernal1:SLOPe POSitive NEGative

	<b>:TRIGger[:SEQuence]:EXTernal1:SLOPe?</b>
<b>Example</b>	TRIG:EXT1:SLOP NEG
Couplings	This same slope is used in the Ext1 selection for the trigger source in the Trigger menu and for the period timer sync source (in the Trigger menu and in the Gate Source menu).
Preset	POSitive
State Saved	Saved in instrument state
<b>Backwards Compatibility SCPI</b>	<b>:TRIGger[:SEQuence]:EXTernal:SLOPe</b> For backward compatibility, the parameter EXTernal is mapped to EXTernal1
<b>Backwards Compatibility SCPI</b>	<b>:TRIGger[:SEQuence]:FRAMe:EXTernal1:SLOPe</b>
Backwards Compatibility Notes	The legacy :TRIGger[:SEQuence]:SLOPe command affects the slopes for the VID, LINE, EXT1, EXT2, and RFB triggers.
Initial S/W Revision	Prior to A.02.00

## External 2

Pressing this key, when it is not selected, selects an external input signal as the trigger. A new sweep/measurement will start when the external trigger condition is met using the external 2 input connector. The external trigger 2 input connector is on the rear panel.

Pressing this key, when it is already selected, accesses the external 2 trigger setup menu.

Key Path	<b>Trigger</b>
<b>Example</b>	TRIG:SOUR EXT2 Swept SA measurement TRIG:<meas>:SOUR EXT2 Measurements other than Swept SA
Dependencies	In some models, there is no second External input. In these models, the External 2 key is blanked and the EXTernal2 parameter will generate a "Hardware missing; Not available for this model number" message.  Grayed out if in use by Point Trigger in the Source Setup menu.  Forced to Free Run if already selected and Point Trigger is set to External 2.
State Saved	Saved in instrument state
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.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

## Trigger Level

Sets the value where the external 2 trigger input will trigger a new sweep/measurement.

Key Path	Trigger, External 2
<b>Remote Command</b>	:TRIGger[:SEquence]:EXTerna12:LEVe1 :TRIGger[:SEquence]:EXTerna12:LEVe1?
<b>Example</b>	TRIG:EXT2:LEV 1.1 V
Couplings	This same level is used for the Ext2 trigger source in the Trigger menu, for the Ext2 selection in the Periodic Timer sync source (in the Trigger menu and in the Gate Source menu), and also for the Ext2 selection in the Gate Source menu.
Preset	1.2 V
State Saved	Saved in instrument state
Min	-5 V
Max	5 V
Default Unit	V
<b>Backwards Compatibility SCPI</b>	:TRIGger[:SEquence]:FRAMe:EXTerna12:LEVe1
Initial S/W Revision	Prior to A.02.00

## Trig Slope

Controls the trigger polarity. It is set positive to trigger on a rising edge and negative to trigger on a falling edge.

Key Path	Trigger, External 2
<b>Remote Command</b>	:TRIGger[:SEquence]:EXTerna12:SLOPe POSitive NEGative :TRIGger[:SEquence]:EXTerna12:SLOPe?
<b>Example</b>	TRIG:EXT2:SLOP NEG
Couplings	This same slope is used in the Ext2 selection for the trigger source in the Trigger menu and for the period timer sync source (in the Trigger menu and in the Gate Source menu).
Preset	POSitive
State Saved	Saved in instrument state
<b>Backwards Compatibility SCPI</b>	:TRIGger[:SEquence]:FRAMe:EXTerna12:SLOPe
Backwards Compatibility Notes	The legacy :TRIGger[:SEquence]:SLOPe command affects the slopes for the VID, LINE, EXT1, EXT2, and RFB triggers.
Initial S/W Revision	Prior to A.02.00

## RF Burst

Pressing this key, when it is not selected, selects the RF Burst as the trigger. A new sweep/measurement will start when an RF burst envelope signal is identified from

the signal at the RF Input connector. Pressing this key, when it is already selected, accesses the RF Burst trigger setup menu.

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.

Key Path	<b>Trigger</b>
<b>Example</b>	TRIG:SOUR RFB Swept SA measurement TRIG:<meas>:SOUR RFB Measurements other than Swept SA
State Saved	Saved in instrument state
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.
Backwards Compatibility Notes	The legacy command: :TRIGger[:SEQuence]:RFBurst:FSElectivity[:STATe] OFF ON 0 1 is not supported in the X-Series, as the hardware to do Frequency Selective burst triggers does not exist in X-Series.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.04.00

### Absolute Trigger Level

Sets the absolute trigger level for the RF burst envelope.

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.

Key Path	<b>Trigger, RF Burst</b>
Scope	Meas Global
<b>Remote Command</b>	:TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute <ampl> :TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute?
<b>Example</b>	TRIG:RFB:LEV:ABS 10 dBm sets the trigger level of the RF burst envelope signal to the absolute level of 10 dBm
Notes	Sending this command does not switch the setting from relative to absolute; to switch it you need to send the :TRIGger[:SEQuence]:RFBurst:LEVel:TYPE command, below.  Amplitude Corrections are not taken into account by the Absolute Trigger Level. For example, if you have given yourself effective gain with an amplitude correction factor, the Absolute Trigger will not fire until you have set the trigger level that far below the displayed signal level, rather than simply to the displayed signal level. This is only true for Amplitude Corrections, not External Gain or Ref Level Offset functions.

	If mode is Bluetooth, the default value is -50 dBm.
Couplings	This same level is used for the RF Burst trigger source in the Trigger menu, for the RF Burst selection in the Periodic Timer sync source (in the Trigger menu and in the Gate Source menu), and also for the RF Burst selection in the Gate Source menu
Preset	-20 dBm
State Saved	Saved in instrument state
Min	-200 dBm
Max	100 dBm
Default Unit	depends on the current selected Y-Axis unit
<b>Backwards Compatibility SCPI</b>	<b>:TRIGger[:SEquence]:FRAMe:RFBurst:LEVe1:ABSolute</b>
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.04.00

Key Path	Trigger, RF Burst
<b>Remote Command</b>	<b>:TRIGger[:SEquence]:RFBurst:LEVe1:TYPE ABSolute RELative</b> <b>:TRIGger[:SEquence]:RFBurst:LEVe1:TYPE?</b>
<b>Example</b>	TRIG:RFB:LEV:TYPE REL sets the trigger level type of the RF burst trigger to Relative.
Preset	ABSolute
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.04.00

### Trigger Slope

It is set positive to trigger on a rising edge and negative to trigger on a falling edge.

Key Path	Trigger, RF Burst
<b>Remote Command</b>	<b>:TRIGger[:SEquence]:RFBurst:SLOPe POSitive NEGative</b> <b>:TRIGger[:SEquence]:RFBurst:SLOPe?</b>
<b>Example</b>	TRIG:RFB:SLOP NEG
Couplings	This same slope is used in the RF Burst selection for the trigger source in the Trigger menu and for the period timer sync source (in the Trigger menu and in the Gate Source menu).
Preset	POSitive
State Saved	Saved in instrument state
<b>Backwards Compatibility SCPI</b>	<b>:TRIGger[:SEquence]:FRAMe:RFBurst:SLOPe</b>



Backwards Compatibility Notes	The legacy :TRIGger[:SEQuence]:SLOPe command affects the slopes for the VID, LINE, EXT1, EXT2, and RFB triggers.
Initial S/W Revision	Prior to A.02.00

## Trig Delay

This setting delays the measurement timing relative to the Periodic Timer.

Key Path	Trigger, Periodic Timer
<b>Remote Command</b>	:TRIGger[:SEQuence]:FRAMe:DELay <time> :TRIGger[:SEQuence]:FRAMe:DELay? :TRIGger[:SEQuence]:FRAMe:DELay:STATe OFF ON 0 1 :TRIGger[:SEQuence]:FRAMe:DELay:STATe?
Notes	Note that delay is used when the sync source is not set to OFF. If the sync source is set to OFF, offset is used.
Preset	Off, 1.000 us
State Saved	Saved in instrument state
Min	-150 ms
Max	+500 ms
Default Unit	s
Initial S/W Revision	Prior to A.02.00

## 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.

The switch is grayed out and Off unless the measurement is a time domain measurement; thus, in Swept SA it is grayed out unless in Zero Span.

Key Path	Trigger, Trigger
<b>Remote Command</b>	:TRIGger[:SEQuence]:XRELative ON OFF 1 0 :TRIGger[:SEQuence]:XRELative?

<b>Example</b>	TRIG:XREL ON
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. Non-forceful grayout, no error if SCPI sent while grayed out.
Preset	Off
State Saved	Saved in instrument state.
Initial S/W Revision	Prior to A.18.00
Control Type	Toggle

### Time 1

This is a property of the Time Qualified Trigger feature. Time 1 is a time duration that may be used in addition to the current trigger criteria to determine when and if to trigger.

Key Path	Trigger, Level, Time 1
<b>Remote Command</b>	:TRIGger[:SEquence]:LEVel:TCRiteria:LOWer <time> :TRIGger[:SEquence]:LEVel:TCRiteria:LOWer?
<b>Example</b>	TRIG:LEV:TCRiteria:LOWer 100 usec
Dependencies	Time 1 must always be less than Time 2 by at least "step size". If the user changes Time 1 to equal to or greater than Time 2, Time 2 will be pushed to Time 1 + step size. If the user changes Time 2 to equal to or less than Time 1, then Time 1 will be reduced to Time 2 - step size. Step size = 1/(1.25 * Span).
Preset	5.0 nsec
State Saved	Saved in instrument state
Min	1/ (1.25 * Span)
Max	10 sec
Default Unit	s
Initial S/W Revision	Prior to A.14.50

### Time 2

This is a property of the Time Qualified Trigger feature. Time 2 is a time duration that may be used in addition to the current trigger criteria to determine when and if to trigger.

Key Path	Trigger, Level, Time 2
<b>Remote Command</b>	:TRIGger[:SEquence]:LEVel:TCRiteria:UPPer <time> :TRIGger[:SEquence]:LEVel:TCRiteria:UPPer?
<b>Example</b>	TRIG:LEVel:TCRiteria:UPPer 100 usec
Dependencies	Time 1 must always be less than Time 2 by at least "step size". If the user changes Time 1 to equal to or greater than Time 2, Time 2 will be pushed to Time 1 + step size. If the user changes Time 2 to equal to or less than Time 1, then Time 1 will be reduced to Time 2 - step size. Step

	size = $1/(1.25 * \text{Span})$ . When Time Criteria is set to "> T1 and < T2", the minimum gap changes to 2 Step Sizes.
Preset	10.0 nsec
State Saved	Saved in instrument state
Min	$1/(1.25 * \text{Span})$
Max	10 sec
Default Unit	s
Initial S/W Revision	A.14.50

### Time Criteria

This parameter is used to define how T1 and T2 will be used to determine if and when to trigger. The different criteria specify how to when to trigger using the time duration(s). The time criteria is used to determine how long the trigger criteria needs to last prior to satisfying the trigger condition.

Key Path	Trigger, Level, Time Criteria
<b>Remote Command</b>	:TRIGger[:SEquence]:LEVel:TCRiteria[:TYPE] OFF   LTLower   GTLower   INSide   OUTSide :TRIGger[:SEquence]:LEV:TCRiteria?
<b>Example</b>	TRIG:LEV:TCR
State Saved	Saved in instrument state
Range	OFF LTL GTL INSide OUTSide
Initial S/W Revision	A.14.50

### Disabled

When the Time Criteria is set to "Disabled", no time duration is being used to control when the trigger occurs.

Key Path	Trigger, Level, Trigger Criteria
<b>Example</b>	:TRIGger:SEquence:LEVel:TCRiteria OFF
State Saved	Saved in instrument state.
Readback	Disabled
Initial S/W Revision	A.14.50

### < Time1

When the Time Criteria is set to "< Time 1", then the trigger condition cannot last as long as Time1. If it does last as long as Time1, then no trigger occurs. If the signal level lasts for < Time1, then the trigger occurs.

Key Path	Trigger, Level, Trigger Criteria
----------	----------------------------------

<b>Example</b>	:TRIGger:SEQuence:LEVel:TCRiteria LTLower
State Saved	Saved in instrument state.
Readback	< Time1
Initial S/W Revision	A.14.50

### > Time1

When the Time Criteria is set to “> Time 1”, then the signal level must last at least as long as Time1 to trigger. If it does not last at least as long as Time1, then no trigger occurs.

Key Path	<b>Trigger, Level, Trigger Criteria</b>
<b>Example</b>	:TRIGger:SEQuence:LEVel: TCRiteria GTLower
State Saved	Saved in instrument state.
Readback	Inside
Initial S/W Revision	A.14.50

### > T1 and < T2

When the Time Criteria is set to “> Time 1 and < Time 2”, then the specified signal level must last at least as long as Time 1, but not as long as Time 2 to trigger. If it does not last at least as long as Time1, then no trigger occurs. Or if the signal level lasts for Time 2 or more, then no trigger occurs.

Key Path	<b>Trigger, Level, Trigger Criteria</b>
<b>Example</b>	:TRIGger:SEQuence:LEV:TCRiteria INSide
State Saved	Saved in instrument state.
Readback	>T1 and <T2
Initial S/W Revision	A.14.50

### < T1 or > T2

When the Time Criteria is set to “< Time 1 or > Time 2”, then the specified signal level can last less than Time1, OR, the signal level can last longer than Time 2 to trigger. If the signal lever lasts for at least Time1, but less than Time 2, no trigger occurs.

Key Path	<b>Trigger, Level, Trigger Criteria</b>
<b>Example</b>	:TRIGger:SEQuence:LEV:TCRiteria OUTSide
State Saved	Saved in instrument state.
Readback	< T1 or > T2
Initial S/W Revision	A.14.50

## Frequency Mask Trigger (FMT)

Key Path	Trigger
<b>Remote Command</b>	TRIGger[:SEquence]:SOURce FMT TRIGger[:SEquence]:SOURce?
<b>Example</b>	TRIG:SOUR FMT
Notes	The amplitude resolution of the Frequency Mask is coupled to the Scale/Division. There are 256 vertical points therefore the amplitude resolution is computed using the algorithm; $(10 * \text{Scale/Div}) / \# \text{ Vertical Points}$
Dependencies	If you were not in Free Run when you entered the FMT Setup View, you can change Trigger Source to Free Run while in the editor. This will allow you to configure the mask with a continually updating trace. When exiting FMT Setup View, the Trigger Source will be changed back to FMT.
Couplings	A remote user can enter or access FMT data via :TRIGger[:SEquence]:FMT[1]2:DATA The upper and lower masks can have different freq/ampl pairs therefore subop code 1 is for the upper mask and subop code 2 is for the lower mask.
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.
Initial S/W Revision	A.13.00

### FMT Editor

This key accesses a menu of keys that enables you to select the frequency mask trigger parameters.

Key Path	Front-panel key
Initial S/W Revision	A.13.00

### Navigate

Let you move through the table to edit the desired point.

Key Path	Trigger, FMT
Min	1
Max	871
Initial S/W Revision	A.13.00

### Frequency

Allows you to edit the frequency of the current row.

Key Path	Trigger, FMT
----------	--------------

<b>Remote Command</b>	:TRIGger[:SEquence]:FMT:MASK[1] 2:DATA <freq>,<amp1>,<freq>,<amp1>} :TRIGger[:SEquence]:FMT:MASK[1] 2:DATA?
<b>Example</b>	:TRIG:FMT:MASK1:DATA -8.000000000E+07, -9.988000000E+02, 8.000000000E+07, -9.988000000E+02 :TRIG:FMT:MASK2:DATA -8.000000000E+07, -9.988000000E+02, 8.000000000E+07, -9.988000000E+02
Notes	To set up mask points remotely they must be sent as Freq/Ampl pairs.
Couplings	If the Relative to CF is ON, the frequency data will be relative. If the Relative to RL is ON, the amplitude data will be relative (in dB unit).
Preset	This setting is unaffected by a Mode Preset or power cycle It is Preset on Restore Mode Defaults
Min	The minimum frequency of a new point will be the frequency value of the point to the left, or the minimum value of the analyzer if it is the first point in the mask. This is to allow a vertical line on the mask. Min frequency is 0 Hz. Min amplitude is -1000 dBm[dB]
Max	The maximum frequency of a new point will be the frequency value of the point to the right, or the maximum value of the analyzer if it is the last point in the mask. This is to allow a vertical line on the mask. Max frequency is 1 THz. Max amplitude is 1000 dBm[dB]
Initial S/W Revision	A.13.00

## Amplitude

Let you edit the Amplitude of the current row.

Key Path	Trigger, FMT
<b>Remote Command</b>	:TRIGger[:SEquence]:FMT:MASK[1] 2:DATA <freq>,<amp1>,<freq>,<amp1>} :TRIGger[:SEquence]:FMT:MASK[1] 2:DATA?
<b>Example</b>	Same as frequency data
Notes	To set up mask points remotely they must be sent as Freq/Ampl pairs.
Couplings	If the Relative to CF is ON, the frequency data will be relative. If the Relative to RL is ON, the amplitude data will be relative (in dB unit).
Preset	This setting is unaffected by a Mode Preset or power cycle It is Preset on Restore Mode Defaults
Min	The minimum amplitude of a new point will be the amplitude value of the point to the left, or the minimum value of the analyzer if it is the first point in the mask. This is to allow a vertical line on the mask. Min frequency is 0 Hz. Min amplitude is -1000 dBm
Max	The maximum amplitude of a new point will be the amplitude value of the point to the right, or the maximum value of the analyzer if it is the last point in the mask. This is to allow a vertical line on the mask. Max frequency is 1 THz. Max amplitude is 1000 dBm[dB]
Initial S/W Revision	A.13.00

## Insert Point Below

Pressing this key 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.

Key Path	Trigger, FMT
Initial S/W Revision	A.13.00

## Delete Point

This is an immediate action key. It will immediately delete the currently-selected point, whether or not that point is being edited, and select Navigate. The point following the currently-selected point (or the point preceding if there is none) will be selected.

Key Path	Trigger, FMT
Initial S/W Revision	A.13.00

## New Mask

Clears any existing mask and creates a new mask of 4 points. Two points will be at 20% +/- the Center frequency and at the Reference Level. The other two points will be at 10% +/- Center Frequency and 20% below the Reference Level.

Key Path	Trigger, FMT
<b>Remote Command</b>	:TRIGger[:SEquence]:FMT:MASK[1] 2:NEW
<b>Example</b>	TRIG:FMT:MASK:NEW
Notes	The mask points generated by New Mask Trace can use X and Y offset to adjust the mask position. The upper and lower masks can have a different X Offset therefore subop code 1 is for the upper mask and subop code 2 is for the lower mask.
Initial S/W Revision	A.13.00

## Mask Type

Used to determine which Mask (upper or lower) is being viewed/edited. Only one mask can be viewed/edited at a time.

Key Path	Trigger, FMT
<b>Remote Command</b>	:TRIGger[:SEquence]:FMT:MASK:EDIT UPPER LOWER :TRIGger[:SEquence]:FMT:MASK:EDIT?
<b>Example</b>	TRIG:FMT:MASK:EDIT UPPER
Couplings	Each Mask will have unique Frequency/Amplitude pairs, Trigger Setup parameters (see section <a href="#">"Trigger Setup" on page 388</a> ), Mask Setup parameters (see section <a href="#">"Mask Setup" on page 390</a> ) and a Mask Name (see section <a href="#">"Mask Name" on page 394</a> ). Changing the View/Edit Mask will result in these parameters being updated.

Preset	This setting is unaffected by a Mode Preset or power cycle It is Preset on Restore Mode Defaults
State Saved	Saved in instrument state
Range	UPPer LOWer
Initial S/W Revision	A.13.00

### Trigger Setup

Opens a menu that enables you to select the trigger setup parameters.

Key Path	Trigger, FMT
Initial S/W Revision	A.13.00

### Trigger Criteria

This parameter is used to define the event that will cause a trigger to occur. The events are ways in which the signal interacts with the frequency mask. The data captured by RTSA is generated using multiple FFT's. The trigger criteria is used to determine which FFT's are used in the data generation.

Key Path	Trigger, FMT, , Trigger Setup
<b>Remote Command</b>	:TRIGger[:SEquence]:FMT:CRITeria ENTer   LEAVe   INSide   OUTSide   ELEave   LENTer :TRIGger[:SEquence]:FMT:CRITeria?
<b>Example</b>	TRIG:FMT:CRIT ENT
Notes	Both upper and lower masks use the same Trigger Criteria and the trigger will occur when either mask meets the Trigger Criteria.
Preset	This setting is unaffected by a Mode Preset or power cycle It is Preset on Restore Mode Defaults
State Saved	Saved in instrument state
Range	Enter Leave Inside Outside Enter→Leave Leave→Enter
Initial S/W Revision	A.13.00

### Trigger Mask

Used to determine which mask is to be used for triggering.

Key Path	Trigger, FMT, Trigger Setup
<b>Remote Command</b>	:TRIGger[:SEquence]:FMT:MASK UPPer   LOWer   BOTH :TRIGger[:SEquence]:FMT:MASK?
<b>Example</b>	TRIG:FMT:MASK UPp
Preset	This setting is unaffected by a Mode Preset or power cycle It is Preset on Restore Mode Defaults
State Saved	Saved in instrument state



Range	Upper, Lower, Both
Initial S/W Revision	A.13.00

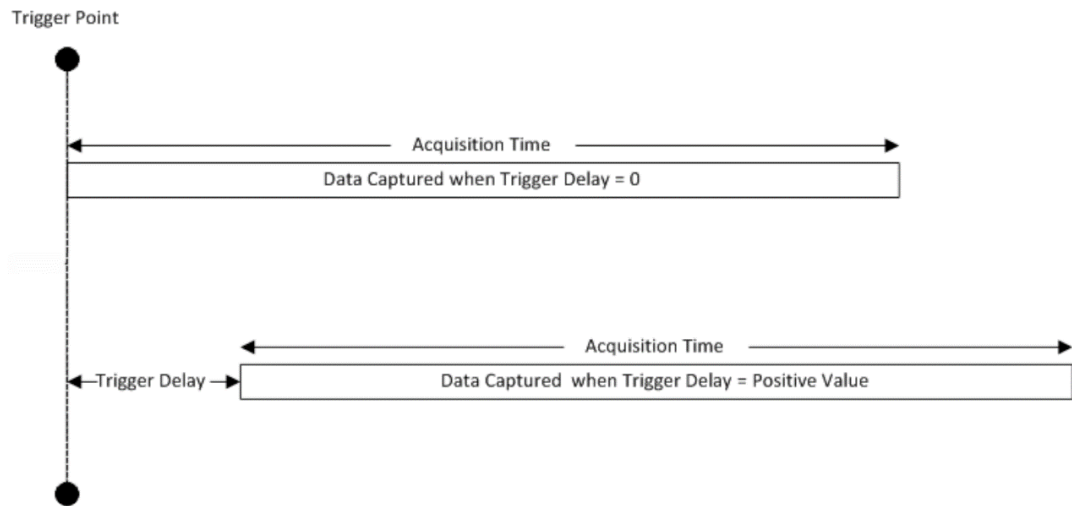
## Trig Delay

Controls a time delay during which the analyzer will wait to begin a sweep after meeting the trigger criteria. You can use negative delay to pre-trigger the instrument in time domain or FFT, but not in swept spans or Density view, if available.

See ["Trig Delay Diagram" on page 390](#)

Key Path	Trigger, FMT
<b>Remote Command</b>	:TRIGger[:SEquence]:FMT:DELAy <time> :TRIGger[:SEquence]:FMT:DELAy? :TRIGger[:SEquence]:FMT:DELAy:STATe OFF ON 0 1 :TRIGger[:SEquence]:FMT:DELAy:STATe?
<b>Example</b>	TRIG:FMT:DEL:STAT ON TRIG:FMT:DEL 100 ms
Couplings	When FMT Trigger Criteria is INSIDE or OUTSIDE, FMT Trigger Delay State is forced to OFF
Preset	30 ms
State Saved	Saved in instrument state
Min	0
Max	FMT Trigger Delay MaxValue is dependent on the current AcquisitionTime. The equation is: MaxValue = $2^{16} \times \text{AcqTime}$ , 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.
Default Unit	s
Initial S/W Revision	A.13.00

### Trig Delay Diagram



### Number of Acquisitions Per Trigger

This specifies how many acquisitions worth of data to return for each satisfied trigger. This is most useful with Spectrogram when you have short Acquisition Times, yet you want more than 1 Spectrogram scan for every triggered result. If the number of acquisitions per trigger is 20 and the Acquisition Time is 30 msec, then you will get 600 msec (20 \* 30 msec) worth of data after the trigger condition has been met.

Key Path	Trigger, FMT
Remote Command	:TRIGger[:SEquence]:FMT:APTRigger <number> :TRIGger[:SEquence]:FMT:APTRigger?
Example	TRIG:FMT:APTR n TRIG:FMT:APTR 20
Couplings	When FMT Trigger Criteria is INSIDE or OUTSIDE, Acq Per Trigger is limited to 1
Preset	1
State Saved	Saved in instrument state
Min	1
Max	MaxValue is limited to 1 when FMT Trigger Criteria is INSIDE or OUTSIDE. MaxValue is limited to 10000 when in Spectrum Measurement and 5000 when in PVT Measurement. MaxValue is limited to 10000/Average Count (Spectrum Measurement) and 5000/Average Count (PVT Measurement) when Averaging is ON.
Initial S/W Revision	A.13.00

### Mask Setup

Opens a menu that enables you to select Mask parameters.

Key Path	Trigger, FMT
Initial S/W Revision	A.13.00

## Build Mask from Trace

This allows the user to generate a mask from the trace displayed in the FMT setup view. The points generated will provide a rough outline of the current trace.

Key Path	Trigger, FMT, Mask Setup
<b>Remote Command</b>	:TRIGger[:SEQuence]:FMT:MASK[1] 2:BUILd
<b>Example</b>	TRIG:FMT:MASK:BUIL
Notes	The mask points generated by Build Mask from Trace can use X and Y offset to adjust the mask position. The upper and lower masks can have a different X Offset therefore subop code 1 is for the upper mask and subop code 2 is for the lower mask.
Initial S/W Revision	A.13.00

## Import Mask From File

Allows the user to import a mask from a file. This key is a shortcut to selecting Recall, Import Data, FMT. Selecting this key will select import type as FMT and bring up the Open dialog box.

Key Path	Trigger, FMT, More 1 of 2, Mask Setup
<b>Remote Command</b>	:MMEMory:LOAD:FMT <filename> The file name must have extension ".csv".
<b>Remote Command</b>	:MMEMory:LOAD:FMT "MYFMT.CSV"
<b>Example</b>	:MMEM:LOAD:FMT "myFmt.csv" recalls the FMT mask data from the file myFmt.csv in the current directory and sets the Trigger Type to FMT.
Notes	The default path is My Documents\Mode\data\FMT
Couplings	All the FMT setup parameters will be updated with the values from the imported file. Trigger Type will change to FMT is not already selected. This will only be the case when the command is executed remotely, as to access this key from the front panel you will have already selected FMT as the trigger.
Initial S/W Revision	A.13.00

## Export Mask to File

Allows the user to export a mask to a file. This key is a shortcut to selecting Save, Export Data, FMT. Selecting this key will select the export type as FMT and bring up the Save As dialog box.

Key Path	Trigger, FMT, Mask Setup
<b>Remote Command</b>	:MMEMory:STORe:FMT <filename>
<b>Remote Command</b>	:MMEMory:STORe:FMT "MYFMT.CSV"
<b>Example</b>	:MMEM:STOR:FMT "MYFMT.CSV" saves the FMT mask data to the file myFmt.csv in the current directory.
Notes	The default path is My Documents\Mode\data\FMT

If the save is initiated via SCPI, and the file already exists, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade. Both single and double quotes are supported for any filename parameter over SCPI.

Initial S/W Revision      A.13.00

### Offsets

Opens a menu that enables you to configure offset parameters.

Key Path                      **Trigger, FMT, Mask Setup**

Initial S/W Revision      A.13.00

### X Offset

Offsets all the frequency points in the mask by the specified frequency.

Key Path                      **Trigger, FMT, Mask Setup, Offsets**

**Remote Command**        :TRIGger[:SEquence]:FMT:MASK[1]|2:OFFSet:X <freq>  
                                 :TRIGger[:SEquence]:FMT:MASK[1]|2:OFFSet:X?

**Example**                    TRIG:FMT:MASK:OFFS:X 10 kHz

Notes                        The upper and lower masks can have a different X Offset therefore subop code 1 is for the upper mask and subop code 2 is for the lower mask.

Couplings                    From the Front Panel, Mask Type (see section "[Mask Type](#)" on page 387) determines which Mask the offset will be applied to.

Preset                        This setting is unaffected by a Mode Preset or power cycle  
                                 It is Preset on Restore Mode Defaults

State Saved                 Saved in instrument state

Min                            -500 GHz

Max                            500 GHz

Initial S/W Revision      A.13.00

### Y Offset

Offsets all the amplitude points in the mask by the specified amplitude.

Key Path                      **Trigger, FMT, Mask Setup, Offsets**

**Remote Command**        :TRIGger[:SEquence]:FMT:MASK[1]|2:OFFSet:Y <rel\_amp1>  
                                 :TRIGger[:SEquence]:FMT:MASK[1]|2:OFFSet:Y?

**Example**                    TRIG:FMT:MASK:OFFS:Y 10 dB

Notes                        The upper and lower masks can have different Y Offset therefore subop code 1 is for the upper mask and subop code 2 is for the lower mask.

Couplings                    From the Front Panel, Mask Type (see section "[Mask Type](#)" on page 387) determines which Mask the offset will be applied to.

Preset	This setting is unaffected by a Mode Preset or power cycle It is Preset on Restore Mode Defaults
State Saved	Saved in instrument state
Min	-Infinity
Max	+Infinity
Default Unit	dB
Initial S/W Revision	A.13.00

### Fixed / Relative

Opens a menu that will allow you to specify that the selected mask is relative to either Center Frequency or Reference level.

Key Path	<b>Trigger, FMT, Mask Setup</b>
Readback	Fixed Rel to CF Rel to RL Rel to CF + RL (square brackets)
Initial S/W Revision	A.13.00

### X Relative to CF

Chooses whether the mask frequency points are coupled to the instrument center frequency, and whether the frequency points are expressed as an offset from the instrument center frequency.

For example, assume the analyzer center frequency is at 1 GHz. If Relative to CF is “Off”, entering a mask point with a frequency coordinate of 300 MHz displays the mask point at 300 MHz, and the mask point will not change frequency if the center frequency changes. If Relative to CF is “On”, entering mask point with a frequency coordinate of 300 MHz displays the mask point at CF + 300 MHz, or 1.3 GHz. Furthermore, if the center frequency changes to 2 GHz, mask point will be displayed at CF + 300 MHz, or 2.3 GHz.

It is possible to change this setting after a mask point has been entered. When changing from On to Off or vice-versa, the frequency values in the mask table change so that the mask points remains in the same position for the current frequency settings of the analyzer.

Key Path	<b>Trigger, FMT, Mask Setup</b>
<b>Remote Command</b>	:TRIGger[:SEquence]:FMT:MASK:RELative:FREQUENCY ON OFF 1 0 :TRIGger[:SEquence]:FMT:MASK:RELative:FREQUENCY?
<b>Example</b>	TRIG:FMT:MASK:REL:FREQ ON makes frequency points relative to the center frequency.
Couplings	The Frequency Values in the Mask Table will be updated to be absolute or relative values so the mask remains in the same position. Frequency values in Mask Table and Export File will the Absolute when X Relative to CF is Off and Relative when X Relative to CF is On.
Preset	This setting is unaffected by a Mode Preset or power cycle

	It is Preset on Restore Mode Defaults.
State Saved	Saved in instrument state.
Initial S/W Revision	A.13.00

### Y Relative to RL

Chooses whether the mask amplitude points are coupled to the instrument reference level, and whether the amplitude points are expressed as an offset from the instrument reference level.

For example, assume you have a mask, and the reference level at -10 dBm. If Relative to RL is "Off", entering a mask point with an amplitude coordinate of -20 dBm displays the mask point at -20 dBm, and the mask point will not change amplitude if the reference level amplitude changes. If Relative to RL is "On", entering mask point with an amplitude coordinate of -20 dB displays the mask point at RL - 20 dB, or -30 dBm. Furthermore, if the reference level amplitude changes to -30 dBm, the mask point will be displayed at RL - 20 dB, or -50 dBm.

It is possible to change this setting after a mask point has been entered. When changing from On to Off or vice-versa, the amplitude values in the mask table change so that the mask points remains in the same position for the current reference level settings of the analyzer.

Key Path	Trigger, FMT, Mask Setup
Remote Command	:TRIGger[:SEquence]:FMT:MASK:RELative:AMPLitude ON OFF 1 0 :TRIGger[:SEquence]:FMT:MASK:RELative:AMPLitude?
Example	:TRIG:FMT:MASK:REL:AMPL ON makes amplitude points relative to the reference level amplitude.
Couplings	The Amplitude Values in the Mask Table will be updated to be absolute or relative values so the mask remains in the same position. Amplitude values in Mask Table and Export File will be Absolute when Y Relative to RL is Off and Relative when Y Relative to RL is On.
Preset	This setting is unaffected by a Mode Preset or power cycle It is Preset on Restore Mode Defaults.
State Saved	Saved in instrument state.
Initial S/W Revision	A.13.00

### Mask Name

Provides a description of up to 60 characters by which the operator can easily identify the limit. Will be stored in the exported file. Can be displayed in the active function area by selecting as the active function, if desired to be in a screen dump.

Key Path	Trigger, FMT, Mask Setup
Remote Command	:TRIGger[:SEquence]:FMT:MASK[1] 2:NAME <string> :TRIGger[:SEquence]:FMT:MASK[1] 2:NAME?
Example	:TRIGger:FMT:MASK1:NAME "G1234MN"

	:TRIGger:FMT:MASK2:NAME "G1234MN"
Notes	The upper and lower masks can have different settings therefore subop code 1 is for the upper mask and subop code 2 is for the lower mask.
Couplings	From the Front Panel, Mask Type (see section 19.3.1.3) determines which Mask will be deleted.
Preset	The original default value is empty string (""). Note that this Mask name parameter has a setting that is unaffected by a Mode Preset or power cycle It can be reset to its default value by using Restore Mode Defaults
State Saved	Saved in State.
Range	Lowercase, uppercase, Numeric,space
Readback	As much of the description will fit on one line of the key, followed by "..." if some of the description will not fit on one line of the key.
Initial S/W Revision	A.13.00

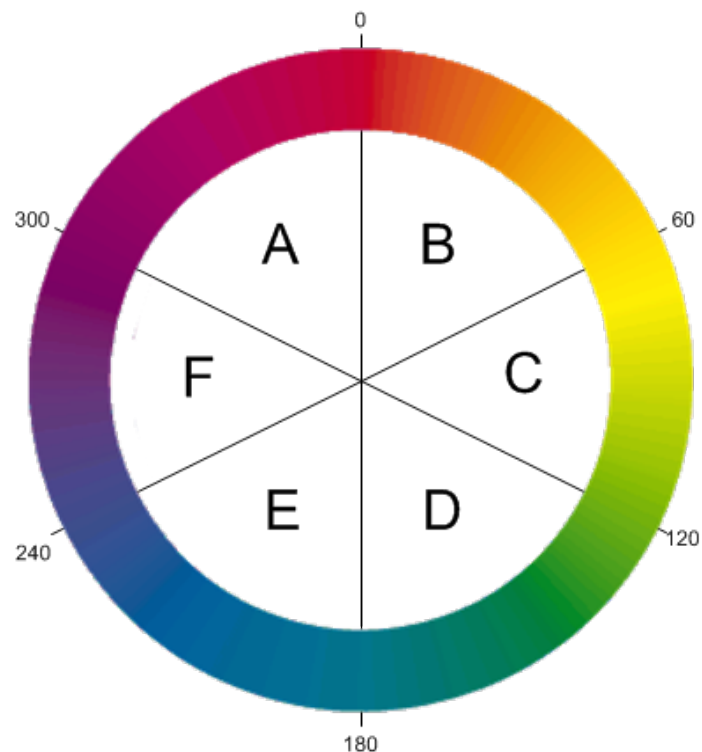
### Mask Color

Opens a menu that enables you to select the Mask color parameters.

Key Path	Trigger, FMT, Mask Setup
Initial S/W Revision	A.13.00

### Mask Hue

This parameter allows you to adjust the Hue of the Mask. The Hues of the colors run from 0 to 359 (360 is the same as 0) and are shown on the color wheel below:



Hue 0 is Red (255,0,0), Hue 120 is Green (0,255,0) and Hue 240 is Blue (0,0,255). Hue 60 is Yellow (255,255,0), Hue 180 is Cyan (0,255,255) and Hue 300 is Magenta (255,0,255). In region A-B, the red value is constant (255), in C-D, the green value is constant (255), and in E-F, the blue value is constant (255). There is no green in region F-A, there is no Red in E-D, and there is no Blue in B-C. Note this color wheel is only applicable when the Mask Opacity (refer to "[Mask Opacity](#)" on page 396) is 100%. Lowering the opacity value will result in less opaque colors.

Key Path	Trigger, FMT, Mask Setup, Mask Color
<b>Remote Command</b>	:TRIGger[:SEquence]:FMT:MASK:HUE <real> :TRIGger[:SEquence]:FMT:MASK:HUE?
<b>Example</b>	TRIG:FMT:MASK:HUE 120
Preset	170
State Saved	Saved in instrument state
Min	0, but the next decrement takes you to 359
Max	359.9, but the next increment takes you back to 0
Initial S/W Revision	A.13.00

### Mask Opacity

This parameter allows you to adjust the Opacity of the mask. The Mask Opacity is fixed at 15% when in the FMT editor. This parameter affects the opacity of the mask when not in the FMT editor. To adjust the Mask Opacity when in the FMT editor turn on the Mask Opacity Preview which displays the Mask as it will look once you exit the FMT editor.

Key Path	Trigger, FMT, Mask Setup, Mask Color
<b>Remote Command</b>	:TRIGger[:SEquence]:FMT:MASK:OPACity <percent> :TRIGger[:SEquence]:FMT:MASK:OPACity?
<b>Example</b>	TRIG:FMT:MASK:OPAC 50
Couplings	When in FMT Editor, changes made to this parameter will only be visible with the Mask Opacity Preview (refer to " <a href="#">Mask Opacity Preview</a> " on page 396) on.
Preset	15
State Saved	Saved in instrument state
Min	0
Max	100
Initial S/W Revision	A.13.00

### Mask Opacity Preview

Displays the Mask Opacity that will be used when not in the FMT editor

Key Path	Trigger, FMT, Mask Setup, Mask Color
<b>Remote Command</b>	:TRIGger[:SEquence]:FMT:MASK:OPACity:PREView ON OFF 1 0 :TRIGger[:SEquence]:FMT:MASK:OPACity:PREView?



<b>Example</b>	TRIG:FMT:MASK:OPAC:PREV ON
Couplings	Changes to Mask Opacity (refer to "Mask Opacity" on page 396) will not be seen when in the FMT Editor unless this parameter is set to ON.
Preset	OFF
State Saved	Saved in instrument state.
Initial S/W Revision	A.13.00

### Delete Mask

Delete the currently selected Mask.

Key Path	Trigger, FMT
<b>Remote Command</b>	:TRIGger[:SEquence]:FMT:MASK[1] 2:DELeTe
<b>Example</b>	TRIG:FMT:MASK:DEL
Notes	The upper and lower masks can have different settings therefore subop code 1 is for the upper mask and subop code 2 is for the lower mask.
Couplings	From the Front Panel, Mask Type (see section "Mask Type" on page 387) determines which Mask will be deleted.
Initial S/W Revision	A.13.00

### Delete All Masks

Delete both Upper and Lower Masks.

Key Path	Trigger, FMT
<b>Remote Command</b>	:TRIGger[:SEquence]:FMT:MASK:DELeTe:ALL
<b>Example</b>	TRIG:FMT:MASK:DEL:ALL
Initial S/W Revision	A.13.00

### Time 1

This is a property of the Time Qualified Trigger feature. Time 1 is a time duration that may be used in addition to the current trigger criteria to determine when and if to trigger.

Key Path	Trigger, FMT, Time 1
<b>Remote Command</b>	:TRIGger[:SEquence]:FMT:TCRiteria:LOWer <time> :TRIGger[:SEquence]:FMT:TCRiteria:LOWer?
<b>Example</b>	TRIG:FMT:TCR:LOW 100 us
Dependencies	Time 1 must always be less than Time 2 by at least "step size". If the user changes Time 1 to equal to or greater than Time 2, Time 2 will be pushed to Time 1 + step size. If the user changes Time 2 to equal to or less than Time 1, then Time 1 will be reduced to Time 2 - step size.

Preset	5.12 us
State Saved	Saved in instrument state
Max	10 sec
Default Unit	s
Initial S/W Revision	Prior to A.14.50

## Time 2

This is a property of the Time Qualified Trigger feature. Time 2 is a time duration that may be used in addition to the current trigger criteria to determine when and if to trigger.

Key Path	Trigger, FMT, Time 2
Remote Command	:TRIGger[:SEquence]:FMT:TCriteria:UPPer <time> :TRIGger[:SEquence]:FMT:TCRieria:UPP?
Example	TRIG:FMT:TCR:UPP 100 usec
Dependencies	Time 1 must always be less than Time 2 by at least “step size”. If the user changes Time 1 to equal to or greater than Time 2, Time 2 will be pushed to Time 1 + step size. If the user changes Time 2 to equal to or less than Time 1, then Time 1 will be reduced to Time 2 – step size. When Time Criteria is set to “> T1 and < T2”, the minimum gap changes to 2 Step Sizes.
Preset	8.535 us
State Saved	Saved in instrument state
Max	10 sec
Default Unit	s
Initial S/W Revision	Prior to A.14.50

## Time Criteria

This parameter is used to define how T1 and T2 will be used to determine if and when to trigger. The different criteria specify how to when to trigger using the time duration (s). The time criteria is used to determine how long the trigger criteria needs to last prior to satisfying the trigger condition.

Key Path	Trigger, FMT, Time Criteria
Remote Command	:TRIGger[:SEquence]:FMT:TCriteria[:TYPE] OFF   LTLower   GTLower   INSide   OUTSide :TRIGger[:SEquence]:FMT:TCriteria[:TYPE]?
Example	TRIG: FMT:TCR GTL
Dependencies	In FMT, Time Qualified Trigger properties are not available when Trigger Criteria is set to Inside, Outside, Enter->Leave, Leave->Enter. If Time 1 or Time 2 have values, they will not be used since Time Criteria will be set to Disabled and all other Time Criteria are not available. When Trigger Criteria changes to Enter or Leave, all Time Criteria become available.
State Saved	Saved in instrument state
Range	OFF LTLower GTLower INSide OUTSide
Initial S/W Revision	A.14.50

## Disabled

When the Time Criteria is set to “Disabled”, no time duration is not being used to control when the trigger occurs.

Key Path	<b>Trigger, FMT, Trigger Criteria</b>
<b>Example</b>	:TRIGger:SEQUence: FMT:TCRiteria OFF
State Saved	Saved in instrument state.
Readback	Disabled
Initial S/W Revision	A.14.50

## < Time1

When the Time Criteria is set to “< Time 1”, then the trigger condition cannot last as long as Time1. If it does last as long as Time1, then no trigger occurs. If the signal stays within the Mask for < Time1, then the trigger occurs.

Key Path	<b>Trigger, FMT, Trigger Criteria</b>
<b>Example</b>	:TRIGger:SEQUence:FMT:TCRiteria LTLower
Dependencies	In FMT, < Time 1 is grayed out when Trigger Criteria is set to Inside, Outside, Enter->Leave, Leave->Enter. When Trigger Criteria changes to Enter or Leave, all Time Criteria become available.
State Saved	Saved in instrument state.
Readback	< Time1
Initial S/W Revision	A.14.50

## > Time1

When the Time Criteria is set to “> Time 1”, then the signal level must last at least as long as Time1 to trigger. If it does not last at least as long as Time1, then no trigger occurs.

Key Path	<b>Trigger, FMT, Trigger Criteria</b>
<b>Example</b>	:TRIGger:SEQUence:FMT: TCRiteria GTLower
Dependencies	In FMT, > Time 1 is grayed out when Trigger Criteria is set to Inside, Outside, Enter->Leave, Leave->Enter. When Trigger Criteria changes to Enter or Leave, all Time Criteria become available.
State Saved	Saved in instrument state.
Readback	> Time1
Initial S/W Revision	A.14.50

## > T1 and < T2

When the Time Criteria is set to “> Time 1 and < Time 2”, then the signal must stay in the Mask at least as long as Time 1, but not as long as Time 2 to trigger. If it does

not last at least as long as Time1, then no trigger occurs. Or if the signal does not stay in the Mask for Time 2 or more, then no trigger occurs.

Key Path	<b>Trigger, FMT, Trigger Criteria</b>
<b>Example</b>	:TRIGger:SEquence:FMT:TCriteria INSide
Dependencies	In FMT, > T1 and < T2 is grayed out when Trigger Criteria is set to Inside, Outside, Enter->Leave, Leave->Enter. When Trigger Criteria changes to Enter or Leave, all Time Criteria become available.
State Saved	Saved in instrument state.
Readback	>T1 and <T2
Initial S/W Revision	A.14.50

### < T1 or > T2

When the Time Criteria is set to “< Time 1 or > Time 2”, then the specified signal can stay in the Mask for less than Time1, OR, the signal can stay in the Mask longer than Time 2 to trigger. If the signal stays in the Mask for at least Time1, but less than Time 2, no trigger occurs.

Key Path	<b>Trigger, FMT, Trigger Criteria</b>
<b>Example</b>	:TRIGger:SEquence:FMT:TCriteria OUTSide
Dependencies	In FMT, < T1 or > T2 is grayed out when Trigger Criteria is set to Inside, Outside, Enter->Leave, Leave->Enter. When Trigger Criteria changes to Enter or Leave, all Time Criteria become available.
State Saved	Saved in instrument state.
Readback	< T1 or > T2
Initial S/W Revision	A.14.50

### 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.

Key Path	<b>Trigger, Auto/Holdoff</b>
<b>Remote Command</b>	:TRIGger[:SEquence]:HOLDoff <time> :TRIGger[:SEquence]:HOLDoff? :TRIGger[:SEquence]:HOLDoff:STATE OFF ON 0 1 :TRIGger[:SEquence]:HOLDoff:STATE?
<b>Example</b>	TRIG:HOLD:STAT ON TRIG:HOLD 100 ms
Dependencies	Unavailable if the selected Input is BBIQ. If this is the case, the key is grayed out if it is pressed the informational message “Feature not supported for this Input” is displayed. If the SCPI command is sent, the error “Settings conflict; Feature not supported for this Input” is generated.

Preset	Off, 100 ms
State Saved	Saved in instrument state
Min	0 s
Max	0.5 s
Default Unit	s
Initial S/W Revision	Prior to A.02.00

## Holdoff Type

Lets you set the Trigger Holdoff Type.

### NOTE

**Holdoff Type is not supported by all measurements. If the current measurement does not support it, this key will be blank and the Holdoff Type will be Normal. If the Holdoff Type SCPI is sent while in such a measurement, the SCPI will be accepted and the setting remembered, but it will have no effect until a measurement is in force that supports Holdoff Type.**

Trigger Holdoff Type functionality:

NORMAL	This is the “oscilloscope” type of trigger holdoff, and is the setting when the Holdoff Type key 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.

Key Path	Trigger, Auto/Holdoff
Remote Command	:TRIGger[:SEquence]:HOLDoff:TYPE NORMal ABOVE BELOW :TRIGger[:SEquence]:HOLDoff:TYPE?
Example	TRIG:HOLD:TYPE NORM
Preset	All modes but GSM/EDGE: Normal GSM/EDGE: Below
State Saved	Saved in instrument state
Initial S/W Revision	A.02.00

# 8 Spectrum Measurement

The Spectrum measurement provides gap free analysis for data in the frequency domain.

Key Path	<b>Meas</b>
Mode	RTSA
Initial S/W Revision	A.13.00

## AMPTD Y Scale

The Amplitude front-panel key activates the Amplitude menu and selects Reference Level or Reference Value (depending on the measurement) as the active function.

Some features in the Amplitude menu apply to multiple measurements; others apply only to specific measurements. Keys that only apply to some measurements are blanked or grayed out in measurements that are not supported.

Key Path	Front-panel key
Initial S/W Revision	Prior to A.02.00

### Reference Level

The Reference Level specifies the amplitude represented by the topmost graticule line.

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.

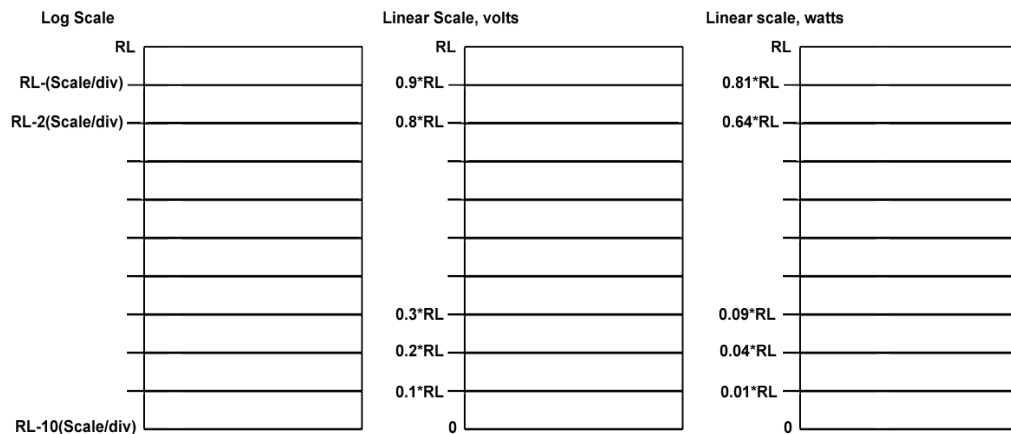
See ["Amplitude Representations" on page 404](#)

Key Path	AMPTD Y Scale
<b>Remote Command</b>	:DISP:WINDow[1]:TRACe:Y[:SCALe]:RLEVe1 <real> :DISP:WINDow[1]:TRACe:Y[:SCALe]:RLEVe1?
<b>Example</b>	DISP:WIND:TRAC:Y:RLEV 20 dBm Sets the reference level to 20 dBm, which displays in the current Y axis unit. For example, if the Y axis unit is dBμV, then 126.99 dBμV will be displayed.
Couplings	If you reduce the attenuation, the analyzer 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 which affect it. When you increase attenuation, the reference level does not change.
Preset	0 dBm
State Saved	Saved in instrument state
Min	RefLevelMin = -170 dBm + RefLevelOffset - ExtGain.
Max	The maximum Ref Level is typically: +30 dBm + RL Offset – External Gain (for MXA and PXA) +23 dBm + RL Offset – External Gain (for EXA and CXA) This maximum value is determined by the maximum power that can be safely applied to the input circuitry. The actual maximum value at any given time may be even less than this, depending on other values including Mech Atten, Int Preamp Gain, Swept IF Gain, FFT IF Gain, Max Mixer Level, and the total attenuation currently available. Note that the maximum reference level is unaffected by the input choice of external mixing.
Default Unit	Depends on the current selected Y axis unit

Backwards Compatibility Notes	<ol style="list-style-type: none"> <li>1. In PSA, there was a restriction on Ref Level Max which was that it could not exceed 0 dBm when the preamp was on. This restriction does not apply to X-Series.</li> <li>2. Ref Level – Ref Level is a display function, not a measurement control function, so a change in the setting does not start a new sweep (unless attenuation changes). This behavior differs from that of legacy analyzers</li> </ol>
Initial S/W Revision	Prior to A.02.00

## Amplitude Representations

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



## Attenuation

This menu 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 that controls all the attenuation functions. Different models in the X-Series come with different configurations.

See ["Dual Attenuator Configurations:"](#) on page 405

See ["Single Attenuator Configuration:"](#) on page 405

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.

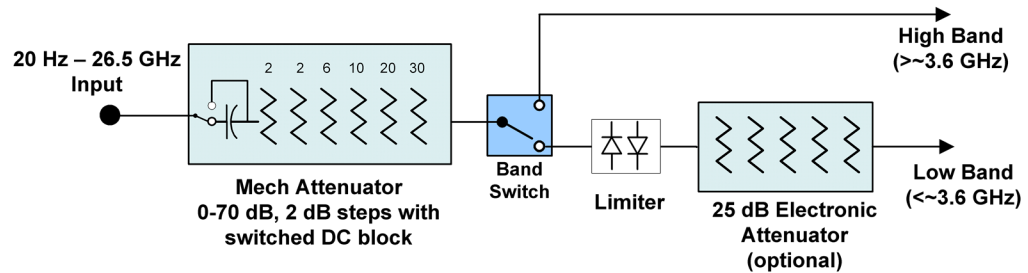
Key Path	<b>AMPTD Y Scale</b>
Scope	Meas Global
Dependencies	In measurements that support the I/Q inputs, this key is unavailable when I/Q is the selected



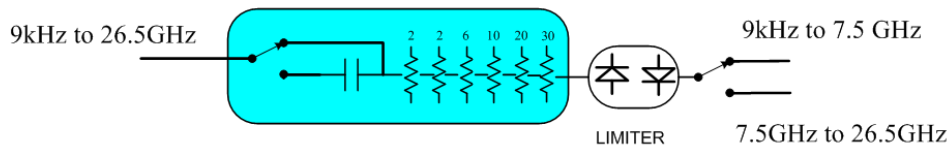
	input, and is replaced by the Range key in that case.
Readback Line	Contains a summary in [ ] brackets of the current total attenuation. See the descriptions of the , " <b>(Mech) Atten</b> " on page 729, and " <b>Enable Elec Atten</b> " on page 731 keys for more detail on the contributors to the total attenuation.  Note that when "Pre-Adjust for Min Clip" is on, this value can change at the start of every measurement.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

### Dual Attenuator Configurations:

Configuration 1: Mechanical attenuator + optional electronic attenuator

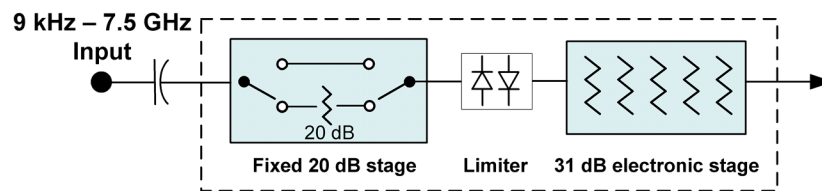


Configuration 2: Mechanical attenuator, no optional electronic attenuator

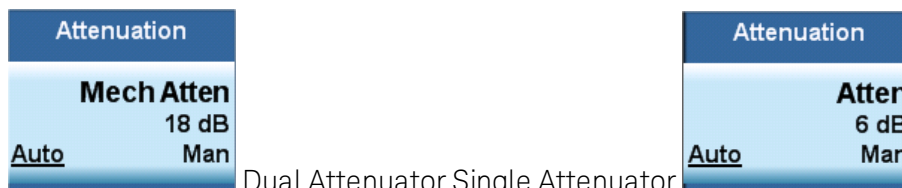


(note that Configuration 2 is not strictly speaking a dual-section attenuator, since there is no electronic section available. However, it behaves exactly like Configuration 1 without the Electronic Attenuator option EA3, therefore for the sake of this document it is grouped into the "Dual Attenuator"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

### Single Attenuator Configuration:



You can tell which attenuator configuration you have by pressing the Attenuation key, which (in most Modes) opens the Attenuation menu. If the first key in the Attenuation menu says **Mech Atten** you have the dual attenuator configuration. If the first key says **Atten** you have the single attenuator configuration.



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

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

### (Mech) Atten

This key is labeled **Mech Atten** in dual attenuator models and **Atten** in single attenuator models. In the dual attenuator configuration, this key only affects the mechanical attenuator.

This key 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 407

Key Path	AMPTD Y Scale, Attenuation
Remote Command	[:SENSE]:POWer[:RF]:ATTenuation <rel_amp1> [:SENSe]:POWer[:RF]:ATTenuation? [:SENSE]:POWer[:RF]:ATTenuation:AUTO OFF ON 0 1 [:SENSe]:POWer[:RF]:ATTenuation:AUTO?
Example	POW:ATT 20 Dual attenuator configuration: sets the mechanical attenuator to 20 dB Single attenuator mode: sets the main attenuation to 20 dB (see below for definition of "main" attenuation). If the attenuator was in Auto, it sets it to Manual.
Dependencies	Some measurements do not support the Auto setting of <b>(Mech) Atten</b> . In these measurements, the Auto/Man selection is not available, and the Auto/Man line on the key disappears. In dual attenuator configurations, when the electronic attenuator is enabled, the mechanical attenuator has no auto setting and the Auto/Man line on the key disappears. The state of Auto/Man is remembered and restored when the electronic attenuator is once again disabled. This is described in more detail in the " <a href="#">Enable Elec Atten</a> " on page 731 key description. See " <a href="#">Attenuator Configurations and Auto/Man</a> " on page 407 for more information on the Auto/Man functionality of Attenuation.
Couplings	When <b>(Mech) Atten</b> is in Auto, it uses the following algorithm to determine a value: If the USB Preamp is connected to USB, use 0 dB.

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	<p>Otherwise, <math>Atten = ReferenceLevel + PreAmpGain + ExternalGain - RefLevelOffset - MaxMixerLevel + IF\ Gain</math>.</p> <p>Limit this value to be between 6 dB and the Max value. No value below 6 dB can ever be chosen by Auto.</p> <p>The resulting value is rounded up to the largest value possible given the attenuation step setting. That is, 50.01 dB would change to 60 dB (for a 10 dB attenuation step).</p> <p>The "IF Gain" term in the equation above is either 0 dB or +10 dB, depending on the settings of FFT IF Gain, Swept IF Gain, max Ref Level and the Auto/Man setting of Mech Atten.</p> <p>In External Mixing and BBIQ, where the Attenuator is not in the signal path, the Attenuator setting changes as described above when <b>(Mech) Atten</b> is in Auto, but no changes are made to the actual attenuator hardware setting until the input is changed back to the RF Input.</p>
Preset	<p>The preset for Mech Attenuation is "Auto."</p> <p>The Auto value of attenuation is: CXA, EXA, MXA and PXA: 10 dB</p>
State Saved	Saved in instrument state
Min	<p>0 dB</p> <p>The attenuation set by this key cannot be decreased below 6 dB with the knob or step keys. To get to a value below 6 dB it has to be directly entered from the keypad or via SCPI. This protects from adjusting the attenuation to a dangerously small value which can put the instrument at risk of damage to input circuitry. However, if the current mechanical attenuation is below 6 dB it can be increased with the knob and step keys, but not decreased.</p>
Max	<p>CXA N9000A-503/507: 50 dB CXA N9000A-513/526: 70dB EXA: 60 dB MXA and PXA: 70 dB</p> <p>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.</p>
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

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### Attenuator Configurations and Auto/Man

As described in the Attenuation key description, 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 the **(Mech) Atten** key (or POW:ATT SCPI) as the "main" attenuation; and the attenuation that is set by the SCPI command POW:EATT as the "soft" attenuation (the POW:EATT command is honored even in the single attenuator configuration, for compatibility purposes). Then the current total attenuation is the sum of the main + soft attenuation. See the **Elec Atten** key description for more on "soft" attenuation.

In the dual attenuator configuration, when the electronic attenuator is enabled, there is no Auto/Man functionality for the mechanical attenuator, and the third line of the key label (the Auto/Man line) disappears:

<b>Mech Atten</b>
0 dB
<u>Auto</u> Man

<b>Mech Atten</b>
0 dB

Mech Atten when elec atten disabled
--

Mech Atten when elec atten enabled
---------------------------------------

vsd05

## Enable Elec Atten

Enables the Electronic Attenuator.

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 410](#) 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 730](#)

See [Error! Reference source not found.](#)

Key Path	AMPTD Y Scale, Attenuation
Remote Command	[ :SENSe ] :POWer [ :RF ] :EATTenuation :STATe OFF   ON   0   1 [ :SENSe ] :POWer [ :RF ] :EATTenuation :STATe ?
Example	POW:EATT:STAT ON
Dependencies	<p>This key only appears in Dual Attenuator models with an Electronic Attenuator installed. It does not appear in models with the Single Attenuator configuration, as in the single attenuator configuration there is no “electronic attenuator” there is only a single integrated attenuator (which has both a mechanical and electronic stage). However, in the single attenuator configuration, EATT SCPI commands are accepted for compatibility with other X-series instruments and set a “soft” attenuation as described in <a href="#">"Attenuator Configurations and Auto/Man" on page 730</a>.</p> <p>The electronic attenuator (and the “soft” attenuation function provided in single attenuator configurations) is unavailable above 3.6 GHz. Therefore, if the Stop Frequency of the analyzer is &gt; 3.6 GHz then the <b>Enable Elec Atten</b> key will be OFF and grayed out.</p> <p>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 <b>Enable Elec Atten</b> key will be OFF and grayed out.</p> <p>If either of the above is true, if the SCPI command is sent, an error indicating that the electronic attenuator is unavailable will be sent.</p> <p>If the electronic/soft Attenuator is enabled, then the Stop Freq of the analyzer is limited to 3.6 GHz and the Internal Preamp is unavailable.</p> <p>The SCPI-only “soft” electronic attenuation for the single-attenuator configuration is not</p>

	available in all measurements; in particular, it is not available in the Swept SA measurement.
Couplings	Enabling and disabling the Electronic Attenuator affects the setting of the Mechanical Attenuator (in dual attenuator configurations). This is described in more detail below this table.
Preset	OFF for Swept SA measurement; ON for all other measurements that support the electronic attenuator
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

### 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 line on the (Mech) Atten key 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 key 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 analyzer 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 analyzer calibration

### Elec Atten

Controls the Electronic Attenuator in dual attenuator configurations. This key 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** key.

Key Path	AMPTD Y Scale, Attenuation
Remote Command	[ :SENSe]:POWer[:RF]:EATTenuation <rel_amp1> [ :SENSe]:POWer[:RF]:EATTenuation?
Notes	Electronic Attenuation's specification is defined only when Mechanical Attenuation is 6 dB.

Dependencies	This key only appears in Dual Attenuator models with an Electronic Attenuator installed. It does not appear in models with the Single Attenuator configuration, as in the single attenuator configuration there is no “electronic attenuator” there is only a single integrated attenuator (which has both a mechanical and electronic stage). However, in the single attenuator configuration, EATT SCPI commands are accepted for compatibility with other X-series instruments and set a “soft” attenuation as described in " <a href="#">Attenuator Configurations and Auto/Man</a> " on page 730. The “soft” attenuation is treated as an addition to the “main” attenuation value set by the Atten softkey or the POW:ATT SCPI command and affects the total attenuation displayed on the Attenuation key and the Meas Bar.  When <b>Enable Elec Atten</b> is off or grayed out, the <b>Elec Atten</b> key is grayed out.
Preset	0 dB
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
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

### (Mech) Atten Step

This controls the step size used when making adjustments to the input attenuation.

This key is labeled **Mech Atten Step** in dual attenuator models and **Atten Step** in single attenuator models. In the dual attenuator configuration, this key only affects the step size of the mechanical attenuator.

Key Path	<b>AMPTD Y Scale, Attenuation</b>
<b>Remote Command</b>	<b>[ :SENSe ] :POWer [ :RF ] :ATTenuation :STEP [ :INCRement ] 10 dB   2 dB [ :SENSe ] :POWer [ :RF ] :ATTenuation :STEP [ :INCRement ] ?</b>
<b>Example</b>	POW:ATT:STEP 2
Notes	Note this feature works like a 1-N 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 CXA and EXA if option FSA (2 dB steps) is not present. If blanked, attempts to set it via SCPI will 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	PXA and MXA: 2 dB EXA and CXA: 10 dB (2 dB with option FSA)
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

## Max Mixer Level

Controls the limitation on the Ref Level for a given attenuation setting, and therefore also interacts with the Auto rules for selecting the attenuation as a coupling from the reference level.

Key Path	AMPTD Y Scale, Attenuation
<b>Remote Command</b>	[ :SENSe]:POWer[:RF]:MIXer:RANGe[:UPPer] <real> [ :SENSe]:POWer[:RF]:MIXer:RANGe[:UPPer]?
<b>Example</b>	POW:MIX:RANG -15 dBm
Preset	-10 dBm
State Saved	Saved in instrument state
Min	-50 dBm
Max	0 dBm
Default Unit	Depends on the current selected Y axis unit, see Swept SA discussion of Y Axis Unit
Initial S/W Revision	Prior to A.02.00

### Max Mixer Lvl Rule

This function is available only in the Swept SA measurement of the SA Mode, and in all measurements of the RTSA Mode.

The **Max Mixer Level Rule** key allows you to optimize the Max Mixer Level setting for certain kinds of measurements.

- **Normal** – Normal is 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 cause ADC overloads. At this mixer level the scale fidelity will be within specifications, thus compression will be negligible.
- **TOI** – Choosing the setting “TOI-limited dynamic range” allows a range of settings of the Max Mixer Level, –50 to –10 dBm, that can be optimum for measurements limited by the analyzer 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** – Choosing the setting “Compression-limited dynamic range” 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 analyzer 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

Key Path	AMPTD Y Scale, Attenuation
Remote Command	[ :SENSE]:POWER[:RF]:MIXer:RULEs NORMa1 TOI COMPRESSion [ :SENSE]:POWER[:RF]:MIXer:RULEs?
Example	POW:MIX:RULE:COMP
Preset	NORM
Initial S/W Revision	A.19.00

## Scale/Div

Sets the units per vertical graticule division on the display when in a spectral view. This function is only available when Scale Type (Log) is selected and the vertical scale is power. When Scale Type (Lin) is selected, Scale/Div is grayed out.

Key Path	AMPTD Y Scale
Remote Command	:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:PDIVision <rel_amp1> :DISPlay:WINDow[1]:TRACe:Y[:SCALe]:PDIVision?
Example	DISP:WIND:TRAC:Y:PDIV 5 DB
Dependencies	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.
Couplings	The Scale/Div key is context sensitive. When in a spectral view, Spectral Scale/Div parameter is shown. When in PVT view, PVT Scale/Div is shown. When Spectral Scale/Div Auto State is On, this parameter is coupled to the Power vs Time Scale/Div parameter.
Preset	10.00 dB / Div
State Saved	Saved in instrument state

Min	0.50 dB
Max	20 dB
Initial S/W Revision	A.13.00

## Scale Type

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

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

When Scale Type (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 analyzer remembers separate Y Axis Unit settings for both Log and Lin.

Key Path	AMPTD Y Scale
<b>Remote Command</b>	:DISP:WINDow[1]:TRACe:Y[:SCALe]:SPACing LINear   LOGarithmic :DISP:WINDow[1]:TRACe:Y[:SCALe]:SPACing?
<b>Example</b>	DISP:WIND:TRAC:Y:SPAC LOG DISP:WIND:TRAC:Y:SPAC?
Dependencies	If Normalize is on, Scale Type forced to Log and is grayed out.
Couplings	Changing the Scale Type always sets the Y Axis unit to the last unit specified for the current amplitude scale. In other words, we restore the Y Axis unit setting appropriate per log/lin.
Preset	LOG
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00

## Presel Center

When this key is pressed, the centering of the preselector filter is adjusted 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 analyzer will turn on the selected marker, perform a peak search, and then perform centering on the marker's center frequency. If the selected marker is already on and between the start and stop frequencies of the analyzer, the analyzer 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 analyzer will first perform a peak search, and then perform centering on the marker's center frequency.

The value displayed on the **Presel Adjust** key will change to reflect the new preselector tuning (see **Presel Adjust**).

A number of considerations should be observed to ensure proper operation. See ["Proper Preselector Operation" on page 415](#).

Key Path	<b>AMPTD Y Scale</b>
<b>Remote Command</b>	<code>[ :SENSe ] :POWer [ :RF ] :PCENter</code>
<b>Example</b>	POW:PCEN
Notes	Note that the rules outlined above under the key description apply for the remote command as well as the key. The result of the command is dependent on marker position, and so forth. Any message shown by the key press is also shown in response to the remote command.
Dependencies	<ul style="list-style-type: none"> <li>- Grayed out if the microwave preselector is off. )</li> <li>- If the selected marker's frequency is below Band 1, advisory message 0.5001 is generated and no action is taken.</li> <li>- Grayed out if entirely in Band 0.</li> <li>- Blank in models that do not include a preselector, such as option 503. If the SCPI is sent in these instruments, it is accepted without error, and the query always returns 0.</li> <li>- Grayed out in the Spectrogram View.</li> </ul>
Couplings	<p>The active marker position determines where the centering will be attempted.</p> <p>If the analyzer is in a measurement such as averaging when centering is initiated, the act of centering the preselector will restart averaging but the first average trace will not be taken until the centering is completed.</p>
Status Bits/OPC dependencies	<p>When centering the preselector, *OPC will not return true until the process is complete and a subsequent measurement has completed, nor will results be returned to a READ or MEASure command.</p> <p>The Measuring bit should remain set while this command is operating and should not go false until the subsequent sweep/measurement has completed.</p>
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

### Proper Preselector Operation

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

3. If the selected marker is off, the analyzer will turn on a marker, perform a peak search, and adjust 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.

4. If the selected marker is already on, the analyzer will attempt the centering at that marker's frequency. There is no preselector for signals below about 3.6 GHz, therefore if the marker is on a signal below 3.6 GHz, no centering will be attempted and an advisory message generated
5. In some models, the preselector can be bypassed. If it is bypassed, no centering will be attempted in that range and a message will be generated.

## Preselector Adjust

Allows you to manually adjust the preselector filter frequency to optimize its response to the signal of interest. This function is only available when "[Presel Center](#)" on page 737 is available.

For general purpose signal analysis, using Presel Center is recommended. Centering the filter minimizes the impact of long-term preselector drift. Presel 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.

Key Path	AMPTD Y Scale
Scope	Meas Global
<b>Remote Command</b>	[ :SENSe ] :POWer [ :RF ] :PADJust <freq> [ :SENSe ] :POWer [ :RF ] :PADJust?
<b>Example</b>	POW:PADJ 100KHz POW:PADJ?
Notes	The value on the key reads out to 0.1 MHz resolution.
Dependencies	<ul style="list-style-type: none"> <li>- Grayed out if microwave preselector is off. )</li> <li>- Grayed out if entirely in Band 0.</li> <li>- Blank in models that do not include a preselector, such as option 503. If the SCPI is sent in these instruments, it is accepted without error, and the query always returns 0.</li> <li>- Grayed out in the Spectrogram View.</li> </ul>
Preset	0 MHz
State Saved	The <b>Presel Adjust</b> value set by <b>Presel Center</b> , or by manually adjusting <b>Presel Adjust</b> , is not saved in instrument state, and does not survive a Preset or power cycle.
Min	-500 MHz
Max	500 MHz
Default Unit	Hz
<b>Backwards Compatibility SCPI</b>	[ :SENSe ] :POWer [ :RF ] :MW:PADJust [ :SENSe ] :POWer [ :RF ] :MMW:PADJust

	PSA had multiple preselectors, but the X-Series has only one. These commands simply alias to [:SENSe]:POWer[:RF]:PADJust
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

<b>Remote Command</b>	[:SENSe]:POWer[:RF]:PADJust:PRESelector MWAVE   MMWave   EXTERNAL [:SENSe]:POWer[:RF]:PADJust:PRESelector?
Notes	PSA had multiple preselectors, and you could select which preselector to adjust. Since the X-Series has only one mm/uW preselector, the preselector selection softkey is no longer available. However, to provide backward compatibility, we accept the legacy remote commands. The command form has no effect, the query always returns MWAVE
Initial S/W Revision	Prior to A.02.00

## Y Axis Unit

Displays the menu keys that enable you to change the vertical (Y) axis amplitude unit. The analyzer retains the entered Y Axis Unit separately for both Log and Lin amplitude scale types. For example, if Scale Type has been set to Log, and you set Y Axis Unit to dBm, pressing Scale Type (Log) sets the Y Axis Unit to dBm. If Scale Type has been set to Lin and you set Y Axis Unit to V, pressing Scale Type (Lin) sets the Y Axis Unit to V. Pressing Scale Type (Log) again sets the Y axis unit back to dBm.

### NOTE

The units of current (A, dBmA, dBuA) are calculated based on 50 ohms input impedance.

All four of the EMI units (dBμA/m, dBμV/m, dBG, dBpT) are treated by the instrument exactly as though they were dBuV. The user must load an appropriate correction factor using Amplitude Corrections for accurate and meaningful results.

If a SCPI command is sent to the analyzer that uses one of the EMI units as a terminator, the analyzer treats it as though DBUV had been sent as the terminator.

Key Path	AMPTD Y Scale
Mode	SA
Scope	Meas Global
<b>Remote Command</b>	:UNIT:POWer DBM   DBMV   DBMA   V   W   A   DBUV   DBUA   DBPW   DBUVM   DBUAM   DBPT   DBG :UNIT:POWer?
<b>Example</b>	UNIT:POW dBmV UNIT:POW?
Notes	The Y axis unit has either logarithmic or linear characteristics. The set of units that is logarithmic consists of dBm, dBmV, dBmA, dBμV, dBμA, dBμV/m, dBμA/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.

Notes	<p>The settings of Y Axis Unit and Scale Type, affect how the data is read over the remote interface. When using the remote interface no unit is returned, so you must know what the Y axis unit is to interpret the results:</p> <p>Example 1, set the following:</p> <p>Scale Type (Log) Y Axis Unit, dBm Scale/Div, 1 dB Ref Level, 10 dBm</p> <p>This sets the top line to 10 dBm with each vertical division representing 1 dB. Thus, if a point on trace 1 is on the fifth graticule line from the top, it represents 5 dBm and will read out remotely as 5.</p> <p>Example 2, set the following:</p> <p>Scale Type (Lin) Y Axis Unit, Volts Ref Level, 100 mV (10 mV/div)</p> <p>This sets the top line to 100 mV and the bottom line to 0 V, so each vertical division represents 10 mV. Thus, if a point on trace 1 is on the fifth graticule line from the top, it represents 50 mV and will read out remotely as 50.</p>
Dependencies	<p>If an amplitude correction with an Antenna Unit other than <b>None</b> is applied and enabled, then that antenna unit is forced and the key with that unit is the only Y Axis Unit available. All other Y Axis Unit keys are grayed out.</p> <p>If an amplitude correction with an Antenna Unit other than <b>None</b> is applied and enabled, and you then turn off that correction or set <b>Apply Corrections</b> to <b>No</b>, the Y Axis Unit that existed before the Antenna Unit was applied is restored.</p>
Couplings	The analyzer retains the entered Y Axis Unit separately for both Log and Lin amplitude scale types
Preset	dBm for log scale, V for linear. The true 'preset' value is dBm, since at preset the Y Scale type is set to logarithmic.
State Saved	Saved in instrument state
Readback line	1-of-N selection
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00, A.04.00, A.11.00

## dBm

Sets the amplitude unit for the selected amplitude scale (log/lin) to dBm.

Key Path	<b>AMPTD Y Scale, Y Axis Unit</b>
<b>Example</b>	UNIT:POW DBM
Dependencies	Grayed out if an Amplitude Correction with an Antenna Unit is ON.
Readback	dBm
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

## dBmV

Sets the amplitude unit for the selected amplitude scale (log/lin) to dBmV.

Key Path	<b>AMPTD Y Scale, Y Axis Unit</b>
<b>Example</b>	UNIT:POW DBMV
Dependencies	Grayed out if an Amplitude Correction with an Antenna Unit is ON.
Readback	dBmV
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

## dBmA

Sets the amplitude unit for the selected amplitude scale (log/lin) to dBmA.

Key Path	<b>AMPTD Y Scale, Y Axis Unit</b>
<b>Example</b>	UNIT:POW DBMA
Dependencies	Grayed out if an Amplitude Correction with an Antenna Unit is ON.
Readback	dBmA
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

## W

Sets the amplitude unit for the selected amplitude scale (log/lin) to watt.

Key Path	<b>AMPTD Y Scale, Y Axis Unit</b>
<b>Example</b>	UNIT:POW W
Dependencies	Grayed out if an Amplitude Correction with an Antenna Unit is ON.
Readback	W
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

## V

Sets the amplitude unit for the selected amplitude scale (log/lin) to volt.

Key Path	<b>AMPTD Y Scale, Y Axis Unit</b>
<b>Example</b>	UNIT:POW V
Dependencies	Grayed out if an Amplitude Correction with an Antenna Unit is ON.
Readback	V
Initial S/W Revision	Prior to A.02.00

Modified at S/W Revision	A.02.00
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**A**

Sets the amplitude unit for the selected amplitude scale (log/lin) to Ampere.

Key Path	<b>AMPTD Y Scale, Y Axis Unit</b>
<b>Example</b>	UNIT:POW A
Dependencies	Grayed out if an Amplitude Correction with an Antenna Unit is ON.
Readback	A
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

**dB $\mu$ V**

Sets the amplitude unit for the selected amplitude scale (log/lin) to dB $\mu$ V.

Key Path	<b>AMPTD Y Scale, Y Axis Unit</b>
<b>Example</b>	UNIT:POW DBUV
Dependencies	Grayed out if an Amplitude Correction with an Antenna Unit is ON.
Readback	dB $\mu$ V
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

**dB $\mu$ A**

Sets the amplitude unit for the selected amplitude scale (log/lin) to dB $\mu$ A.

**NOTE**

The unit dBuA can also appear as an Antenna Unit. This will be used by customers using current probes, because current probes are often supplied with conversion tables that provide the transducer factors. When dBuA is used as an Antenna Unit the normal conversion from power to amps for dBuA (based on the analyzer input impedance) is not done, but instead the conversion is based solely on the Correction that contains the transducer factors. This is what distinguishes dBuA as a normal unit from dBuA as an antenna unit. When querying the Y-Axis unit, you can query the Antenna Unit to distinguish between regular dBuA and the dBuA antenna unit. If :CORR:CSET:ANT? returns NOC (for No Conversion), you are using a normal Y Axis dBuA. If it returns UA you are using an Antenna Unit dBuA.

Key Path	<b>AMPTD Y Scale, Y Axis Unit</b>
<b>Example</b>	UNIT:POW DBUA
Dependencies	Grayed out if an Amplitude Correction with an Antenna Unit is ON.



Readback	dB $\mu$ A
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

### dBpW

Sets the amplitude unit for the selected amplitude scale (log/lin) to dBpW.

Key Path	<b>AMPTD Y Scale, Y Axis Unit</b>
<b>Example</b>	UNIT:POW DBPW
Dependencies	Grayed out if an Amplitude Correction with an Antenna Unit is ON.
Readback	dB $\mu$ A
Initial S/W Revision	A.11.00

### Antenna Unit

When a Correction is turned on that uses an Antenna Unit, the Y Axis Unit changes to that Antenna Unit. All of the keys in the Y-Axis Unit menu are then greyed out, except the Antenna Unit key. The unit being used is shown on this key and is shown as selected in the submenu.

Key Path	<b>AMPTD Y Scale, Y Axis Unit</b>
Dependencies	Grayed out if no Amplitude Correction with an Antenna Unit is on.
Readback line	Currently selected unit
Initial S/W Revision	A.11.00

### dB $\mu$ V/m

Sets the amplitude unit for the selected amplitude scale (log/lin) to dB $\mu$ V/m. This is an antenna unit, and this key is grayed out unless a Correction with this Antenna Unit selected is ON. If this is the case, all of the other Antenna Units are grayed out.

Key Path	<b>AMPTD Y Scale, Y Axis Unit, Antenna Unit</b>
<b>Example</b>	UNIT:POW DBUVM
Dependencies	Grayed out if no Amplitude Correction with an Antenna Unit is on.
Readback	dB $\mu$ V/m
Initial S/W Revision	A.02.00

### dB $\mu$ A/m

Sets the amplitude unit for the selected amplitude scale (log/lin) to dB $\mu$ A/m. This is an antenna unit, and this key is grayed out unless a Correction with this Antenna Unit selected is ON. If this is the case, all of the other Antenna Units are grayed out.

Key Path	<b>AMPTD Y Scale, Y Axis Unit, Antenna Unit</b>
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<b>Example</b>	UNIT:POW DBUAM
Dependencies	Grayed out if no Amplitude Correction with an Antenna Unit is on.
Readback	dB $\mu$ A/m
Initial S/W Revision	A.02.00

### dB $\mu$ A

Sets the amplitude unit for the selected amplitude scale (log/lin) to dB $\mu$ A. This is an antenna unit, and this key is grayed out unless a Correction with this Antenna Unit selected is ON. If this is the case, all of the other Antenna Units are grayed out.

Key Path	<b>AMPTD Y Scale, Y Axis Unit, Antenna Unit</b>
<b>Example</b>	UNIT:POW DBUAM
Dependencies	Grayed out if no Amplitude Correction with an Antenna Unit is on.
Readback	dB $\mu$ A
Initial S/W Revision	A.11.00

### dBpT

Sets the amplitude unit for the selected amplitude scale (log/lin) to dBpT. This is an antenna unit, and this key is grayed out unless a Correction with this Antenna Unit selected is ON. If this is the case, all of the other Antenna Units are grayed out.

Key Path	<b>AMPTD Y Scale, Y Axis Unit, Antenna Unit</b>
<b>Example</b>	UNIT:POW DBPT
Dependencies	Grayed out if no Amplitude Correction with an Antenna Unit is on.
Readback	dBpT
Initial S/W Revision	A.02.00

### dBG

Sets the amplitude unit for the selected amplitude scale (log/lin) to dBG. This is an antenna unit, and this key is grayed out unless a Correction with this Antenna Unit selected is ON. If this is the case, all of the other Antenna Units are grayed out.

Key Path	<b>AMPTD Y Scale, Y Axis Unit, Antenna Unit</b>
<b>Example</b>	UNIT:POW DBG
Dependencies	Grayed out if no Amplitude Correction with an Antenna Unit is on.
Readback	dBG
Initial S/W Revision	A.02.00

### None

This is selected if no Antenna Unit is currently on, however you cannot actually set this value, since it is always grayed out. The key is included simply to provide an

indication on the Readback line of the Antenna Unit key when there is no Antenna Unit selected.

Key Path	<b>AMPTD Y Scale, Y Axis Unit, Antenna Unit</b>
Readback	"None"
Initial S/W Revision	A.11.00

## 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.

See ["More Information" on page 423](#)

Key Path	<b>AMPTD Y Scale</b>
Mode	<b>SA</b>
Scope	Meas Global
<b>Remote Command</b>	<b>:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:RLEVe1:OFFSet &lt;rel_amp1&gt;</b> <b>:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:RLEVe1:OFFSet?</b>
<b>Example</b>	DISP:WIND:TRAC:Y:RLEV:OFFS 12.7 Sets the Ref Level Offset to 12.7 dB. The only valid suffix is dB. If no suffix is sent, dB will be assumed.
Preset	0 dBm
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
Backwards Compatibility Notes	<p>6. In pre-X-Series instruments, Ref Level Offset could not be adjusted by the knob or step keys. That is no longer the case.</p> <p>7. In ESA and PSA, Ref Level Offset was applied to the data as it was acquired; thus if the Offset changed the new offset was not applied until new trace data was taken. In X-Series, the offset is applied as the data is displayed/queried, so if you change the offset, it will change the data immediately.</p>
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.04.00

## More Information

Offsets are used when gain or loss occurs between a device under test and the analyzer input. Thus, the signal level measured by the analyzer 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 analyzer 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.

## μW Path Control

The **μW Path Control** functions include the **μW Preselector Bypass** (Option MPB) and **Low Noise Path** (Option LNP) controls in the High Band path circuits.

When the μW Preselector is bypassed, the user has better flatness, but will be subject to spurs from out of band interfering signals. When the Low Noise Path is enabled, the analyzer automatically switches around certain circuitry in the high frequency bands which can contribute to noise, when it is appropriate based on other analyzer settings.

For most applications, the preset state is Standard Path, which gives the best remote-control throughput, minimizes acoustic noise from switching and minimizes the risk of wear out in the hardware switches. For applications that utilize the wideband IF paths, the preset state is the μW Preselector Bypass path, 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.

Users may choose Low Noise Path Enable. It gives 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 the Low Noise Path, however its compression threshold and third-order intercept are much poorer than that of the non-preamp Low Noise 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.

Key Path	<b>AMPTD Y Scale</b>
Mode	SA, BASIC, PNOISE, VSA , LTE, LTETDD
Scope	Meas Global
<b>Remote Command</b>	[ :SENSe ] :POWer [ :RF ] :MW:PATH STD   LNPath   MPBypass   FULL [ :SENSe ] :POWer [ :RF ] :MW:PATH?
<b>Example</b>	:POW:MW:PATH LNP Enables the Low Noise path
Notes	<p>If a Presel Center is performed, the analyzer will momentarily switch to the Standard Path, regardless of the setting of <b>μW Path Control</b></p> <p>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 <b>Low Noise Path Enable</b> . In the case where the DC Block is switched in the analyzer is now AC coupled. However, if the user has selected DC coupling, the UI will still behave as though it were DC coupled, including all annunciation, warnings, status bits, and responses to SCPI queries. This is because, based on other settings, the analyzer could switch out the low noise path at any time and hence go back to being DC coupled.</p> <p>Alignment switching ignores the settings in this menu, and restores them when finished.</p>
Dependencies	Unavailable in BBIQ and External Mixing
Preset	All modes other than IQ Analyzer mode and VXA: STD IQ Analyzer, VXA and WLAN mode: MPB option present and licensed: MPB MPB option not present and licensed: STD
State Saved	Save in instrument state
Readback	Value selected in the submenu
Initial S/W Revision	A.04.00
Modified at S/W Revision	A.10.00

### Standard Path

This path gives 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.

Key Path	<b>AMPTD Y Scale, μW Path Control</b>
<b>Example</b>	:POW:MW:PATH STD
Readback Text	Standard Path
Initial S/W Revision	A.04.00

## μW Preselector Bypass

This key toggles the preselector bypass switch for band 1 and higher. When the microwave preselector 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 analyzer.

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 will appear lower in amplitude and have a much wider shape factor compared to the real signal.

Key Path	AMPTD Y Scale, μW Path Control
<b>Example</b>	:POW:MW:PATH MPB
Dependencies	Key is blanked if current mode does not support it. Key is grayed out if mode supports it but current measurement does not support it. Key is blank unless Option MPB is present and licensed. If SCPI command sent when MPB not present, error -241, "Hardware missing; Option not installed" is generated.
Readback Text	μW Preselector Bypass
Initial S/W Revision	A.04.00

<b>Remote Command</b>	[ :SENSe ] :POWer [ :RF ] :MW:PRESelector [ :STATe ] ON OFF 0 1 [ :SENSe ] :POWer [ :RF ] :MW:PRESelector [ :STATe ] ?
<b>Example</b>	:POW:MW:PRES OFF Bypasses the microwave preselector

Notes	The ON parameter sets the STD path (:POW:MW:PATH STD) The OFF parameter sets path MPB (:POW:MW:PATH MPB)
Preset	ON

## Internal Preamp

Accesses a menu of keys that control the internal preamps. Turning on the preamp gives a better noise figure, but a poorer 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 will always reflect 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".

Key Path	<b>AMPTD Y Scale</b>
Scope	Meas Global
<b>Remote Command</b>	[ :SENSe ] :POWer [ :RF ] :GAIN [ :STATe ] OFF   ON   0   1 [ :SENSe ] :POWer [ :RF ] :GAIN [ :STATe ] ?
Dependencies	Preamp is not available on all hardware platforms. If the preamp is not present or is unlicensed, the key is not shown. The preamp is not available when the electronic/soft attenuator is enabled.
Couplings	The act of connecting the U7227A USB Preamplifier to one of the analyzer's USB ports will cause the Internal Preamp to be switched on. When this happens an informational message will be generated: "Internal Preamp turned on for optimal operation with USB Preamp." Note that if the Internal Preamp was already on, there will be no change to the setting, but if it was Off it will be switched On, to Full Range. Note that this same action occurs when the SA mode is selected while the USB Preamp is connected to one of the analyzer's USB ports, if it is the first time that the SA mode has run since powerup, or if the last time the SA mode was running the USB Preamp was NOT connected. Subsequently disconnecting the USB Preamp from USB does not change the Internal Preamp setting nor restore the previous setting.
Preset	OFF
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.14.00

Key Path	<b>AMPTD Y Scale, Internal Preamp</b>
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Scope	Meas Global
<b>Remote Command</b>	[ :SENSe ] :POWer [ :RF ] :GAIN :BAND LOW   FULL [ :SENSe ] :POWer [ :RF ] :GAIN :BAND ?
Dependencies	Preamp is not available on all hardware platforms. If the preamp is not present or is unlicensed, the key is not shown. If a POW:GAIN:BAND FULL command is sent when a low band preamp is available, the preamp band parameter is to LOW instead of FULL, and an "Option not installed" message is generated.
Preset	LOW
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00

### Off

Turns the internal preamp off

Key Path	<b>AMPTD Y Scale, Internal Preamp</b>
<b>Example</b>	:POW:GAIN OFF
Readback	Off
Initial S/W Revision	Prior to A.02.00

### 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** key label.

Key Path	<b>AMPTD Y Scale, Internal Preamp</b>
<b>Example</b>	:POW:GAIN ON :POW:GAIN:BAND LOW
Readback	Low Band
Initial S/W Revision	Prior to A.02.00

### Full Range

Sets the internal preamp to use its full range. The low band (0-3.6 GHz or 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) preamp is displayed in square brackets on the **Full Range** key label. If the high band option is not installed the Full Range key does not appear.

Key Path	<b>AMPTD Y Scale, Internal Preamp</b>
<b>Example</b>	:POW:GAIN ON :POW:GAIN:BAND FULL



8 Spectrum Measurement  
AMPTD Y Scale

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Readback	Full Range
Initial S/W Revision	Prior to A.02.00

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## Auto Couple

The Auto Couple feature provides a quick and convenient way to automatically couple multiple instrument settings. This helps ensure accurate measurements and optimum dynamic range. When the Auto Couple feature is activated, either from the front panel or remotely, all parameters of the current measurement that have an Auto/Manual mode are set to Auto mode and all measurement settings dependent on (or coupled to) the Auto/Man parameters are automatically adjusted for optimal performance.

However, the Auto Couple key actions are confined to the current measurement only. It does not affect other measurements in the mode, and it does not affect markers, marker functions, or trace or display attributes.

See "[More Information](#)" on page 430

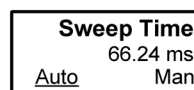
Key Path	Front-panel key
Remote Command	:COUPlE ALL NONE
Example	:COUP ALL
Notes	:COUPlE ALL puts all Auto/Man parameters in Auto mode (equivalent to pressing the <b>Auto Couple</b> key). :COUPLE NONE puts all Auto/Man parameters in manual mode. It decouples all the coupled instrument parameters and is not recommended for making measurements.
Initial S/W Revision	Prior to A.02.00

### More Information

There are two types of functions that have Auto/Manual modes.

#### Auto/Man Active Function keys

An Auto/Man toggle key controls the binary state associated with an instrument parameter by toggling between **Auto** (where the parameter is automatically coupled to the other parameters it is dependent upon) and **Man** (where the parameter is controlled independent of the other parameters), as well as making the parameter the active function. The current mode is indicated on the softkey with either **Auto** or **Man** underlined as illustrated below.



vsd07

#### Auto/Man 1-of-N keys

An Auto/Man 1-of-N key allows you to manually pick from a list of parameter values, or place the function in Auto, in which case the value is automatically selected (and indicated).

- If in Auto, Auto is underlined on the calling key.

- If in manual operation, manual is indicated on the calling key, but note that the calling key simply opens the menu and does **not** actually toggle the function.

## BW

Accesses a menu that enables you to select the filter type and the resolution bandwidth value. Filter Type controls the FFT windowing function to be used and the Res BW allows you to select from a pre-calculated selection of Resolution Bandwidth (RBW) values, which are computed using the following formula:

$RBW = \text{Span} / \text{Ratio}$ , where Ratio is the Span/RBW ratio determined by the selected Filter Type

Key Path	Front-panel key
Initial S/W Revision	A.13.00

### Res BW

This key displays the currently selected calculated resolution bandwidth value. Pressing this key accesses a menu of manual selections (Res BW 1 through Res BW 6) that can be used to change the Res BW value. The default selection is Res BW 2.

All values are calculated using the following formula:

$$RBW = \text{Span} / \text{Filter Type Ratio}$$

Therefore changing the Res BW selection, results in changing the Filter Type Ratio used by the FFT windowing function.

The SCPI command that returns the Res BW value is `[:SENSE]:BANDwidth[:RESolution]?`

Key Path	BW
<b>Remote Command</b>	<code>[:SENSe]:BANDwidth BWIDth[:RESolution]:SELEct RBW1   RBW2   RBW3   RBW4   RBW5   RBW6</code> <code>[:SENSe]:BANDwidth BWIDth[:RESolution]:SELEct?</code>
<b>Example</b>	BAND:SEL RBW1
Preset	Auto Couple chooses the preset value
State Saved	Saved in instrument state
Readback line	1-of-N selection
Initial S/W Revision	A.13.00

### Auto

Activates the auto rules for the Res BW. Setting Auto to on selects the preset value for the Res BW.

Key Path	BW, Res BW
<b>Remote Command</b>	<code>[:SENSe]:BANDwidth BWIDth[:RESolution]:SELEct:AUTO[:STATe] OFF   ON   0   1</code> <code>[:SENSe]:BANDwidth BWIDth[:RESolution]:SELEct:AUTO[:STATe]?</code>

<b>Example</b>	BAND:SEL:AUTO 1
Preset	ON
Initial S/W Revision	A.13.00

### Res BW 1

Selects the Res BW that is computed using the 1024 point FFT window function ratio.

Key Path	<b>BW, Res BW</b>
<b>Example</b>	BAND:SEL RBW1
Notes	Res BW 1 uses Filter Type Ratio of the 1024 point FFT window function size.
Couplings	The actual Res BW value is calculated using the algorithm $RBW = \text{Span} / \text{Filter Type Ratio}$ , therefore any changes to the Span or Filter Type may result in the computed Res BW value changing.
State Saved	Saved in instrument state.
Readback	Res BW 1 <computed Res BW value>
Initial S/W Revision	A.13.00

### Res BW 2

Selects the Res BW that is computed using the 512 point FFT window function ratio.

Key Path	<b>BW, Res BW</b>
<b>Example</b>	BAND:SEL RBW2
Notes	Res BW 2 uses Filter Type Ratio of the 512 point FFT window function size.
Couplings	The actual Res BW value is calculated using the algorithm $RBW = \text{Span} / \text{Filter Type Ratio}$ , therefore any changes to the Span or Filter Type may result in the computed Res BW value changing.  Not supported when Filter Type is RECTangular.
State Saved	Saved in instrument state.
Readback	Res BW 2 <computed Res BW value>
Initial S/W Revision	A.13.00

### Res BW 3

Selects the Res BW that is computed using the 225 point FFT window function ratio.

Key Path	<b>BW, Res BW</b>
<b>Example</b>	BAND:SEL RBW3
Notes	Res BW 3 uses Filter Type Ratio of the 225 point FFT window function size.
Couplings	The actual Res BW value is calculated using the algorithm $RBW = \text{Span} / \text{Filter Type Ratio}$ ,

	therefore any changes to the Span or Filter Type may result in the computed Res BW value changing. Not supported when Filter Type is RECTangular.
State Saved	Saved in instrument state.
Readback	Res BW 3 <computed Res BW value>
Initial S/W Revision	A.13.00

### Res BW 4

Selects the Res BW that is computed using the 128 point FFT window function ratio.

Key Path	<b>BW, Res BW</b>
<b>Example</b>	BAND:SEL RBW4
Notes	Res BW 4 uses Filter Type Ratio of the 128 point FFT window function size.
Couplings	The actual Res BW value is calculated using the algorithm $RBW = \text{Span} / \text{Filter Type Ratio}$ , therefore any changes to the Span or Filter Type may result in the computed Res BW value changing. Not supported when Filter Type is RECTangular.
State Saved	Saved in instrument state.
Readback	Res BW 4 <computed Res BW value>
Initial S/W Revision	A.13.00

### Res BW 5

Selects the Res BW that is computed using the 64 point FFT window function ratio.

Key Path	<b>BW, Res BW</b>
<b>Example</b>	BAND:SEL RBW5
Notes	Res BW 5 uses Filter Type Ratio of the 64 point FFT window function size.
Couplings	The actual Res BW value is calculated using the algorithm $RBW = \text{Span} / \text{Filter Type Ratio}$ , therefore any changes to the Span or Filter Type may result in the computed Res BW value changing. Not supported when Filter Type is RECTangular.
State Saved	Saved in instrument state.
Readback	Res BW 5 <computed Res BW value>
Initial S/W Revision	A.13.00

### Res BW 6

Selects the Res BW that is computed using the 32 point FFT window function ratio.

Key Path	<b>BW, Res BW</b>
<b>Example</b>	BAND:SEL RBW6
Notes	Res BW 6 uses Filter Type Ratio of the 32 point FFT window function size.
Dependencies	The max Span and max Res BW allowed depends on the installed BW option.
Couplings	The actual Res BW value is calculated using the algorithm $RBW = \text{Span} / \text{Filter Type Ratio}$ , therefore any changes to the Span or Filter Type may result in the computed Res BW value changing. Not supported when Filter Type is RECTangular.
State Saved	Saved in instrument state.
Readback	Res BW 6 <computed Res BW value>
Initial S/W Revision	A.13.00

## Filter Type

Enables you to select the FFT Windowing function to use

Key Path	<b>BW</b>
<b>Remote Command</b>	[ :SENSe]:BANDwidth BWIDth:SHAPE GAUSSian   FLATtop   BHARRis   RECTangular   HANNing   KAISer [ :SENSe]:BANDwidth BWIDth:SHAPE? Note: BAND:SEL RBW1 must be sent before using RECT filter type.
<b>Example</b>	BAND:SHAP GAUS
Notes	GAUSSian= Gaussian FLATtop = Flattop BHARRis = Blackman-Harris RECTangular = Rectangular HANNing = Hanning KAISer = Kaiser We use SHAPE instead of TYPE (even though the key name uses Type) for backwards compatibility because TYPE is used in Swept SA measurement.
Couplings	Changing the Filter Type will change the RBW values based on the formula: $RBW = \text{Span} / \text{Filter Type Ratio}$ .
Preset	KAISer
State Saved	Saved in instrument state
Readback line	1-of-N selection
Initial S/W Revision	A.13.00

## Gaussian

Selects Gaussian as the FFT window function.

Key Path	<b>BW, Filter Type</b>
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<b>Example</b>	BAND:SHAP GAUS
Couplings	The actual Res BW value is calculated using the algorithm $RBW = \text{Span} / \text{Filter Type Ratio}$ , therefore any changes to the Span or Filter Type may result in the computed Res BW value changing.
State Saved	Saved in instrument state.
Readback	Gaussian
Initial S/W Revision	A.13.00

### Flattop

Selects Flattop as the FFT window function.

Key Path	<b>BW, Filter Type</b>
<b>Example</b>	BAND:SHAP FLAT
Couplings	The actual Res BW value is calculated using the algorithm $RBW = \text{Span} / \text{Filter Type Ratio}$ , therefore any changes to the Span or Filter Type may result in the computed Res BW value changing.
State Saved	Saved in instrument state.
Readback	Flattop
Initial S/W Revision	A.13.00

### Blackman-Harris

Selects Blackman-Harris as the FFT window function.

Key Path	<b>BW, Filter Type</b>
<b>Example</b>	BAND:SHAP BHAR
Couplings	The actual Res BW value is calculated using the algorithm $RBW = \text{Span} / \text{Filter Type Ratio}$ , therefore any changes to the Span or Filter Type may result in the computed Res BW value changing.
State Saved	Saved in instrument state.
Readback	Blackman-Harris
Initial S/W Revision	A.13.00

### Rectangular

Selects Rectangular as the FFT window function.

Key Path	<b>BW, Filter Type</b>
<b>Example</b>	BAND:SHAP RECT
Couplings	Must send BAND:SEL RBW1 before using RECT filter type The actual Res BW value is calculated using the algorithm $RBW = \text{Span} / \text{Filter Type Ratio}$ , therefore any changes to the Span or Filter Type may result in the computed Res BW value changing.



State Saved	Saved in instrument state.
Readback	Rectangular
Initial S/W Revision	A.13.00

### Hanning

Selects Hanning as the FFT window function.

Key Path	<b>BW, Filter Type</b>
<b>Example</b>	BAND:SHAP HANN
Couplings	The actual Res BW value is calculated using the algorithm $RBW = \text{Span} / \text{Filter Type Ratio}$ , therefore any changes to the Span or Filter Type may result in the computed Res BW value changing.
State Saved	Saved in instrument state.
Readback	Hanning
Initial S/W Revision	A.13.00

### Kaiser

Selects Kaiser as the FFT window function.

Key Path	<b>BW, Filter Type</b>
<b>Example</b>	BAND:SHAP KAIS
Couplings	The actual Res BW value is calculated using the algorithm $RBW = \text{Span} / \text{Filter Type Ratio}$ , therefore any changes to the Span or Filter Type may result in the computed Res BW value changing.
State Saved	Saved in instrument state.
Readback	Kaiser
Initial S/W Revision	A.13.00

## Cont (Continuous Measurement/Sweep)

Sets the analyzer for Continuous measurement operation. The single/continuous state is Meas Global so the setting will affect all measurements. If you are Paused, pressing **Cont** does a Resume.

Key Path	Front-panel key
<b>Remote Command</b>	:INITiate:CONTinuous OFF ON 0 1 :INITiate:CONTinuous?
<b>Example</b>	:INIT:CONT 0 puts analyzer in Single measurement operation. :INIT:CONT 1 puts analyzer in Continuous measurement operation
Preset	ON (Note that SYST:PRESet sets INIT:CONT to ON but *RST sets INIT:CONT to OFF)
State Saved	Saved in instrument state
Backwards Compatibility Notes	For Spectrum Analysis mode in ESA and PSA, there is no <b>Cont</b> hardkey, instead there is a <b>Sweep Single/Cont</b> key. In these analyzers, switching the <b>Sweep Single/Cont</b> key from Single to Cont restarts averages (displayed average count reset to 1), but does not restart <b>Max Hold</b> and <b>Min Hold</b> . The X-Series has <b>Single</b> and <b>Cont</b> keys in place of the <b>SweepSingleCont</b> key. In the X-Series, if in single measurement, the <b>Cont</b> key (and INIT:CONT ON ) switches to continuous measurement, but never restarts a measurement and never resets a sweep.
Initial S/W Revision	Prior to A.02.00

In Swept SA Measurement (Spectrum Analysis Mode):

The analyzer takes repetitive sweeps, averages, measurements, etc., when in Continuous mode. When the average count reaches the Average/Hold Number the count stops incrementing, but the analyzer keeps sweeping. See the Trace/Detector section for the averaging formula used both before and after the Average/Hold Number is reached. The trigger condition must be met prior to each sweep. The type of trace processing for multiple sweeps, is set under the Trace/Detector key, with choices of **Trace Average**, **Max Hold**, or **Min Hold**.

In Other Measurements/Modes:

With **Avg/Hold Num** (in the **Meas Setup** menu) set to **Off** or set to **On** with a value of 1, a sweep is taken after the trigger condition is met; and the analyzer continues to take new sweeps after the current sweep has completed and the trigger condition is again met. However, with **Avg/Hold Num** set to On with a value >1, multiple sweeps (data acquisitions) are taken for the measurement. The trigger condition must be met prior to each sweep. The sweep is not stopped when the average count k equals the number N set for Avg/Hold Num is reached, but the number k stops incrementing. A measurement average usually applies to all traces, marker results, and numeric results. But sometimes it only applies to the numeric results.

## 8 Spectrum Measurement

### Cont (Continuous Measurement/Sweep)

If the analyzer is in Single measurement, pressing the **Cont** key does not change  $k$  and does not cause the sweep to be reset; the only action is to put the analyzer into Continuous measurement operation.

If it is already in continuous sweep:

the INIT:CONT 1 command has no effect

the INIT:CONT 0 command will place the analyzer in Single Sweep but will have no effect on the current sequence until  $k = N$ , at which point the current sequence will stop and the instrument will go to the idle state.

## File

See "File" on page 247

## FREQ Channel

Accesses a menu of keys that allow you to control the Frequency and Channel parameters of the instrument.

Some features in the Frequency menu are the same for all measurements – 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.

Key Path	Front-panel key
Initial S/W Revision	Prior to A.02.00

### Center Freq

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, which means that both Start Frequency and Stop Frequency will change.

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**.

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 Settings** key in its **Mode Setup** menu.

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

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

See ["RF Center Freq" on page 445](#)

See [Ext Mix Center Freq](#)

See ["I/Q Center Freq" on page 446](#)

See ["Center Frequency Presets" on page 442](#)

Key Path	FREQ Channel
Scope	Meas Global
<b>Remote Command</b>	[ :SENSe ] :FREQuency :CENTer <freq> [ :SENSe ] :FREQuency :CENTer ?

<b>Example</b>	FREQ:CENT 50 MHz FREQ:CENT UP changes the center frequency to 150 MHz if you use FREQ:CENT:STEP 100 MHz to set the center frequency step size to 100 MHz FREQ:CENT?
Notes	This command sets either the RF or I/Q Center Frequency depending on the selected input. For RF input it is equivalent to FREQ:RF:CENT For I/Q input it is equivalent to FREQ:IQ:CENT Preset and Max values are dependent on Hardware Options (5xx) If no terminator (e.g. MHz) is sent the terminator Hz is used. If a terminator with unit other than Frequency is used, an invalid suffix error message is generated.
Dependencies	The Center Frequency can be limited by Start or Stop Freq limits, if the Span is so large that Start or Stop reach their limit.
Couplings	When operating in "swept span", any value of the Center Frequency or Span that is within the frequency range of the analyzer 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 analyzer's frequency range
Preset	Depends on instrument maximum frequency, mode, measurement, and selected input. See <a href="#">"Center Frequency Presets" on page 442</a> and <a href="#">"RF Center Freq" on page 445</a> and <a href="#">Ext Mix Center Freq</a> and <a href="#">"I/Q Center Freq" on page 446</a> .
State Saved	Saved in instrument state
Min	Depends on instrument maximum frequency, mode, measurement, and selected input.. See <a href="#">"Center Frequency Presets" on page 442</a> and <a href="#">"RF Center Freq" on page 445</a> and <a href="#">"I/Q Center Freq" on page 446</a> .
Max	Depends on instrument maximum frequency, mode, measurement, and selected input.. See <a href="#">"Center Frequency Presets" on page 442</a> and <a href="#">"RF Center Freq" on page 445</a> and <a href="#">"I/Q Center Freq" on page 446</a> .
Default Unit	Hz
Status Bits/OPC Dependencies	Non-overlapped
Initial S/W Revision	Prior to A.02.00

### 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 N9000A)		1.805 GHz	3.6 GHz 3.7 GHz

<b>Freq Optio n</b>	<b>CF after Mode Prese t</b>	<b>Stop Freq after Mode Prese t</b>	<b>Max Freq (can't tune abov e)</b>	
503 (N9000A)		1.505 GHz	3.0 GHz	3.08 GHz
504 (M9420A)		1 GHz	3.8GHz	3.88 GHz
506 (M9420A)		1 GHz	6.0GHz	6.08 GHz
507 (all but N9000A)		3.505 GHz	7.0 GHz	7.1 GHz
507 (N9000A)		3.755 GHz	7.5 GHz	7.58 GHz
508 (all but N9038A)		1.805 GHz	3.6 GHz	8.5 GHz
508 (N9038A)		4.205 GHz	8.4 GHz	8.5 GHz
513		6.805 GHz	13.6 GHz	13.8 GHz
526 (all but N9000A and N9038A)		13.255 GHz	26.5 GHz	27.0 GHz
526 (N9000A)		13.255 GHz	26.5 GHz	26.5 5 GHz
526 (N9038A)		1.805 GHz	3.6 GHz	27.0 GHz
532	16.005 GHz		32.0 GHz	32.5 GHz
543	21.505 GHz		43.0 GHz	TBD
544	22.005 GHz		44.0 GHz	44.5 GHz
550	25.005 GHz		50.0 GHz	51 GHz

Input 2:

<b>Model</b>	<b>CF after Mode Preset</b>	<b>Stop Freq after Mode Preset</b>	<b>Max Freq (can't tune above)</b>
N9000A opt C75	0.7505GHz	1.5 GHz	1.58 GHz
N9038A	505 MHz	1 GHz	1.000025 GHz

Tracking Generator Frequency Limits (N9000A only):

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

Tracking Generator Frequency Limits(M9290A only):

<b>Tracking Generator Option</b>	<b>Min Freq (clips to this freq when turn TG on and can't tune below while TG on)</b>	<b>If above this Freq, Stop Freq clipped to this Freq when TG turned on</b>	<b>Max Freq (can't tune above) while TG on</b>
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

The following table shows the Center Frequency Presets for modes other than Spectrum Analyzer:

<b>Mode</b>	<b>CF Preset for RF</b>
WCDMA	1 GHz
WIMAXOFDMA,	1 GHz
BASIC	1 GHz
ADEMOD	1 GHz
VSA	1 GHz
TDSCDMA	1 GHz



Mode	CF Preset for RF
PNOISE	1 GHz
LTE	1 GHz
LTETDD	1 GHz
MSR	1 GHz
GSM	935.2 MHz
NFIGURE	1.505 GHz

### RF Center Freq

SCPI command for specifying the RF Center Frequency. This command will set the Center Frequency to be used when the RF input is selected, even if the RF input is not the input that is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Scope	Meas Global
<b>Remote Command</b>	[ :SENSe ] :FREQuency :RF :CENTer <freq> [ :SENSe ] :FREQuency :RF :CENTer?
<b>Example</b>	FREQ:RF:CENT 30 MHz
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode.
Dependencies	If the electronic/soft attenuator is enabled, any attempt to set Center Frequency such that the Stop Frequency would be >3.6 GHz fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a “-221, Settings conflict” warning. If Source Mode is set to Tracking, and the Max or Min Center 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.
Preset	See table above
State Saved	Saved in instrument state.
Min	-79.999995 MHz, unless Source Mode is set to Tracking, in which case it is limited by the minimum frequency of the Source
Max	See table above. Basically instrument maximum frequency - 5 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, also depends on the value of the other three interdependent parameters Span, Start Frequency and Stop Frequency
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

## Ext Mix Center Freq

SCPI command for specifying the External Mixer Center Frequency. This command will set the Center Frequency to be used when the External Mixer is selected, even if the External Mixer input is not the input which is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Scope	Meas Global
<b>Remote Command</b>	[ :SENSe ] :FREQuency:EMIXer:CENTer <freq> [ :SENSe ] :FREQuency:EMIXer:CENTer?
<b>Example</b>	:FREQ:EMIX:CENT 60 GHz :FREQ:EMIX:CENT?
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode.
Couplings	When returning to External Mixing after having been switched to one of the other inputs (e.g., RF), you will come back into the settings that you had when you left External Mixing. So you will come back to the band you were in with the Center Frequency that you had. However, Span is not an input-dependent parameter, therefore you will bring the span over from the other input. Therefore, the analyzer comes back with the span from the previous input, limited as necessary by the current mixer setup.
Preset	When a Mode Preset is performed while in External Mixing, the Start frequency of the current Mode is set to the nominal Min Freq of the lowest harmonic range in the Harmonic Table for the current mixer setup. Similarly, the Stop frequency of the current Mode is set to the nominal Max Freq of the highest harmonic range in the Harmonic Table. The Center Freq thus presets to the point arithmetically equidistant from these two frequencies.  If the current measurement has a limited Span available to it, and cannot achieve the Span shown in the table (Span=Stop Freq – Start Freq), the analyzer uses the maximum Span the measurement allows, and still sets the Center Freq to the midpoint of the Start and Stop Freq values in the Harmonic Table.  When Restore Input/Output Defaults is performed, the mixer presets to the 11970A, whose Start and Stop frequencies are 26.5 and 40 GHz respectively. The center of these two frequencies is 33.25 GHz.  Therefore, after a Restore Input/Output Defaults, if you go into External Mixing and do a Mode Preset while in the Spectrum Analyzer Mode, the resulting Center Freq is 33.25 GHz.
State Saved	Saved in instrument state.
Min	The minimum frequency in the currently selected mixer band + 5 Hz
Max	The maximum frequency in the currently selected mixer band - 5 Hz  If the knob or step keys are being used, also depends on the value of the other three interdependent parameters Span, Start Frequency and Stop Frequency
Initial S/W Revision	A.08.01

## I/Q Center Freq

SCPI command for specifying the I/Q Center Frequency. This command will set the Center Frequency to be used when the I/Q input is selected, even if the I/Q input is not the input which is selected at the time the command is sent. Note that the

**Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Scope	Meas Global
<b>Remote Command</b>	[ :SENSe ] :FREQuency :IQ :CENTer <freq> [ :SENSe ] :FREQuency :IQ :CENTer ?
<b>Example</b>	FREQ:IQ:CENT: 30 MHz
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode.
Preset	0 Hz
State Saved	Saved in instrument state.
Min	-40.049995 MHz
Max	40.049995 MHz
Initial S/W Revision	Prior to A.02.00

## 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**.

Key Path	<b>FREQ Channel</b>
<b>Remote Command</b>	[ :SENSe ] :FREQuency :STARt <freq> [ :SENSe ] :FREQuency :STARt ?
<b>Example</b>	FREQ:STAR 200 MHz FREQ:STAR?
Notes	Max values depends on Hardware Options (5xx)
Dependencies	By direct entry: <p>You cannot set Start frequency &gt; 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.</p> <p>With the knob or step keys:</p> <p>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.</p> <p>The Start Frequency can be limited by Span limits, if the Stop Frequency is below its preset value.</p> <p>If the electronic/soft attenuator is enabled, any attempt to set the Start Frequency such that the Stop Frequency would be &gt;3.6 GHz fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a “-221, Settings conflict” warning.</p> <p>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</p>

	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	<p>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 key descriptions for those keys. These couplings also affect Start Freq and Stop Freq.</p> <p>You cannot set Start frequency = Stop frequency. You cannot select zero span by setting Start = Stop. The instrument will alter the value of the last setting to maintain a minimum value of 10 Hz for the difference between Start and Stop.</p>
Preset	<p>Start Freq does not preset. On Mode Preset, Span &amp; 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.</p> <p>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.</p> <p>If the current measurement has a limited Span available to it, and cannot achieve the Span shown in the table (Span=Stop Freq – Start Freq), the analyzer uses the maximum Span the measurement allows, and 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 <math>\frac{1}{2}</math> of the maximum Span.</p> <p>When Restore Input/Output Defaults is performed, the mixer presets to the 11970A, whose Start frequency is 26.5 GHz.</p> <p>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.</p>
State Saved	Saved in instrument state
Min	<p>-80 MHz, unless Source Mode is set to Tracking, in which case it is limited by the minimum frequency of the Source</p> <p>If the knob or step keys are being used, depends on the value of the other three interdependent parameters</p> <p>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.</p>
Max	<p>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.</p> <p>If the knob or step keys are being used, it depends on the value of the other three interdependent parameters.</p> <p>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. It can be queried with the SCPI command :FREQ:START? MAX.</p>
Default Unit	Hz
Status Bits/OPC dependencies	Non-overlapped
Initial S/W Revision	Prior to A.02.00

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Modified at S/W Revision	A.03.00
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## 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**.

Key Path	<b>FREQ Channel</b>
<b>Remote Command</b>	[ :SENSe ] :FREQuency :STOP <freq> [ :SENSe ] :FREQuency :STOP?
<b>Example</b>	FREQ:STOP 220 MHz FREQ:STOP?
Notes	Preset and Max values are dependent on Hardware Options (5xx)
Dependencies	<p>By direct entry:</p> <p>You cannot set the Stop frequency &lt; 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.</p> <p>With the knob or step keys:</p> <p>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.</p> <p>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 &gt;3.6 GHz fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning.</p> <p>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.</p>
Couplings	<p>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 key descriptions for those keys. These couplings also affect Start Freq and Stop Freq.</p> <p>You cannot set Start frequency = Stop frequency. You cannot select zero span by setting Start = Stop. The instrument will alter the value of the last setting to maintain a minimum value of 10 Hz for the difference between Start and Stop.</p>
Preset	<p>On Mode Preset, Span &amp; CF preset, and Stop Freq is derived. See "<a href="#">Center Frequency Presets</a>" on <a href="#">page 765</a> for a table which shows the Stop Freq after Preset for various model and option numbers).</p> <p>On a Meas Preset only Span presets, CF does not, so Stop Freq will vary depending on CF.</p>

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	<p>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.</p> <p>If the current measurement has a limited Span available to it, and cannot achieve the Span shown in the table (Span=Stop Freq – Start Freq), the analyzer uses the maximum Span the measurement allows, and 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.</p> <p>When Restore Input/Output Defaults is performed, the mixer presets to the 11970A, whose Stop frequency is 40 GHz.</p> <p>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.</p>
State Saved	Saved in instrument state
Min	<p>-79.999999999 MHz, unless Source Mode is set to Tracking, in which case it is limited by the minimum frequency of the Source</p> <p>If the knob or step keys are being used, depends on the value of the other three interdependent parameters</p> <p>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. It can be queried with the SCPI command :FREQ:STOP? MIN.</p>
Max	<p>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.</p> <p>If the knob or step keys are being used, depends on the value of the other three interdependent parameters.</p> <p>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. It can be queried with the SCPI command :FREQ:STOP? MAX.</p>
Default Unit	Hz
Status Bits/OPC dependencies	Non-overlapped
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

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## CF Step

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

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

Key Path	FREQ Channel
Remote Command	[ :SENSe ] :FREQuency :CENTer :STEP [ :INCRement ] <freq> [ :SENSe ] :FREQuency :CENTer :STEP [ :INCRement ] ? [ :SENSe ] :FREQuency :CENTer :STEP :AUTO OFF   ON   0   1 [ :SENSe ] :FREQuency :CENTer :STEP :AUTO ?
Example	FREQ:CENT:STEP:AUTO ON FREQ:CENT:STEP 500 MHz FREQ:CENT UP increases the current center frequency value by 500 MHz FREQ:CENT:STEP? FREQ:CENT:STEP:AUTO?
Notes	Preset and Max values are depending on Hardware Options (503, 507, 508, 513, 526)
Notes	Preset and Max values are dependent on Hardware Options (5xx)
Dependencies	Freq Offset is not available in External Mixing. In this case the Freq Offset key is grayed out and shows a value of zero. It will once again be available, and show the previously set value, when you return to the RF Input.
Dependencies	Span, RBW, Center frequency If the electronic/soft attenuator is enabled, any attempt to change the value of the center frequency >3.6 GHz by pressing the Up-arrow key, fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a “-221, Settings conflict” warning.
Couplings	When auto-coupled in a non-zero span, the center frequency step size is set to 10% of the span. When auto-coupled in zero span, the center frequency step size is set to the equivalent -3 dB RBW value.
Preset	Auto ADEMOD: 1 MHz 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.
Default Unit	Hz
Status Bits/OPC dependencies	non-overlapped
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

## Freq Offset

Enables you to set a frequency offset value to account for frequency conversions outside of the analyzer. 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 analyzer 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.

See ["More Information" on page 452](#).

Key Path	<b>FREQ Channel</b>
Scope	Meas Global
<b>Remote Command</b>	[ :SENSe ] :FREQuency:OFFSet <freq> [ :SENSe ] :FREQuency:OFFSet?
<b>Example</b>	FREQ:OFFS 10 MHz
Notes	Preset and Max values are dependent on Hardware Options (503, 507, 508, 513, 526)
Dependencies	Freq Offset is not available in External Mixing. In this case the Freq Offset key 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.
Preset	See <a href="#">"Center Frequency Presets" on page 765</a>
State Saved	Saved in instrument state
Min	-500 GHz
Max	500 GHz
Default Unit	Hz
Status Bits/OPC dependencies	Non-overlapped
<b>Backwards Compatibility SCPI</b>	<b>DISPlay:WINDow[1]:TRACe:X[:SCALE]:OFFSet</b> The DISPlay version of the command is in the instrument for compatibility across platforms and is not recommended for new development.
Backwards Compatibility Notes	<ol style="list-style-type: none"> <li>1. In pre-X-Series instruments, Frequency Offset could not be adjusted by the knob or step keys. That is no longer the case.</li> <li>2. Some previous spectrum analyzers did not adjust frequency counter results for the Frequency Offset. The X-Series does adjust the frequency counter for the offset.</li> </ol>
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.04.00, A.08.50

### More Information

This command does not affect any bandwidths or the settings of relative frequency parameters such as delta markers or span. It does not affect the current hardware settings of the analyzer, but only the displayed frequency values. Entering an offset does not affect the trace position or display, just the value of the start and stop



frequency and the values represented by the trace data. The frequency values of exported trace data, queried trace data, markers, trace data used in calculations such as N dB points, trace math, etc., are all affected by Freq Offset. Changing the offset, even on a trace that is not updating will immediately change all of the above, without taking new data.

**NOTE**

If a trace is exported with a nonzero Freq Offset, the exported data will contain the trace data with the offset applied. Therefore, if that trace were to be imported back into the analyzer, you would want Freq Offset to be 0, or the offset would be applied again to data which is already offset. No such care need be taken when saving a State+Trace file because the data and state are saved together.

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## Input/Output

See ["Input/Output" on page 138](#)

## 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. The functions in this menu include a 1-of-N selection of the control mode Normal, Delta, Fixed, or Off for the selected marker.

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 and the green marker readout in the upper right corner of the display.

Programmatically, to set the Marker's X-Axis value use the `:CALCulate:MARKer [1]|2|3|4|5|6|7|8|9|10|11|12:X <freq|time>` command. To query the Marker's Y-Axis value, use the `:CALCulate:MARKer [1]|2|3|4|5|6|7|8|9|10|11|12:Y?` query. See ["Setting/Querying the Marker X Axis Value" on page 456](#) and ["Setting/Querying the Marker Y Axis Value" on page 458](#) for information on these functions.

When Marker is pressed, if the selected marker is Off, pressing Marker sets it to Normal and places it at the center of the screen on the trace determined by the Marker Trace rules. 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.

### NOTE

**Markers can be on and not be visible because 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 Peak Search.**

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.

The command in the table below selects the marker and sets the marker control mode as described under **Normal**, **Delta**, **Fixed** and **Off**, below. All interactions and dependencies detailed under the key description are enforced when the remote command is sent.

See ["Marker Control Mode" on page 456](#).

See ["Setting/Querying the Marker X Axis Value" on page 456](#).

See ["Setting the Marker X Position in Trace Points" on page 457](#).

See ["Setting/Querying the Marker Y Axis Value" on page 458](#).

See ["Marker Backwards Compatibility" on page 459](#)

Key Path	Front-panel key
<b>Remote Command</b>	<code>:CALCulate:MARKer[1] 2 ... 12:MODE POSition DELTA FIXed OFF</code> <code>:CALCulate:MARKer[1] 2 ... 12:MODE?</code>
Preset	OFF (all markers)

State Saved	The marker control mode is saved in instrument state
<b>Backwards Compatibility SCPI</b>	<b>:CALCulate:MARKer[1] 2 ... 12:MODE SPAN BAND</b> To support band function backwards compatibility, both of these legacy parameters are accepted and aliased to POSition. They are never returned to a query. See " <a href="#">Band Function Backwards Compatibility</a> " on page 798 for more information.
Initial S/W Revision	Prior to A.02.00

## Marker Control 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 whose 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.

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

In the Swept SA measurement, the Preset control mode is **Off** for all markers.

## Setting/Querying the Marker X Axis Value

The command below sets the marker X Axis value in the current marker X Axis Scale unit. In each case the marker that is addressed becomes the selected marker. It has no effect (other than to cause the marker to become selected) if the control mode is **Off**, but it is the SCPI equivalent of entering an X value if the control mode is **Normal**, **Delta**, or **Fixed**.

<b>Remote Command</b>	<b>:CALCulate:MARKer[1] 2 ... 12:X &lt;freq time&gt;</b> <b>:CALCulate:MARKer[1] 2 ... 12:X?</b>
Notes	If no suffix is sent it will use the fundamental units for the current marker X Axis Scale. If a suffix is sent that does not match the current marker X Axis Scale unit, an invalid suffix message will be generated.  If the specified marker is Fixed and a Marker Function is on, a message is generated. If the key is pressed, an advisory message is generated. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning.  The query returns the marker's absolute X Axis value if the control mode is <b>Normal</b> or <b>Fixed</b> . It returns the offset from the marker's reference marker if the control mode is <b>Delta</b> . The query is returned in the fundamental units for the current marker X Axis scale: Hz for <b>Frequency</b> and <b>Inverse Time</b> , seconds for <b>Period</b> and <b>Time</b> . If the marker is <b>Off</b> the response is not a number.

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
Default Unit	determined by X Axis Scale
<b>Backwards Compatibility SCPI</b>	<b>:CALCulate:MARKer[1] 2 ... 4:X:CENTer</b> This alias is provided for compatibility with the Band Power function in PSA and ESA. See details in the "Marker Function" section under " <a href="#">Band Function Backwards Compatibility</a> " on page 798
Backwards Compatibility Notes	In earlier Agilent analyzers, markers were position markers, which means that Normal and Delta markers stayed at the same screen position when X Axis parameters were changed. In the X-Series, markers are value markers, which means that when the analyzer's X Axis settings are changed, the marker's X Axis value in fundamental X Axis units remains unchanged. See " <a href="#">Marker Backwards Compatibility</a> " on page 459 for a full discussion of this change.
Initial S/W Revision	<b>Prior to A.02.00</b>

## Setting the Marker X Position in Trace Points

The command below sets the marker X position in trace points. It has no effect if the marker control mode is **Off**. But it is the SCPI equivalent of entering a value if the control mode is **Normal** or **Delta** or **Fixed** – except the setting is in trace points rather than X Axis Scale units.

### NOTE

The entered value in Trace Points is immediately translated into the current X Axis Scale units for setting the value of the marker. The marker's value in X Axis Scale Units, NOT trace points, will be preserved if a change is made to the X Axis scale settings. Thus, if you use this command to place a marker on bucket 500, which happens at that time to correspond to 13 GHz, and then you change the Start Frequency so that bucket 500 is no longer 13 GHz, the marker will stay at 13 GHz, NOT at bucket 500! This is important to realize as it differs from the behavior of past Agilent analyzers.

<b>Remote Command</b>	<b>:CALCulate:MARKer[1] 2 ... 12:X:POSition &lt;real&gt;</b> <b>:CALCulate:MARKer[1] 2 ... 12:X:POSition?</b>
Notes	If the specified marker is Fixed and a Marker Function is on, a message is generated. If the key is pressed, an advisory message is generated. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning.  The query returns the marker's absolute X Axis value in trace points if the control mode is <b>Normal</b> or <b>Fixed</b> . It returns the offset from the marker's reference marker in trace points if the control mode is <b>Delta</b> . The value is returned as a real number, not an integer, corresponding to the translation from X Axis Scale units to trace points
Preset	After a preset, if X is queried with no value sent first, the center of screen value will be returned. So if per default, the number of Trace points is 1001, the center value will be 500.
Min	0

Max	Number of trace points – 1
Default Unit	unitless
<b>Backwards Compatibility SCPI</b>	<b>:CALCulate:MARKer[1] 2 ... 4:X:POSition:CENTer</b> This alias is provided for compatibility with the Band Power function in PSA and ESA. See details in the “Marker Function” section under <a href="#">"Band Function Backwards Compatibility" on page 798</a>
Initial S/W Revision	Prior to A.02.00

## Setting/Querying the Marker Y Axis Value

The fundamental item of marker data accessed by users is the marker's Y-Axis value. The query below is used to select the marker and read the marker's Y-Axis value.

In the command form, it selects the marker and sets the marker Y Axis value; the default unit is the current Y Axis unit. The command form has no effect (other than selecting the marker) unless the marker control mode is **Fixed**.

<b>Remote Command</b>	<b>:CALCulate:MARKer[1] 2 ... 12:Y &lt;real&gt;</b> <b>:CALCulate:MARKer[1] 2 ... 12:Y?</b>
<b>Example</b>	CALC:MARK2:MODE POS turns on marker 2 as a normal marker. CALC:MARK2:X 20 GHZ moves marker 2 to 20 GHz if X Axis Scale is Frequency. If X Axis Scale is Time, an Invalid Suffix error is generated.
Notes	The command <b>:CALCulate:MARKer[1] 2 3 4 5 6 7 8 9 10 11 12:Y?</b> returns the marker Y-axis result, if the control mode is <b>Normal</b> , <b>Fixed</b> or <b>Delta</b> . If the marker is <b>Off</b> the response is 9.91e37 (“not a number”). If no suffix is sent it will use the current Y Axis unit. If a suffix is sent that does not have units of absolute amplitude, an invalid suffix error will be generated. If a marker function is on for the specified marker, a Settings Conflict message is generated.
Preset	Trace value at center of screen. There is no way to predict what this will be after a preset.
Min	–∞ (minus infinity)
Max	+∞ (plus infinity)
Backwards Compatibility Notes	As a result of the change from position markers to value markers (see below), 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. In the past, since markers could never be offscreen they always returned a valid result. In the X-Series, markers which are offscreen return not a number as a result; hence the potential now exists for not a number to be returned for a marker Y-Axis query. Also, in some previous analyzers linear ratios read out on the display in %. In the X-Series they display as dimensionless quantities. E.g., a quantity which used to display as 52% now displays as .52. The SCPI behavior is unaffected as it has always read out the ratio rather than the percentage.
Initial S/W Revision	<b>Prior to A.02.00</b>

## Querying the Marker Z Axis Value

The command below queries the marker Z Axis value in the Spectrogram View only. The Z Axis value of a marker represents the time value of the marker (see

“Representation of Time” under the Spectrogram View description). In each case the marker that is addressed becomes the selected marker.

<b>Remote Command</b>	<b>:CALCulate:MARKer[1] 2 ... 12:Z?</b>
Notes	The query returns the marker's absolute Z Axis value if the control mode is <b>Normal</b> or <b>Fixed</b> . It returns the offset from the marker's reference marker if the control mode is <b>Delta</b> . For Spectrogram, the Z Axis value represents the amount of time transpired since the start of the recording of traces.
Preset	9.91E+37
Min	-Infinity
Max	+Infinity

## Setting or Querying the Marker Z Position

The command below sets the Marker Z position in the Spectrogram View only. Setting the Z Position sets which of the 300 traces in the Spectrogram the selected marker will appear on. In each case the marker that is addressed becomes the selected marker. It has no effect (other than to cause the marker to become selected) if the control mode is **Off**, but it is the SCPI equivalent of making a Marker Z entry if the control mode is **Normal**, **Delta**, or **Fixed**.

<b>Remote Command</b>	<b>:CALCulate:MARKer[1] 2 ... 12:Z:POsition &lt;integer&gt;</b> <b>:CALCulate:MARKer[1] 2 ... 12:Z:POsition?</b>
Notes	The command sets or queries the Z Axis position. In the Spectrogram View, this value correlates to be one of the 300 stored traces. Each Z Axis position represents a different stored trace.
Preset	0
Min	0
Max	Number of traces stored is limited to 300.
Default Unit	unitless

## Marker Backwards Compatibility

In earlier Agilent 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 analyzer'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 analyzer, 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 analyzer. 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 which 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.

## Select Marker

Specifies the selected marker. The term “selected marker” is used throughout this document to specify which marker will be affected by the functions.

Key Path	<b>Marker</b>
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.
Initial S/W Revision	Prior to A.02.00

## Normal

Sets the control mode for the selected marker to **Normal** and turns on the active function for setting its value. 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.

**A Normal mode (POSITION type) 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.

Key Path	<b>Marker</b>
<b>Example</b>	:CALC:MARK:MODE POS sets Marker 1 to Normal.
Notes	See the description under the “Marker” key.
Couplings	The marker addressed by this command becomes the selected marker on the front panel.
State Saved	The marker control mode (Normal, Delta, Fixed, Off) and X Axis value are saved in instrument state.
<b>Backwards Compatibility SCPI</b>	<b>:CALCulate:MARKer[1] 2 ... 12:STATe ON 1</b> Setting a marker which is OFF to ON or 1 selects the marker, puts it in Normal mode and places it at the center of the screen. Setting a marker which is not OFF to ON has no effect (does not change its control mode). Example: CALC:MARK2:STAT ON sets Marker 2 to Normal if it was off; otherwise it does nothing. The response to the query will be ON unless the marker is OFF.
Initial S/W Revision	Prior to A.02.00



<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 12:STATE OFF ON 0 1 :CALCulate:MARKer[1] 2 ... 12:STATE?
Preset	OFF
Initial S/W Revision	Prior to A.02.00

## Delta

Sets the control mode for the selected marker to Delta and turns on the active function for setting its delta value. 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.

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.

Key Path	<b>Marker</b>
<b>Example</b>	:CALC:MARK:MODE DELT sets marker 1 to Delta.
Notes	See the description under the "Marker" key.
State Saved	The marker control mode (Normal, Delta, Fixed, Off) and X Axis value are saved in instrument state
Backwards Compatibility Notes	Previously, pressing Delta (or sending the <b>CALC:MARK:MODE:DELTa</b> command) always moved the reference marker to the delta marker. Now it only does so if the marker was already a delta marker.
Initial S/W Revision	Prior to A.02.00

## Fixed

Sets the control mode for the selected marker to 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.

See ["Fixed Marker X Axis Value" on page 462](#).

See ["Fixed Marker Y Axis Value" on page 462](#).

See [Fixed Marker Z Axis Value](#)

### Fixed Marker X Axis Value

Key Path	<b>Marker, Fixed</b>
<b>Example</b>	:CALC:MARK:MODE FIX sets Marker 1 to Fixed.
Notes	See the description under the “Marker” key, above.
Dependencies	<ul style="list-style-type: none"> <li>– You cannot directly set the X or Y 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.</li> <li>– You cannot directly set the Y value of a Fixed marker while Normalize is turned on. If an attempt is made to do so while Normalize is on, a warning message is generated.</li> </ul>
State Saved	The marker control mode (Normal, Delta, Fixed, Off) and X and Y Axis values are saved in instrument state
Backwards Compatibility Notes	In legacy analyzers, only a Reference marker could be Fixed, and it was always Fixed. Additionally it could not be moved. In the X-Series, any marker can be set to Fixed and can be moved to any X or Y value.
Initial S/W Revision	Prior to A.02.00

### Fixed Marker Y Axis Value

Key Path	<b>Marker, Fixed</b>
<b>Example</b>	:CALC:MARK:MODE FIX sets Marker 1 to Fixed.
Notes	See the description under the <b>Marker</b> key.
Dependencies	You cannot directly set the X or Y 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.
State Saved	The marker control mode (Normal, Delta, Fixed, Off) and X and Y Axis values are saved in instrument state
Default Unit	depends on the current selected Y axis unit
Initial S/W Revision	Prior to A.02.00

### Fixed Marker Z Axis Value

The Marker Z position determines which of the 301 traces (0-300) the selected marker is on. It cannot be set above the maximum trace in the Spectrogram window and, unlike the Marker X position, will not move off screen in the Spectrogram Window if the storage size is smaller than the number of traces that can be viewed.

If Spectrogram is on, the marker result block has a third line displaying the time value of Marker Z. If the marker is a delta marker, the delta time value is displayed. Although the Z Marker position can be moved to trace 0, this is not recommended, as the current trace value is constantly being updated by new acquisitions and therefore the Z time value for trace 0 is not completely registered until the trace is completed.

Marker Z position is only available in the Spectrogram View

Key Path	<b>Marker, Fixed</b>
<b>Example</b>	:CALC:MARK2:MODE FIX sets Marker 2 to Fixed. :CALC:MARK2:Z:POS 150 puts Marker 2 on Trace 150
Dependencies	Only appears in the Spectrogram view, otherwise blanked
State Saved	The marker control mode (Normal, Delta, Fixed, Off) and X, Y and Z Axis values are saved in instrument state
Initial S/W Revision	A.07.01

## Off

Turns off the selected marker.

In addition, Off 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/Interval Span: 0
- Auto Trace: On

Off does not affect which marker is selected.

Key Path	<b>Marker</b>
<b>Example</b>	:CALC:MARK:MODE OFF sets Marker 1 to Off.
Notes	See the description under the “Marker” key.
State Saved	The marker control mode (Normal, Delta, Fixed, Off) is saved in instrument state
<b>Backwards Compatibility SCPI</b>	:CALCulate:MARKer[1] 2 ... 12:STATe OFF 0
Initial S/W Revision	Prior to A.02.00

## Properties

Opens a menu used to set certain properties of the selected marker.

Key Path	<b>Marker</b>
Initial S/W Revision	Prior to A.02.00

## Select Marker

Specifies the selected marker. The term “selected marker” is used throughout this document to specify which marker will be affected by the functions.

Key Path	<b>Marker</b>
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.
Initial S/W Revision	Prior to A.02.00

## Relative To

Selects the marker that the selected marker will be relative to (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.

Key Path	<b>Marker, Properties</b>
<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 12:REFerence <integer> :CALCulate:MARKer[1] 2 ... 12:REFerence?
<b>Example</b>	CALC:MARK1:REF 2 sets the marker 1 reference marker to 2 and turns marker 1 on as a delta marker.
Notes	A marker cannot be relative to itself so that choice is grayed out. If the grayed out key is pressed, an advisory message is generated.
Notes	This command causes the marker specified with the subopcode to become selected. Range (for SCPI command): 1 to 12. If the range is exceeded the value is clipped.
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 <b>Fixed</b> 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 <b>Restore Mode Defaults</b> . This is not reset by <b>Marker Off, All Markers Off</b> , or <b>Preset</b> .
State Saved	Saved in instrument state. Not affected by Marker Off and hence not affected by Preset or power cycle.
Min	1
Max	12
Status Bits/OPC dependencies	none Default (selected when <b>Restore Mode Defaults</b> is pressed): next higher numbered marker or 1 if marker 12.
Initial S/W Revision	Prior to A.02.00

## Select Marker

Specifies the selected marker. The term “selected marker” is used throughout this document to specify which marker will be affected by the functions.

Key Path	<b>Marker</b>
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.
Initial S/W Revision	Prior to A.02.00

### X Axis Scale

Accesses a menu that enables you to affect 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 465.

Key Path	<b>Marker, Properties</b>
<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 12:X:READout FREQuency   TIME   ITIME   PERiod :CALCulate:MARKer[1] 2 ... 12:X:READout? :CALCulate:MARKer[1] 2 ... 12:X:READout:AUTO ON OFF 1 0 :CALCulate:MARKer[1] 2 ... 12:X:READout:AUTO?
<b>Example</b>	CALC:MARK3:X:READ TIME sets the marker 3 X Axis Scale to Time.
Notes	This command causes the specified marker to become selected.
Preset	AUTO Marker Preset (selected when a marker is turned <b>Off</b> ): <b>Auto</b> (see below). In most measurements the Auto settings results in Frequency being the preset readout.
State Saved	Saved in instrument state
Backwards Compatibility Notes	The X Axis Scale of a marker ( <b>Readout</b> in legacy analyzers) now has only one value, not one value for frequency domain and another value for time domain. The value changes (if in Auto) when the domain of the trace it is on changes. This means that the default behaviors are identical, but if the user changes the readout manually in swept and expects the default to remain in zero span, there may be some backwards compatibility problems. As an example, in the old instruments, if the user set Readout to Period in a swept span, and the instrument was set to zero span, the readout changed to Time, the default for Zero Span. Now, it will stay in Period even in Zero Span until the user changes it or sets it back to Auto.  Additionally, all choices for X Axis Scale are now always allowed. In legacy analyzers the choices of X Axis Scale were restricted based on the domain the instrument was currently in. Since the new behavior is less restrictive this should not show up as a backwards compatibility issue.
Initial S/W Revision	Prior to A.02.00

### More Information

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.

### Auto

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.

Key Path	<b>Marker, Properties, X Axis Scale</b>
<b>Example</b>	CALC:MARK2:X:READ:AUTO ON sets the marker 2 X-axis scaling to automatically select the most appropriate units.
Initial S/W Revision	Prior to A.02.00

### Frequency

Sets the marker X Axis scale to Frequency, displaying the absolute frequency of a normal marker or the frequency of the delta marker relative to the reference marker. Frequency is the auto setting for frequency domain traces.

If Frequency is selected for a time domain trace, all of the 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.

Key Path	<b>Marker, Properties, X Axis Scale</b>
<b>Example</b>	CALC:MARK2:X:READ:FREQ sets the marker 2 X Axis scale to Frequency.
Notes	1-of-N readback is <b>Frequency</b>
State Saved	The X Axis Scale setting is saved in instrument state.
Initial S/W Revision	Prior to A.02.00

### Period

Sets the marker X Axis scale to Period, displaying 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 will be the reciprocal of 0, which is infinitely large. The display will show "---" and a SCPI query will return infinity.

If Period is selected for a time domain trace, all of the 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.

Key Path	<b>Marker, Properties, X Axis Scale</b>
<b>Example</b>	CALC:MARK2:X:READ PER sets the marker 2 X Axis scale to Period.
Notes	1-of-N readback is <b>Period</b>
State Saved	The X Axis Scale setting is saved in instrument state.
Initial S/W Revision	Prior to A.02.00

### Time

Sets the marker X Axis scale to Time, displaying 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.

Key Path	<b>Marker, Properties, X Axis Scale</b>
<b>Example</b>	CALC:MARK2:X:READ TIME sets the marker 2 X Axis Scale to Time..
Notes	1-of-N readback is <b>Time</b>
Couplings	Frequency domain traces taken in FFT mode have no valid time data. Therefore when 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.
State Saved	The X Axis Scale setting is saved in instrument state
Initial S/W Revision	Prior to A.02.00

### Inverse Time

Sets the marker X Axis scale to Inverse Time, displaying 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 will show “---” and a SCPI query will return infinity.

Key Path	<b>Marker, Properties, X Axis Scale</b>
<b>Example</b>	:CALC:MARK2:X:READ ITIM sets the marker 2 X Axis scale to Inverse Time.
Notes	1-of-N readback is <b>Inverse Time</b>
Couplings	Frequency domain traces taken in FFT mode have no valid time data. Therefore when Inverse Time is selected for markers on such traces, the X Axis value is undefined, shows as “---” and returns not a number to a query.
State Saved	The X Axis Scale setting is saved in instrument state
Initial S/W Revision	Prior to A.02.00

## Marker Trace

Selects the trace that you want your marker to be placed on. 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.

Key Path	Marker, Properties
<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 12:TRACe 1   2   3   4   5   6   7   8   9   10   11   12 :CALCulate:MARKer[1] 2 ... 12:TRACe?
<b>Example</b>	CALC:MARK1:TRAC 2 Places marker 1 on trace 2.
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 key instead of a trace number.
Couplings	Traces 1–6 are Spectrum traces and Traces 7–12 are PvT traces. Thus, selecting Marker Trace 7 is equivalent to selecting Trace 1 of the PvT trace. The state of Marker Trace is not affected by the Auto Couple key. If a Marker Trace is chosen manually, Auto Init goes to Off for that marker. Sending the remote command causes the addressed marker to become selected.
Preset	Presets on 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
Readback line	[TraceN, Auto Init] or [TraceN, Manual] where N is the trace number to which the marker is currently assigned.
Initial S/W Revision	A.13.00

## Marker Trace

Selects the trace that you want your marker to be placed on. 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.

See ["Auto Init On" on page 469](#).

See ["Auto Init Rules Flowchart" on page 469](#).

See ["Auto Init OFF" on page 470](#).

Key Path	Marker, Properties
<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 12:TRACe 1 2 3 4 5 6



:CALCulate:MARKer[1] 2 ... 12:TRACe?	
<b>Example</b>	CALC:MARK1:TRAC 2 places marker 1 on trace 2.
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 key instead of a trace number.
Couplings	The state of Marker Trace is not affected by the Auto Couple key. If a Marker Trace is chosen manually, Auto Init goes to Off for that marker. Sending the remote command causes the addressed marker to become selected.
Preset	Presets on Preset or All Markers Off
State Saved	The Marker Trace and state of <b>Auto Init</b> for each marker is saved in instrument state.
Min	1
Max	6
Readback line	[TraceN, Auto Init] or [TraceN, Manual] where N is the trace number to which the marker is currently assigned.
Initial S/W Revision	Prior to A.02.00

### Auto Init On

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

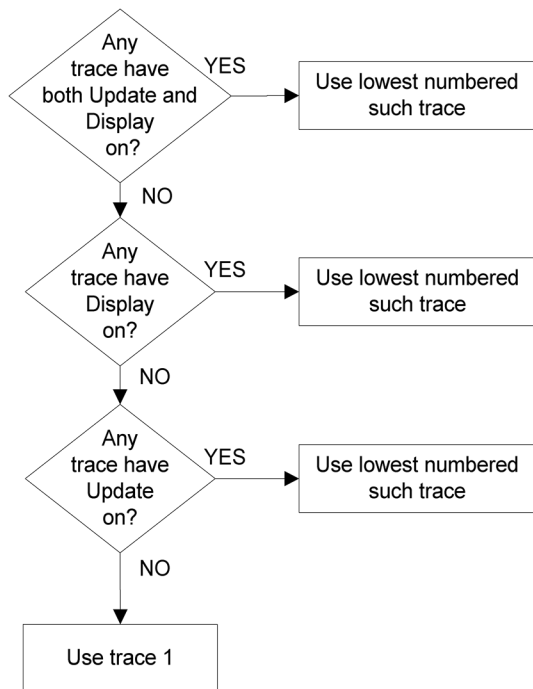
When the marker moves between traces the marker's X position in trace points is retained as it moves. For moving between active traces this generally means the x-axis value of the marker will not change. But for moving to or from an inactive trace, the x-axis value will take on that of the new trace 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!

Marker Trace is set to 1, and Auto Init is set to On, on a Preset or All Markers Off.

### 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.

### Auto Init OFF

This command associates the marker with the specified trace and turns Marker Trace, Auto Init 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.

The query returns the number of the trace on which the marker is currently placed, even if that marker is in Auto mode.

<b>Remote Command</b>	<code>:CALCulate:MARKer[1] 2 ... 12:TRACe:AUTO OFF ON 0 1</code> <code>:CALCulate:MARKer[1] 2 ... 12:TRACe:AUTO?</code>
Notes	Turning Marker Trace Auto Init off has no effect on the trace on which the marker is currently placed. The response to the query will be 0 if OFF, 1 if ON.
Couplings	The state of Auto Init is not affected by the Auto Couple key. 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. Sending the remote command causes the addressed marker to become selected.
Preset	ON

Backwards Compatibility Notes	<p>The Marker Trace Auto function in legacy analyzers has been replaced by Marker Trace Auto Init, but the same SCPI command is used for the new function. This should work fine for most legacy users. See the sections on "Auto Init On" on page 469, "Auto Init OFF" on page 470 and the "Auto Init Rules Flowchart" on page 469 for details.</p> <p>The new auto functionality causes markers to automatically go to the appropriate trace when the marker is first turned on. Users who counted on markers changing traces when a trace was put in or out of View will have to modify their code.</p>
Initial S/W Revision	Prior to A.02.00

## 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 off screen 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.

Key Path	<b>Marker, Properties</b>
<b>Remote Command</b>	<pre>:CALCulate:MARKer[1] 2 ... 12:LINes[:STATe] OFF ON 0 1 :CALCulate:MARKer[1] 2 ... 12:LINes[:STATe]?</pre>
<b>Example</b>	:CALC:MARK2:LIN:ON turns Lines on for marker 2.
Couplings	Sending the remote command causes the addressed marker to become selected.
Preset	OFF
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00

## 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 the Marker Table on turns the Peak Table off and vice versa.

Key Path	<b>Marker</b>
<b>Remote Command</b>	<pre>:CALCulate:MARKer:TABLE[:STATe] OFF ON 0 1 :CALCulate:MARKer:TABLE[:STATe]?</pre>
<b>Example</b>	CALC:MARK:TABL ON turns on the marker table.
Preset	OFF
State Saved	The on/off state of the Marker Table is saved in instrument state
Initial S/W Revision	Prior to A.02.00

## 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.

Key Path	Marker
<b>Remote Command</b>	:CALCulate:MARKer:COUple[:STATe] OFF ON 0 1 :CALCulate:MARKer:COUple[:STATe]?
<b>Example</b>	:CALC:MARK:COUP ON sets Couple Markers on.
Preset	Off, presets on Mode Preset and All Markers Off
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00

## All Markers Off

Turns off all markers. See Marker, "Off" on page 786.

Key Path	Marker
<b>Remote Command</b>	:CALCulate:MARKer:AOFF
<b>Example</b>	CALC:MARK:AOFF turns off all markers.
Couplings	Sets the selected marker to 1.
Preset	n/a.
Initial S/W Revision	Prior to A.02.00

## Marker To

The Marker -> key accesses menu keys that can 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**.

Key Path	<b>Front-panel key</b>
Notes	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. Consistent with other remote marker commands, sending a Marker To remote command will never change which marker is selected.
Initial S/W Revision	Prior to A.02.00

### Mkr->CF

Sets the center frequency of the analyzer 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 key is pressed, it will be turned on at the center of the screen as a normal type marker.

Key Path	<b>Marker -&gt;</b>
<b>Remote Command</b>	<b>:CALCulate:MARKer[1] 2 ... 12[:SET]:CENTER</b>
<b>Example</b>	CALC:MARK2:CENt sets the CF of the analyzer to the value of marker 2.
Notes	Sending this command selects the subopcoded marker If specified marker is off, this command will turn it on at the center of the screen as a normal type marker.
Dependencies	This function is not available (key is grayed out) when x-axis is the time domain
Couplings	All the usual couplings associated with setting Center Frequency apply (see " <a href="#">FREQ Channel</a> " on <a href="#">page 764</a> .)
Initial S/W Revision	Prior to A.02.00

### Mkr->CF Step

Sets the center frequency (CF) step size of the analyzer 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 key is pressed, it will be turned on at the center of the screen as a normal type marker.

Key Path	<b>Marker -&gt;</b>
<b>Remote Command</b>	<b>:CALCulate:MARKer[1] 2 ... 12[:SET]:STEP</b>
<b>Example</b>	CALC:MARK1:STEP sets the CF step to the value (or delta value) of marker 1.
Notes	Sending this command selects the subopcoded marker If specified marker is off, this command will turn it on at the center of the screen as a normal type marker.
Dependencies	This function is not available (key is grayed out) when x-axis is the time domain
Couplings	All the usual couplings associated with setting CF Step apply (see "FREQ Channel" on page 764 ).
Initial S/W Revision	Prior to A.02.00

### 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 key is pressed, it will be turned on at the center of the screen as a normal type marker.

Key Path	<b>Marker -&gt;</b>
<b>Remote Command</b>	<b>:CALCulate:MARKer[1] 2 ... 12[:SET]:STARt</b>
<b>Example</b>	CALC:MARK1:STAR sets the start frequency to the value (or delta value) of marker 1.
Notes	Sending this command selects the subopcoded marker If specified marker is off, this command will turn it on at the center of the screen as a normal type marker.
Dependencies	This function is not available (key is grayed out) when x-axis is the time domain
Couplings	All the usual couplings associated with setting Start Frequency apply (see "FREQ Channel" on page 764 ).
Initial S/W Revision	Prior to A.02.00

### 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 key is pressed, it will be turned on at the center of the screen as a normal type marker.

Key Path	<b>Marker -&gt;</b>
<b>Remote Command</b>	<b>:CALCulate:MARKer[1] 2 ... 12[:SET]:STOP</b>
<b>Example</b>	CALC:MARK3:STOP sets the stop frequency to the value (or delta value) of marker 3.

Notes	Sending this command selects the subopcoded marker If specified marker is off, this command will turn it on at the center of the screen as a normal type marker.
Dependencies	This function is not available (key is grayed out) when x-axis is the time domain
Couplings	All the usual couplings associated with setting Stop Frequency apply (see "FREQ Channel" on page 764).
Initial S/W Revision	Prior to A.02.00

### 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 key is pressed, it will be turned on at the center of the screen as a normal type marker, and its amplitude applied to the reference level.

Key Path	<b>Marker -&gt;</b>
<b>Remote Command</b>	<b>:CALCulate:MARKer[1] 2 ... 12[:SET]:RLEVel</b>
<b>Example</b>	CALC:MARK2:RLEV sets the reference level of the analyzer to the amplitude of marker 2.
Notes	Sending this command selects the subopcoded marker If specified marker is off, this command will turn it on at the center of the screen as a normal type marker.
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 the user 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.
Initial S/W Revision	Prior to A.02.00

### Mkr $\Delta$ ->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.

Key Path	<b>Marker -&gt;</b>
<b>Remote Command</b>	<b>:CALCulate:MARKer[1] 2 ... 12[:SET]:DELTA:CENTer</b>
<b>Example</b>	CALC:MARK2:CENT sets the CF of the analyzer to the value of marker 2.

Notes	Sending this command selects the subopcoded marker
Dependencies	This function is only available when the selected marker is a delta marker. Otherwise the key is grayed out. In addition, this function is not available when x-axis is the time domain
Initial S/W Revision	Prior to A.02.00

## Mkr $\Delta$ ->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.

Key Path	<b>Marker -&gt;</b>
<b>Remote Command</b>	<b>:CALCulate:MARKer[1] 2 ... 12[:SET]:DELTA:SPAN</b>
<b>Example</b>	CALC:MARK2:DELT:SPAN sets the start and stop frequencies to the values of marker 2 and its reference marker.
Notes	Sending this command selects the subopcoded marker
Dependencies	This function is only available when the selected marker is a delta marker. Otherwise the key 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 "SPAN X Scale").
<b>Backwards Compatibility SCPI</b>	<b>:CALCulate:MARKer[1] 2 ... 12[:SET]:SPAN</b>
Backwards Compatibility Notes	In earlier ESA and PSA products, Mkr $\Delta$ ->Span would adjust the span and change the delta marker to a normal marker placing it at the center of screen. In all the X-Series products, this is no longer true. The markers will remain in delta mode and the delta and reference marker will end up on opposite edges of the display.
Initial S/W Revision	Prior to A.02.00



## Marker Function

The Marker Function key opens up a menu of softkeys that allow you to control the Marker Functions of the instrument. Marker Functions perform post-processing operations on marker data. 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, marker 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 477](#).

See ["Fixed marker functions" on page 478](#).

See ["Interval Markers" on page 478](#).

Key Path	Front-panel key
Remote Command	:CALCulate:MARKer[1] 2 ... 12:FUNCTION NOISE   BPOWER   BDENSITY   OFF :CALCulate:MARKer[1] 2 ... 12:FUNCTION?
Notes	Sending this command selects the subopcoded marker The marker function result is queried in the same way as the Marker Result, as outlined in the Marker section, with the CALC:MARK:Y? command.
Dependencies	Fixed markers: It is not possible to change the Band Function for a Fixed marker; so all of the Band Function keys 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.
Preset	OFF
State Saved	The band function for each marker is saved in instrument state
Backwards Compatibility Notes	The introduction of adjustable-width Band Functions in the X-Series fundamentally changes the way Band Power markers are controlled. See the section entitled <a href="#">"Band Function Backwards Compatibility" on page 478</a> below for a complete discussion of programming Band Functions in a backwards compatible fashion.
Initial S/W Revision	Prior to A.02.00

### More Information

The units to be used for displaying Marker Function results in Delta mode vary depending on what is the reference marker and what it is referenced to.

Marker Functions are different from Measurements, which automatically perform complex sequences of setup, data acquisition, and display operations in order to measure specified signal characteristics. Marker Functions are specified for each individual marker and may be turned on individually for each marker.

The **Marker Fctn** menu controls which marker functions are turned on and allows you to adjust setup parameters for each function. The Marker Functions are **Marker Noise**, **Band/Interval Power**, and **Band/Interval Density**, only one of which can be on for a given marker.

If the selected marker is off, pressing Marker Fctn 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 will be 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.

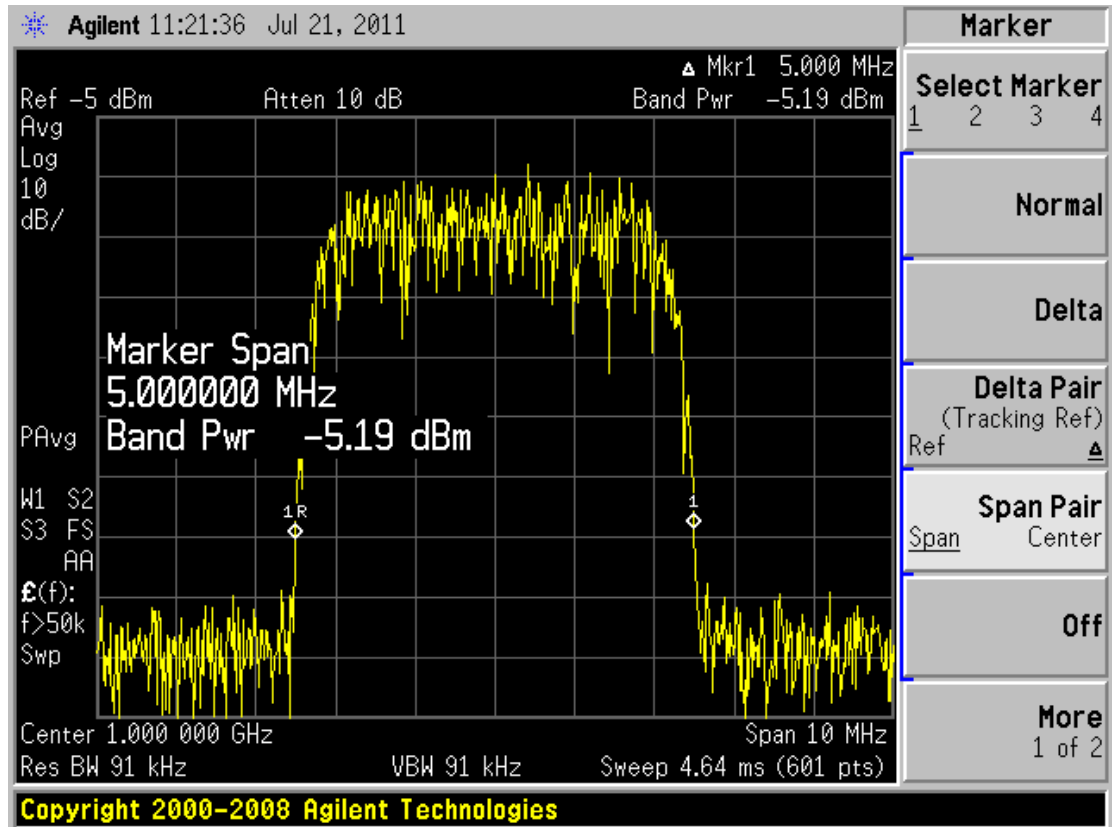
## Interval Markers

What is an interval marker? The band power marker computes the total power within a span in a nonzero span. The results computation must include the RBW. 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.

## Band Function Backwards Compatibility

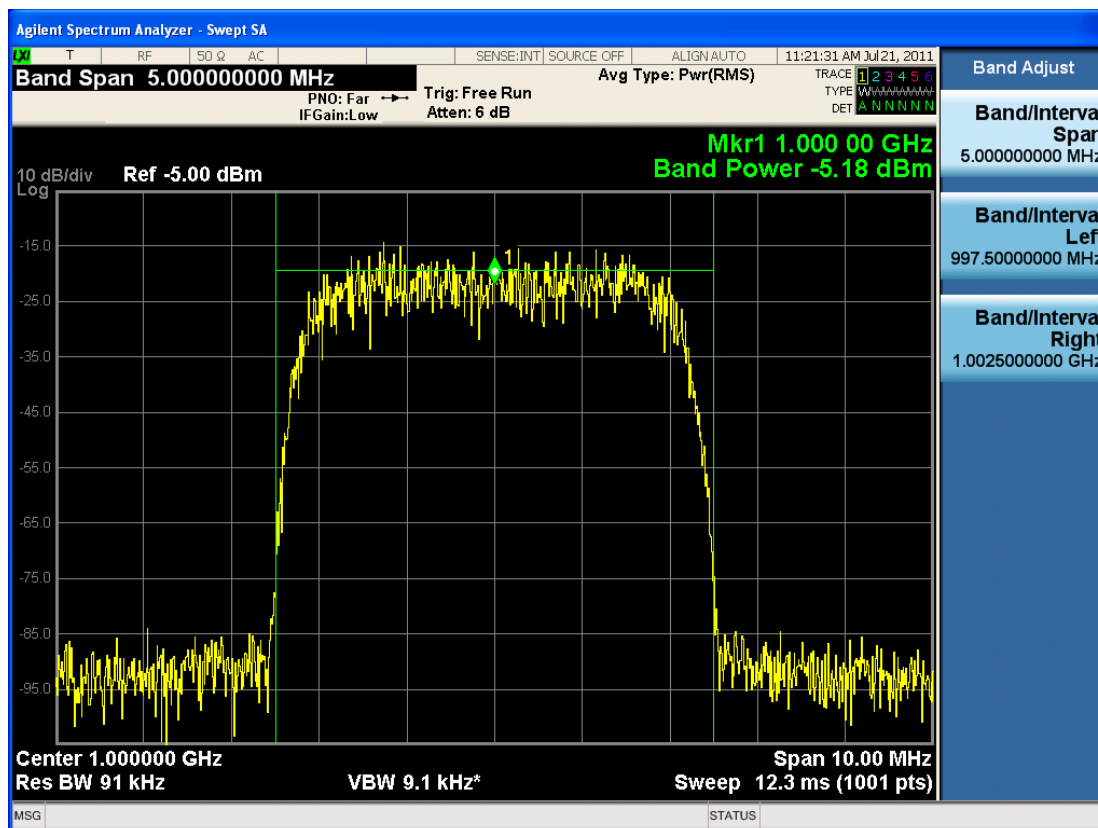
To define the Band Power function, the ESA and PSA analyzers used Delta Marker functionality with two markers, for example, Marker 1 and its Reference Marker, as shown below:



e

The marker modes known as Span Pair and Delta Pair (Band Pair in ESA) were used to set two markers for the primary purpose of defining the band of a Band Power function. The two markers were set by adjusting their span and centerpoint (Span Pair mode) or by adjusting their locations independently to directly define the Start and Stop edges of the band (Band Pair/Delta Pair modes).

In the X-Series, the introduction of adjustable-width Band Functions fundamentally changes the way Band Power markers are controlled, by using a single marker to completely define the function, as shown below:



In the X-Series the marker itself has a width attribute, which you set using the Band Span function. The marker shows “wings” that define the edges of the band in which the Band Power is being measured. You only need one marker, not a pair of markers, to completely define a Band Power function (making it possible to do Delta Band Power, which PSA and ESA could not do).

Additional control functions of Band Left and Band Right are provided for the case when you need to precisely set the band edges. Note that the marker itself always remains centered in the band.

To map the old Span Pair and Band Pair/Delta Pair functions to the X-Series for code compatibility, aliases and compatibility commands were added. Since Span Pair and Band Pair/Delta Pair were primarily used for making band power measurements, the aliases are provided for setting the parameters of a Band Function. If the user was using the old commands for anything other than Band Power these aliases will likely not yield compatible results.

For example, some users took advantage of the fact that the Band Pair commands let you arbitrarily set the frequency (time) of a delta marker and its non-fixed reference marker. In these cases, which had nothing to do with band Power, the new commands will not be compatible. For these use cases the user must use two markers and position each using the CALC:MARK:X commands, since “marker pairs” do not exist anymore.

Note that all of the alias commands described below cause the specified marker to become selected.

### Marker Mode compatibility

To setup Band Power measurements in the ESA and PSA, you had to send the :CALCulate:MARKer[1]2|3|4:MODE POSition|DELTA|BAND|SPAN|OFF

command with either the BAND or SPAN parameter, in order to turn on the marker control modes that let you use a pair of delta markers as Band Power markers. In the X-Series this is no longer necessary, as there are no special marker modes for Band power. So when this command is sent with either a BAND or SPAN parameter it is aliased to simply turn on Normal markers. Thus:

Old command	Aliased to
:CALCulate:MARKer[1]2 3 4:MODE:BAND	:CALCulate:MARKer[1]2 3 4:MODE:POSition
:CALCulate:MARKer[1]2 3 4:MODE:SPAN	:CALCulate:MARKer[1]2 3 4:MODE:POSition

### Span Pair Compatibility

In the past, the Span Pair function was used with a marker pair to set the band for Band Power. The following SCPI commands were used when performing this setup programmatically:

:CALCulate:MARKer[1]2|3|4:X:CENTer <param>

:CALCulate:MARKer[1]2|3|4:X:CENTer?

:CALCulate:MARKer[1]2|3|4:X:SPAN <param>

:CALCulate:MARKer[1]2|3|4:X:SPAN?

These commands are now aliased as follows to preserve the old functionality as much as possible:

Old command	Aliased to
:CALCulate:MARKer[1]2 3 4:X:CENTer	:CALCulate:MARKer[1]2 3 4:X
:CALCulate:MARKer[1]2 3 4:X:SPAN	:CALCulate:MARKer[1]2 3 4:FUNCtion:BAND:SPAN

### Delta Pair/Band Pair functionality

Another way to set the marker pair for Band Power was with the Delta Pair function (Band Pair in ESA). The following SCPI commands were used when performing this setup programmatically:

:CALCulate:MARKer[1]2|3|4:X:STARt <param>

:CALCulate:MARKer[1]2|3|4:X:STARt?

```
:CALCulate:MARKer[1]2|3|4:X:STOP <param>
```

```
:CALCulate:MARKer[1]2|3|4:X:STOP?
```

These commands are now aliased as follows to preserve the old functionality as much as possible:

Old command	Aliased to
:CALCulate:MARKer [1]2 3 4:X:START	:CALCulate:MARKer [1]2 3 4:FUNCTion:BAND:LEFT
:CALCulate:MARKer [1]2 3 4:X:STOP	:CALCulate:MARKer [1]2 3 4:FUNCTion:BAND:RIGHT

### Arbitrary Marker Pair functionality

Another use case was to use the START and STOP commands to arbitrarily set the frequency (time) of a delta marker and its reference marker without being in Band Power mode. This use case is not supported with a backwards compatibility command, but since in the X-Series you can arbitrarily set any marker's value and any reference marker's value, it is easy to fix this problem in code; but the user will have to change their code.

Old command	User must change to
:CALCulate:MARKer1:X:START <param>	:CALCulate:MARKer1:X <param> <param>
:CALCulate:MARKer1:X:STOP <param>	:CALCulate:MARKer2:X <param> <param>

(in the example marker 1 and marker 2 are used; in practice, use the reference marker number for the STOP marker number, which is usually marker number+1)

### Band changes with analyzer settings

In the past, when a marker pair was used to set the width of the band for Band Power, the markers held their screen positions when analyzer frequency settings such as Span changed. The result of this was that as the Span changed, the frequency difference and hence the width of the band changed as well. In the X-Series, as a result of the change from position markers to value markers, the width of the band remains constant as frequency settings of the analyzer change.

### Offscreen Markers

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 by setting Band Span to a high value in order to force Band Power markers to the left and right edges of the screen will have to rewrite their code.

Furthermore, since markers could never be offscreen, Band Power always returned a valid result. In the X-Series, if either edge of the Band is offscreen, Band Power returns not a number as a result.

### Direct Marker Positioning

The following commands were used in ESA and PSA to directly set the marker to a specific trace point (“bucket”) position when they were being used in Span Pair and Delta Pair/Band Pair modes:

```
:CALCulate:MARKer[1]2|3|4:X:POSition:CENTer <param>
:CALCulate:MARKer[1]2|3|4:X:POSition:CENTer?
:CALCulate:MARKer[1]2|3|4:X:POSition:SPAN <param>
:CALCulate:MARKer[1]2|3|4:X:POSition:SPAN?
:CALCulate:MARKer[1]2|3|4:X:POSition:STARt <param>
:CALCulate:MARKer[1]2|3|4:X:POSition:STARt?
:CALCulate:MARKer[1]2|3|4:X:POSition:STOP <param>
:CALCulate:MARKer[1]2|3|4:X:POSition:STOP?
```

They are aliased very similarly to the non-position commands (above) however a translation to/from trace points (buckets) is also performed:

Old command	Aliased to
:CALCulate:MARKer [1]2 3 4:X:POSition:CENTer	:CALCulate:MARKer[1]2 3 4:X:POSition
:CALCulate:MARKer [1]2 3 4:X:POSition:SPAN	:CALCulate:MARKer [1]2 3 4:FUNC:BAND:SPAN
:CALCulate:MARKer [1]2 3 4:X:POSition:STARt	:CALCulate:MARKer [1]2 3 4:FUNC:BAND:LEFT
:CALCulate:MARKer [1]2 3 4:X:POSition:STOP	:CALCulate:MARKer [1]2 3 4:FUNC:BAND:RIGHT

In each case but the first (:X:POSition:CENTer), the analyzer first converts the specified value in trace points to the current X Axis Scale Units (e.g., frequency or time) of the trace upon which the marker resides. Then, that value is used in the alias command to set the desired value.

The query form of the command returns the marker function span in trace points (buckets) by translating back based on the X Axis Scale settings at the time the query is sent.

**NOTE**

The value in Trace Points is translated into the current X Axis Scale units for the purpose of setting the value of the marker. However, the marker's span value, LEFT value, or RIGHT value in X Axis Scale Units, NOT trace points, will be preserved if a change is made to the X Axis scale settings. For example, if you use this command to set a marker function span of 500 buckets, which happens at that time to correspond to 13 GHz, and then you change the analyzer's Start Frequency so that 500 buckets is no longer 13 GHz, the span will stay at 13 GHz, NOT at 500 buckets! This is important to realize as it differs from the legacy behavior.

The UP/DOWN parameters will increment/decrement by one bucket. For this the analyzer performs a conversion to buckets and back.

## Select Marker

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

Key Path	Marker
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.
Initial S/W Revision	Prior to A.02.00

## Marker Noise

Turns on the Marker Noise function for the selected marker, making it a noise marker. If the selected marker is off, it is turned on in **Normal** mode and located at the center of the screen.

When **Marker Noise** is selected while in the **Marker Function Off** state, the **Band Span** or **Interval Span** is initialized to 5% of the screen width.

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.

See ["More Information" on page 485](#).

See ["Off-trace Markers" on page 485](#).

Key Path	Marker Function
<b>Example</b>	<p>CALC:MARK:FUNC NOIS turns on marker 1 as a noise marker.</p> <p>CALC:MARK:FUNC? returns the current marker function for the marker specified. In this case it returns the string: NOIS.</p> <p>CALC:MARK:Y? returns the y-axis value of the Marker Noise function for marker 1 (if Marker Noise is ON for marker 1). Note that the delta value when the Y axis unit is Watt is the square of the delta value when the Y axis unit is Volt. For example, when the percent ratio with Y axis unit in Volt is 0.2, the percent ratio with Y axis unit in Watt will be <math>0.2^2 = 0.04</math>. When you read the value out remotely you have to know whether your Y Axis Unit is log (dB), linear (V or A), or power</p>



	(W).
Notes	See the description under the <a href="#">"Marker Function" on page 797</a> key.
Dependencies	Fixed markers: It is not possible to change the Band Function for a Fixed marker; so all of the Band Function keys are grayed out for a Fixed marker.
Couplings	Average detector and Power Averaging auto selected when Marker Noise on If the selected (specified) marker is off, selecting Marker Noise via front panel or SCPI will turn the marker on.
Initial S/W Revision	Prior to A.02.00

### More Information

To guarantee accurate data for noise-like signals, a correction for equivalent noise bandwidth is made by the analyzer. 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.

### Off-trace Markers

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 trace, then it uses only that subset of the Band Width that is on-trace. If the marker itself is off-trace, its value becomes undefined.

Neither band/interval power nor band/interval density markers are defined if any part of the band is off-trace (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 analyzer or in the controlling computer, the result will still be considered valid.

### Band/Interval Power

Turns on the Band/Interval Power function for the selected marker. If the selected marker is off it is turned on in **Normal** marker and located at the center of the screen.

When **Band/Interval Power** is selected while in the **Marker Function Off** state, the **Band Span** or **Interval Span** is initialized to 5% of the screen width.

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 will usually cause measurement inaccuracy.

Key Path	<b>Marker Function</b>
<b>Example</b>	CALC:MARK:FUNC BPOW turns on marker 1 as a band power marker. CALC:MARK2:FUNC? returns the current setting of marker function for marker 2. In this case it

	returns the string: BPOW. CALC:MARK:Y? returns the y-axis value of the Band Power function for marker 1. Note that the delta value when the Y axis unit is Watt is the square of the delta value when the Y axis unit is Volt. For example, when the percent ratio with Y axis unit in Volt is 0.2, the percent ratio with Y axis unit in Watt will be $0.22 = 0.04$ . When you read the value out remotely you have to know whether your Y Axis Unit is log (dB), linear (V or A), or power (W).
Notes	See the description under the " <a href="#">Marker Function</a> on page 797" key, above.
Dependencies	Fixed markers: It is not possible to change the Band Function for a Fixed marker, so all of the Band Function keys are grayed out for a Fixed marker.
Couplings	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. If the selected (specified) marker is off, selecting Band Power via the front panel or SCPI will turn the marker on.
Initial S/W Revision	Prior to A.02.00

## Band/Interval Density

Turns on the Band/Interval Density function for the selected marker. If the selected marker is off it is turned on in **Normal** marker mode and located at the center of the screen.

When **Band/Interval Density** is selected while in the **Marker Function Off** state, the **Band Span** or **Interval Span** is initialized to 5% of the screen width.

See "[More Information](#)" on page 487.

See "[What is band/interval density?](#)" on page 487

Key Path	Marker Function
<b>Example</b>	CALC:MARK:FUNC BDEN turns on marker 1 as a band density marker. CALC:MARK:FUNC? returns the current setting of band function for the marker specified. In this case it returns the string: BDEN. CALC:MARK:Y? returns the y-axis value of the Band Density function for marker 1. Note that the delta value when the Y axis unit is Watt is the square of the delta value when the Y axis unit is Volt. For example, when the percent ratio with Y axis unit in Volt is 0.2, the percent ratio with Y axis unit in Watt will be $0.22 = 0.04$ . When you read the value out remotely you have to know whether your Y Axis Unit is log (dB), linear (V or A), or power (W).
Notes	The zero-width case 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.
Notes	See the description under the " <a href="#">Marker Function</a> on page 797" key.
Dependencies	Fixed markers: It is not possible to change the Band Function for a Fixed marker, so all of the Band Function keys are grayed out for a Fixed marker.
Couplings	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. If the selected (specified) marker is off, selecting Band Density via front panel or SCPI will turn

	the marker on.
State Saved	n/a.
Initial S/W Revision	Prior to A.02.00

### More Information

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 markers assume that the signal to be measured is noise-like. Based on this assumption, we can actually make reasonable measurements under very nonideal 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.

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 will usually cause measurement inaccuracy.

### What is band/interval density?

On frequency domain traces, the average density across a band is the total band power divided by the bandwidth over which it is measured.

On time domain traces, interval density is the average power in the interval divided by the noise bandwidth of the RBW of the trace.

### Marker Function Off

Turns off band functions for the selected marker.

Key Path	<b>Marker Function</b>
<b>Example</b>	:CALC:MARK:FUNC OFF turns off marker functions for marker 1
Notes	See the description under the " <a href="#">Marker</a> " on page 778 key, above.
Dependencies	Fixed markers: It is not possible to change the Band Function for a Fixed marker, so all of the Band Function keys are grayed out for a Fixed marker, including Off
Couplings	Turning off the marker function has no effect on the band span nor does it turn the marker off.
Initial S/W Revision	Prior to A.02.00

### Band Adjust

Opens a menu that lets you set the width or left or right edges of the band.

It is legal to change the width of the band even if there is no marker function on. Generally this can only happen by sending the SCPI command since access to the menu is restricted if no marker function is on.

Key Path	<b>Marker Function</b>
Dependencies	If the marker is Fixed, Band Adjust is grayed out.

	If the marker function is Off, Band Adjust is grayed out.
Couplings	If any of the Band Adjust functions are the active function, the wings and arms of the selected marker display in green; otherwise they display in white.
Backwards Compatibility Notes	If any of the band adjust SCPI commands (including the legacy compatibility commands documented under " <a href="#">Band Function Backwards Compatibility</a> " on page 798) are sent while the marker function is off, they will be accepted and the value stored. If sent while the marker is off, they will be accepted and ignored.
Initial S/W Revision	Prior to A.02.00

## Band/Interval Span

Sets the width of the span for the selected marker.

It is legal to change the width of the band even if there is no marker function on. Generally this can only happen by sending the SCPI command since access to the menu is restricted if no marker function is on.

In the table below,  $\text{sweep\_width} = \max(1, \text{sweep\_points} - 1)$  and  $\text{sweep\_points}$  is the number of sweep points, set in the **Sweep** menu.

Key Path	<b>Marker Function, Band Adjust</b>
<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 12:FUNCtion:BAND:SPAN <freq> :CALCulate:MARKer[1] 2 ... 12:FUNCtion:BAND:SPAN?
<b>Example</b>	:CALC:MARK12:FUNC:BAND:SPAN 20 MHz sets the band span of marker 12 to 20 MHz :CALC:MARK:FUNC:BAND:SPAN? queries the band span of Marker 1
Notes	Units are those of the trace's domain, Hz for frequency domain, s for time domain.
Notes	Sending this command selects the subcoded 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/Interval Span necessarily changes the Band/Interval Left and Band/Interval Right values Band/Interval Span is set to 0 when the marker is turned off Band/Interval 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, set to 5% of span, when a marker function is turned on
State Saved	Saved in instrument state
Min	0 Hz
Max	Infinity. Unlike legacy analyzers, where the markers were forced to be on screen, X-Series marker values are not limited and do not clip

<b>Backwards Compatibility SCPI</b>	:CALCulate:MARKer[1] 2 ... 4:X:SPAN See " <a href="#">Band Function Backwards Compatibility</a> " on page 798
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<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 4:X:POSition:SPAN <param> :CALCulate:MARKer[1] 2 ... 4:X:POSition:SPAN?
Preset	50
Backwards Compatibility Notes	The old command, :CALCulate:MARKer[n]:X:POSition:SPAN <param> was used to set the span between a delta marker and its reference marker in trace points (buckets) in Span Pair mode. There is no new command for setting the span of a Band Function in trace points. So, when this command is received, the analyzer first converts the specified span in trace points to the current X Axis Scale Units (e.g., frequency or time) of the trace upon which the marker resides. Then, that value is sent to the :CALC:MARKer[n]:FUNCtion:BAND:SPAN <param> command to set the span of the marker's Band Function. The query form of the command will return the marker function span in trace points (buckets) by translating back based on the X Axis Scale settings at the time the query is sent. ! See " <a href="#">Band Function Backwards Compatibility</a> " on page 798 for more information
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### Band/Interval Left

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

It is legal to change the width of the band even if there is no marker function on. Generally this can only happen by sending the SCPI command since access to the menu is restricted if no marker function is on.

In the table below,  $\text{sweep\_width} = \max(1, \text{sweep\_points} - 1)$  and  $\text{sweep\_points}$  is the number of sweep points, set in the **Sweep** menu.

Key Path	<b>Marker Function, Band Adjust</b>
<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 12:FUNcTion:BAND:LEFT <freq> :CALCulate:MARKer[1] 2 ... 12:FUNcTion:BAND:LEFT?
<b>Example</b>	:CALC:MARK12:FUNC:BAND:LEFT 20 GHz sets the left edge of the band span of marker 12 to 20 GHz :CALC:MARK:FUNC:BAND:LEFT? queries the band span of Marker 1
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.
Notes	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

	<p>domain will be used (Hz for freq domain traces, s for time domain traces).</p> <p>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.</p>
Couplings	<p>Changing the Band/Interval Left necessarily changes the Band/Interval Span and Band/Interval Center values.</p> <p>Band/Interval Span is set to 0 when the marker is turned off so that means Band/Interval Left is set to the center value at this time.</p> <p>Band/Interval Span is set to 5% of span when any marker function is turned on if and only if it is zero at that time.</p>
Preset	If 0, Band/Interval Span is set to 5% of span, when a marker function is turned on, which affects Band/Interval Left.
State Saved	Saved in instrument state
Min	0 Hz
Max	Infinity. Unlike legacy analyzers, where the markers were forced to be on screen, X-Series marker values are not limited and do not clip
<b>Backwards Compatibility SCPI</b>	<p><b>:CALCulate:MARKer[1] 2 ... 4:X:START</b></p> <p>See <a href="#">"Band Function Backwards Compatibility" on page 798</a></p>
Initial S/W Revision	Prior to A.02.00
<b>Remote Command</b>	<p><b>:CALCulate:MARKer[1] 2 ... 4:X:POSITION:START &lt;integer&gt;</b></p> <p><b>:CALCulate:MARKer[1] 2 ... 4:X:POSITION:START?</b></p>
Preset	0
<b>Backwards Compatibility SCPI</b>	<p>The legacy command,</p> <p><b>:CALCulate:MARKer[n]:X:POSITION:START &lt;param&gt;</b></p> <p>was used to control the Reference marker in trace points (buckets) in Band Pair/Delta Pair mode. There is no new command for setting the start of a Band Function in trace points. So, when this command is received, the analyzer first converts the specified span in trace points to the current X Axis Scale Units (e.g., frequency or time) of the trace upon which the marker resides.</p> <p><b>:CALC:MARKer[n]:FUNCTION:BAND:LEFT &lt;param&gt;</b></p> <p>command to set the start of the marker's Band Function.</p> <p>The query form of the command will return the marker function LEFT value in trace points (buckets) by translating back based on the current X Axis Scale settings at the time the query is sent.</p> <p>See <a href="#">"Band Function Backwards Compatibility" on page 798</a> for more information</p>
Initial S/W Revision	Prior to A.02.00

## Band/Interval Right

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

In the table below,  $\text{sweep\_width} = \max(1, \text{sweep\_points} - 1)$  and  $\text{sweep\_points}$  is the number of sweep points, set in the **Sweep** menu.

It is legal to change the width of the band even if there is no marker function on. Generally this can only happen by sending the SCPI command since access to the menu is restricted if no marker function is on.

Key Path	<b>Marker Function, Band Adjust</b>
<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 12:FUNCtion:BAND:RIGHT <freq> :CALCulate:MARKer[1] 2 ... 12:FUNCtion:BAND:RIGHT?
<b>Example</b>	:CALC:MARK12:FUNC:BAND:RIGHT 20 GHz sets the right edge of the band span of marker 12 to 20 GHz :CALC:MARK:FUNC:BAND:RIGHT? queries the band span of Marker 1
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.
Notes	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/Interval Right necessarily changes the Band/Interval Span and Band/Interval Center values Band/Interval 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/Interval Span is set to 5% of span, when a marker function is turned on, which affects Band/Interval Right
State Saved	Saved in instrument state
Min	0 Hz
Max	Infinity. Unlike legacy analyzers, where the markers were forced to be on screen, X-Series marker values are not limited and do not clip
<b>Backwards Compatibility SCPI</b>	:CALCulate:MARKer[1] 2 ... 4:X:STOP See " <a href="#">Band Function Backwards Compatibility</a> " on page 798
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<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 4:X:POSition:STOP <integer> :CALCulate:MARKer[1] 2 ... 4:X:POSition:STOP?
Preset	1000, the actual value is dependent on the selected number of sweep points.
<b>Backwards Compatibility SCPI</b>	The legacy command, :CALCulate:MARKer[n]:X:POSition:STOP <param>

---

was used to control the Delta marker in trace points (buckets) in Band Pair/Delta Pair mode. There is no new command for setting the stop of a Band Function in trace points. So, when this command is received, the analyzer first converts the specified span in trace points to the current X Axis Scale Units (e.g., frequency or time) of the trace upon which the marker resides. Then, that value is sent to the

**:CALC:MARKer[n]:FUNction:BAND:RIGHT <param>**

command to set the stop of the marker's Band Function.

The query form of the command will return the marker function RIGHT value in trace points (buckets) by translating back based on the current X Axis Scale settings at the time the query is sent.

See "[Band Function Backwards Compatibility](#)" on page 798 for more information

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## Meas

The information in this section is common to all measurements. For key and remote command information for a specific measurement, refer to the section that describes the measurement of interest.

Measurements available under the Meas key are specific to the current Mode.

When viewing Help for measurements, note the following:

**NOTE**

**Operation for some keys differs between measurements. The information displayed in Help pertains to the current measurement. To see how a key operates in a different measurement, exit Help (press the Cancel Esc key), select the measurement, then reenter Help (press the Help key) and press that key.**

---

Key Path	Front-panel key
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## Remote Measurement Functions

This section contains the following topics:

["Measurement Group of Commands" on page 814](#)

["Current Measurement Query \(Remote Command Only\)" on page 817](#)

["Limit Test Current Results \(Remote Command Only\)" on page 817](#)

["Data Query \(Remote Command Only\)" on page 817](#)

["Calculate/Compress Trace Data Query \(Remote Command Only\)" on page 817](#)

["Calculate Peaks of Trace Data \(Remote Command Only\)" on page 823](#)

["Hardware-Accelerated Fast Power Measurement \(Remote Command Only\)" on page 824](#)

["Format Data: Numeric Data \(Remote Command Only\)" on page 838](#)

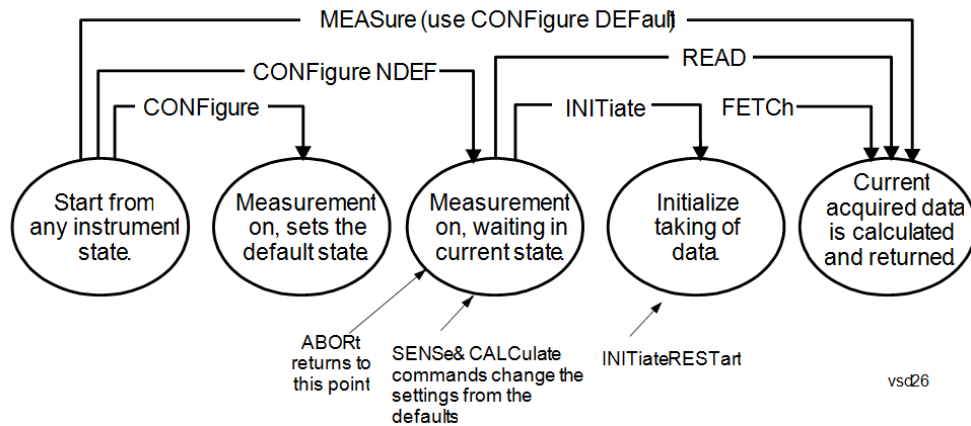
["Format Data: Byte Order \(Remote Command Only\)" on page 839](#)

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## Measurement Group of Commands



## Measure Commands:

```
:MEASure:<measurement>[n]?
```

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 use 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 with the CONFIGure command. Use the commands in the SENSE:<measurement> and CALCulate:<measurement> subsystems to change the settings. Then you can use the READ? command to initiate the measurement and query the results.

---

If you need to repeatedly make a given measurement with settings other than the factory defaults, you can use the commands in the SENSE:<measurement> and CALCulate:<measurement> subsystems to set up the measurement. Then use the READ? command to initiate the measurement and query results.

Measurement settings persist if you initiate a different measurement and then return to a previous one. Use READ:<measurement>? if you want to use those persistent settings. If you want to go back to the default settings, use MEASure:<measurement>?.

---

Configure Commands:

:CONFigure:<measurement>

This command stops the current measurement (if any) and sets up the instrument for the specified measurement 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.

In the Swept SA measurement in Spectrum Analyzer mode the CONFigure command also turns the averaging function on and sets the number of averages to 10 for all measurements.

:CONFigure: <measurement>: NDEFault stops the current measurement and changes to the specified measurement. It does not change the settings to the defaults. It does not initiate the taking of measurement data unless INIT:CONTinuous is ON.

The CONFigure? query returns the current measurement name.

The CONFigure:CATalog? query returns a quoted string of all licensed measurement names in the current mode. For example, "SAN, CHP, OBW, ACP, PST, TXP, SPUR, SEM, LIST".

---

Fetch Commands:

:FETCh:<measurement>[n]?

This 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 several types of data (different [n] values, for example, both scalars and trace data) from a single measurement. FETCh saves you the time of re-making the measurement. 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 an INITiate followed by a FETCh.

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. 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)

FETCh may be used to return results other than those specified with the original READ or MEASure command that you sent.

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INITiate Commands:

:INITiate:<measurement>

This command is not available for measurements in all the instrument modes:

- 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

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measurement other than the current one is specified, the instrument will switch to that measurement and then initiate it.

- For example, suppose you have previously initiated the ACP measurement, but now 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.
- Does not change any of the measurement settings. For example, if you have previously started 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 your selected measurement is currently active (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. It also holds off additional commands on GPIB until the acquisition is complete.

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READ Commands:

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:READ:<measurement>[n]?

- Does not preset the measurement to the factory default settings. For example, if you have previously initiated the ACP measurement and you send READ:ACP? it will initiate a new measurement using the same instrument settings.
  - Initiates the measurement and puts valid data into the output buffer. If a measurement other than the current one is specified, the instrument will switch to that measurement before it initiates the measurement and returns results.
  - For example, suppose you have previously initiated the ACP measurement, but now you are running the channel power measurement. Then 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.
  - Blocks other SCPI communication, waiting until the measurement is complete before returning the results
  - If the optional [n] value is not included, or is set to 1, the scalar measurement results will be returned. 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. The binary data formats should be used when handling large blocks of data since they are smaller and faster than the ASCII format. (FORMat:DATA)
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### Current Measurement Query (Remote Command Only)

This command returns the name of the measurement that is currently running.

<b>Remote Command</b>	:CONFiGure?
<b>Example</b>	CONF?
Initial S/W Revision	Prior to A.02.00

### Limit Test Current Results (Remote Command Only)

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.

<b>Remote Command</b>	:CALCuLate:CLIMits:FAIL?
<b>Example</b>	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.
Initial S/W Revision	Prior to A.02.00

### Data Query (Remote Command Only)

Returns the designated measurement data for the currently selected measurement and subopcode.

n = any valid subopcode for the current measurement. See the measurement command results table for your current measurement, for information about what data is returned for the subopcodes.

This command uses the data setting specified by the FORMat:BORDER and FORMat:DATA commands and can return real or ASCII data. (See the format command descriptions under Input/Output in the Analyzer Setup section.)

<b>Remote Command</b>	:CALCuLate:DATA[n]?
Notes	The return trace depends on the measurement. In CALCulate:<meas>:DATA[n], n is any valid subopcode for the current measurement. It returns the same data as the FETCh:<measurement>? query where <measurement> is the current measurement.
Initial S/W Revision	Prior to A.02.00

### Calculate/Compress Trace Data Query (Remote Command Only)

Returns compressed data for the currently selected measurement and sub-opcode [n].

n = any valid sub-opcode for that measurement. See the MEASure:<measurement>? command description of your specific measurement for information on the data that can be returned.

The data is returned in the current Y Axis Unit of the analyzer. The command is used with a sub-opcode <n> (default=1) to specify the trace. With trace queries, it is best if the analyzer is not sweeping during the query. Therefore, it is generally advisable to be in Single Sweep, or Update=Off.

This command is used to compress or decimate a long trace to extract and return only the desired data. A typical example would be to acquire N frames of GSM data and return the mean power of the first burst in each frame. The command can also be used to identify the best curve fit for the data.

<b>Remote Command</b>	:CALCulate:DATA<n>:COMPRESS? BLOCK   CFIT   MAXimum   MINimum   MEAN   DMEan   RMS   RMSCubed   SAMPLE   SDEVIation   PPHase [,<soffset> [,<length>[,<roffset>[,<rlimit>]]]]
<b>Example</b>	To query the mean power of a set of GSM bursts: Supply a signal that is a set of GSM bursts. Select the IQ Waveform measurement (in IQ Analyzer Mode). Set the sweep time to acquire at least one burst. Set the triggers such that acquisition happens at a known position relative to a burst. Then query the mean burst levels using, CALC:DATA2:COMP? MEAN, 24e-6, 526e-6 (These parameter values correspond to GSM signals, where 526e-6 is the length of the burst in the slot and you just want 1 burst.)
<b>Notes</b>	The command supports 5 parameters. Note that the last 4 (<soffset>, <length>, <roffset>, <rlimit>) are optional. But these optional parameters must be entered in the specified order. For example, if you want to specify <length>, then you must also specify <soffset>. See details below for a definition of each of these parameters.  This command uses the data in the format specified by FORMat:DATA, returning either binary or ASCII data.
<b>Initial S/W Revision</b>	Prior to A.02.00

- BLOCK or block data - returns all the data points from the region of the trace data that you specify. For example, it could be used to return the data points of an input signal over several timeslots, excluding the portions of the trace data that you do not want. (This is x,y pairs for trace data and I,Q pairs for complex data.)
- CFIT or curve fit - applies curve fitting routines to the data. <soffset> and <length> are required to define the data that you want. <roffset> is an optional parameter for the desired order of the curve equation. The query will return the following values: the x-offset (in seconds) and the curve coefficients ((order + 1) values).

MIN, MAX, MEAN, DME, RMS, RMSC, SAMP, SDEV and PPH return one data value for each specified region (or <length>) of trace data, for as many regions as possible until you run out of trace data (using <roffset> to specify regions). Or they return the number of regions you specify (using <rlimit>) ignoring any data beyond that.

- MINimum - returns the minimum data point (y value) for the specified region (s) of trace data. For I/Q trace data, the minimum magnitude of the I/Q pairs is returned.
- MAXimum - returns the maximum data point (y value) for the specified region(s) of trace data. For I/Q trace data, the maximum magnitude of the I/Q pairs is returned.
- MEAN - returns a single value that is the arithmetic mean of the data point values (in dB/ dBm) for the specified region(s) of trace data. For I/Q trace data, the mean of the magnitudes of the I/Q pairs is returned. See the following equations.

**NOTE**

If the original trace data is in dB, this function returns the arithmetic mean of those log values, not log of the mean power which is a more useful value. The mean of the log is the better measurement technique when measuring CW signals in the presence of noise. The mean of the power, expressed in dB, is useful in power measurements such as Channel Power. To achieve the mean of the power, use the RMS option.

Equation 1

Mean Value of Data Points for Specified Region(s)

$$MEAN = \frac{1}{n} \sum_{X_i \in \text{region}(s)} X_i$$

where  $X_i$  is a data point value, and  $n$  is the number of data points in the specified region(s).

Equation 2

Mean Value of I/Q Data Pairs for Specified Region(s)

$$MEAN = \frac{1}{n} \sum_{X_i \in \text{region}(s)} |X_i|$$

where  $|X_i|$  is the magnitude of an I/Q pair, and  $n$  is the number of I/Q pairs in the specified region(s).

- DMEan - returns a single value that is the mean power (in dB/ dBm) of the data point values for the specified region(s) of trace data. See the following

equation:

Equation 3

DMEan Value of Data Points for Specified Region(s)

$$\text{DME} = 10 \times \log_{10} \left( \frac{1}{n} \sum_{X_i \in \text{region}(s)} 10^{\frac{X_i}{10}} \right)$$

- RMS - returns a single value that is the average power on a root-mean-squared voltage scale (arithmetic rms) of the data point values for the specified region(s) of trace data. See the following equation.

**NOTE**

For I/Q trace data, the rms of the magnitudes of the I/Q pairs is returned. See the following equation.

This function is very useful for I/Q trace data. However, if the original trace data is in dB, this function returns the rms of the log values which is not usually needed.

Equation 4

RMS Value of Data Points for Specified Region(s)

$$\text{RMS} = \sqrt{\frac{1}{n} \sum_{X_i \in \text{region}(s)} X_i^2}$$

where  $X_i$  is a data point value, and  $n$  is the number of data points in the specified region(s).

Equation 5

RMS Value of I/Q Data Pairs for Specified Region(s)

$$\text{RMS} = \sqrt{\frac{1}{n} \sum_{X_i \in \text{region}(s)} X_i X_i^*}$$

where  $X_i$  is the complex value representation of an I/Q pair,  $X_i^*$  its conjugate complex number, and  $n$  is the number of I/Q pairs in the specified region(s).

Once you have the rms value for a region of trace data (linear or I/Q), you may want to calculate the mean power. You must convert this rms value (peak volts) to power in dBm:

$$10 \times \log[10 \times (\text{rms value})^2]$$



- SAMPlE - returns the first data value (x,y pair) for the specified region(s) of trace data. For I/Q trace data, the first I/Q pair is returned.
- SDEViation - returns a single value that is the arithmetic standard deviation for the data point values for the specified region(s) of trace data. See the following equation.
- For I/Q trace data, the standard deviation of the magnitudes of the I/Q pairs is returned. See the following equation.

Equation 6

Standard Deviation of Data Point Values for Specified Region(s)

$$SDEV = \sqrt{\frac{1}{n} \sum_{X_i \in \text{region}(s)} (X_i - \bar{X})^2}$$

where  $X_i$  is a data point value,  $\bar{X}$  is the arithmetic mean of the data point values for the specified region(s), and  $n$  is the number of data points in the specified region(s).

$$SDEV = \sqrt{\frac{1}{n} \sum_{X_i \in \text{region}(s)} (|X_i| - \bar{X})^2}$$

where  $|X_i|$  is the magnitude of an I/Q pair,  $\bar{X}$  is the mean of the magnitudes for the specified region(s), and  $n$  is the number of data points in the specified region(s).

- PPHase - returns the x,y pairs of both rms power (dBm) and arithmetic mean phase (radian) for every specified region and frequency offset (Hz). The number of pairs is defined by the specified number of regions. This parameter can be used for I/Q vector (n=0) in Waveform (time domain) measurement and all parameters are specified by data point in PPHase.

The rms power of the specified region may be expressed as:

$$\text{Power} = 10 \times \log [10 \times (\text{RMS I/Q value})] + 10.$$

The RMS I/Q value (peak volts) is:

$$\sqrt{\frac{1}{n} \sum_{X_i \in \text{region}} X_i X_i^*}$$

where  $X_i$  is the complex value representation of an I/Q pair,  $X_i^*$  its conjugate complex number, and  $n$  is the number of I/Q pairs in the specified region.

The arithmetic mean phase of the specified region may be expressed as:

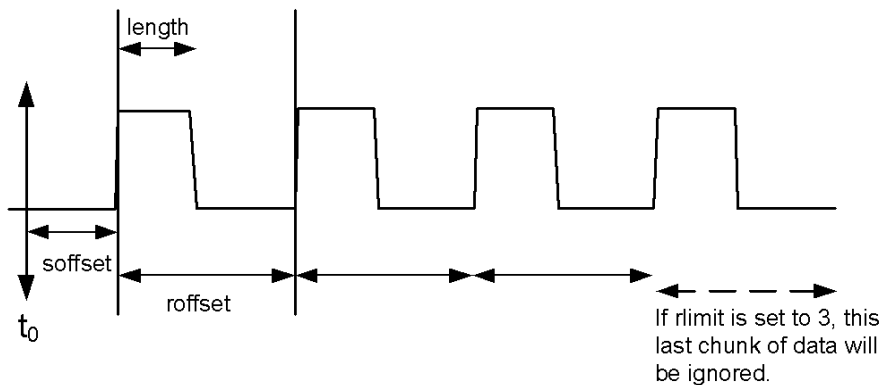
$$\frac{1}{n} \sum_{Y_i \in \text{region}} Y_i$$

where  $Y_i$  is the unwrapped phase of I/Q pair with applying frequency correction and  $n$  is the number of I/Q pairs in the specified region.

The frequency correction is made by the frequency offset calculated by the arithmetic mean of every specified region's frequency offset. Each frequency offset is calculated by the least square method against the unwrapped phase of I/Q pair.

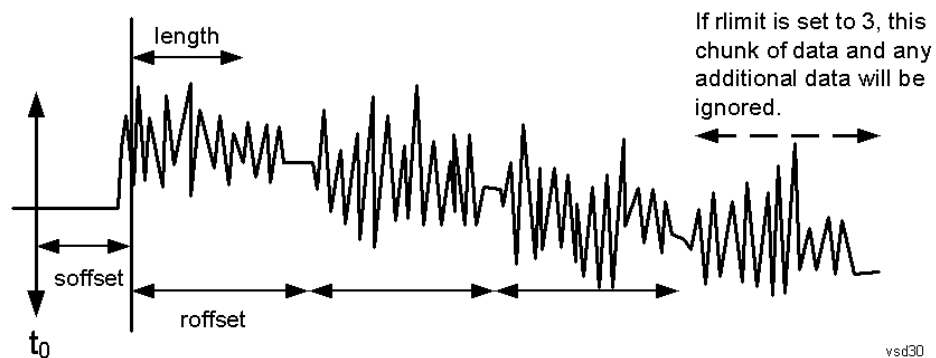
### Sample Trace Data - Constant Envelope

(See below for explanation of variables.)



### Sample Trace Data - Not Constant Envelope

(See below for explanation of variables.)



<soffset> - start offset is an optional real number. (It is in seconds for time-domain traces, and is a dimensionless index 0 to Npoints - 1, for frequency-domain traces). It specifies the amount of data at the beginning of the trace that will be ignored before the decimation process starts. It is the time or frequency change from the start of the trace to the point where you want to start using the data. The default value is zero.

<length> - is an optional real number. (It is in seconds for time-domain traces, and is a dimensionless index 0 to Npoints - 1, for frequency-domain traces). It defines how much data will be compressed into one value. This parameter has a default value equal to the current trace length.

<roffset> - repeat offset is an optional real number. (It is in seconds for time-domain traces, and is a dimensionless index 0 to Npoints - 1, for frequency-domain traces). It defines the beginning of the next field of trace elements to be compressed. This is relative to the beginning of the previous field. This parameter has a default value equal to the <length> variable. Note that this parameter is used for a completely different purpose when curve fitting (see CFIT above).

<rlimit> - repeat limit is an optional integer. It specifies the number of data items that you want returned. It will ignore any additional items beyond that number. You can use the Start offset and the Repeat limit to pick out exactly what part of the data you want to use. The default value is all the data.

### Calculate Peaks of Trace Data (Remote Command Only)

Returns a list of all the peaks for the currently selected measurement and sub-opcode [n]. The peaks must meet the requirements of the peak threshold and excursion values.

n = any valid sub-opcode for the current measurement. See the MEASure:<measurement> command description of your specific measurement for information on the data that can be returned.

The command can only be used with specific sub-opcodes with measurement results that are trace data. Both real and complex traces can be searched, but complex traces are converted to magnitude in dBm. In many measurements the sub-opcode n=0, is the raw trace data which cannot be searched for peaks. And Sub-opcode n=1, is often calculated results values which also cannot be searched for peaks.

This command uses the data setting specified by the FORMat:BORDER and FORMat:DATA commands and can return real or ASCII data. If the format is set to INT,32, it returns REAL,32 data.

The command has four types of parameters:

- Threshold (in dBm)
- Excursion (in dB)
- Sorting order (amplitude, frequency, time)
- Optional in some measurements: Display line use (all, > display line, < display line)

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<b>Remote Command</b>	For Swept SA measurement: :CALCulate:DATA[1] 2 ... 6:PEAKS? <threshold>,<excursion>[,AMPLitude   FREQuency   TIME[,ALL   GTDLine   LTDLine]]
	For most other measurements:

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	<code>:CALCulate:DATA[1] 2 ... 6:PEAKs? &lt;threshold&gt;,&lt;excursion&gt;[,AMPLitude   FREQuency   TIME]</code>
<b>Example</b>	<p>Example for Swept SA measurement in Spectrum Analyzer Mode:</p> <p>CALC:DATA4:PEAK? -40, 10, FREQ, GTDL This will identify the peaks of trace 4 that are above -40 dBm, with excursions of at least 10 dB. The peaks are returned in order of increasing frequency, starting with the lowest frequency. Only the peaks that are above the display line are returned.</p> <p>Query Results 1:</p> <p>With FORMat:DATA REAL, 32 selected, it returns a list of floating-point numbers. The first value in the list is the number of peak points that are in the following list. A peak point consists of two values: a peak amplitude followed by its corresponding frequency (or time).</p> <p>If no peaks are found the peak list will consist of only the number of peaks, (0).</p>
<b>Notes</b>	<p>&lt;n&gt; - is the trace that will be used</p> <p>&lt;threshold&gt; - is the level below which trace data peaks are ignored. Note that the threshold value is required and is always used as a peak criterion. To effectively disable the threshold criterion for this command, provide a substantially low threshold value such as -200 dBm. Also note that the threshold value used in this command is independent of and has no effect on the threshold value stored under the Peak Criteria menu.</p> <p>&lt;excursion&gt; - is the minimum amplitude variation (rise and fall) required for a signal to be identified as peak. Note that the excursion value is required and is always used as a peak criterion. To effectively disable the excursion criterion for this command, provide the minimum value of 0.0 dB. Also note that the excursion value used in this command is independent of and has no effect on the excursion value stored under the Peak Criteria menu.</p> <p>Values must be provided for threshold and excursion. The sorting and display line parameters are optional (defaults are AMPLitude and ALL).</p> <p>Note that there is always a Y-axis value for the display line, regardless of whether the display line state is on or off. It is the current Y-axis value of the display line which is used by this command to determine whether a peak should be reported</p> <p>Sorting order:</p> <p>AMPLitude - lists the peaks in order of descending amplitude, with the highest peak first (default if optional parameter not sent)</p> <p>FREQuency - lists the peaks in order of occurrence, left to right across the x-axis.</p> <p>TIME - lists the peaks in order of occurrence, left to right across the x-axis.</p> <p>Peaks vs. Display Line:</p> <p>ALL - lists all of the peaks found (default if optional parameter not sent).</p> <p>GTDLLine (greater than display line) - lists all of the peaks found above the display line.</p> <p>LTDLine (less than display line) - lists all of the peaks found below the display line.</p>
Initial S/W Revision	Prior to A.02.00

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### Hardware-Accelerated Fast Power Measurement (Remote Command Only)

The Fast Power option (FP2) enables very fast channel power measurements for instruments with the prerequisite hardware (DP2 and/or B40). It accomplishes this by performing real-time overlapped FFTs at the hardware layer, using software for basic post-processing before returning the result to the user. The upshot of this

approach is improved throughput for user applications that require many sequential power measurements.

The analysis bandwidth of FP2 is limited by the licenses in the instrument, but its maximum overall analysis bandwidth per acquisition is 40 MHz.

FP2 is remote-only, which means the instrument does not switch to any particular mode or measurement. FP2 commands can be sent while another application is in use on the front panel.

Each Fast Power measurement can be predefined using an array index, and up to 1,000 measurements can be stored. In the following documentation, instances of [1,2,...,999] can be substituted with a particular measurement index, e.g. CALC:FPOW:POW1?, CALC:FPOW:POW2?, CALC:FPOW:POW134?. In this way, power measurements can be defined one time in a batch, and then executed multiple times without having to redefine them, similar to “list mode” on other measurements.

In addition to basic channel power measurements, there are a number of other measurement “functions” for each channel, including peak power, peak frequency, and power spectral density. See the Function parameter for more information.

### Reset Fast Power Measurement (Remote Command Only)

Resets the measurement configuration to the defaults.

Mode	All
<b>Remote Command</b>	:CALCulate:FPOWer:POWer[1,2,...,999]:RESet
<b>Example</b>	:CALC:FPOW:POW1:RES
Notes	Option FP2 is required.
Initial S/W Revision	A.14.00

### Define Fast Power Measurement (Remote Command Only)

Fast Power acquisitions are configured using the DEFine command. This command accepts a comma-delimited string of configuration parameters and their appropriate values, which are all specified in the subsection below.

Mode	All
<b>Remote Command</b>	:CALCulate:FPOWer:POWer[1,2,...,999]:DEFine "configuration string"
<b>Example</b>	:CALC:FPOW:POW1:DEF "CenterFrequency=2e9, AcquisitionTime=0.005"
Notes	See below for a list of measurement variables that can be defined in the configuration string.
Initial S/W Revision	A.14.00

## Acquisition Time

Example	CALC:FPOW:POW1:DEF "AcquisitionTime=0.002"
Notes	The acquisition time parameter sets the time in which the entire spectrum is measured. An increase in the acquisition time yields an improvement in measurement repeatability.
Preset	0.001 s
Range	0 s to 1 s
Default Unit	Time (s)
Initial S/W Revision	A.14.00

## Center Frequency

Example	CALC:FPOW:POW1:DEF "CenterFrequency=2e9"
Notes	The center frequency parameter sets the frequency in which the measurement is centered around. The OffsetFrequency parameter is calculated relative to the center frequency.
Preset	1 GHz
Range	0 Hz to maximum instrument frequency
Default Unit	Frequency (Hz)
Initial S/W Revision	A.14.00

## DC Coupled

Example	CALC:FPOW:POW1:DEF "DCCoupled=True"
Notes	The DC coupled parameter allows the user to specify whether the DC blocking capacitor is utilized. Set parameter to true when measuring frequencies below 10 MHz.
Preset	False
Range	True (DC Coupled) or False (AC Coupled)
Default Unit	Boolean
Initial S/W Revision	A.14.00

## DetectorType

Example	CALC:FPOW:POW1:DEF "DetectorType=Peak"
Notes	Option FP2 is required. The detector type parameter allows the user to choose whether a RMS average or peak value is used during the measurement.
Preset	RmsAverage
Range	RmsAverage, Peak
Initial S/W Revision	A.14.00

## Do Noise Correction

Example	CALC:FPOW:POW1:DEF "DoNoiseCorrection=True"
Notes	<p>When noise correction is enabled, the linear noise power contributed by the analyzer is subtracted from all measurements. This effectively lowers the noise floor of the analyzer.</p> <p>When noise correction is enabled, the first measurement for a given set of input parameters will take extra time. This is because the analyzer takes an extra acquisition with the RF input disconnected from the analyzer's front end to measure the noise of just the analyzer. The measured noise floor is stored in a cache so the noise acquisition will occur only once for the same state settings. In other words, if noise correction was turned on and the analyzer made an acquisition at frequency A, then frequency B, and back again to frequency A, the hidden initial noise floor acquisition would only occur for the first acquisition at frequency A and the cached noise floor would be used the second time frequency A was measured.</p>
Preset	False
Range	True (enable noise correction) or False (disable noise correction)
Default Unit	Boolean
Initial S/W Revision	A.14.00

## Do Spur Suppression

Example	CALC:FPOW:POW1:DEF "DoSpurSuppression=True"
Notes	<p>When measuring very low level signals, or when large out-of-band inputs are input into the analyzer, sometimes unwanted spurs and residuals can appear in the measured spectrum. Spur suppression is a method to help minimize the levels of these internally generated spurs and residuals.</p> <p>When spur suppression is enabled, the analyzer will automatically take two acquisitions using two different internal analog LO frequencies. The FFT spectrums from both acquisitions are combined by taking the minimum power between both traces on a per FFT bin basis. External signals will have the same amplitude for both traces and therefore will return the expected amplitudes. However, low level spurs and residuals generated internally to the analyzer tend to move to different FFT bins depending on the internal analog LO frequency used, and therefore tend to be suppressed using this spur suppression method.</p> <p>Because two acquisitions, rather than a single acquisition, are made when spur suppression is enabled, the measurement time will always be slower when spur suppression is enabled.</p>
Preset	False
Range	True (enable spur suppression) or False (disable spur suppression)
Default Unit	Boolean
Initial S/W Revision	A.14.00

## Electronic Attenuator Bypass

Example	CALC:FPOW:POW1:DEF "ElecAttBypass =False"
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Notes	The electronic attenuation bypass parameter allows the user to either utilize or bypass the electronic attenuator. The electronic attenuator is only available for frequencies up to 3.6 GHz. Set parameter to true when using frequencies above 3.6 GHz and set the parameter to false when using the preamp.
Preset	True
Range	True (bypass electronic attenuator) or False (use electronic attenuator)
Default Unit	Boolean
Initial S/W Revision	A.14.00

### Electronic Attenuation

Example	CALC:FPOW:POW1:DEF "ElecAttenuation=10"
Notes	Option EA3 is required. The electronic attenuation value parameter sets the amount of electrical attenuation from 0 to 24 dB (1 dB steps). Set "ElecAttBypass=False" to make sure the electronic attenuator path is enabled.
Preset	0 dB
Range	0 – 24 dB (1 dB steps)
Default Unit	dB
Initial S/W Revision	A.14.00

### IF Gain

Example	CALC:FPOW:POW1:DEF "IFGain=10"
Notes	The IF gain parameter allows the user to specify the gain at the IF stage anywhere from -6 to 16 dB (1 dB steps). This is an advanced feature, and for most cases this should remain at its default value of 0 dB.
Preset	0 dB
Range	-6 – 16 dB (1 dB steps)
Default Unit	dB
Initial S/W Revision	A.14.00

### IF Type

Example	CALC:FPOW:POW1:DEF "IFType=B25M"
Notes	The IF type parameter allows the user to select between different IF paths. For example, if the signal is less than 25 MHz wide, then the user can select the B25M path to take advantage of additional filtering on this analog IF path.



Preset	B40M
Range	B10M, B25M, B40M
Initial S/W Revision	A.14.00

### Include Power Spectrum

Example	CALC:FPOW:POW1:DEF "IncludePowerSpectrum=True"
Notes	The power spectrum parameter allows the user to read data on the entire spectrum for diagnostic purposes. It is not recommended for production use. See CALC:FPOW:POW[n]:READ2? for details on the binary format of the response.
Preset	False
Range	True (return both channel power and full power spectrum) or False (returns only channel power)
Default Unit	Boolean
Initial S/W Revision	A.14.00

### Mechanical Attenuation

Example	CALC:FPOW:POW1:DEF "MechAttenuation=10"
Notes	The mechanical attenuation value parameter sets the amount of mechanical attenuation anywhere from 0 to 70 dB (2 dB steps).
Preset	0 dB
Range	0 – 70 dB (2 dB steps)
Default Unit	dB
Initial S/W Revision	A.14.00

### Preamp Mode

Example	CALC:FPOW:POW1:DEF "PreAmpMode=Low"
Notes	The license for the appropriate preamp is required. The preamp mode parameter specifies whether the preamps are being utilized. Low allows any preamps up to 3.6 GHz, and Full allows all licensed preamps. Set "ElecAttBypass=True" in order to utilize any preamps.
Preset	Off
Range	Off, Low, Full
Initial S/W Revision	A.14.00

## Resolution Bandwidth Mode

Example	CALC:FPOW:POW1:DEF "PreAmpMode=Low"
Notes	The resolution bandwidth mode parameter allows the user to choose whether the RBW filter is automatically or manually set. The BestSpeed value minimizes measurement time, while the Narrowest value minimizes RBW size (minimum of two FFT bins per RBW). To manually specify an RBW, set this parameter to Explicit, and set the ResolutionBW parameter to the desired value.
Preset	BestSpeed
Range	BestSpeed, Narrowest, Explicit
Initial S/W Revision	A.14.00

## Resolution Bandwidth

Example	CALC:FPOW:POW1:DEF "ResolutionBW=25e3"
Notes	The resolution bandwidth parameter sets the 3-dB bandwidth of the RBW filter. The ResolutionBWMode parameter must be set to Explicit in order to manually set the RBW.
Preset	0 Hz
Default Unit	Hz
Initial S/W Revision	A.14.00

## Trigger Delay

Example	CALC:FPOW:POW1:DEF "TriggerDelay=0.025"
Notes	The trigger delay parameter sets the time after an external trigger is detected until the measurement is performed.
Preset	0 s
Range	0 – 1 s
Default Unit	Seconds
Initial S/W Revision	A.14.00

## Trigger Level

Example	CALC:FPOW:POW1:DEF "TriggerLevel=2"
Notes	The trigger level parameter sets the voltage value at which an external trigger is detected.
Preset	1.2 V
Range	-5 to 5 V
Default Unit	Volts
Initial S/W Revision	A.14.00

### Trigger Slope

Example	CALC:FPOW:POW1:DEF "TriggerSlope=Negative"
Notes	The trigger slope parameter indicates the direction of the edge trigger voltage for detection.
Preset	Positive
Range	Positive, Negative
Initial S/W Revision	A.14.00

### Trigger Source

Example	CALC:FPOW:POW1:DEF "TriggerSource=Ext1"
Notes	The trigger source parameter allows the user to choose between measurement's triggering freely or controlled by an external input. Ext1 and Ext2 correspond to Trigger 1 In and Trigger 2 In, respectively.
Preset	Free
Range	Free, Ext1, Ext2
Initial S/W Revision	A.14.00

### Trigger Timeout

Example	CALC:FPOW:POW1:DEF "TriggerTimeout=0.1"
Notes	The trigger timeout parameter sets the time in which the analyzer will wait for a trigger before automatically performing the measurement.
Preset	1 s
Range	0 – 1 s
Default Unit	Seconds
Initial S/W Revision	A.14.00

### Signal Input

Example	CALC:FPOW:POW1:DEF "SignalInput=Fp50MHzCW"
Notes	The signal input parameter allows the user to select between using the main RF input or the internal analyzer reference CW signal of 50 MHz.
Preset	FpMainRf
Range	FpMainRf, Fp50MHzCW
Initial S/W Revision	A.14.00

## Use Preselector

Example	CALC:FPOW:POW1:DEF "UsePreSelector=True"
Notes	The preselector parameter allows the user to either utilize or bypass the front end tunable filter at frequencies above 3.6 GHz. For frequencies below 3.6 GHz, the preselector is automatically bypassed, so you do not need to set this parameter to False in those cases.
Preset	False
Range	True (use preselector above 3.6 GHz), or False (preselector bypassed)
Default Unit	Boolean
Initial S/W Revision	A.14.00

## Channel Bandwidth Array

Example	CALC:FPOW:POW1:DEF "Bandwidth=[3.84e6, 5e6, 3.84e6]"
Notes	The bandwidth parameter array defines the bandwidth of each channel that will be measured. All array parameters should have the same number of elements. Alternatively, if all the elements are the same value, a single number with no square brackets can be used to define the parameter.
Preset	[1e6]
Range	0 to 40 MHz
Default Unit	Hz
Initial S/W Revision	A.14.00

## Channel Filter Type Array

Example	CALC:FPOW:POW1:DEF "FilterType=[RRC, IBW, RRC]"
Notes	The filter type parameter allows the user to choose between an integration bandwidth (IBW) filter or a root-raised-cosine (RRC) filter. The integration bandwidth filter weighs all frequencies within the bandwidth equally. The root-raised-cosine filter has an associated shape parameter, defined by the FilterAlpha parameter. All array parameters should have the same number of elements. Alternatively, if all the elements are the same value, a single value with no square brackets can be used to define the parameter.
Preset	[IBW]
Range	IBW, RRC
Initial S/W Revision	A.14.00

## Channel Filter Alpha Array

Example	CALC:FPOW:POW1:DEF "FilterAlpha=[0.5, 0.0, 0.5]"
Notes	The filter alpha parameter allows the user to adjust the alpha value associated with the root-

	raised-cosine (RRC) filter type. Set FilterType to RRC in order to utilize this parameter. All array parameters should have the same number of elements. Alternatively, if all the elements are the same value, a single number with no square brackets can be used to define the parameter.
Preset	[0.22]
Range	0.0 – 1.0
Initial S/W Revision	A.14.00

### Channel Measurement Function Array

Example	CALC:FPOW:POW1:DEF "Function=[BandPower, PeakPower, BandPower]"
Notes	This parameter array defines what measurement is being made for each individually-specified channel: BandPower: Total power within the specified bandwidth of the channel (dBm) BandDensity: Total power density within the specified bandwidth of the channel (dBm/Hz) PeakPower: The peak power value within the specified bandwidth of the channel (dBm) PeakFrequency: The frequency which corresponds to the peak power value within the specified bandwidth of the channel. This frequency is relative to the center frequency (Hz) XdBBandwidth: The half power (-3.01 dB) bandwidth of the highest amplitude signal that resides within the channel (Hz), dB is configurable using XdBBandwidth parameter OccupiedBandwidth: The bandwidth at which 99% of the total power resides within the channel (Hz), percentage configurable using OccupiedBandwidthPercent parameter All array parameters should have the same number of elements. Alternatively, if all the elements are the same value, a single value with no square brackets can be used to define the parameter.
Preset	[BandPower]
Range	BandPower, BandDensity, PeakPower, PeakFrequency, XdBBandwidth, OccupiedBandwidth
Initial S/W Revision	A.14.00

### Channel Offset Frequency Array

Example	CALC:FPOW:POW1:DEF "OffsetFrequency=[-5e6, 0, 5e6]"
Notes	The offset frequency parameter array defines the difference between the center frequency to the center frequency of each channel. All array parameters should have the same number of elements.
Preset	[0]
Range	0 to 20 MHz
Default Unit	Hz
Initial S/W Revision	A.14.00

### Channel Occupied Bandwidth Percent Array

Example	CALC:FPOW:POW1:DEF "OccupiedBandwidthPercent =[0.95, 0.95, 0.95]"
Notes	This parameter only applies for channels whose Function is set to OccupiedBandwidth. The occupied bandwidth percent parameter specifies the percent of total power in these channels. The valid range for this parameter is 0.0 to 1.0, where 1.0 represents 100%. The default for this parameter is 0.99, which will return the bandwidth that contains 99% of the total channel power.
Preset	[0.99]
Range	0 – 1.0
Initial S/W Revision	A.14.00

### Channel x-dB Bandwidth Array

Example	CALC:FPOW:POW1:DEF "XdBBandwidth =[-6.02, -3.01, -1.0]"
Notes	This parameter only applies for channels whose Function is set to XdBBandwidth. The X dB bandwidth parameter is used to specify the power relative to the peak channel power over which the bandwidth is calculated. The parameter value must be a negative number.
Preset	[-3.01]
Range	-200 to 0 dB
Default Unit	dB
Initial S/W Revision	A.14.00

### Define Fast Power Measurement Query (Remote Command Only)

The DEFine? command is used to retrieve a list of all defined parameters in an ASCII string format

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**R** :CALCulate:FPOWer:POWer[1,2,...,999]:DEFine?

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**C**  
**o**  
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**a**  
**n**

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**d**

**E** :CALC:FPOW:POW1:DEF?

**x  
a  
m  
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e**

---

**N** This command query is used to retrieve a list of all defined parameters in an ASCII format.

**O** The following is an example of the returned results:

**t** "DCCoupled=False,ElecAttBypass=True,ElecAttenuation=0,IFGain=0,MechAttenuation=0,PreAmpMode=Off,PreSelectorOf  
**e** fset=0,UsePreSelector=False,ExternalReferenceFrequency=10000000,FrequencyReferenceSource=AutoExternalFrequenc  
**s** yReference,IFType=B40M,LOMode=SLW,SignalInput=FpMainRf,AcquisitionTime=0.001,CenterFrequency=1000000000,Re  
solutionBW=0,ResolutionBWMode=BestSpeed,DetectorType=RmsAverage,Bandwidth=[1000000],OffsetFrequency=  
[0],Function=[BandPower],FilterType=[BW],FilterAlpha=[0.22],OccupiedBandwidthPercent=[0.99],XdBBandwidth=[-  
3.01],DoNoiseCorrection=False,DoSpurSuppression=False,MeasurementMethod=HardwareFFT,IncludePowerSpectrum=F  
alse,TriggerDelay=0,TriggerLevel=1.2,TriggerSlope=Positive,TriggerSource=Free,TriggerTimeout=1"

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### Configure Fast Power Measurement (Remote Command Only)

The configure command begins hardware setup and returns immediately, with no acquisition made. This can be used in parallel with other hardware operations to effectively hide the hardware setup time.

---

Mode	All
<b>Remote Command</b>	:CALCulate:FPOWer:POWer[1,2,...,999]:CONFigure
<b>Example</b>	:CALC:FPOW:POW1:CONF

---

Notes	Option FP2 is required.
Initial S/W Revision	A.14.00

### Initiate Fast Power Measurement (Remote Command Only)

The INITiate command begins an acquisition and returns immediately. The results of the measurement can be retrieved using FETCh.

Mode	All
<b>Remote Command</b>	:CALCulate:FPOWer:POWer[1,2,...,999]:INITiate
<b>Example</b>	:CALC:FPOW:POW1:INIT
Notes	Option FP2 is required.
Initial S/W Revision	A.14.00

### Fetch Fast Power Measurement (Remote Command Only)

The FETCh command query is used to retrieve the results of an acquisition initiated by the INIT command. The returned results are in ASCII string format. The string begins and ends with quotation marks.

Mode	All
<b>Remote Command</b>	:CALCuLate:FPOWer:POWer[1,2,...,999]:FETCh?
<b>Example</b>	:CALC:FPOW:POW1:FETC?
Notes	Option FP2 is required. Returns m comma-separated ASCII values, where m corresponds to the number of bandwidths defined. 1. Declared function return in the 1st specified channel 2. Declared function return in the 2nd specified channel ... m. Declared function return in the last specified channel The INIT and FETC? command sequence performs the same functionality of a single CALC:FPOW:POW[n]? query. Units of the returned values are dependent on the Function parameter for each channel.
Initial S/W Revision	A.14.00

### Execute Fast Power Measurement (Remote Command Only)

This command query is used as shorthand for an INIT command immediately followed by a FETC? command. The returned results are in ASCII string format. The string begins and ends with quotation marks.



Mode	All
<b>Remote Command</b>	:CALCulate:FPOWer:POWer[1,2,...,999]?
<b>Example</b>	:CALC:FPOW:POW1?
Notes	Option FP2 is required. See notes for Fast Power Fetch for return format.
Initial S/W Revision	A.14.00

### Binary Read Fast Power Measurement (Remote Command Only)

This command query is used as shorthand for an INIT command immediately followed by a FETC? command. The returned results are in a binary format.

Mode	All
<b>Remote Command</b>	:CALCulate:FPOWer:POWer[1,2,...,999]:READ? :CALCulate:FPOWer:POWer[1,2,...,999]:READ1?
<b>Example</b>	:CALC:FPOW:POW1:READ? :CALC:FPOW:POW1:READ1?
Notes	Option FP2 is required. Returns m 4 byte floating point binary values (Little-Endian), where m corresponds to the number of bandwidths defined.
Initial S/W Revision	A.14.00

### Diagnostic Binary Read Fast Power Measurement (Remote Command Only)

This command query is used as shorthand for an INIT command immediately followed by a FETC? command. The returned results are in a binary format. This command is used primarily for diagnostic purposes to test for ADC overloads and to visibly inspect the spectrum.

Mode	All
<b>Remote Command</b>	:CALCulate:FPOWer:POWer[1,2,...,999]:READ2?
<b>Example</b>	:CALC:FPOW:POW1:READ2?
Notes	Option FP2 is required. <div style="display: flex; align-items: flex-start; margin-top: 10px;"> <div style="background-color: #cccccc; padding: 2px 5px; margin-right: 10px;"><b>NOTE</b></div> <div> <p><b>Spectrum data is only returned if the IncludePowerSpectrum parameter is set to True. If IncludePowerSpectrum is False, the number of spectrum points will be zero (0).</b></p> <p>Units of the returned values are dependent on the Function parameter per channel (e.g. dBm for BandPower, Hz for PeakFrequency). Returns binary data (Little-Endian) that contains information on m amount of channels, along with ADC over range and full spectrum data.</p> </div> </div>

---

The following is the binary format of the response.

Bandwidth Return Value

1. Number of channels specified, m [4 byte int]
2. Declared function result for the 1st specified channel [4 byte float]
3. Declared function result for the 2nd specified channel [4 byte float]
- ...
- (m + 1). Declared function result for the last (mth) specified channel [4 byte float]

ADC Over Range

1. ADC over-range occurred (1: true, 0: false) [2 byte short]

Spectrum Data

1. Number of points in the spectrum data, k [4 byte int]
  2. Start frequency of spectrum data (Hz) [8 byte double]
  3. Step frequency of spectrum data (Hz) [8 byte double]
  4. FFT bin at 1st point (dBm) [4 byte float]
  5. FFT bin at 2nd point (dBm) [4 byte float]
  - ...
  - (k + 3). FFT bin at last (kth) point (dBm) [4 byte float]
- 

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### Format Data: Numeric Data (Remote Command Only)

This command specifies the format of the trace data input and output. It specifies the formats used for trace data during data transfer across any remote port. It affects only the data format for setting and querying trace data for the :TRACe[:DATA], TRACe[:DATA]?, :CALCulate:DATA[n]? and FETCh:SANalyzer[n]? commands and queries.

---

<b>Remote Command</b>	<b>:FORMat[:TRACe][:DATA] ASCii INTEger,32 REAL,32  REAL,64</b> <b>:FORMat[:TRACe][:DATA]?</b>
-----------------------	---

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Notes      The query response is:

ASCii: ASC,8

REAL,32: REAL,32

REAL,64: REAL,64

INTEger,32: INT,32

When the numeric data format is REAL or ASCii, data is output in the current Y Axis unit. When the data format is INTEger, data is output in units of m dBm (.001 dBm).

The INT,32 format returns binary 32-bit integer values in internal units (m dBm), in a definite length block.

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Dependencies	Sending a data format spec with an invalid number (for example, INT,48) generates no error. The analyzer simply uses the default (8 for ASCii, 32 for INTEger, 32 for REAL).
--------------	--

Sending data to the analyzer which does not conform to the current FORMat specified, results in an error. Sending ASCII data when a definite block is expected generates message -161 "Invalid"

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	Block Data" and sending a definite block when ASCII data is expected generates message -121 "Invalid Character in Number".
Preset	AScii
Backwards Compatibility Notes	Note that the INT,32 format is only applicable to the command, TRACe:DATA. This preserves backwards compatibility for the Swept SA measurement. For all other commands/queries which honor FORMat:DATA, if INT,32 is sent the analyzer will behave as though it were set to REAL,32.
Initial S/W Revision	Prior to A.02.00

The specs for each output type follow:

AScii - Amplitude values are in ASCII, in the current Y Axis Unit, one ASCII character per digit, values separated by commas, each value in the form:

SX.YYYYYEsZZ

Where:

S = sign (+ or -)

X = one digit to left of decimal point

Y = 5 digits to right of decimal point

E = E, exponent header

s = sign of exponent (+ or -)

ZZ = two digit exponent

REAL,32 - Binary 32-bit real values in the current Y Axis Unit, in a definite length block.

REAL,64 - Binary 64-bit real values in the current Y Axis Unit, in a definite length block.

### Format Data: Byte Order (Remote Command Only)

This command selects the binary data byte order for data transfer and other queries. It controls whether binary data is transferred in normal or swapped mode. This command affects only the byte order for setting and querying trace data for the :TRACe[:DATA], TRACe[:DATA]? , :CALCulate:DATA[n]? and FETCh:SANalyzer[n]? commands and queries.

By definition any command that says it uses FORMat:DATA uses any format supported by FORMat:DATA.

The NORMal order is a byte sequence that begins with the most significant byte (MSB) first, and ends with the least significant byte (LSB) last in the sequence: 1|2|3|4. SWAPped order is when the byte sequence begins with the LSB first, and ends with the MSB last in the sequence: 4|3|2|1.

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**Remote Command**      :FORMat:BORDER NORMa1 | SWAPped

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	<b>:FORMat:BORDER?</b>
Preset	NORMal
Initial S/W Revision	Prior to A.02.00

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## Meas Setup

The Meas Setup key opens a menu of softkeys that allow you to control the most important parameters for the current measurement.

**NOTE**

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

Key Path	Front-panel key
Initial S/W Revision	Prior to A.02.00

### 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 521](#).

See ["AVER:CLE command" on page 522](#).

Key Path	Meas Setup
<b>Remote Command</b>	[ :SENSe]:AVERage:COUNT <integer> [ :SENSe]:AVERage:COUNT?
Couplings	Restarting any of these functions (Average, Max Hold or Min Hold) restarts all of them, as there is only one count. When in Density View, averaging only affects the Real Time Spectrum (White) Trace, not the Density Bitmap.
Preset	100
State Saved	Saved in instrument state
Min	1
Max	10000
Initial S/W Revision	A.13.00

### More Information

When in Single, the trace update stops when N is reached. You can add more trace updates 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, 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 trace holding in Cont, the value of N is irrelevant. But for averaging, each new trace update is exponentially averaged in with a weighting equal to N.

The Average/Hold Number is not affected by Auto Couple.

## AVER:CLE command

The AVER:CLE command (below) resets the average/hold count and does an INIT:IMM, which begins another set of trace updates when trigger conditions are satisfied. It only does this if an active trace is in Average or Hold type.

Parameter Name	Restart & Reset Average Counter
<b>Remote Command</b>	[ :SENSe ] :AVERage :CLEar
<b>Example</b>	AVER:COUN 100 AVER:CLE Sets the current count (k and K) to 1 and restarts the averaging process.
Notes	When the instrument receives this command it performs an INIT:IMM, if and only if there is an active trace in Max Hold, Min Hold, or Average type.
Default Unit	Enter
Initial S/W Revision	A.13.00

## Limits

The limits key opens a menu of softkeys to control the limits for the current measurement. Limits arrays can be entered by the user, sent over SCPI, or loaded from a file.

Key Path	<b>Meas Setup</b>
Dependencies	This key will only appear 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 analyzer application, which means they will survive a power cycle.
Initial S/W Revision	A.02.00

## 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.

Key Path	<b>Meas Setup, Limits</b>
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.
Initial S/W Revision	A.02.00

## Limit

Selects whether the limit and margin are displayed. If Test Limits is on, this also determines whether the test trace (see ["Test Trace" on page 844](#)) 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 849). 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 (All Limits)** is on (see "Test Limits" on page 855). If the trace is not tested, no report of the trace passing or failing is seen on the graticule. Note that the SCPI queries of Limit Pass/Fail are independent of these conditions; the test is always performed when queried over SCPI.

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 analyzer X-axis. Traces which are not updating (in View, for example) will not change color if the analyzer 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.

Key Path	Meas Setup, Limits
<b>Remote Command</b>	:CALCulate:LLINe[1] 2 ... 6:DISPlay OFF ON 0 1 :CALCulate:LLINe[1] 2 ... 6:DISPlay?
<b>Example</b>	:CALC:LLIN2:DISP ON turns on the display for limit line 2.
Dependencies	This command will generate an “Option not available” error message unless you have the proper option installed in your instrument.
Couplings	Limit display ON selects the limit. Testing is done on all displayed limits if <b>Test Limits (All Limits)</b> is ON. Entering the limit menu from the GUI turns on the selected limit.
Preset	OFF
State Saved	Saved in instrument state.
<b>Backwards Compatibility SCPI</b>	:CALCulate:LLINe[1] 2:STATe OFF ON 0 1 In the past you had to send the DISP command as well as the STATe command in order to get a limit on and testing. Now, the DISP command is sufficient, but we accept the state command and map it to DISP

Initial S/W Revision	A.02.00
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## Properties

Accesses a menu which lets you set the properties of the selected limit.

Key Path	<b>Meas Setup, Limits</b>
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Initial S/W Revision	A.02.00
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## 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.

Key Path	<b>Meas Setup, Limits, Properties</b>
----------	---------------------------------------

Notes	The selected limit is remembered even when not in the Limit Menu.
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Preset	Limit 1, not affected by Mode Preset, preset by Restore Mode Defaults.
--------	--

State Saved	Saved in instrument state.
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## Test Trace

Selects the trace you want the limit to test. A limit is applied to one and only one trace; each trace can have both an upper and a lower limit. When executing Limit Test, the limit is applied only to the specified trace.

A trace can have multiple limit lines simultaneously; in that case, only one upper and one lower limit line will affect the color of the trace. Other limit lines will be displayed, and will affect the pass/fail status, but the trace will not turn red if it crosses a secondary limit line.

Key Path	<b>Meas Setup, Limits, Properties</b>
----------	---------------------------------------

<b>Remote Command</b>	<b>:CALCulate:LLINe[1] 2 ... 6:TRACe 1 2 3 4 5 6</b>
-----------------------	--

	<b>:CALCulate:LLINe[1] 2 ... 6:TRACe?</b>
--	---

<b>Example</b>	:CALC:LLIN3:TRAC 2 applies limit 3 to trace 2.
----------------	--

Notes	When the trace display is off, the trace is not tested. The trace is tested only when the trace display is on and Test Limits (see <a href="#">"Test Limits" on page 855</a> ) is on.
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Couplings	This matters when testing a trace or limit line for failure, via <b>:CALC:LLIN3:FAIL?</b> or <b>:CALC:TRAC2:FAIL?</b>
-----------	---

Preset	Limits 1 and 2 preset to 1, Limits 3 and 4 preset to 2, Limits 5 and 6 preset to 3 Not affected by Mode Preset, preset by Restore Mode Defaults.
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State Saved	Saved in instrument state.
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Min	1
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Max	6
-----	---



Readback	Trace 1 2 3 4 5 6
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### 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.

Key Path	<b>Meas Setup, Limits, Properties</b>
<b>Remote Command</b>	:CALCulate:LLINe[1] 2 ... 6:TYPE UPPER LOWER :CALCulate:LLINe[1] 2 ... 6:TYPE?
<b>Example</b>	:CALC:LLIN2:TYPE LOW sets limit line 2 to act as a lower limit.
Couplings	If a margin has already been set for this limit line, and this key is used to change the limit type, then the margin value will reverse 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.
Initial S/W Revision	A.02.00

### Interpolation

Accesses a menu which lets you set the frequency and amplitude interpolation of the selected limit.

Key Path	<b>Meas Setup, Limits, Properties</b>
Readback	[Lin Log Frequency, Lin Log Amplitude]
Initial S/W Revision	A.02.00

### Frequency Interpolation

This key is grayed out if Time is the selected X Axis Units. Sets the interpolation between frequency points, allowing you to determine how limit trace values are computed between points in a limit table. The available interpolation modes are linear and logarithmic. If frequency interpolation is logarithmic (Log), frequency values between limit points are computed by first taking the logarithm of both the table values and the intermediate value. A linear interpolation is then performed in this logarithmic frequency space. An exactly analogous manipulation is done for logarithmic amplitude interpolation.

Note that the native representation of amplitude is in dB.

For linear amplitude interpolation and linear frequency interpolation, the interpolation is computed as:

$$y = 20 \log\left(\frac{10^{\frac{y_{i+1}}{20}} - 10^{\frac{y_i}{20}}}{f_{i+1} - f_i} (f - f_i) + 10^{\frac{y_i}{20}}\right)$$

For linear amplitude interpolation and log frequency interpolation, the interpolation is computed as:

$$y = 20 \log \left( \frac{10^{\frac{y_{i+1}}{20}} - 10^{\frac{y_i}{20}}}{\log f_{i+1} - \log f_i} (\log f - \log f_i) + 10^{\frac{y_i}{20}} \right)$$

For log amplitude interpolation and linear frequency interpolation, the interpolation is computed as:

$$y = \frac{y_{i+1} - y_i}{f_{i+1} - f_i} (f - f_i) + y_i$$

For log amplitude interpolation and log frequency interpolation, the interpolation is computed as:

$$y = \frac{y_{i+1} - y_i}{\log f_{i+1} - \log f_i} (\log f - \log f_i) + y_i$$

**NOTE**

Interpolation modes determine how limit values are computed between points in the limit table. The appearance of a limit trace is also affected by the amplitude scale, which may be linear or logarithmic.

Key Path	Meas Setup, Limits, Properties, Interpolation
Remote Command	:CALCulate:LLINE[1] 2 ... 6:CONTRol:INTERpolate:TYPE LOGarithmic   LINear  :CALCulate:LLINE[1] 2 ... 6:CONTRol:INTERpolate:TYPE?
Example	:CALC:LLIN:CONT:INT:TYPE LIN sets limit line 1 frequency interpolation to linear.
Preset	Linear, not affected by Mode Preset, preset by Restore Mode Defaults.
State Saved	Saved in instrument state.
Initial S/W Revision	A.02.00

### Amplitude Interpolation

Sets the interpolation to linear or logarithmic for the specified limiting points set, allowing you to determine how limit trace values are computed between points in a limit table. See Frequency Interpolation for the equations used to calculate limit values between points.

Key Path	Meas Setup, Limits, Properties, Interpolation
Remote Command	:CALCulate:LLINE[1] 2 ... 6:AMPLitude:INTERpolate:TYPE LOGarithmic   LINear  :CALCulate:LLINE[1] 2 ... 6:AMPLitude:INTERpolate:TYPE?
Example	:CALC:LLIN:AMPL:INT:TYPE LIN sets limit line 1 amplitude interpolation to linear.
Preset	Logarithmic, not affected by Mode Preset, preset by Restore Mode Defaults.

State Saved	Saved in instrument state.
Initial S/W Revision	A.02.00

### Fixed / Relative

Opens a menu which will allow you to specify that the selected limit is relative to either Center Frequency or Reference level.

Key Path	<b>Meas Setup, Limits, Properties</b>
Readback	Fixed Rel to CF Rel to RL Rel to CF + RL (square brackets)
Backwards Compatibility Notes	You can now set relative amplitude and relative frequency independently for each limit line. :CALC:LLIN:CMOD REL makes all limit lines relative to the center frequency and reference level. :CALC:LLIN:CMOD? returns 1 if Limit Line 1 is set Relative to CF, and returns 0 otherwise.
Initial S/W Revision	A.02.00

### Relative to CF

Chooses whether the limit line frequency points are coupled to the instrument center frequency, and whether the frequency points are expressed as an offset from the instrument center frequency. If the limit lines are specified with time, this has no effect. The limit table must in this case support negative frequencies.

For example, assume you have a frequency limit line, and the analyzer center frequency is at 1 GHz. If Relative to CF is “Off”, entering a limit line segment with a frequency coordinate of 300 MHz displays the limit line segment at 300 MHz, and the limit line segment will not change frequency if the center frequency changes. If Relative to CF is “On”, entering a limit line segment with a frequency coordinate of 300 MHz displays the limit line segment at CF + 300 MHz, or 1.3 GHz. Furthermore, if the center frequency changes to 2 GHz, the limit line segment will be displayed at CF + 300 MHz, or 2.3 GHz.

It is possible to change this setting after a limit line has been entered. When changing from On to Off or vice-versa, the frequency values in the limit line table change so that the limit line remains in the same position for the current frequency settings of the analyzer.

Pressing this button makes Center Frequency the active function.

Key Path	<b>Meas Setup, Limits, Properties, Fixed/Relative</b>
Remote Command	:CALCulate:LLINe[1] 2 ... 6:FREQuency:CMODe:RELative ON   OFF   1   0 :CALCulate:LLINe[1] 2 ... 6:FREQuency:CMODe:RELative?
Example	:CALC:LLIN:FREQ:CMOD:REL ON makes limit line 1 relative to the center frequency.
Notes	If the Trace Domain is changed to Time (:CALCulate:LLINe:CONTRol:DOMain TIME), the command : :CALCulate:LLINe[1] 2 3 4 5 6:FREQuency:CMODe:RELative ON OFF 1 0 will have no effect.
Couplings	Pressing this button makes Center Frequency the active function.
Preset	Off, not affected by Mode Preset, preset by Restore Mode Defaults.

State Saved	Saved in instrument state.
Initial S/W Revision	A.02.00

### Relative to RL

Chooses whether the limit line amplitude points are coupled to the instrument reference level, and whether the amplitude points are expressed as an offset from the instrument reference level.

For example, assume you have a limit line, and the reference level at  $-10$  dBm. If Relative to RL is “Off”, entering a limit line segment with an amplitude coordinate of  $-20$  dB displays the limit line segment at  $-20$  dBm, and the limit line segment will not change amplitude if the reference level amplitude changes. If Relative to RL is “On”, entering a limit line segment with an amplitude coordinate of  $-20$  dB displays the limit line segment at  $RL - 20$  dB, or  $-30$  dBm. Furthermore, if the reference level amplitude changes to  $-30$  dBm, the limit line segment will be displayed at  $RL - 20$  dB, or  $-50$  dBm.

It is possible to change this setting after a limit line has been entered. When changing from On to Off or vice-versa, the amplitude values in the limit line table change so that the limit line remains in the same position for the current reference level settings of the analyzer.

Key Path	<b>Meas Setup, Limits, Properties, Fixed/Relative</b>
<b>Remote Command</b>	:CALCulate:LLINE[1] 2 ... 6:AMPLitude:CMODE:RELative ON   OFF   1   0 :CALCulate:LLINE[1] 2 ... 6:AMPLitude:CMODE:RELative?
<b>Example</b>	:CALC:LLIN:AMPL:CMOD:REL ON makes limit line 1 relative to the reference level amplitude.
Couplings	Pressing this button makes Reference level the active function.
Preset	Off, not affected by Mode Preset, preset by Restore Mode Defaults.
State Saved	Saved in instrument state.
Initial S/W Revision	A.02.00

### Description

Provides a description of up to 60 characters by which the operator can easily identify the limit. Will be stored in the exported file. Can be displayed in the active function area by selecting as the active function, if desired to be in a screen dump.

Key Path	<b>Meas Setup, Limits, Properties</b>
<b>Remote Command</b>	:CALCulate:LLINE[1] 2 ... 6:DESCription “Description” :CALCulate:LLINE[1] 2 ... 6:DESCription?
<b>Example</b>	:CALC:LLIN:DESC “European Emissions”
Dependencies	60 characters max
Preset	” (null String), not affected by Mode Preset, preset by Restore Mode Defaults.

State Saved	Saved in instrument state.
Readback	As much of the description will fit on one line of the key, followed by “...” if some of the description will not fit on one line of the key.
Initial S/W Revision	A.02.00

### Comment

Sets an ASCII comment field, which will be stored in an exported file. Can be displayed in the active function area by selecting as the active function, if desired to be in a screen capture. The Limits .csv file supports this field.

Key Path	<b>Meas Setup, Limits, Properties</b>
<b>Remote Command</b>	:CALCulate:LLINe[1] 2 ... 6:COMMeNt "text" :CALCulate:LLINe[1] 2 ... 6:COMMeNt?
<b>Example</b>	:CALC:LLIN1:COMM "this is a comment"
Dependencies	60 characters max
Preset	"" (null String), not affected by Mode Preset, preset by Restore Mode Defaults.
State Saved	Saved in instrument state.
Readback	As much of the description will fit on one line of the key, followed by “...” if some of the description will not fit on one line of the key.
Initial S/W Revision	A.02.00

### 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 key until Off is underlined. 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.

Key Path	<b>Meas Setup, Limits</b>
<b>Remote Command</b>	:CALCulate:LLINe[1] 2 ... 6:MARGIn <rel_amp1> :CALCulate:LLINe[1] 2 ... 6:MARGIn?

	<code>:CALCulate:LLINe[1] 2 ... 6:MARGin:STATe OFF ON 0 1</code>
	<code>:CALCulate:LLINe[1] 2 ... 6:MARGin:STATe?</code>
<b>Example</b>	<p><code>:CALC:LLIN1:MARG -2dB</code> sets limit line 1's margin to -2 dB (Limit Line 1 is by default an upper limit).</p> <p><code>:CALC:LLIN2:MARG 1dB</code> sets limit line 2's margin to 1 dB (Limit Line 2 is by default a lower limit).</p> <p><code>:CALC:LLIN2:MARG:STAT OFF</code> turns off the margin for limit line 2 and removes any tests associated with that margin line.</p>
Notes	The queries "Limit Line Fail?" ( <code>:CALCulate:LLINe[1] 2 3 4 5 6:FAIL?</code> ) and "Trace Fail?" ( <code>:CALCulate:TRACe[1] 2 3 4 5 6:FAIL?</code> ) will return 1 if the margin fails.
Couplings	This will affect <code>:CALC:LLIN3:FAIL</code> or <code>:CALC:TRAC2:FAIL?</code>
Preset	Not affected by Mode Preset, set to 0 dB for all Limits by Restore Mode Defaults.
State Saved	Saved in instrument state.
Min	-40 dB (Upper); 0 dB (Lower)
Max	0 dB (Upper); 40 dB (Lower);
Default Unit	dB
Initial S/W Revision	A.02.00

## Edit

Opens the Table Editor for the selected 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 its 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 analyzer 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.**

When exiting the edit menu (by using the Return key or by pressing an instrument front panel key), the editor window turns off, however the Limit is still on and displayed, and the amplitude scale remains **Log**.

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 analyzer application, which means they will survive a power cycle.

Key Path	<b>Meas Setup, Limits</b>
Couplings	A remote user can enter or access limit line data via <code>:CALCulate:LLINe[1] 2 3 4 5 6:DATA</code>
Initial S/W Revision	A.02.00

## Navigate

Lets you move through the table to edit the desired point

Key Path	<b>Meas Setup, Limits, Edit</b>
Notes	There is no value readback on the key
Min	1
Max	2000
Initial S/W Revision	A.02.00

## Frequency

Lets you edit the frequency of the current row.

Key Path	<b>Meas Setup, Limits, Edit</b>
Notes	There is no value readback on the key
Min	0
Max	1 THz
Initial S/W Revision	A.02.00

## Amplitude

Lets you edit the Amplitude of the current row.

Key Path	<b>Meas Setup, Limits, Edit</b>
Notes	There is no value readback on the key
Min	-1000 dBm
Max	1000 dBm
Initial S/W Revision	A.02.00

## Insert Point Below

Pressing this key 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.

Key Path	<b>Meas Setup, Limits, Edit</b>
Initial S/W Revision	A.02.00

## Delete Point

This is an immediate action key. It will immediately delete the currently-selected point, whether or not that point is being edited, and select Navigate. The point following the currently-selected point (or the point preceding if there is none) will be selected.

Key Path	<b>Meas Setup, Limits, Edit</b>
Initial S/W Revision	A.02.00

## Copy from Limit

Copies an existing limit into the current limit, including all secondary parameters (Description, Associated Trace, Type, Margin, Interpolation, Relative to CF/RL).

Key Path	Meas Setup, Limits, Edit
<b>Remote Command</b>	:CALCulate:LLINE[1] 2 ... 6:COPY LLINE1   LLINE2   LLINE3   LLINE4   LLINE5   LLINE6
<b>Example</b>	:CALC:LLINE2:COPY LLINE1 copies the data from line 1 into line 2.
Notes	Auto return to the Edit menu.
Initial S/W Revision	A.02.00

## Build from Trace

Builds a limit using an existing trace. This command will overwrite all data in the limit. Since a straight copy would typically have hundreds or thousands of segments, the data will be approximated to better represent a limit line; small excursions whose width is less than 10 trace buckets will sometimes not be captured. Secondary parameters which are not associated with traces (Description, Associated Trace, Type, Margin, Interpolation, Relative to CF/RL) will be unchanged.

When taking a trace in order to build a limit, it will often work well to take the trace with a resolution bandwidth wider than the expected measurement, a video bandwidth lower than the expected measurement, and with the detector set to Max Hold or Min Hold.

Note that an upper limit will be built above the trace, while a lower limit will be built below the trace. If the trace is constant, the limit should pass after being built.

Key Path	Meas Setup, Limits, Edit
<b>Remote Command</b>	:CALCulate:LLINE[1] 2 ... 6:BUILD TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6
<b>Example</b>	:CALC:LLIN2:BUILD TRACE1 builds limit line 2 based on the data in trace 1. This will overwrite the data in the table editor.
Notes	Auto return to Edit menu.
Initial S/W Revision	A.02.00

## Offset

Enters a menu which allows you to offset the limit trace by a specified frequency, time, or amplitude. The offsets will be immediately applied to the limit trace for display and failure calculation; the offset can also be applied to the points in the limit line.

Key Path	Meas Setup, Limits, Edit
Initial S/W Revision	A.02.00



## X Offset

Offsets the limit trace by some specified frequency (for Frequency-based limit lines) or a time (for time-based limit lines).

Key Path	Meas Setup, Limits, Edit, Offset
<b>Remote Command</b>	:CALCulate:LLINE[1] 2 ... 6:OFFSet:X <value> :CALCulate:LLINE[1] 2 ... 6:OFFSet:X?  <value> = <freq> if Limit X-Axis Unit is Frequency, <value> = <time> if Limit X-Axis Unit is Time
<b>Example</b>	:CALC:LLIN:OFFS:X -50MHZ sets the X axis offset to -50 MHz. :CALC:LLIN:OFFS:UPD will apply the X axis offset to all points in the limit line, then reset the X axis offset to zero.
Preset	0 Hz if Limit X-Axis Unit is Frequency 0 S if Limit X-Axis Unit is Time
State Saved	Saved in instrument state, survives Preset
Min	-500 GHz
Max	500 GHz
Default Unit	Determined by X axis scale.
Initial S/W Revision	A.02.00

## Y Offset

Offsets all segments in the limit line by some specified amplitude.

Key Path	Meas Setup, Limits, Edit, Offset
<b>Remote Command</b>	:CALCulate:LLINE[1] 2 ... 6:OFFSet:Y <rel ampl> :CALCulate:LLINE[1] 2 ... 6:OFFSet:Y?
<b>Example</b>	:CALC:LLIN:OFFS:Y -3 dB sets the Y axis offset to -3 dB. :CALC:LLIN:OFFSet:UPD will apply the Y axis offset to all points in the limit line, then reset the Y axis offset to zero.
Preset	0 dB
State Saved	Saved in instrument state.
Min	-Infinity
Max	+Infinity
Default Unit	dB
Initial S/W Revision	A.02.00

## Apply Offsets to Limit Table

Adds the X and Y offsets to each point in the limit table, then resets the X and Y offset values to zero. This has no effect on the position of the limit trace.

For example, if the X offset is -10 MHz and the Y offset is 1 dB, the values in the limit table will be updated as follows: 10 MHz will be subtracted from each X value, 1 dB will be added to each Y value. The offset values will then be reset to zero. The limit

trace will not be moved and the limit table will be updated to accurately reflect the currently-displayed limit trace.

Key Path	<b>Meas Setup, Limits, Edit, Offset</b>
<b>Remote Command</b>	<b>:CALCulate:LLINe[1] 2 ... 6:OFFSet:UPDate</b>
<b>Example</b>	:CALC:LLIN:OFFS:UPD sets updates the limit table to reflect the X and Y offsets, then resets the offsets to zero.
State Saved	No state
Initial S/W Revision	A.02.00

### Scale X Axis

Matches the X Axis to the selected Limit, as well as possible.

For frequency limits and a frequency-domain X-axis, sets the Start and Stop Frequency to contain the minimum and maximum Frequency of the selected Limit. 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.

For time limits and a time-domain X-axis, sets the sweep time to match the maximum Time of the selected Limit.

If the domain of the selected limit does not match the domain of the X Axis, no action is taken. Standard clipping rules apply, if the value in the table is outside the allowable range for the X axis.

Key Path	<b>Meas Setup, Limits, Edit</b>
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”
Initial S/W Revision	A.02.00

### Delete Limit

Deletes the currently selected limit line. Pressing Delete Limit purges the data from the limit line tables.

Limit data – including secondary parameters such as description, margin value, etc. – will be cleared and returned to factory preset settings.

When this key is pressed a prompt is placed on the screen that says “Please press Enter or OK key to delete limit. Press ESC or Cancel to close this dialog.” The deletion is only performed if you press OK or Enter; if so, after the deletion, the informational message “Limit deleted” appears in the MSG line.

Key Path	<b>Meas Setup, Limits</b>
<b>Remote Command</b>	<b>:CALCulate:LLINe[1] 2 ... 6:DELeTe</b>

<b>Example</b>	:CALC:LLIN2:DEL deletes all data for limit line 2.
Initial S/W Revision	A.02.00

### 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.

This command only affects the display, and has no impact on remote behavior. Limit queries over SCPI test the trace against the limit regardless of whether the trace or the limit is turned on (exception: the query :CALCulate:TRACe[1]|2|3|4|5|6:FAIL? tests only the limits that are turned on for that trace).

Key Path	<b>Meas Setup, Limits</b>
<b>Remote Command</b>	:CALCulate:LLINe:TEST OFF ON 0 1 :CALCulate:LLINe:TEST?
<b>Example</b>	:CALC:LLIN:TEST ON turns on testing, and displays the results in the upper left corner.
Preset	On, not affected by Mode Preset, preset by Restore Mode Defaults.
State Saved	Saved in instrument state.
Initial S/W Revision	A.02.00

### 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 softkey in the Limit Table Editor will read Time instead of Frequency

Switching the limit-line definition between Freq and Time will erase all of the current limit lines. When you do this from the front panel, a warning dialog will pop up letting you know that you are about to erase all the limit lines, and prompting you to hit "OK" if you are sure:

Changing the X Axis Unit will erase all your limit lines. Are you sure you want to do this? Press **Enter** or **OK** to proceed, or **Cancel(Esc)** to cancel.

Key Path	<b>Meas Setup, Limits</b>
<b>Remote Command</b>	:CALCulate:LLINe:CONTRol:DOMain FREQ TIME :CALCulate:LLINe:CONTRol:DOMain?
<b>Example</b>	:CALC:LLIN:CON:DOM FREQ deletes all currently existing limit lines, then sets all limit lines to be specified in terms of frequency.
Couplings	This 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.
Initial S/W Revision	A.02.00

### 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 key is pressed a prompt is placed on the screen that says "Please press Enter or OK key to delete all limits. Press ESC or Cancel to close this dialog." The deletion is only performed if you press OK or Enter; if so, after the deletion, the informational message "All Limits deleted" appears in the MSG line.

Key Path	<b>Meas Setup, Limits</b>
<b>Remote Command</b>	:CALCulate:LLINe:ALL:DELeTe
<b>Example</b>	:CALC:LLIN:ALL:DEL deletes all data for all limit lines.
Initial S/W Revision	A.02.00

### 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.

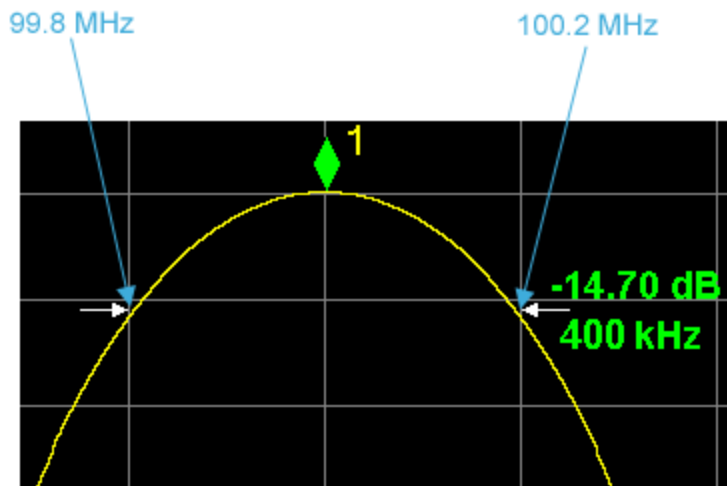
See "[N dB Points Results Queries](#)" on page 537.

See "More Information" on page 538.

Key Path	Meas Setup
Remote Command	:CALCulate:BWIDth BANDwidth:NDB <rel_ampl> :CALCulate:BWIDth BANDwidth:NDB? :CALCulate:BWIDth BANDwidth[:STATe] OFF ON 0 1 :CALCulate:BWIDth BANDwidth[:STATe]?
Notes	If the selected marker is turned <b>Off</b> it turns off N dB Points. N DB Points is unaffected by Auto Couple
Preset	Off, -3.01 dB OFF
Preset	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
Backwards Compatibility Notes	In ESA, N dB points paid attention to the peak excursion and peak threshold set in the Search Criteria menu under Peak Search. This is not the case in the X-Series. In ESA, an invalid N dB reading was indicated, both onscreen and remotely, with a value of -100. In the X-Series it is indicated on screen by --- but remotely still by -100 Hz
Initial S/W Revision	Prior to A.02.00

### N dB Points Results Queries

You can query the width of the N dB band as well as the right and left edges of the band. For example, for the signal shown below, the marker is at 100 MHz and each graticule division represents 200 kHz. The N dB value is -14.7 dB and this makes the width of the NdB band 400 kHz. The frequencies at the left and right edge of the N dB band are as shown, 99.8 MHz and 100.2 MHz:



The following queries return the following values:

CALC:BAND:RES? 400 kHz

CALC:BAND:RLEF? 99.8 MHz

CALC:BAND:RRIG? 100.2 MHz

<b>Remote Command</b>	:CALCulate:BWIDth BANDwidth:RESult?
<b>Example</b>	:CALC:MARK:AOff Set selected marker to 1 :CALC:MARK:MAX Put marker 1 on peak :CALC:BWID ON Turn on N dB for the selected marker (1) :CALC:BWID:NDB-3.01 Set the offset to -3.01 dB :CALC:BWID:RES? Query the result
Notes	-100 returned if invalid reading
Initial S/W Revision	Prior to A.02.00

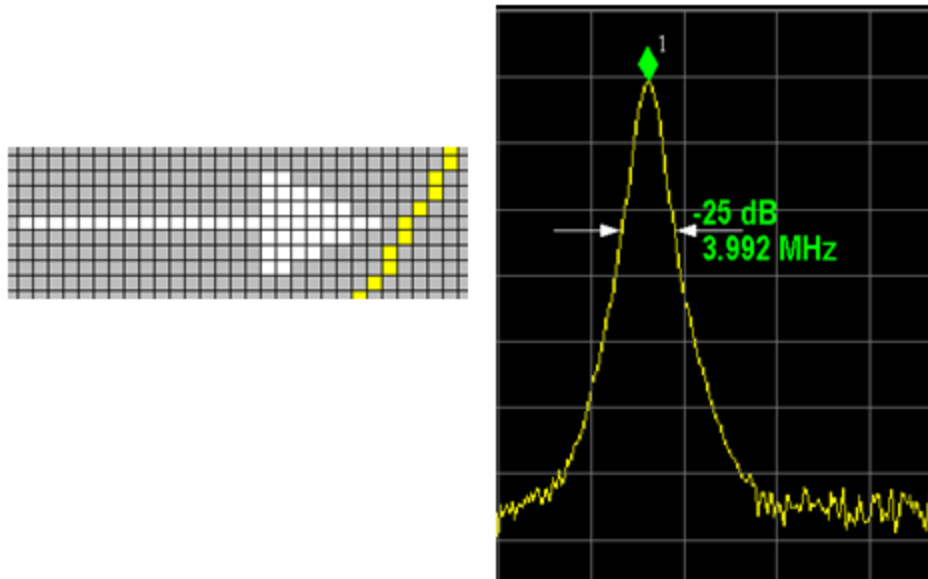
<b>Remote Command</b>	:CALCulate:BWIDth BANDwidth:RLEFt?
<b>Example</b>	:CALC:BWID:RLEF? Return the leftmost X Axis value for the N dB band
Notes	-100 returned if invalid reading
Initial S/W Revision	Prior to A.17.00

<b>Remote Command</b>	:CALCulate:BWIDth BANDwidth:RRIGht?
<b>Example</b>	:CALC:BWID:RRIG? Return the rightmost X Axis value for the N dB band
Notes	-100 returned if invalid reading
Initial S/W Revision	Prior to A.17.00

## 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. There is one pixel between the arrow and the trace



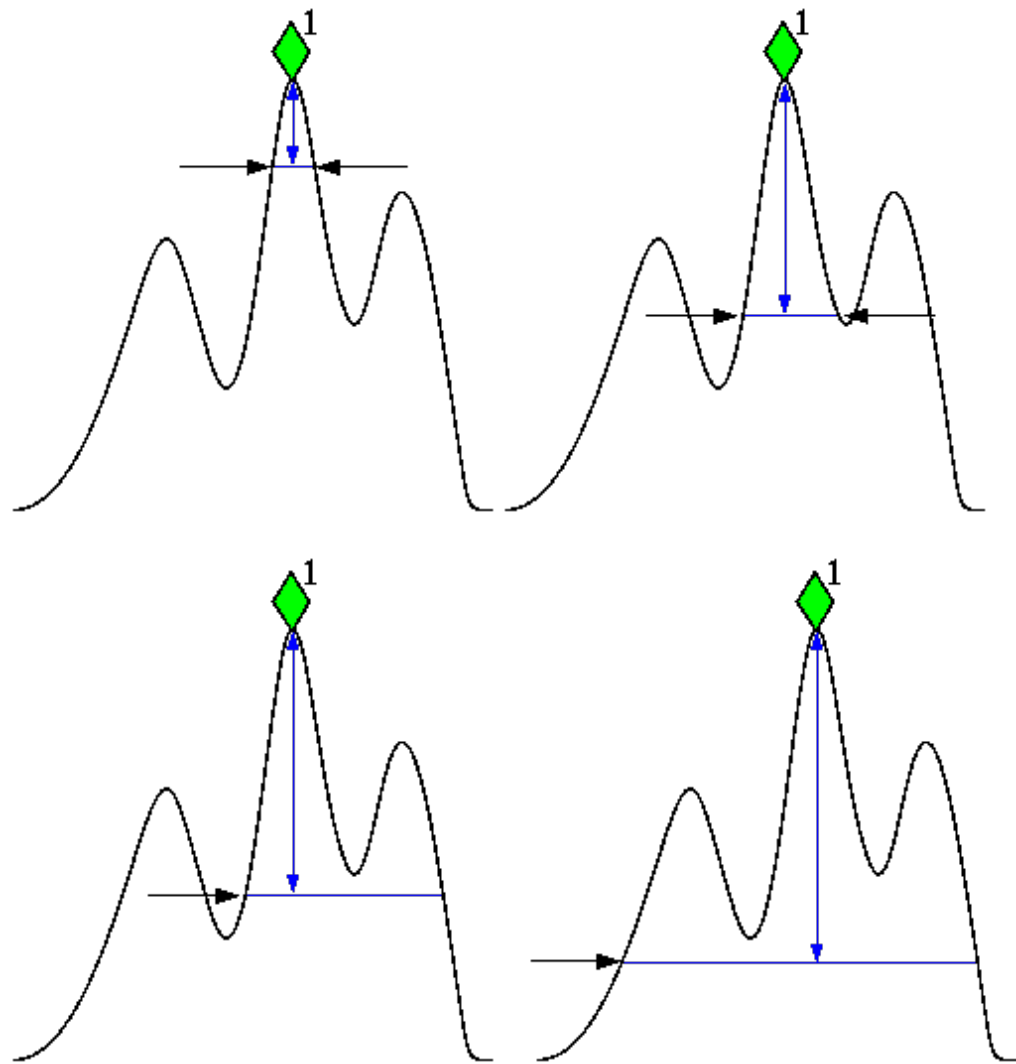
N dB Points can be used to measure the bandwidth of a signal; it is commonly used in conjunction with a tracking generator to measure filter bandwidths.

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.

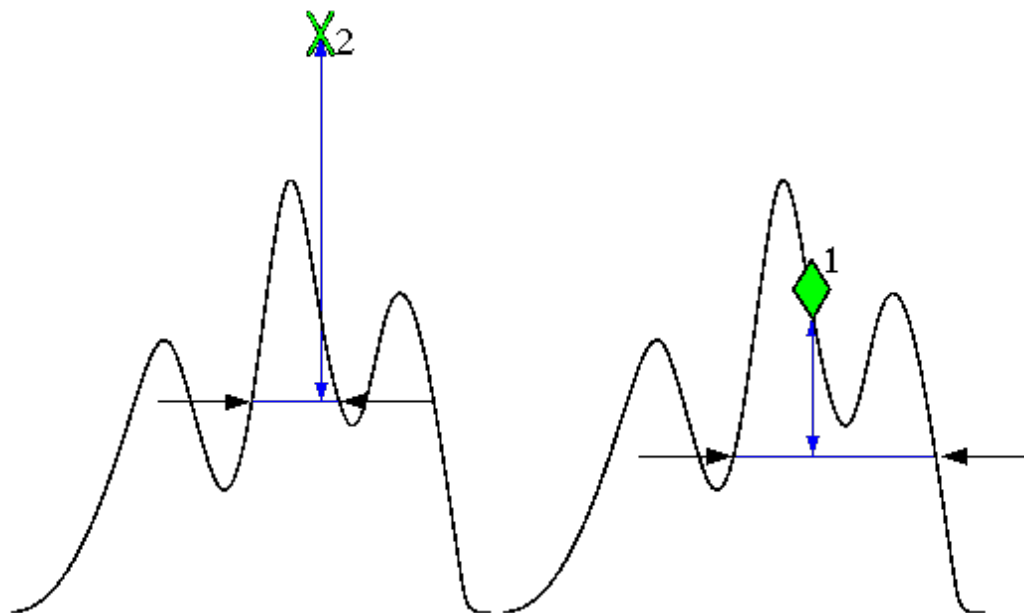
If the analyzer is unable to find data that is N dB below the marker on either side of the marker, the arrows are displayed at the indicator point of the marker, no value (--) will be displayed as the result and -100 Hz returned remotely (see figure below):



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.







### PhNoise Opt

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

See ["More Information" on page 543](#)

Path	Meas Setup
<b>Remote Command</b>	[ :SENSe ] :FREQuency :SYNThesis [ :STATe ] 1   2   3   4   5 [ :SENSe ] :FREQuency :SYNThesis [ :STATe ] ?
<b>Example</b>	FREQ:SYNT 2    selects optimization for best wide offset phase noise
Range	All but EPO: Best Close-In Best Wide-Offset Fast Tuning EPO: Best Close-In Best Wide-Offset Fast Tuning Balanced Best Spurs
Range (Long Form)	No EPx option: Best Close-In $\Phi$ Noise [offset < 20 kHz] Best Wide-Offset $\Phi$ Noise [offset > 30 kHz] Fast Tuning [same as Close-in] EPO: Best Close-In $\Phi$ Noise [offset < 600 kHz] Balance Noise & Spurs [offset < 600 kHz]

---

Best Spurs  
[offset < 600 kHz]  
Best Wide-Offset  $\Phi$  Noise  
[offset > 800 kHz]  
Fast Tuning  
EP1:  
Best Close-In  $\Phi$  Noise  
[offset < 140 kHz]  
Best Wide-Offset  $\Phi$  Noise  
[offset > 160 kHz]  
Fast Tuning  
[single loop]  
EP2 & EP3:  
Best Close-In  $\Phi$  Noise  
[offset < 70 kHz]  
Best Wide-Offset  $\Phi$  Noise  
[offset > 100 kHz]  
Fast Tuning  
[medium loop bw]  
EP4:  
Best Close-In  $\Phi$  Noise  
[offset < 90 kHz]  
Best Wide-Offset  $\Phi$  Noise  
[offset > 130 kHz]  
Fast Tuning  
[same as Close-in]

---

## Notes

Parameter:

- 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.
- 2: optimizes phase noise for wide frequency offsets from the carrier.
- 3: optimizes LO for tuning speed
- 4: In instruments with EP0, balances close-in phase noise with spur avoidance. In instruments without EP0 this setting is accepted but no action taken.
- 5: In instruments with EP0, emphasizes spur avoidance with close-in phase noise performance. In instruments without EP0 this setting is accepted but no action taken.
- The actual behavior varies somewhat depending on model number and option; you always get fast tuning by choosing #3, but in some models, the “Fast Tuning” choice is identical to the “Best Close-In” choice. Specifically:
- Models with option EP0 (for example UXA), have a two stage local oscillator, which switches to a single loop for fast tuning
  - Models with option EP1 (for example PXA), have a two-loop local oscillator, which
-

	switches to a single loop for fast tuning
	<ul style="list-style-type: none"> <li>- Models with option EP2 (available, for example, for MXA), 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 Close-In; this is useful when you have to look across a wide range of spans</li> <li>- In all other cases, Fast Tuning is the same as Best Close-In.</li> </ul>
Dependencies	Does not appear in all models. The key is blank in those models, but the SCPI command is accepted for compatibility (although no action is taken).
Preset	Because this function is in Auto after preset, and because Span after preset > 314.16 kHz (see Auto rules, next section) the state of this function after Preset will be 2
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.15.00
<hr/>	
Path	Meas Setup, PhNoise Opt
<b>Remote Command</b>	<code>[ :SENSe]:FREQuency:SYNTHeSis:AUTO[:STATe] OFF ON 0 1</code> <code>[ :SENSe]:FREQuency:SYNTHeSis:AUTO[:STATe]?</code>
<b>Example</b>	FREQ:SYNT:AUTO ON
Preset	ON
State Saved	Saved in instrument state.
Initial S/W Revision	Prior to A.02.00

### More Information

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.

Here is detail about the various settings you can choose:

- ["Auto " on page 544](#)
- ["Best Close-in  \$\Phi\$  Noise" on page 544](#)
- ["Best Wide-offset  \$\Phi\$  Noise" on page 544](#)
- ["Fast Tuning" on page 545](#)
- ["Balance Noise and Spurs " on page 544](#)
- ["Best Spurs " on page 544](#)
- ["Phase Noise Optimization Auto Rules" on page 545](#)

## Auto

---

SCPI Example                   FREQ:SYNT:AUTO ON

---

Selects the LO (local oscillator) phase noise behavior to optimize dynamic range and speed for various instrument operating conditions. See "[Phase Noise Optimization Auto Rules](#)" on page 545 for details on the Auto rules.

### Best Close-in $\Phi$ Noise

---

SCPI Example                   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 analyzers this annotation appears as [offset <20 kHz]

In instruments with Option EPO, the LO is configured for the best possible phase noise at offsets up to 600 kHz from the carrier, regardless of spurious products that occur with some center frequencies.

### Balance Noise and Spurs

---

SCPI Example                   FREQ:SYNT 4

---

In instruments with EPO, 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  $\pm 1$  octave around 400 kHz offset. The spurs will always be below  $-70$  dBc.

### Best Spurs

---

SCPI Example                   FREQ:SYNT 5

---

In instruments with EPO, the LO is configured for better phase noise than the "Wide-Offset" case close to the carrier, but the configuration has 11 dB worse phase noise than the "Best Close-In" case mostly within  $\pm 1$  octave around 300 kHz offset. Spurs are even lower than in the "Balance Noise and Spurs" 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 $\Phi$ Noise

---

SCPI Example                   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 analyzers 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  $\pm 1$  octave around 400 kHz offset. The spurs will always be below  $-70$  dBc.

## Fast Tuning

---

SCPI Example

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” 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 the Best Spurs configuration. It is available with this “Fast Tuning” label to inform the user, and to make the user interface more consistent with other X-Series analyzer family members.

(In models whose hardware does not provide for a fast tuning option, the settings for Best Close-in  $\Phi$  Noise are used if Fast Tuning is selected. This gives the fastest possible tuning for that hardware set.)

## Phase Noise Optimization Auto Rules

The X-Series has several grades of LO that offer different configurations when in the Auto Mode.

- ["Models with Option EP0" on page 546](#) (available in UXA)
- ["Models with Option EP1" on page 546](#) (available in PXA)
- ["Models with Option EP2" on page 546](#) (available, for example, in MXA for excellent phase noise)
- ["Models with Option EP4" on page 547](#)(available in CXA for improved phase noise)

– "All other Models" on page 547

### Models with Option EP0

Auto will choose:

Balanced Noise and Spurs whenever:

Center frequency is  $< 699.9$  kHz

Otherwise, Auto will choose Fast Tuning whenever:

Span  $> 114.1$  MHz, or when

RBW  $> 800$  kHz

Otherwise, Auto will choose Best Wide-offset  $\Phi$  Noise whenever:

RBW  $> 290$  kHz, or when

Span  $> 4.2$  MHz

Otherwise, Auto will choose Balanced Noise and Spurs.

The RBW to be used in the calculations above is the equivalent  $-3$  dB bandwidth of the current RBW filter.

These rules apply whether in swept spans, zero span, or FFT spans.

### Models with Option EP1

Auto will choose:

Fast Tuning whenever:

Span  $> 44.44$  MHz, or when

RBW  $> 1.9$  MHz, or if

Source Mode is set to "Tracking"

otherwise Auto will choose Best Close in Phase Noise whenever:

Center frequency is  $< 195$  kHz, or when

CF  $\geq 1$  MHz and Span  $\leq 1.3$  MHz and RBW  $\leq 75$  kHz

otherwise, Auto will choose Best Wide-offset Phase Noise

The RBW to be used in the calculations above is the equivalent  $-3$  dB bandwidth of the current RBW filter.

These rules apply whether in swept spans, zero span, or FFT spans.

### Models with Option EP2

Auto will choose:

Best Close-in  $\Phi$  Noise whenever:

CF < 130 kHz , or when

CF > 12 MHz and Span < 495 kHz and RBW < 40 kHz

Otherwise, Auto will choose Fast Tuning whenever:

Span > 22 MHz, or when

RBW > 400 kHz, or when

CF ≤ 12 MHz and Span < 495 kHz and RBW < 23 kHz

Otherwise, Auto will choose Best Wide-offset  $\Phi$  Noise.

The RBW to be used in the calculations above is the equivalent -3 dB bandwidth of the current RBW filter.

These rules apply whether in swept spans, zero span, or FFT spans.

### **Models with Option EP4**

Auto will choose:

Fast Tuning whenever:

Span > 101 MHz or when

RBW > 1.15 MHz or if

Source Mode is set to “Tracking”

otherwise, Auto will choose Best Close in Phase Noise whenever:

CF is < 109 kHz or when

CF ≥ 4.95 MHz and Span ≤ 666 kHz and RBW < 28 kHz

Otherwise, Auto will choose Best Wide-offset  $\Phi$  Noise.

The RBW to be used in the calculations above is the equivalent -3 dB bandwidth of the current RBW filter.

These rules apply whether in swept spans, zero span, or FFT spans.

### **All other Models**

Auto will choose:

Fast Tuning whenever:

Span > 12.34 MHz, or when

RBW > 250 kHz, or if

Source Mode is set to “Tracking”

Otherwise, Auto will choose Best Close in Phase Noise whenever:

Center frequency is < 25 kHz, or when

CF ≥ 1 MHz and Span ≤ 141.4 kHz and RBW ≤ 5 kHz

Otherwise, Auto will choose Best Wide-offset Phase Noise

Note that in these models, the hardware does not actually provide for an extra-fast tuning option, so the settings for Fast Tuning are actually the same as Best Close-in, 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.

The RBW to be used in the calculations above is the equivalent  $-3$  dB bandwidth of the current RBW filter.

These rules apply whether in swept spans, zero span, or FFT spans.

## ADC Dither

Accesses the menu to control the ADC Dither function. The dither function 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.

Key Path	Meas Setup
<b>Remote Command</b>	[ :SENSe ] :ADC:DITHer [ :STATe ] OFF   ON   HIGH [ :SENSe ] :ADC:DITHer [ :STATe ] ?
<b>Example</b>	ADC:DITH:HIGH Sets the ADC dither setting to High ADC:DITH ON Sets the ADC dither setting to Medium In older instruments the "Medium" key was labeled "On" and the SCPI for this setting is NOT changing.
Dependencies	In some models, the "High" parameter is not available. In some instruments, the HIGH parameter is honored and the HIGH state set, and returned to a query, but the Medium dither level is actually used.
Preset	AUTO
<b>Backwards Compatibility SCPI</b>	The old command



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	[:SENSe]:ADC:DITHer AUTO is aliased to [:SENSe]:ADC:DITHer:AUTO[:STATe] ON; because of this, the [:SENSe]:ADC:DITHer function cannot be a true Boolean, so the query, [:SENSe]:ADC:DITHer? returns OFF or ON (not 1 or 0 like a true Boolean)
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

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### Auto

Sets the ADC dither to automatic. The analyzer 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 analyzer 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.

---

Key Path	<b>Meas Setup, ADC Dither</b>
<b>Remote Command</b>	[ :SENSe ] :ADC :DITHer :AUTO [ :STATe ] OFF   ON   0   1 [ :SENSe ] :ADC :DITHer :AUTO [ :STATe ] ?
<b>Example</b>	ADC:DITH:AUTO ON
Preset	ON
State Saved	Saved in instrument state
Readback	The "Auto" is underlined, and the readback value is whatever setting is auto-selected
Initial S/W Revision	Prior to A.02.00

---

### 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.

---

Key Path	<b>Meas setup, ADC Dither</b>
<b>Example</b>	ADC:DITH:ON
Readback	If manually selected, the readback is Medium, with the "Man" underlined
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

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## 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.

Key Path	<b>Meas setup, ADC Dither</b>
<b>Example</b>	ADC:DITH:OFF
Readback	If manually selected, the readback is Off, with the “Man” underlined.
Initial S/W Revision	Prior to A.02.00

## IF Gain

To take full advantage of the RF dynamic range of the analyzer, there is an added switched IF amplifier with approximately 10 dB of gain. When you can turn it on without overloading the analyzer, the dynamic range is always better with it on than off. The **IF Gain** key can be used to set the IF Gain function to High Gain (the extra 10 dB), or to Low Gain. These settings affect sensitivity and IF overloads.

Key Path	<b>Meas Setup</b>
<b>Remote Command</b>	[ :SENSe ] : IF : GAIN [ : STATE ] ON   OFF   1   0 [ :SENSe ] : IF : GAIN [ : STATE ] ?
<b>Example</b>	IF:GAIN ON
Couplings	If the start frequency of the instrument is less than 10 MHz, and you put IF Gain in Manual High, a warning condition is generated and remains in effect as long as this condition exists. The warning message is about a possible IF overload.
Preset	OFF
State Saved	Saved in instrument state.
Readback Line	High Gain (ON or 1 in SCPI) or Low Gain (OFF or 0 in SCPI)
Initial S/W Revision	A.13.00

## Auto

Activates the auto rules for IF Gain. This sets the IF Gain to its default value which is Low Gain (Off)

Key Path	<b>Meas setup</b>
<b>Remote Command</b>	[ :SENSe ] : IF : GAIN : AUTO [ : STATE ] OFF   ON   0   1 [ :SENSe ] : IF : GAIN : AUTO [ : STATE ] ?
<b>Example</b>	IF:GAIN:AUTO ON
Preset	ON
Initial S/W Revision	A.13.00

## Low Gain

Forces IF Gain to be off.

---

Key Path	<b>Meas Setup, IF Gain</b>
<b>Example</b>	IF:GAIN OFF
State Saved	Saved in instrument state.
Readback	Low Gain
Initial S/W Revision	A.13.00

---

### High Gain

Forces IF Gain to be on.

---

Key Path	<b>Meas Setup, IF Gain</b>
<b>Example</b>	IF:GAIN:SWEP ON
State Saved	Saved in instrument state.
Readback	High Gain
Initial S/W Revision	A.13.00

---

### Meas Preset

This key returns the Meas Local variables in the Real Time SA measurement to their preset values. The only exception is Limits On/Off, which is a persistent Meas Local variable. It will be set to Off by a Mode Preset but not by Meas Preset.

Meas Preset is only supported via the front panel. There is no SCPI command for Meas Preset.

---

Key Path	<b>Meas Setup</b>
Initial S/W Revision	A.13.00

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## Mode

See ["Mode" on page 224](#)

## Mode Preset

Returns the active mode to a known state.

Mode Preset does the following for the currently active mode:

- Aborts the currently running measurement.
- Brings up the default menu for the mode, with no active function.
- Sets measurement Global settings to their preset values for the active mode only.
- Activates the default measurement.
- Brings up the default menu for the mode.
- Clears the input and output buffers.
- Sets Status Byte to 0.

Mode Preset does not:

- Cause a mode switch
- Affect mode persistent settings
- Affect system settings
- See "[How-To Preset](#)" on page 554 for more information.

Key Path	Front-panel key
Remote Command	:SYSTem:PRESet
Example	:SYST:PRES
Notes	<p>*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.</p> <p>Clears all pending OPC bits. The Status Byte is set to 0.</p>
Couplings	A Mode Preset aborts the currently running measurement, activates the default measurement, and gets the mode to a consistent state with all of the default couplings set.
Backwards Compatibility Notes	<p>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.</p> <p>There is also no "Preset Type" as there is on the PSA. There is a green Mode Preset front-panel key that does a <b>Mode Preset</b> 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.</p> <p>The settings and correction data under the Input/Output front-panel key (examples: Input Z Corr,</p>

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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.

---

Initial S/W Revision      Prior to A.02.00

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## How-To Preset

The table below shows all possible presets, their corresponding SCPI commands and front-panel access (key paths). Instrument settings depend on the current measurement context. Some settings are local to the current measurement, some are global (common) across all the measurements in the current mode, and some are global to all the available modes. In a similar way, restoring the settings to their preset state can be done within the different contexts.

Auto Couple - is a measurement local key. It sets all Auto/Man parameter couplings in the measurement to Auto. Any Auto/Man selection that is local to other measurements in the mode will not be affected.

Meas Preset - is a measurement local key. Meas Preset resets all the variables local to the current measurement except the persistent ones.

Mode Preset - resets all the current mode's measurement local and measurement global variables except the persistent ones.

Restore Mode Defaults - resets ALL the Mode variables (and all the Meas global and Meas local variables), including the persistent ones.

Type Of Preset	SCPI Command	Front Panel Access
Auto Couple	:COUPle ALL	Auto Couple front-panel key
Meas Preset	:CONFigure: <Measurement>	Meas Setup Menu
Mode Preset	:SYSTem:PRESet	Mode Preset (green key)
Restore Mode Defaults	:INSTrument:DEFault	Mode Setup Menu
Restore All Mode Defaults	:SYSTem:DEFault MODes	System Menu; Restore System Default Menu
*RST	*RST	not possible (Mode Preset with Single)
Restore Input/Output Defaults	:SYSTem:DEFault INPut	System Menu; Restore System Default Menu
Restore Power On Defaults	:SYSTem:DEFault PON	System Menu; Restore System Default Menu
Restore Alignment Defaults	:SYSTem:DEFault ALIGn	System Menu; Restore System Default Menu
Restore Miscellaneous Defaults	:SYSTem:DEFault MISC	System Menu; Restore System Default Menu

Restore All System Defaults	:SYSTem:DEFault [ALL] :SYSTem:PRESet:PERsistent	System Menu; Restore System Default Menu
User Preset	:SYSTem:PRESet:USER	User Preset Menu
User Preset All Modes	:SYSTem:PRESet:USER:ALL	User Preset Menu
Power On Mode Preset	:SYSTem:PON:TYPE MODE	System Menu
Power On User Preset	:SYSTem:PON:TYPE USER	System Menu
Power On Last State	:SYSTem:PON:TYPE LAST	System Menu

### Preset Type (Remote Command Only)

As stated in the Backward Compatibility section, to be compatible with ESA/PSA the PRESet:TYPE command will be implemented as a no-op.

Mode	All
<b>Remote Command</b>	:SYSTem:PRESet:TYPE FACTory  MODE  USER :SYSTem:PRESet:TYPE?
<b>Example</b>	:SYST:PREs:TYPE FACT
Notes	This command is supported for backward compatibility only. It is a no-op which does not change the behavior of any preset operation.
Preset	This is unaffected by Preset but is set to Mode on a "Restore System Defaults->All"
State Saved	No
Initial S/W Revision	<b>Prior to A.02.00</b>

## Mode Setup

The Mode Setup menu is used to control functions that are independent of which measurement is currently running. In the RTSA mode, the only such functions are Restore Mode Defaults and Global Settings.

Key Path	<b>Front-panel key</b>
Initial S/W Revision	A.13.00

### Restore Mode Defaults

Resets the state for the currently active mode by resetting the mode persistent settings to their factory default values, clearing mode data and by performing a Mode Preset. This function will never cause a mode switch. This function performs a full preset for the currently active mode; whereas, Mode Preset performs a partial preset. Restore Mode Defaults does not affect any system settings. System settings are reset by the Restore System Defaults function. This function does reset mode data; as well as settings.

Key Path	<b>Mode Setup</b>
<b>Remote Command</b>	<b>:INSTrument:DEFault</b>
<b>Example</b>	:INST:DEF
Notes	Clears all pending OPC bits. The Status Byte is set to 0. A message comes up saying: "If you are sure, press key again".
Couplings	A Restore Mode Defaults will cause 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.
Initial S/W Revision	Prior to A.02.00

### Global Settings

Opens a menu that allows you to switch certain Meas Global parameters to a Mode Global state. These switches apply to all Modes that support global settings. No matter what Mode you are in when you set the "Global Center Frequency" switch to on, it applies to all Modes that support Global Settings.

Key Path	<b>Mode Setup</b>
Initial S/W Revision	Prior to A.02.00

### Global Center Freq

The software maintains a Mode Global value called "Global Center Freq".

When the **Global Center Freq** key is switched to **On** in any mode, the current mode's center frequency is copied into the Global Center Frequency, and from then on all



modes that support global settings use the Global Center Frequency. So you can switch between any of these modes and the Center Freq will remain unchanged.

Adjusting the Center Freq of any mode which supports Global Settings, while **Global Center Freq is On**, will modify the Global Center Frequency.

When **Global Center Freq** is turned **Off**, the Center Freq of the current mode is unchanged, but now the Center Freq of each mode is once again independent.

When **Mode Preset** is pressed while **Global Center Freq** is **On**, the Global Center Freq is preset to the preset Center Freq of the current mode.

This function is reset to Off when the Restore Defaults key is pressed in the Global Settings menu, or when **System, Restore Defaults, All Modes** is pressed.

Key Path	<b>Mode Setup, Global Settings</b>
Scope	Mode Global
<b>Remote Command</b>	<b>:INSTrument:COUPle:FREQuency:CENTer ALL NONE</b> <b>:INSTrument:COUPle:FREQuency:CENTer?</b>
<b>Example</b>	INST:COUP:FREQ:CENt ALL INST:COUP:FREQ:CENt?
Preset	Set to Off on Global Settings, Restore Defaults and System, Restore Defaults, All Modes
Range	On Off
Initial S/W Revision	Prior to A.02.00

<b>Remote Command</b>	<b>:GLOBal:FREQuency:CENTer[:STATe] 1 0 ON OFF</b> <b>:GLOBal:FREQuency:CENTer[:STATe]?</b>
Preset	Off
Initial S/W Revision	Prior to A.02.00

### Restore Defaults

This key resets all of the functions in the Global Settings menu to Off. This also occurs when **System, Restore Defaults, All Modes** is pressed.

Key Path	<b>Mode Setup, Global Settings</b>
<b>Remote Command</b>	<b>:INSTrument:COUPle:DEFault</b>
<b>Example</b>	INST:COUP:DEF
<b>Backwards Compatibility SCPI</b>	<b>:GLOBal:DEFault</b>
Initial S/W Revision	Prior to A.02.00

## Peak Search

Pressing the Peak Search key displays the Peak Search menu and places the selected marker on the trace point with the maximum y-axis value for that marker's trace. The Peak Search features allow you to define specific search criteria to determine which signals can be considered peaks, excluding unwanted signals from the search.

### NOTE

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.

See "[More Information](#)" on page 558.

Key Path	Front-panel key
<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 12:MAXimum
<b>Example</b>	CALC:MARK2:MAX performs a peak search using marker 2. CALC:MARK2:Y? queries the marker amplitude (Y-axis) value for marker 2. CALC:MARK2:X? queries the marker frequency or time (X-axis) value for marker 2. SYST:ERR? can be used to query the errors to determine if a peak is found. The message "No peak found" will be returned after an unsuccessful search.
Notes	Sending this command selects the subopcoded marker.
Initial S/W Revision	Prior to A.02.00

## More Information

The behavior of a Peak Search is dependent on settings under the Peak Criteria softkey on the second page of the menu. If **Same as "Next Peak" Criteria** is selected, and either **Pk Excursion** or **Pk Threshold** are on, a signal must meet those criteria to 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 Peak Search menu. Then go to the other menus that you need to access. Finally, you can get back to the Peak Search key menu by using the front panel Return key and pressing it as many times as

required to navigate back through the previously accessed menus until you get back to the Peak Search menu.

## Next Peak

Pressing Next Peak moves the selected marker to the peak that has the next highest amplitude less than the marker's current value. Only peaks which meet all enabled peak criteria are considered. If there is no valid peak lower than the current marker position, a "No peak found" message is generated and the marker is not moved.

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

Key Path	<b>Peak Search</b>
<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 12:MAXimum:NEXT
<b>Example</b>	CALC:MARK2:MAX:NEXT Selects marker 2 and moves it to the peak that is closest in amplitude to the current peak, but the next lower value.
Notes	Sending this command selects the subopcoded marker.
State Saved	Not part of saved state.
Initial S/W Revision	Prior to A.02.00

## Next Pk Right

Pressing Next Pk Right moves the selected marker to the nearest peak right of the current marker that meets all enabled peak criteria. If there is no valid peak to the right of the current marker position, a "No peak found" message is generated and the marker is not moved.

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

Key Path	<b>Peak Search</b>
<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 12:MAXimum:RIGHT
<b>Example</b>	CALC:MARK2:MAX:RIGH Selects marker 2 and moves it to the next peak to the right of the current marker position.
Notes	Sending this command selects the subopcoded marker.
State Saved	Not part of saved state.
Initial S/W Revision	Prior to A.02.00

## Next Pk Left

Pressing Next Pk Left moves the selected marker to the nearest peak left of the current marker that meets all enabled peak criteria. If there is no valid peak to the left of the current marker position, a "No peak found" message is generated and the marker is not moved.

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

Key Path	<b>Peak Search</b>
<b>Remote Command</b>	<b>:CALCulate:MARKer[1] 2 ... 12:MAXimum:LEFT</b>
<b>Example</b>	CALC:MARK2:MAX:LEFT selects marker 2 and moves it to the next peak to the left of the current marker position.
State Saved	Not part of saved state.
Initial S/W Revision	Prior to A.02.00

## Marker Delta

Performs the same function as the Delta 1-of-N selection key in the Marker menu. Basically this sets the control mode for the selected marker to Delta mode. See the Section ["Marker" on page 778](#) for the complete description of this function. The key is duplicated here in the Peak Search Menu to allow you to conveniently perform a peak search and change the marker's control mode to Delta without having to access two separate menus.

Key Path	<b>Peak Search or Marker</b>
Notes	Whenever the selected marker is in Delta mode and you are in the Peak Search menu, the Marker Delta key should be highlighted and the active function for setting its delta value turned on.
Initial S/W Revision	Prior to A.02.00

## Mkr->CF

Assigns the selected marker's frequency to the Center Frequency setting. See the Section ["Marker To" on page 796](#) for the description of this function. The key is duplicated here in the Peak Search Menu to allow you to conveniently perform a peak search and marker to CF without having to access two separate menus.

Key Path	<b>Peak Search or Marker -&gt;</b>
Dependencies	Same as specified under Marker To
Initial S/W Revision	Prior to A.02.00

## Mkr->Ref Lvl

Assigns the selected marker's level to the Reference Level setting. See the Section ["Marker To" on page 796](#) for the description of this function. The key is duplicated here in the Peak Search Menu to allow you to conveniently perform a peak search and marker to RL without having to access two separate menus.

Key Path	<b>Peak Search or Marker -&gt;</b>
Dependencies	Same as specified under Marker To
Initial S/W Revision	Prior to A.02.00

## Peak Criteria

Pressing this key opens the Peak Criteria menu and allows you to adjust the Pk Threshold and Pk Excursion parameters used for peak search functions.

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.

Key Path	<b>Peak Search</b>
Backwards Compatibility Notes	In the ESA, this menu was called Search Criteria; in the PSA, it was called Search Param. The menu structure in X-Series is different (for clarity) but the functionality is essentially the same. Basically, the Peak Excursion and Peak Threshold keys appeared at the top level of this menu in the PSA/ESA, whereas in the X-Series they are one level down under “Next Peak” Criteria
Initial S/W Revision	Prior to A.02.00

### “Peak Search” Criteria

This menu lets you decide what kind of search you want to do when the Peak Search key is pressed (or the equivalent SCPI command sent).

Note that there are two “types” of peak search functions. One type is the “Peak Search” type, the other type is the “Next Peak” type. “Next Peak” searches (for example, Next Peak, Next Pk Left, Next Pk Right) are always checked using the Excursion and Threshold criteria as long as these criteria are On. The “Peak Search” type of search, simply finds the highest point on the trace. However you can change the “Peak Search” type of search 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.

When **Highest Peak** is selected, pressing **Peak Search** simply finds the highest peak on the marker’s trace. If **Same as “Next Peak” Criteria** is selected, then the search is also forced to consider the Excursion and Threshold found under the “**Next Peak**” **Criteria** menu.

Key Path	<b>Peak Search, Peak Criteria</b>
Remote Command	:CALCulate:MARKer:PEAK:SEARch:MODE MAXimum PARAmeter

<b>:CALCulate:MARKer:PEAK:SEARch:MODE?</b>	
Notes	MAXimum corresponds to the <b>Highest Peak</b> setting PARameter corresponds to the <b>Same as “Next Peak” Criteria</b> setting
Preset	MAXimum
State Saved	Saved in instrument state.
Readback line	Current state
Backwards Compatibility Notes	The submenu called “Peak Search” Criteria in the X-Series was called Peak Search Type in the ESA, and in the PSA was not a submenu but a single called Peak Search with a toggle between Param and Max.  Nonetheless, the functionality and SCPI commands are identical in all three, only the structure of the user interface is different
Initial S/W Revision	Prior to A.02.00

### Highest Peak

When this key is selected, pressing the Peak Search key or issuing the equivalent SCPI command finds the maximum point on the trace, subject to the peak-search qualifications. This also affects the Peak Search half of Pk-Pk search and the Continuous Peak Search.

Key Path	<b>Peak Search, Peak Criteria, “Peak Search” Criteria</b>
<b>Example</b>	CALC:MARK:PEAK:SEAR:MODE MAX
Readback	Highest Peak
Initial S/W Revision	Prior to A.02.00

### Same as “Next Peak” Criteria

When this key is selected, pressing the Peak Search key or issuing the equivalent SCPI command finds the maximum point on the trace, but subject to the Excursion and Threshold set under the Next Peak Criteria menu. The search is, of course, also subject to the peak-search qualifications. This also affects the Peak Search half of Pk-Pk search and the Continuous Peak Search.

Key Path	<b>Peak Search, Peak Criteria, “Peak Search” Criteria</b>
<b>Example</b>	CALC:MARK:PEAK:SEAR:MODE PAR
Readback	Use Excurs & Thr
Initial S/W Revision	Prior to A.02.00

### “Next Peak” Criteria

This key opens up a menu which allows you to independently set the Peak Excursion and Peak Threshold and turn them on and off.

Key Path	<b>Peak Search, Peak Criteria</b>
Backwards	In the X-Series, you can enable <b>Pk Excursion</b> and <b>Pk Threshold</b> independently, but they default to

Compatibility Notes	“both on”. Since “both on” is always the case in ESA and PSA, this difference should not cause code compatibility problems.
Initial S/W Revision	Prior to A.02.00

### Pk 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 564](#).

Key Path	Peak Search, Peak Criteria, “Next Peak” Criteria
Remote Command	:CALCulate:MARKer:PEAK:EXCursion <rel_amp1> :CALCulate:MARKer:PEAK:EXCursion? :CALCulate:MARKer:PEAK:EXCursion:STATE OFF ON 0 1 :CALCulate:MARKer:PEAK:EXCursion:STATE?
Example	:CALC:MARK:PEAK:EXC:STAT ON :CALC:MARK:PEAK:EXC 30 DB sets the minimum peak excursion requirement to 30 dB
Dependencies	Available only when Y axis unit is amplitude units, otherwise grayed out.
Couplings	Whenever you adjust the value of Pk Excursion (with the knob, step keys, or by completing a numeric entry), and Peak Threshold is turned ON, the Peak Threshold Line and the Peak Excursion Region are displayed.
Preset	6.0 dB ON
Preset	6.0 dB ON
State Saved	Saved in instrument state
Min	0.0 dB
Max	100.0 dB
Initial S/W Revision	Prior to A.02.00

## 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.

## Pk 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.

Key Path	Peak Search, Peak Criteria, "Next Peak Criteria"
Remote Command	:CALCulate:MARKer:PEAK:THReshold <amp1> :CALCulate:MARKer:PEAK:THReshold? :CALCulate:MARKer:PEAK:THReshold:STATe OFF ON 0 1 :CALCulate:MARKer:PEAK:THReshold:STATe?
Example	CALC:MARK:PEAK:THR:STAT ON turns on the threshold criterion. CALC:MARK:PEAK:THR -60 dBm sets the threshold to $-60$ dBm.
Dependencies	When Ref Level Offset changes, Peak Threshold must change by the same amount.
Preset	$-90.0$ dBm ON
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.
Default Unit	depends on the current selected Y axis unit
Initial S/W Revision	Prior to A.02.00

### Pk Threshold Line

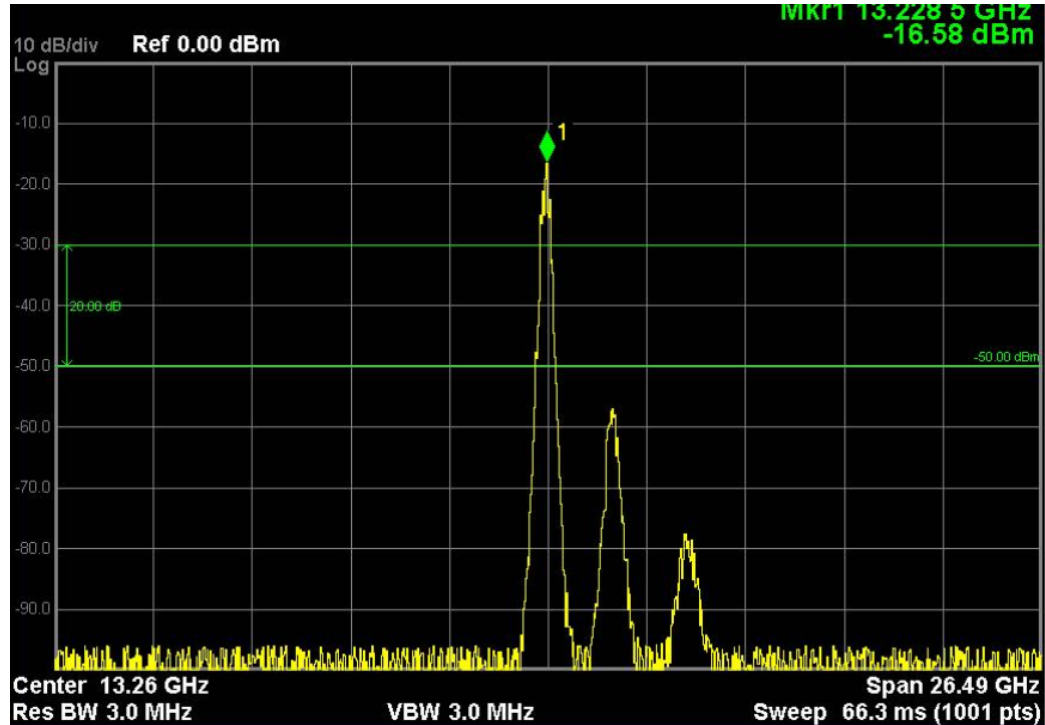
Turns the peak threshold line on or off. Preset state is off. No equivalent SCPI command.

See ["More Information" on page 565](#).

Key Path	Peak Search, Peak Criteria, "Next Peak" Criteria
Initial S/W Revision	Prior to A.02.00

### More Information

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.



This function is automatically set to 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 to 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.

## Peak Table

Opens the Peak Table menu.

The Peak Table provides a displayed list of up to 20 signal peaks from the selected trace. If more than one trace window is displayed, the selected trace in the selected window is used. If there are more than 20 signals which meet the peak search criteria, only the 20 highest peaks are listed.

The Peak Table is updated after each sweep. The list of peaks in the Peak Table can be ordered either by ascending frequency or by descending amplitude. In either case, the entire trace is first evaluated and the 20 highest peaks are selected for inclusion in the list. After the peaks are selected, they are then sorted and displayed according to the Peak Sort setting.

Key Path	<b>Peak Search</b>
Initial S/W Revision	Prior to A.02.00

### Peak Table On/Off

Turns Peak Table on/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.

Key Path	<b>Peak Search, Peak Table</b>
<b>Remote Command</b>	:CALCulate:MARKer:PEAK:TABLE:STATE OFF ON 0 1 :CALCulate:MARKer:PEAK:TABLE:STATE?
<b>Example</b>	CALC:MARK:PEAK:TABL:STAT ON Turns on and displays the peak table.
Dependencies	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.
Initial S/W Revision	Prior to A.02.00

### Peak Sort

Sets the peak table sorting routine to list the peaks in order of descending amplitude, ascending frequency or descending “Delta to Limit” value. The remote command can also be used to sort the peaks found using the :CALCulate:DATA:PEAKs command.

Key Path	<b>Peak Search, Peak Table</b>
<b>Remote Command</b>	:CALCulate:MARKer:PEAK:SORT FREQuency AMPLitude DELTA :CALCulate:MARKer:PEAK:SORT?
<b>Example</b>	CALC:MARK:PEAK:SORT AMPL Sets sorting routine to list peaks in order of descending

	amplitude. CALC:MARK:PEAK:SORT?
Preset	AMPLitude
State Saved	Saved in instrument state.
<b>Backwards Compatibility SCPI</b>	<b>:TRACe:MATH:PEAK:SORT</b> for ESA backward compatibility.
Backwards Compatibility Notes	In the ESA, when Peak Sort was set to ascending frequency, the Peak Table search algorithm would search left to right, including every peak which met the search criteria until the table was full, even if that meant only part of the trace was searched. In the X-Series, the sort is done correctly, sorting the top 20 peaks by ascending frequency.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.18.00

### Peak Readout

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

**All (ALL)** - lists all the peaks defined by the peak criteria, in the current sort setting.

**Above Display Line (GTDLine)** - lists the peaks that are greater than the defined display line, and that meet the peak criteria. They are listed in the current sort order.

**Below Display Line (LTDLine)** - lists the peaks that are less than the defined display line, and that meet the peak criteria. They are listed in the current sort order.

If the peak threshold is defined and turned on, then the peaks must meet this peak criteria in addition to the display line requirements.

See "[More Information](#)" on page 568.

Key Path	<b>Peak Search, Peak Table</b>
<b>Remote Command</b>	<b>:CALCulate:MARKer:PEAK:TABLE:READout ALL GTDLine LTDLine</b> <b>:CALCulate:MARKer:PEAK:TABLE:READout?</b>
<b>Example</b>	CALC:MARK:PEAK:TABL:READ GTDL
Dependencies	Turning Display Line off forces Readout to ALL
Preset	All
Preset	All
State Saved	Saved in instrument state.
Readback line	1-of-N selection
Backwards Compatibility Notes	In ESA the display line does not have to be on for a peak to be qualified "above display line" or "below display line." In X-Series the display line has to be on to be used to exclude peaks.
Initial S/W Revision	Prior to A.02.00

### More Information

If the Display Line (see the Section “View/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 Figures 1–2 and 1–3 to understand what happens if both Display Line and Pk Threshold are turned on.

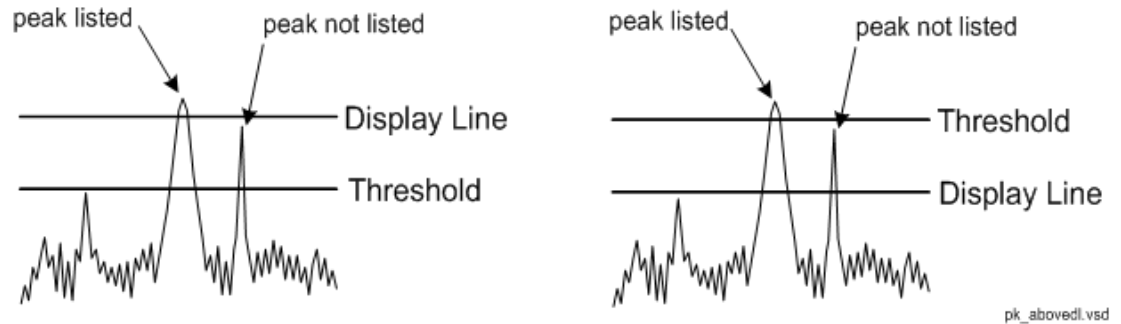


Figure 1- 2 Above Display Line Peak Identification

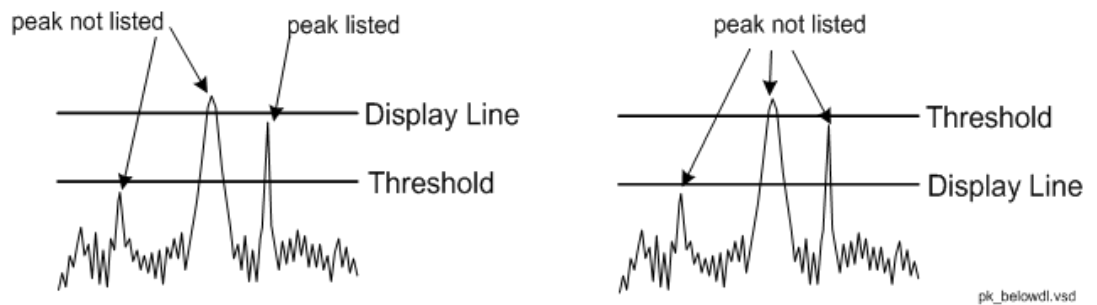


Figure 1- 3Below Display Line Peak Identification

### All

Sets the peak table to display the 20 highest peaks in the order specified by the current Peak Sort setting. If the Peak Criteria are turned on, then only peaks that meet the defined Pk Excursion and Pk Threshold values will be found.

Key Path	<b>Peak Search, Peak Table, Peak Readout</b>
<b>Example</b>	CALC:MARK:PEAK:TABL:READ ALL
Notes	Auto return after pressed
Readback	All
Initial S/W Revision	Prior to A.02.00

### Above Display Line

Sets the peak table to display only the 20 highest peaks above the display line in the order specified by the current Sort setting. If the Peak Criteria are turned on, then only peaks that meet the defined criteria will be found. If the display line is not already on, it is turned on (it has to be on or it cannot be used to exclude peaks).

Key Path	<b>Peak Search, Peak Table, Peak Readout</b>
<b>Example</b>	CALC:MARK:PEAK:TABL:READ GTDL
Notes	Auto return after pressed
Dependencies	When Above Display Line is selected, Display Line is turned on and becomes the active function.
Readback	Above DL
Initial S/W Revision	Prior to A.02.00

### Below Display Line

Sets the peak table to display only the 20 highest peaks below the display line as defined by the peak in the order specified by the current Sort setting. If the Peak Criteria are turned on, then only peaks that meet the defined criteria will be found. If the display line is not already on, it is turned on (it has to be on or it cannot be used to exclude peaks).

Key Path	<b>Peak Search, Peak Table, Peak Readout</b>
<b>Example</b>	CALC:MARK:PEAK:TABL:READ LTDL
Notes	Auto return after pressed
Dependencies	When Below Display Line is selected, Display Line is turned on and becomes the active function.
Readback	Below DL
Initial S/W Revision	Prior to A.02.00

### Δ to Limit On/Off

Turns the Δ to Limit column on and off in the Peak Table.

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

The Limit to use for this column is specified using the Delta to Limit Line key.

Key Path	<b>Peak Search, Peak Table</b>
<b>Remote Command</b>	:CALCulate:MARKer:PEAK:TABLE:DTLimit LLINE1 LLINE2 LLINE3 LLINE4 LLINE5 LLINE6 :CALCulate:MARKer:PEAK:TABLE:DTLimit?  :CALCulate:MARKer:PEAK:TABLE:DTLimit:STATE ON OFF :CALCulate:MARKer:PEAK:TABLE:DTLimit:STATE?
<b>Example</b>	CALC:MARK:PEAK:TABL:DTL:STAT ON CALC:MARK:PEAK:TABL:DTL LLINE1
Preset	LLINE1

	OFF
Initial S/W Revision	A.18.00
Control Type	Toggle
Control Name	$\Delta$ to Limit

### $\Delta$ to Limit Line

Selects the Limit to be used for the  $\Delta$  to Limit column in the Peak Table.

(For the SCPI command, see  $\Delta$  to Limit On/Off)

Key Path	<b>Peak Search, Peak Table</b>
<b>Example</b>	CALC:MARK:PEAK:TABL:DTL:STAT ON
Initial S/W Revision	A.18.00
Control Type	1 of N
Control Name	$\Delta$ to Limit Line

## 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 571.

Key Path	<b>Peak Search</b>
<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 12:CPSearch[:STATE] ON OFF 1 0 :CALCulate:MARKer[1] 2 ... 12:CPSearch[:STATE]?
<b>Example</b>	CALC:MARK:CPS ON Turns on Continuous Peak Search.
Notes	Sending this command selects the subopcoded marker
Couplings	The Continuous Peak Search key is grayed out when the selected marker is a <b>Fixed</b> 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 key grayed out. <b>Signal Track</b> and <b>Continuous Peak Search</b> are mutually exclusive so if <b>Signal Track</b> is on, <b>Continuous Peak Search</b> 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.
Backwards Compatibility Notes	In ESA and PSA, the Continuous Pk function would only consider a peak within a small window relative to the marker's previous position, and thus was designed to track a signal drifting in frequency but with similar amplitude. The new Continuous Peak Search function simply performs a Peak Search operation after each sweep with no regard for the marker's previous position.

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Because of this difference, the SCPI commands for the old command (CPEak) is not accepted by the X-Series.

Also in ESA and PSA, Continuous Pk was grayed out when span equaled zero. The new Continuous Peak Search function will be available within zero span.

Also in ESA and PSA, turning Continuous Pk on would not automatically execute a peak search. A peak search would not be performed until the end of the next sweep. The new Continuous Peak Search function will perform a peak search when it is turned on, without waiting for the next sweep to complete.

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Initial S/W Revision

Prior to A.02.00

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### 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 analyzer 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 repeak 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 little “hat” is placed above the marker.



## Pk-Pk Search

Finds and displays the amplitude and frequency (or time, if in zero span) differences between the highest and lowest y-axis value. It places the selected marker on the minimum value on its selected trace. And it places that marker's reference marker on the peak of its selected trace. This function turns on the reference marker and sets its mode to **Fixed** 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.

Key Path	<b>Peak Search</b>
<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 12:PTPeak
<b>Example</b>	CALC:MARK:PTP CALC:MARK:Y? queries the delta amplitude value for marker 1.
Notes	Turns on the Marker $\Delta$ active function.
Notes	Sending this command selects the subopcoded marker.
Dependencies	Pk-Pk Search is grayed out when <b>Coupled Markers</b> is on.
Couplings	The selected marker becomes a delta marker if not already in delta mode.
State Saved	Not part of saved state.
Initial S/W Revision	Prior to A.02.00

## Min Search

Moves the selected marker to the minimum y-axis value on the current trace. Minimum (negative) peak searches do not have to meet the peak search criteria. It just looks for the lowest y-axis value. If the selected marker is Off, it is turned on before the minimum search is performed.

Key Path	<b>Peak Search</b>
<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 12:MINimum
<b>Example</b>	CALC:MARK:MIN Selects marker 1 and moves it to the minimum amplitude value.
Notes	Sending this command selects the subopcoded marker.
State Saved	Not part of saved state.
Initial S/W Revision	Prior to A.02.00



## Print

See ["Print" on page 251](#)

## 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 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	LLine_	(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.

If the filename you entered ends with \_dddd, where d=any number, 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.

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Key Path	Front-panel key
Notes	No remote command for this key specifically.
Initial S/W Revision	Prior to A.02.00

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## Recall

The **Recall** menu lets you choose what you want to recall, and where you want to recall it from. Among the types of files you can recall are **States and Traces**. In addition, an **Import (Data)** option lets you recall a number of data types stored in CSV files (as used by Excel and other spreadsheet programs).

The default paths for Recall are data type dependent and are the same as for the Save key.

Key Path	Front-panel key
Notes	<p>No remote command for this key specifically, but the :MMEM:LOAD command is available for specific file types. An example is :MMEM:LOAD:STATE &lt;filename&gt;.</p> <p>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.</p>
Backwards Compatibility Notes	<p>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.</p> <p>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.</p>
Backwards Compatibility Notes	<p>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.</p> <p>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.</p> <p>It may be appropriate to issue a warning if the state is limited on the recall; warnings do not go out to SCPI so this would only affect the manual user.</p> <p>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.</p>
Initial S/W Revision	Prior to A.02.00

## State

The **Recall State** menu lets you choose a register or file from which to recall the state.

The content of a state file includes all of the settings and data required to return the analyzer as closely as possible to the Mode it was in, with the exact settings that were in place, when the save occurred. The Mode settings in each state file include the settings that are affected by Mode Preset, as well as the additional settings affected by Restore Mode Defaults; all of the Mode's settings. In addition, all of the settings of the **Input/Output** system are included, even though they are outside of the Mode's state, because they are needed to restore the complete setup. Persistent System settings (for example, GPIB address) are not affected by either a Mode Preset or Restore Mode Defaults, nor are they included in a saved State 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.

After the recall completes, the message "File <filename> recalled" or "Recalled State Register <register number>" is displayed.

For rapid recalls, the State menu lists 16 registers that you can choose from to recall. Pressing a Register key initiates the recall. You can also select a file from which to recall.

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 the INST:SEL command (for example, SA for the Spectrum Analyzer).

See ["More Information" on page 578](#).

Key Path	<b>Recall</b>
Mode	All
<b>Remote Command</b>	:MMEMory:LOAD:STATe <filename>
<b>Example</b>	:MMEM:LOAD:STAT "myState.state" This recalls the file myState.state on the default path
<b>Example</b>	MMEM:LOAD:STAT "MyStateFile.state" This loads the state file data (on the default file directory path) into the instrument state.
Notes	When you pick a file to recall, the 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. <ul style="list-style-type: none"> <li>- 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.</li> </ul>

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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 analyzer exits the Recall menu and returns to the previous menu.

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**Backwards  
Compatibility SCPI**

:MMEMory:LOAD:STATE 1,<filename>

For backwards compatibility, the above syntax is supported. The "1" is simply ignored.

Initial S/W Revision

Prior to A.02.00

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### More Information

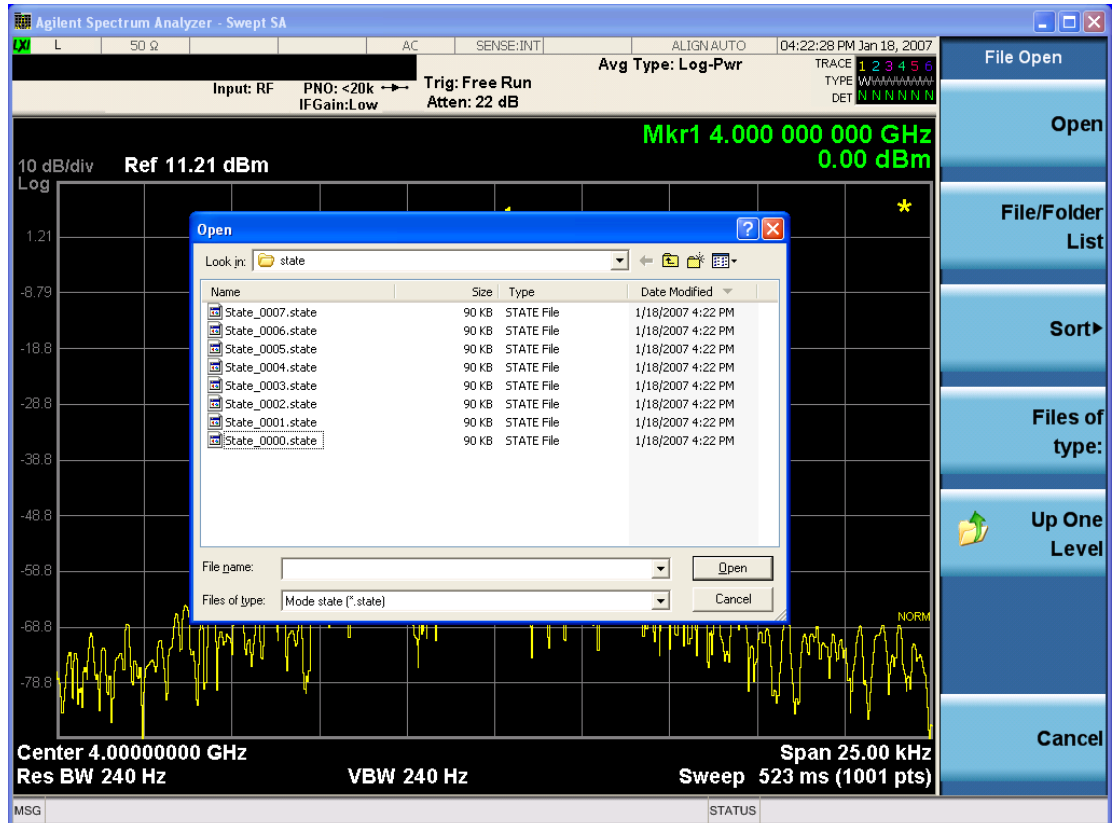
In measurements that support saving Traces, for example, Swept SA, the Trace data is saved along with the State in the State file. When recalling the State, the Trace data is recalled as well. Traces are recalled exactly as they were stored, including the writing mode and update and display modes. If 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.

## From File...

When you press “From File”, the analyzer brings up a Windows dialog and a menu entitled “File Open.” This menu allows you to navigate to the various fields in the Windows dialog without using a keyboard or mouse. The **Tab** and **Arrow** keys can also be used for dialog navigation.



Listed below are the functions of the various fields in the dialog, and the corresponding softkeys:

### Open

Performs the recall of the specified file. While the recall is being performed, the floppy icon appears briefly in the Meas bar.

### File/Folder List

Enables you to navigate to the center of the dialog that contains the list of files and folders. Once here you can get information about the file and use the tab keys to navigate to the other fields in the dialog, such as Look In.

### Look In

The **Look In** field shows the path from which the file will be recalled and allows you to change the path using the up and down arrow keys to navigate to other paths; the Enter key to open a directory; and the Backspace key to go back one directory. The **Look In** field first uses the last path from the Save As dialog **Save In:** path for that

same file type. There is no softkey for directly navigating to the Look In field, but you can use the left tab to get here from the File/Folder List.

User specified paths are remembered when you leave and return to a Mode and are reset back to the default using **Restore Mode Defaults**.

### Sort

Accesses a menu that enables you to sort the files within the File Open dialog. Only one sorting type can be selected at a time and the sorting happens immediately. The sorting types are **By Date**, **By Name**, **By extension**, and **By Size**.

### Files of Type

This field shows the file suffix for the type of file you have selected to recall. For example, if you navigated here while recalling State, "Mode state (\*.state)" is in the field. If you navigated here while recalling Trace, "Mode state (\*.trace)" is in the field. If you navigated here while importing a trace data file, "Trace Data (\*.csv)" is in the field. For some file types, there is more than one choice in the dropdown menu, which you can select by using the up and down arrow keys and Enter.

### Up One Level

This key corresponds to the icon of a folder with the up arrow that is in the tool bar of the dialog. When pressed, it causes the file and folder list to navigate up one level in the directory structure. The Backspace key does the same thing.

### Cancel

This key corresponds to the **Cancel** selection in the dialog. It causes the current **Open** request to be cancelled. The ESC key does the same thing.

Key Path	<b>Recall, State</b>
Notes	Brings up the Open dialog for recalling a State Save Type
Initial S/W Revision	Prior to A.02.00

## 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 save. To do this, press the **Edit Register Names** key, choose the register whose name you wish to edit, and then enter the desired label using the Alpha Editor or an external PC keyboard.

The maximum number of characters that can be added is 30. In most cases, 30 characters will fit on two lines of the key.

For more information and the SCPI command, see Edit Register Names under the **Save, State** function.

Key Path	<b>Recall, State</b>
Mode	All
Dependencies	N9060A-7FP or N9060B-2FP license required to edit the register names. When the feature is not



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	licensed, sending the SCPI command generates an error, -221, "Settings conflict;Option not available"
Initial S/W Revision	A.11.00

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### Register 1 thru Register 16

Selecting any one of these register keys causes the State of the mode from the specified Register to be recalled. Each of the register keys annotates whether it is empty or at what date and time it was last modified. In addition, you can use the **Edit Register Names** key under **Save, State** to enter custom names for each register.

Registers are shared by all modes, so recalling from any one of the registers will cause a mode switch to the mode that was active when the save to the Register occurred.

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.

After the recall completes, the message "Register <register number> recalled" appears in the message bar. 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.

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Key Path	<b>Recall, State</b>
<b>Example</b>	*RCL 1
Range	1-16 from front panel, 1-128 from SCPI
Readback	Date and time with seconds resolution are displayed on the key OR A custom name of up to 30 characters entered using the <b>Save, State,Edit Register Names</b> key OR “(empty)” if no prior save operation has been performed to this register.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	Prior to A.11.00

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### Register 1 thru Register 16

Selecting any one of these register keys causes the State of the mode from the specified Register to be recalled. Each of the register keys annotates whether it is empty or at what date and time it was last modified. In addition, you can use the **Edit Register Names** key under **Save, State** to enter custom names for each register.

Registers are shared by all modes, so recalling from any one of the registers will cause a mode switch to the mode that was active when the save to the Register occurred.

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.

After the recall completes, the message "Register <register number> recalled" appears in the message bar. 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.

Key Path	<b>Recall, State</b>
<b>Example</b>	*RCL 1
Range	1-16 from front panel, 1-128 from SCPI
Readback	Date and time with seconds resolution are displayed on the key OR A custom name of up to 30 characters entered using the <b>Save, State,Edit Register Names</b> key OR “(empty)” if no prior save operation has been performed to this register.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	Prior to A.11.00

## Trace

This key selects Trace as the data type to be imported. When pressed a second time, it brings up the Trace Menu, which lets you select the Trace into which the data will be imported.

The trace file contains “meta” data that describes the state of the analyzer when the trace was exported (see ["Trace File Contents" on page 926](#)). If the meta data in the file does not match the current SA state, the “invalid data indicator” (\*) is displayed.

Key Path	<b>Recall, Data</b>
<b>Remote Command</b>	:MMEMory:LOAD:TRACe:DATA TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6   TRACE7   TRACE8   TRACE9   TRACE10   TRACE11   TRACE12,<filename>
<b>Example</b>	:MMEM:LOAD:TRAC:DATA TRACE2, "myTrace2.csv" Imports the 2nd trace from the file myTrace2.csv in the current path. The default path is My Documents\RTSA\data\traces
Notes	TRACE1-TRACE6 corresponds to Spectrum Trace1-6 and TRACE7-TRACE12 corresponds to the Pvt Trace1-6.
Dependencies	For both Spectrum and Power vs Time 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 does not match the number of acquisition 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, <b>Trace Update</b> is always turned OFF for that trace and <b>Trace Display</b> is always turned ON.
Readback	Selected Trace
Status Bits/OPC dependencies	Sequential - aborts the current measurement.
Initial S/W Revision	A.13.00

### Trace Selection

These keys let you select which Trace to import the data into; TRACE1 – TRACE12. TRACE1–TRACE6 corresponds to Spectrum Trace1–6 and TRACE7–TRACE12 corresponds to the Pvt Trace1–6. The default is the currently selected trace, selected in this menu or in the Trace/Det, Export Data, Recall Trace, or Save Trace menus; except if you have chosen **All** then **All** remains chosen until you specifically change it to a single trace.

Once selected, the key returns back to the Import Data menu and the selected Trace number is annotated on the key. The next step is to select the Open key in the Import Data menu.

Key Path	<b>Recall, Data, Trace</b>
Notes	Auto return
Preset	not part of Preset, but is reset to TRACE1 by Restore Mode Defaults; survives shutdown
State Saved	The current trace number is saved in instrument state
Initial S/W Revision	A.13.00

### Data (Import)

Importing a data file loads data that was previously saved from the current measurement or from other measurements and/or modes that produce compatible data files. The Import Menu only contains Data Types that are supported by the current measurement.

Since the commonly exported data files are in .csv format, the data can be edited by the user prior to importing. This allows you to export a data file, manipulate the data in Excel (the most common PC Application for manipulating .csv files) and then import it.

Importing Data loads measurement data from the specified file into the specified or default destination, depending on the data type selected. Selecting an Import Data menu key will not actually cause the importing to occur, since the analyzer still needs to know from where to get the data. Pressing the Open key in this menu brings up the Open dialog and Open menu that provides you with the options from where to

recall the data. Once a filename has been selected or entered in the Open menu, the recall occurs as soon as the Open button is pressed.

Key Path	<b>Recall</b>
Mode	All
Notes	The menu is built from whatever data types are available for the mode. Some keys will be missing completely, so the key locations in the sub-menu will vary. No SCPI command directly controls the Data Type that this key controls. The Data Type is included in the MMEM:LOAD commands.
Dependencies	If a file type is not used by a certain measurement, it is grayed out for that measurement. The key for a file type will not show at all if there are no measurements in the Mode that support it.
Preset	Is not affected by Preset or shutdown, but is reset during Restore Mode Defaults
Readback	The data type that is currently selected
Initial S/W Revision	Prior to A.02.00

## Amplitude Correction

This key selects the Amplitude Corrections as the data type to be imported. When pressed a second time, it brings up the Select Menu, which lets you select the Correction into which the data will be imported.

Amplitude Corrections are fully discussed in the documentation of the Input/Output key, under the Corrections key.

A set of preloaded Corrections files can be found in the directory  
/My Documents/ EMC Limits and Ampcor.

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 Unit in the file.

Key Path	<b>Recall</b>
Mode	SA EDGE GSM PN
<b>Remote Command</b>	:MMEMory:LOAD:CORRection 1 2 3 4 5 6 7 8, <filename>
<b>Example</b>	:MMEM:LOAD:CORR 2, "myAmpcor.csv" recalls the Amplitude Correction data from the file myAmpcor.csv in the current directory to the 2nd Amplitude Correction table, and turns on Correction 2. The default path is D:\User_My_Documents\Instrument\My Documents\amplitudeCorrections\
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

	<p>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.</p> <p>This key does not appear unless you have the proper option installed in your instrument.</p> <p>This command will generate an “Option not available” error unless you have the proper option installed in your instrument.</p>
Couplings	When a correction file is loaded from mass storage, it is automatically turned on ( <b>Correction ON</b> ) and <b>ApplyCorrections</b> is set to On. This allows you to see its effect, thus confirming the load.
Readback	selected Correction
<b>Backwards Compatibility SCPI</b>	<b>:MMEMory:LOAD:CORRection ANTenna   CABLe   OTHer   USER, &lt;filename&gt;</b> For backwards compatibility, ANTenna maps to 1, CABLe maps to 2, OTHer maps to 3 and USER maps to 4
Initial S/W Revision	A.02.00

### Amplitude Correction

These keys let you select which Correction to import the data into. Once selected, the key returns back to the Import Data menu and the selected Correction number is annotated on the key. The next step is to select the Open key in the Import Data menu.

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 Units.

Key Path	<b>Recall, Data, Amplitude Correction</b>
Notes	auto return
Dependencies	Only Correction 1 may be used to load a Correction that contains an Antenna Unit other than None
Preset	Not part of Preset, but is reset to Correction 1 by Restore Input/Output Defaults; survives shutdown.
State Saved	The current Correction number is saved in instrument state
Initial S/W Revision	A.02.00

### Trace Selection

These keys let you select which Trace to import the data into; TRACE1 – TRACE12. TRACE1–TRACE6 corresponds to Spectrum Trace1–6 and TRACE7–TRACE12 corresponds to the Pvt Trace1–6. The default is the currently selected trace, selected in this menu or in the Trace/Det, Export Data, Recall Trace, or Save Trace menus; except if you have chosen **All** then **All** remains chosen until you specifically change it to a single trace.

Once selected, the key returns back to the Import Data menu and the selected Trace number is annotated on the key. The next step is to select the Open key in the Import Data menu.

Key Path	<b>Recall, Data, Trace</b>
Notes	Auto return
Preset	not part of Preset, but is reset to TRACE1 by Restore Mode Defaults; survives shutdown
State Saved	The current trace number is saved in instrument state
Initial S/W Revision	A.13.00

## Limit

This key selects Limit Lines as the data type to be imported. When pressed a second time, it brings up the Limits Menu, which lets you select into which Limit the data will be imported.

A set of preloaded Limits files can be found in the directory

/My Documents/ EMC Limits and Ampcor.

Under this directory, the directory called Limits (Legacy Naming) contains a set of legacy limits, generally the same files that were supplied with older Agilent EMC analyzers, that use the legacy suffix .lim, and the old 8-character file names. In the directory called Limits, the same files can be found, with the same suffix, but with longer, more descriptive filenames.

Key Path	<b>Recall, Data</b>
<b>Remote Command</b>	<b>:MMEMory:LOAD:LIMit LLINE1   LLINE2, &lt;filename&gt;</b>
<b>Example</b>	:MMEM:LOAD:LIM LLINE2, "myLimitLine2.csv" Imports the 2nd Limit Line from the file myLimitLine2.csv in the current path. The default path is My Documents\SA\data\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.
Readback	Selected Limit Line
Status Bits/OPC dependencies	Sequential - aborts the current measurement
Initial S/W Revision	A.02.00

### Limit Selection

These keys let you pick which Limit Line to import the data into; either 1, 2, 3, 4, 5 or 6. The default is the currently selected limit. Once selected, the key returns back to the Import Data menu and the selected Limit Line number is annotated on the key. Now you have selected exactly what needs to be imported. In order to trigger an import of the selected Limit Line, you must select the Open key in the Import Data menu.

An example of using this menu is: If you select 2 and continue to the File Open menu, Limit Line 2 will be imported from the file selected or entered in File Name option in the File Open dialog.

Key Path	<b>Recall, Data, Limit Line</b>
Notes	Auto return
Preset	Not part of Preset, but is reset to LLINE1 by Restore Mode Defaults; survives a shutdown.
State Saved	The selected limit number is saved in instrument state
Initial S/W Revision	A.02.00

### Recall FMT From File

Allows you to import a mask from a file. Selecting this key will select recall type as FMT and bring up the Open dialog box.

Key Path	<b>Recall, Data (Import), FMT</b>
<b>Remote Command</b>	<b>:MMEMory:LOAD:FMT &lt;filename&gt;</b> The file name must have extension ".csv".
<b>Example</b>	:MMEM:LOAD:FMT "myFmt.csv" recalls the FMT mask data from the file myFmt.csv in the current directory and sets the Trigger Type to FMT.
Notes	The default path is My Documents\Mode\data\FMT
Couplings	All the FMT setup parameters will be updated with the values from the imported file. Trigger Type will change to FMT is not already selected. This will only be the case when the command is executed remotely.
Initial S/W Revision	A.13.00

### Open...

When you press "Open", the analyzer brings up a Windows dialog and a menu entitled "File Open." This menu allows you to navigate to the various fields in the Windows dialog without using a keyboard or mouse. The **Tab** and **Arrow** keys can also be used for dialog navigation.

See "[From File...](#)" on page 919 in **Recall, State**, for a full description of this dialog and menu.

Key Path	<b>Recall, Data</b>
Notes	The key location is mode-dependent and will vary. Brings up Open dialog for recalling a <mode specific> Save Type

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Initial S/W Revision      Prior to A.02.00

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## Restart

The Restart function restarts the current sweep, or measurement, or set of averaged/held sweeps or measurements. If you are Paused, pressing Restart does a Resume.

The Restart function is accessed in several ways:

- Pressing the Restart key
- Sending the remote command INIT:IMMEDIATE
- Sending the remote command INIT:RESTART

See ["More Information" on page 589](#)

Key Path	Front-panel key
<b>Remote Command</b>	:INITiate[:IMMEDIATE] :INITiate:RESTART
<b>Example</b>	:INIT:IMM :INIT:REST
Notes	:INITiate:RESTART and :INITiate:IMMEDIATE perform exactly the same function.
Couplings	Resets average/hold count k. For the first sweep overwrites all active (update=on) traces with new current data. For application modes, it resets other parameters as required by the measurement.
Status Bits/OPC dependencies	This is an Overlapped command. The STATus:OPERation register bits 0 through 8 are cleared. The STATus:QUESTionable register bit 9 (INTegrity sum) is cleared. The SWEEPING bit is set. The MEASURING bit is set.
Backwards Compatibility Notes	For Spectrum Analysis mode in ESA and PSA, the <b>Restart</b> hardkey and the INITiate:RESTART command restart trace averages (displayed average count reset to 1) for a trace in <b>Clear Write</b> , but did not restart <b>Max Hold</b> and <b>Min Hold</b> . In the X-Series, the <b>Restart</b> hardkey and the INITiate:RESTART command restart not only <b>Trace Average</b> , but <b>MaxHold</b> and <b>MinHold</b> traces as well. For wireless comms modes in ESA and PSA, the <b>Restart</b> hardkey and the INITiate:RESTART command restart every measurement, which includes all traces and numeric results. There is no change to this operation.
Initial S/W Revision	Prior to A.02.00

## More Information

The **Restart** function first aborts the current sweep/measurement as quickly as possible. It then resets the sweep and trigger systems, sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the analyzer is in the process of aligning when **Restart** is executed, the alignment finishes before the restart function is performed.

Even when set for Single operation, multiple sweeps may be taken when Restart is pressed (for example, when averaging/holding is on). Thus when we say that **Restart** "restarts a measurement," we may mean:

- It restarts the current sweep
- It restarts the current measurement
- It restarts the current set of sweeps if any trace is in Trace Average, Max Hold or Min Hold
- It restarts the current set of measurements if Averaging, or Max Hold, or Min Hold is on for the measurement
- depending on the current settings.

With **Average/Hold Number** (in **Meas Setup** menu) set to 1, or Averaging off, or no trace in Trace Average or Hold, a single sweep is equivalent to a single measurement. A single sweep is taken after the trigger condition is met; and the analyzer stops sweeping once that sweep has completed. However, with **Average/Hold Number** > 1 and at least one trace set to **Trace Average, Max Hold, or Min Hold (SA Measurement)** or **Averaging on (most other measurements)**, multiple sweeps/data acquisitions are taken for a single measurement. The trigger condition must be met prior to each sweep. The sweep is stopped when the average count  $k$  equals the number  $N$  set for **Average/Hold Number**. A measurement average usually applies to all traces, marker results, and numeric results; but sometimes it only applies to the numeric results.

Once the full set of sweeps has been taken, the analyzer will go to idle state. To take one more sweep without resetting the average count, increment the average count by 1, by pressing the step up key while **Average/Hold Number** is the active function, or sending the remote command `CALC:AVER:TCON UP`.

## Save

The **Save** menu lets you choose what you want to save and where you want to save it. Among the types of files you can save are **States**, **Traces**, and **Screen Images**. In addition, an **Export (Data)** option lets you save a number of data types as CSV files for easy import into Excel and other spreadsheet programs.

Key Path	<b>Front-panel key</b>
Mode	All
Notes	No remote command for this key specifically, but the :MMEM:STORe command is available for specific file types. An example is :MMEM:STOR:STATe <filename>.
Initial S/W Revision	Prior to A.02.00

## State

The Save State menu lets you choose a register or file for saving the state.

The content of a state file includes all of the settings and data required to return the analyzer as closely as possible to the Mode it was in, with the exact settings which were in place, when the save occurred. The Mode settings in each state file include the settings that are affected by Mode Preset, as well as the additional settings affected by Restore Mode Defaults; all of the Mode's settings. In addition, all of the settings of the **Input/Output** system are included, even though they are outside of the Mode's state, because they are needed to restore the complete setup. Persistent **System** settings (for example, Verbose SCPI) are not affected by either Mode Preset or Restore Mode Defaults, nor are they included in a saved State file.

After the save completes, the message "File <filename> saved" or "State Register <register number> saved" is displayed.

For rapid saving, the State menu lists 16 registers to save to. Pressing a Register key initiates the save. You can also select a file to save to.

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 the INST:SEL command (for example, SA for the Spectrum Analyzer).

Key Path	<b>Save</b>
Mode	All
<b>Remote Command</b>	<b>:MMEMory:STORe:STATe &lt;filename&gt;</b>
<b>Example</b>	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 <b>Save State</b> menu, so that you can see the Register

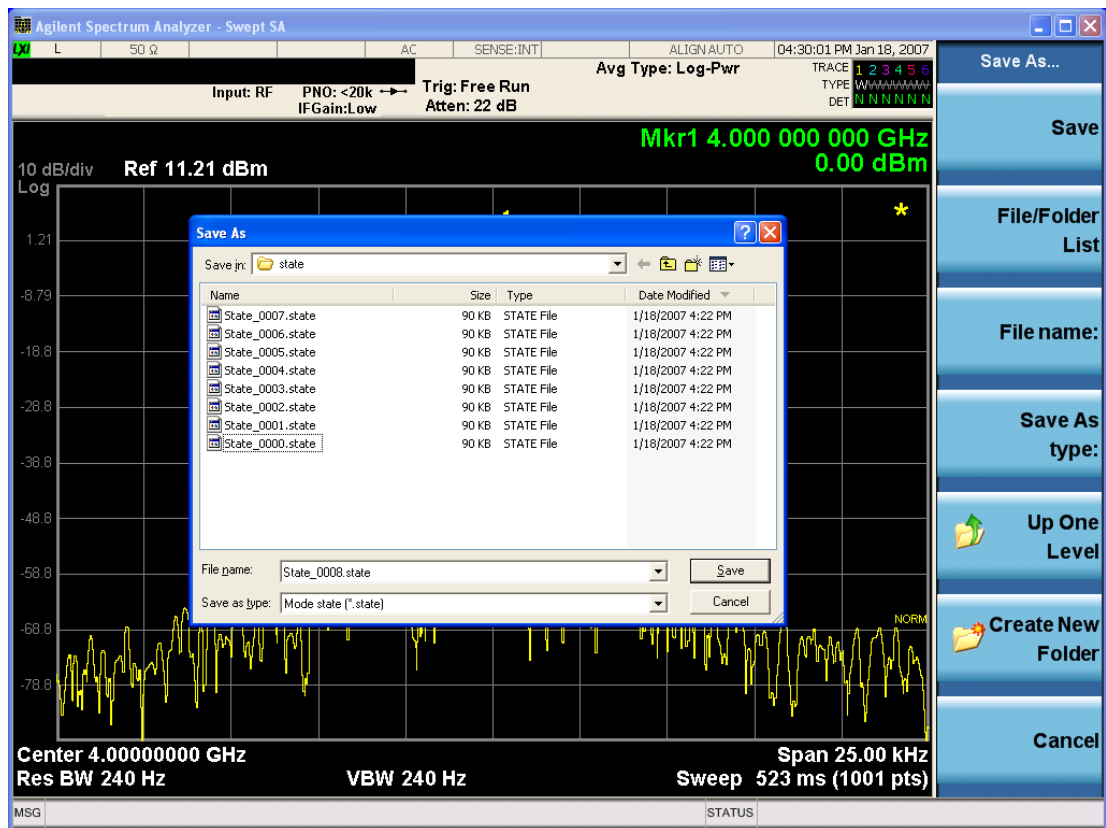
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	key update. After saving to a file, the analyzer automatically returns to the previous menu and any Save As dialog goes away.
<b>Backwards Compatibility SCPI</b>	<b>:MMEMory:STORe:STATe 1,&lt;filename&gt;</b> For backwards compatibility, the above syntax is supported. The "1" is simply ignored. The command is sequential.
Initial S/W Revision	Prior to A.02.00

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### To File . . .

When you press "To File", the analyzer brings up a Windows dialog and a menu entitled "**Save As.**" This menu allows you to navigate to the various fields in the Windows dialog without using a keyboard or mouse. The **Tab** and **Arrow** keys can also be used for dialog navigation.



The Listed below are the functions of the various fields in the dialog, and the corresponding softkeys:

#### Save

Performs the save to the specified file of the selected type. If the file already exists, a dialog will appear that allows you to replace the existing file by selecting **OK**, or you can Cancel the request. If you select OK, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade.

While the save is being performed, the floppy icon appears briefly in the Meas bar.

#### File/Folder List

Enables you to navigate to the center of the dialog that contains the list of files and folders. Once here you can get information about the file and use the tab keys to navigate to the other fields in the dialog, such as Save In.

#### Save In

The Save In field shows the path to which the file will be saved and allows you to change the path using the up and down arrow keys to navigate to other paths; the Enter key to open a directory; and the Backspace key to go back one directory. The **Save In field** defaults to the default path for this type of file and remembers the last path you used to save this type of file. There is no softkey for directly navigating to the Save In field but you can use left tab to get here from the File/Folder List.

User specified paths are remembered when you leave and return to a Mode and are reset back to the default using **Restore Mode Defaults**.

#### File Name

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 replace or modify this filename using the File Name key. See the ["Quick Save " on page 890](#) documentation for more on the automatic file naming algorithm.

When you press the **File Name** key the analyzer displays the Alpha Editor. Use the knob to choose the letter to add and the front-panel Enter key to add the letter to the file name. The BK character moves you back and the FW character moves you forward in the filename. The Select key on the front panel generates a space character. When you are done entering the filename press the **Done** softkey. This returns back to the **File Open** dialog and menu, but does not cause the save to occur.

#### Save As Type

This field shows the file suffix for the type of file you have selected to save. For example, if you navigated here while saving State, "Mode state (\*.state)" is in the field. If you navigated here from saving Trace, "Mode state (\*.trace)" is in the field. If you navigated here while exporting a trace data file, "Trace Data (\*.csv)" is in the field. For some file types, there is more than one choice in the dropdown, which you can select by using the up and down arrow keys and Enter.

#### Up One Level

This key corresponds to the icon of a folder with the up arrow that is in the tool bar of the dialog. When pressed, it causes the file and folder list to navigate up one level in the directory structure. The Backspace key does the same thing.

#### Create New Folder

This key corresponds to the icon of a folder with the "\*" that is in the tool bar of the dialog. When pressed, a new folder is created in the current directory with the name **New Folder** and you can enter a new folder name using the Alpha Editor.

#### Cancel

This key corresponds to the **Cancel** selection in the dialog. It causes the current **Save As** request to be cancelled. The ESC key does the same thing.

Key Path	<b>Save, State</b>
Mode	All
Notes	Brings up Save As dialog for saving a State Save Type
Initial S/W Revision	Prior to A.02.00

### 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 save. To do this, press the **Edit Register Names** key,

choose the register whose name you wish to edit, and then enter the desired label using the Alpha Editor or an external PC keyboard.

The maximum number of characters that can be added is 30. In most cases, 30 characters will fit on two lines of the key.

See ["More Information" on page 595](#)

Key Path	<b>Save, State</b>
Mode	All
<b>Remote Command</b>	<b>:MMEMory:REGister:STATe:LABe1 &lt;reg number&gt;,"label"</b> <b>:MMEMory:REGister:STATe:LABe1? &lt;reg number&gt;</b>
<b>Example</b>	:MMEM:REG:STAT:LAB 1,"my label"
Notes	<reg number> is an integer from 1 to 16. If the SCPI specifies an invalid register number an error message is generated, -222,"Data out of range;Invalid register label number" "label" is a string from 0 to 30 characters in length. If a label exceeds 30 characters, an error message is generated, -150,"String data error;Label clipped to 30 characters" "label" of length 0 erases the custom label and restores the default (time and date) label. E.g.: :MMEM:REG:STAT:LAB 1,""
Dependencies	N9060A-7FP or N9060B-2FP license required to edit the register names. When the feature is not licensed, sending this command generates an error, -221,"Settings conflict;Option not available"
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"
Initial S/W Revision	A.11.00

### More Information

When you edit one of the register names, the time and date field will be replaced by the custom name.

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.

The \*SAV and \*RCL commands will not be affected by the custom register names, nor will the MMEM commands.

### Register 1 thru Register 16

Selecting any one of these register menu keys 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 use the **Edit Register Names** key to enter custom names for each 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.

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.

Key Path	<b>Save, State</b>
Mode	All
<b>Example</b>	*SAV 1
Range	1-16 from front panel, 1-128 from SCPI
Readback	Date and time with seconds resolution are displayed on the key OR A custom name of up to 30 characters entered using the <b>Edit Register Names</b> key OR “(empty)” if no prior save operation has been performed to this register.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.11.00

## Register 1 thru Register 16

Selecting any one of these register menu keys 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 use the **Edit Register Names** key to enter custom names for each 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.

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.



Key Path	<b>Save, State</b>
Mode	All
<b>Example</b>	*SAV 1
Range	1-16 from front panel, 1-128 from SCPI
Readback	Date and time with seconds resolution are displayed on the key OR A custom name of up to 30 characters entered using the <b>Edit Register Names</b> key OR “(empty)” if no prior save operation has been performed to this register.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.11.00

### Trace (+State)

The **Save Trace (+State)** menu lets you choose a register or file specifying where to save the Trace+State state file.

A saved state contains all of the settings and data required to return the analyzer as closely as possible to the exact setup it had when the save occurred. This includes the Input/Output settings, even though they are outside of the Mode’s state, because they are needed to restore the complete setup. A Trace+State file also includes trace data from one trace or all traces, which will load in View mode when the Trace+State file is recalled.

After the save completes, the message "File <filename> saved" or "Trace Register <register number> saved" is displayed.

For rapid saves, the Trace (+State) menu lists 5 registers to save to. Pressing a Register key initiates the save. You can also select a file to save to.

The default path for all State Files including .trace files is:

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 IQAnalyzer).

This key is grayed out for measurements that do not 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. You may select to save one trace or ALL traces.

Key Path	<b>Save</b>
Mode	SA
<b>Remote Command</b>	:MMEMory:STORe:TRACe TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6   ALL,<filename>

	<code>:MMEMory:STORe:TRACe:REGister TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6   ALL,&lt;integer&gt;</code>
<b>Example</b>	<p><code>:MMEM:STOR:TRAC TRACE1</code>, "myState.trace" saves the file myState.trace on the default path and flags it as a "single trace" file with Trace 1 as the single trace (even though all of the traces are in fact stored).</p> <p><code>:MMEM:STOR:TRAC ALL</code>, "myState.trace" saves the file myState.trace on the default path and flags it as an "all traces" file</p> <p><code>:MMEM:STOR:TRAC:REG TRACE1, 2</code> stores trace 1 data in trace register 2</p>
<b>Notes</b>	<p>This command actually performs a save state, which in the Swept SA measurement includes the trace data. However it flags it (in the file) as a "save trace" file of the specified trace (or all traces).</p> <p>Some modes and measurements do not have available all 6 traces. The Phase Noise mode command, for example, is: <code>MMEMory:STORe:TRACe TRACE1 TRACE2 TRACE3 ALL,&lt;filename&gt;</code></p> <p>Some modes and measurements have more than 6 traces available. The Realtime SA mode command, for example, is: <code>MMEMory:STORe:TRACe TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6   TRACE7   TRACE8   TRACE9   TRACE10   TRACE11   TRACE12   ALL,&lt;filename&gt;</code></p> <p>The range for the register parameter is 1-5</p> <p>When you initiate a save, if the file already exists, a dialog will appear that allows you to replace the existing file by selecting <b>OK</b> or you can Cancel the request. If you select OK, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade.</p> <p>Both single and double quotes are supported for any filename parameter over remote.</p> <p>After saving to a register, that register's menu key is updated with the date and time of the save.</p> <p>After saving to a register, you remain in the <b>Save Trace</b> menu, so that you can see the Register key update. After saving to a file, the analyzer automatically returns to the previous menu and any Save As dialog goes away.</p>
Initial S/W Revision	Prior to A.02.00

## Register 1 thru Register 16

Selecting any one of these register menu keys 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 use the **Edit Register Names** key to enter custom names for each 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.

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.

Key Path	<b>Save, State</b>
Mode	All
<b>Example</b>	*SAV 1
Range	1-16 from front panel, 1-128 from SCPI
Readback	Date and time with seconds resolution are displayed on the key OR A custom name of up to 30 characters entered using the <b>Edit Register Names</b> key OR “(empty)” if no prior save operation has been performed to this register.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.11.00

### From Trace

Accesses a menu that enables you to select the trace to be saved. Once a trace is selected, the key returns to the Save Trace menu and the selected trace number is annotated on the key. The default is the currently selected trace, selected in this menu or in the Trace/Det, Export Data, Import Data or Recall Trace menus, except if you have chosen All then it remains chosen until you specifically change it to a single trace. To save the Trace you must select the **Save As** key in the Save 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.

Key Path	<b>Save, Trace + State</b>
Mode	SA
Initial S/W Revision	Prior to A.02.00

### To Trace

These menu selections let you choose the Trace where the recalled saved trace will go. Not all modes have the full 6 traces available. The default is the currently selected trace, selected in this menu or in the Trace/Detector, Export Data, Import Data, or Save Trace menus, except if you have chosen All, then it remains chosen until you specifically change it to a single trace.

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.

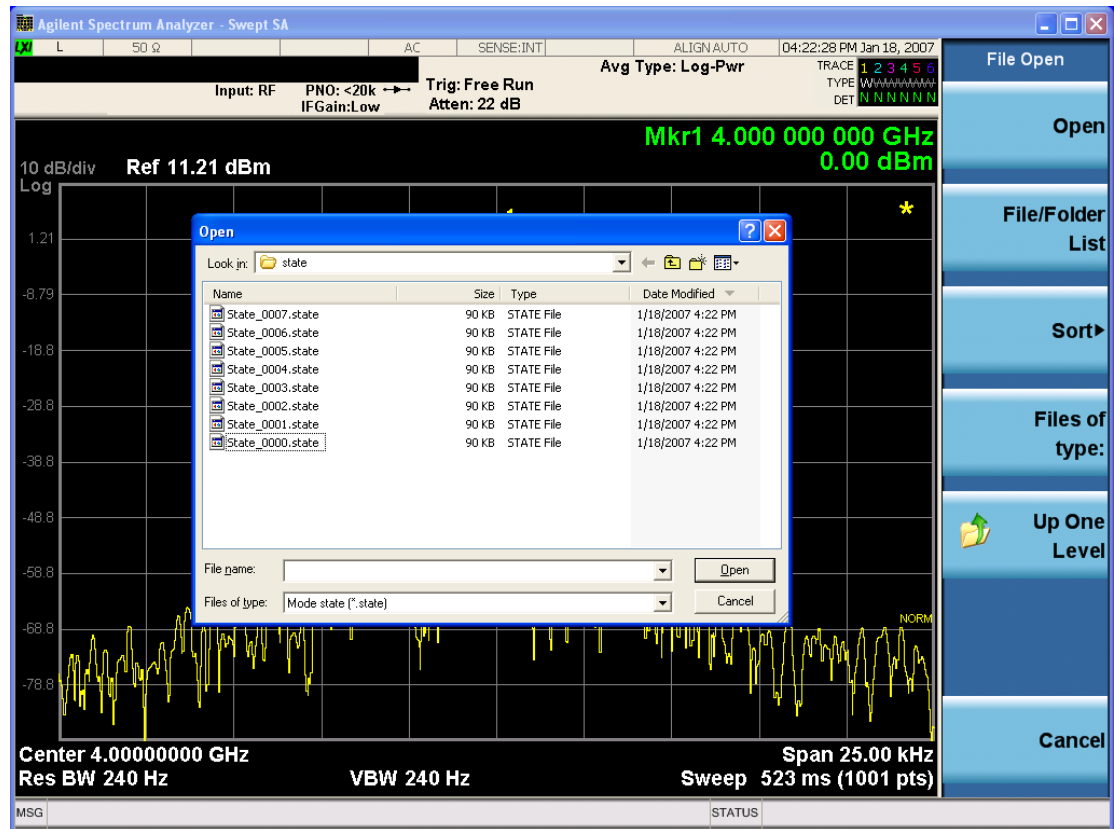
Once selected, the key returns back to the Recall Trace menu and the selected Trace number is annotated on the key. Now you have selected exactly where the trace needs to be recalled. To trigger a recall of the selected Trace, you must select the **Open** key in the Recall Trace menu.

When you select a trace, it makes that trace the current trace, so it displays on top of all of the other traces.

Key Path	Save, Data, Trace
Mode	SA
Initial S/W Revision	Prior to A.02.00

### From File...

When you press “From File”, the analyzer brings up a Windows dialog and a menu entitled “File Open.” This menu allows you to navigate to the various fields in the Windows dialog without using a keyboard or mouse. The **Tab** and **Arrow** keys can also be used for dialog navigation.



Listed below are the functions of the various fields in the dialog, and the corresponding softkeys:

#### Open

Performs the recall of the specified file. While the recall is being performed, the floppy icon appears briefly in the Meas bar.

#### File/Folder List

Enables you to navigate to the center of the dialog that contains the list of files and folders. Once here you can get information about the file and use the tab keys to navigate to the other fields in the dialog, such as Look In.

#### Look In

The **Look In** field shows the path from which the file will be recalled and allows you to change the path using the up and down arrow keys to navigate to other paths; the Enter key to open a directory; and the Backspace key to go back one directory. The **Look In field** first uses the last path from the Save As dialog **Save In:** path for that same file type. There is no softkey for directly navigating to the Look In field, but you can use the left tab to get here from the File/Folder List.

User specified paths are remembered when you leave and return to a Mode and are reset back to the default using **Restore Mode Defaults**.

#### Sort

Accesses a menu that enables you to sort the files within the File Open dialog. Only one sorting type can be selected at a time and the sorting happens immediately. The sorting types are **By Date, By Name, By extension, and By Size**.

#### Files of Type

This field shows the file suffix for the type of file you have selected to recall. For example, if you navigated here while recalling State, "Mode state (\*.state)" is in the field. If you navigated here while recalling Trace, ""Mode state (\*.trace)" is in the field. If you navigated here while importing a trace data file, "Trace Data (\*.csv)" is in the field. For some file types, there is more than one choice in the dropdown menu, which you can select by using the up and down arrow keys and Enter.

#### Up One Level

This key corresponds to the icon of a folder with the up arrow that is in the tool bar of the dialog. When pressed, it causes the file and folder list to navigate up one level in the directory structure. The Backspace key does the same thing.

#### Cancel

This key corresponds to the **Cancel** selection in the dialog. It causes the current **Open** request to be cancelled. The ESC key does the same thing.

Key Path	<b>Recall, State</b>
Notes	Brings up the Open dialog for recalling a State Save Type
Initial S/W Revision	Prior to A.02.00

## Data (Export)

Exporting a data file stores data from the current measurement to mass storage files. The Export Menu only contains data types that are supported by the current measurement.

Since the commonly exported data files are in .csv format, the data can be edited by you prior to importing. This allows you to export a data file, manipulate the data in Excel (the most common PC Application for manipulating .csv files) and then import it.

Selecting an Export Data menu key will not actually cause the exporting to occur, since the analyzer still needs to know where you wish to save the data. Pressing the Save As key in this menu brings up the Save As dialog and Save As menu that allows

you to specify the destination file and directory. Once a filename has been selected or entered in the Open menu, the export will occur as soon as the Save key is pressed.

Key Path	<b>Save</b>
Mode	All
Notes	The menu is built from whatever data types are available for the mode. So the key locations in the sub menu will vary. No SCPI command directly controls the Data Type that this key controls. The Data Type is included in the MMEM:STORe commands.
Dependencies	If a file type is not used by a certain measurement, that type is grayed out for that measurement. The key for a file type will not show at all if there are no measurements in the Mode that support it.
Preset	Is not affected by a Preset or shutdown, but is reset during Restore Mode Defaults
Readback	The data type that is currently selected
Initial S/W Revision	Prior to A.02.00

## Amplitude Correction

Pressing this key selects **Amplitude Corrections** as the data type to be exported. Pressing this key again brings up the Select Menu, which allows the user to select which **Amplitude Correction** to save.

Amplitude Corrections are fully discussed in the documentation of the Input/Output key, under the Corrections softkey.

See "[Correction Data File](#)" on page 603

Key Path	<b>Save</b>
<b>Remote Command</b>	:MMEMory:STORe:CORRection 1 2 3 4 5 6, <filename>
<b>Example</b>	:MMEM:STOR:CORR 2 "myAmpcor.csv" saves Correction 2 to the file myAmpcor.csv on the current path. The default path is My Documents\amplitudeCorrections.
Notes	If the save is initiated via SCPI, and the file already exists, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade. Both single and double quotes are supported for any filename parameter over SCPI.
Dependencies	Corrections are not supported by all Measurements. If in a Mode in which some Measurements support it, this key will be grayed out in measurements that do not. The key will not show at all if no measurements in the Mode support it. This key will not appear unless you have the proper option installed in your instrument.
Readback	Selected Correction
<b>Backwards Compatibility SCPI</b>	:MMEMory:STORe:CORRection ANTenna   CABLe   OTHer   USER, <filename> For backwards compatibility, ANTenna maps to 1, CABLe maps to 2, OTHer maps to 3 and USER maps to 4
Initial S/W Revision	A.02.00

## 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.

Line #	Type of field	Example	Notes
1	File type, must be "Amplitude Correction"	Amplitude Correction	May not be omitted
2	File Description (in quotes)	"Correction Factors for 11966E"	60 characters max; may be empty but may not be omitted. If exceeds 60 characters, error -233 Too much data reported
3	Comment (in quotes)	"Class B Radiated"	60 characters max; may be empty but may not be omitted. . If exceeds 60 characters, error -233 Too much data reported
4	Instrument Version, Model #	A.02.06,N9020A	May be empty but may not be omitted
5	Option List, File Format Version	K03 LFE EXM ,01	May be empty but may not be omitted
6	Freq Unit to be used for all frequency values in the file	Frequency Unit,MHz	assumed to be Hz if omitted
7	Antenna Unit	Antenna Unit,None	If omitted leaves the Antenna unit unchanged. The amplitude unit in the Antenna Unit field is a conversion factor that is used to adjust the Y Axis Units of the current mode, if the mode supports Antenna Units. For more details on antenna correction data, refer to the Input/Output,Corrections key description. Allowable values: dBuV/m, dBuA/m, dBG, dBpT, None
8	Freq Interpolation	Frequency Interpolation,Linear	if omitted leaves the Freq Interpolation unchanged. Allowable values: Linear, Logarithmic

Line #	Type of field	Example	Notes
9	Bias value in mA	Bias,0.00	If omitted leaves the Bias value unchanged (added as of A.08.50)
10	Bias State	Bias State,On	If omitted leaves the Bias State unchanged. Allowable values: On, Off (added as of A.08.50)
11	Overlap, two values, Freq1 and Freq2, separated by commas.	Overlap,33500,40000	Uses Freq Unit from line 6. Thus, in this example Freq1=33.5 GHz, Freq2= 40.0 GHz (see note below). If omitted leaves the overlap unchanged (added as of A.08.50)
12	DATA marker	DATA	Corrections data begins in the next line

Lines 2 through 5 can be empty but must appear in the file. Lines 6 through 11 are optional, the lines can be left out of the file altogether.

The Overlap row and the two Bias rows apply only to external mixing. Both are read-only, they are never written by the analyzer. The only way to insert or modify these rows is to edit the file with a text editor or a spreadsheet editor. These rows are intended for use by mixer manufacturers, as they allow the manufacturer to insert data about how the mixer corrections were generated and how they should be applied. The Bias rows allow you to specify whether to turn Bias on or off when the Correction is turned on and to specify a Bias value (turning off the Correction does not change the Bias, but turning it back on again sets it to the value specified in the file). The Overlap row allows you to specify an overlap region in which two different corrections may be applied. It is expected that in the corrections data itself, there will be TWO corrections values exactly at Max Freq, otherwise Overlap is ignored. The way the overlap is processed is as follows: if at any given time the current analyzer Start Freq is greater than Freq 1 and lower than Freq 2, and the current Stop Freq is greater than Freq 2, extend the first correction point at or above Freq 2 down to Freq 1, rather than using the correction data between Freq1 and Freq2.

The Antenna Unit row can only be used in Correction register 1, because there can only be one setting for Antenna Unit at any given time. If a Correction whose Antenna Unit is set to anything but None is loaded into any Correction register but 1, an error is generated (Mass storage error; Can only load an Antenna Unit into Correction 1). When a correction file is saved from any Correction register but 1, Antenna Unit is always written as None.

Similarly, the Bias rows can only be used in Correction register 1, because there can only be one setting for Bias at any given time. If a Correction file with a Bias or Bias



State row is loaded into any Correction register but 1, an error is generated: Mass storage error; Can only load Bias Settings into Correction 1

The data follows the DATA row, as comma separated X, Y pairs; one pair per line.

For example, suppose you have an Antenna to correct for on an N9020A version A.02.06 and the correction data is:

- 0 dB at 200 MHz
- 17 dB at 210 MHz
- 14.8 dB at 225 MHz

Then the file will look like:

- Amplitude Correction
- "Correction Factors for 11966E"
- "Class B Radiated"
- A.02.06,N9020A
- P13 EA3 UK6,01
- Frequency Unit,MHz
- Antenna Unit,dBuV/m
- Frequency Interpolation,Linear
- DATA
- 200.000000,0.00
- 210.000000,17.00
- 225.000000,14.80

The choices for the 1 of N fields in the metadata are as follows:

- Frequency Unit: Hz, kHz, MHz, GHz
- Antenna Unit: dBuV/m, dBuA/m, dBG, dBpT, None
- Frequency Interpolation: Logarithmic, Linear

### **Amplitude Correction**

These keys let you choose which Correction to save. Once selected, the key returns back to the Export Data menu and the selected Correction number is annotated on the key.

The next step in the Save process is to select the Save As key in the Export Data menu.

Key Path	<b>Save, Data, Amplitude Correction</b>
Preset	Not part of a Preset, but is reset to Correction 1 by Restore Input/Output Defaults. Survives a shutdown.
Readback	1
Initial S/W Revision	A.02.00

## Trace

Pressing this key selects Traces as the data type to be exported. Pressing this key when it is already selected brings up the Trace Menu, which allows you to select which Trace to save.

The trace file contains “meta” data which describes the current state of the analyzer. The metadata is detailed in ["Trace File Contents" on page 606](#) below.

Key Path	<b>Save, Data</b>
<b>Remote Command</b>	<code>:MMEMory:STORe:TRACe:DATA TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6   ALL   TRACE7   TRACE8   TRACE9   TRACE10   TRACE11   TRACE12,&lt;filename&gt;</code>
<b>Example</b>	<code>:MMEM:STOR:TRAC:DATA TRACE2, "myTrace2.csv"</code> Exports the 2nd trace to the file myTrace2.csv in the current path. The default path is My Documents\SA\data\traces
Notes	If the save is initiated via SCPI, and the file already exists, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade. Both single and double quotes are supported for any filename parameter over SCPI.
Dependencies	For both Spectrum and Power vs Time measurements, traces cannot be recalled from a trace file that was saved with ALL traces selected.
Readback	selected Trace
Status Bits/OPC dependencies	Sequential - waits for previous measurement to complete
Initial S/W Revision	A.13.00

## Trace File Contents

A Trace Data File contains the data for one trace.

### Metadata:

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” which, if changed, cause a measurement restart.

- Measurement Type (Spectrum or PVT)
- Number of Points
- PVT Number of Points
- Acquisition Time (Frequency or PVT Acquisition Time depending on the Measurement Type)
- Start Frequency
- Stop Frequency
- Average Count (actual; not the limit for the instrument)
- Average Type
- RBW
- RBW Filter Type
- RBW Filter BW Type
- Trigger (source, level, slope, delay)
- Preamp (on/off, band)
- Phase Noise optimization setting
- IF Gain
- AC/DC setting (RF Coupling)
- External Reference setting
- Input (which input is in use)
- RF calibrator on/off
- External Gain
- Attenuation
- Ref Level Offset
- X-Axis Unit
- Y-Axis Unit
- Trace name/number
- Trace Type

- Detector
- Pvt Detector
- Trace math (function, operand1, operand2, offset, reference)

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.

An example output for both Spectrum and Pvt traces are provided below.

### Spectrum trace metadata example

Trace	
Real Time SA	
A.13.00	N9030A
526 540 ALV ATP B1A B1X B1Y B25 B40 BBA CR3 CRP DCF DDA DP2 DRD EA3 EDP EMC EP1 ERC ESP EXM FS1 FSA FT2 LFE LNP MAT MPB NFE NUL P26 PFR PNC RT2 RTL RTS S40 SB1 SEC SM1 TVT YAS YAV	1
Segment	0
Measurement Type	Spectrum
Number of Points	821
Pvt Number of Points	1024
Acquisition Time	0.0300005
Start Frequency	1.993E+10
Stop Frequency	2.009E+10
Average Count	0
Average Type	Voltage
RBW	680000
RBW Filter	Gaussian
RBW Filter BW	3dB
Trigger Source	Free
Trigger Level	1.2
Trigger Slope	Positive
Trigger Delay	0

PreAmp State	Off
PreAmp Band	Low
Phase Noise Optimization	Fast
If Gain	Low
RF Coupling	DC
Ext Ref	10000000
Input	RF
RF Calibrator	Off
External Gain	0
Attenuation	10
Ref Level Offset	0
X Axis Units	Hz
Y Axis Units	dBm
Detector	Peak
Pvt Detector	Peak
Trace Name	Spectrum Trace1
Trace Type	Clearwrite
Trace Math	Off
Trace Math Oper1	Trace5
Trace Math Oper2	Trace6
Trace Math Offset	0
DATA	
Spectrum X	Spectrum Trace 1 Y
19925000000	-64.96347
19925195122	-64.783043
19925390244	-64.444908
(Continue until Number of Points)	

**Power vs Time metadata example**

Trace	
Real Time SA	
A.13.00	N9030A
526 540 ALV ATP B1A	1
B1X B1Y B25 B40 BBA	
CR3 CRP DCF DDA DP2	
DRD EA3 EDP EMC EP1	
ERC ESP EXM FS1 FSA	
FT2 LFE LNP MAT MPB	
NFE NUL P26 PFR PNC	

RT2 RTL RTS S40 SB1	
SEC SM1 TVT YAS YAV	
Segment	0
Measurement Type	Pvt
Number of Points	821
Pvt Number of Points	1024
Acquisition Time	0.0300005
Start Frequency	1.993E+10
Stop Frequency	2.009E+10
Average Count	0
Average Type	Voltage
RBW	680000
RBW Filter	Gaussian
RBW Filter BW	3dB
Trigger Source	Free
Trigger Level	1.2
Trigger Slope	Positive
Trigger Delay	0
PreAmp State	Off
PreAmp Band	Low
Phase Noise Optimization	Fast
If Gain	Low
RF Coupling	DC
Ext Ref	10000000
Input	RF
RF Calibrator	Off
External Gain	0
Attenuation	10
Ref Level Offset	0
X Axis Units	Hz
Y Axis Units	dBm
Detector	Peak
Pvt Detector	Peak
Trace Name	Pvt Trace1
Trace Type	Clearwrite
Trace Math	Off
Trace Math Oper1	Trace5



## Select Trace

These softkeys let you pick which Trace to save. Once selected, the key returns back to the Export Data menu and the selected trace name/number is annotated on the key. The default is the currently selected trace, selected in this menu or in the Trace/Det, Import Data, Recall Trace or Save Trace menus, except if you have chosen **All** then **All** remains chosen until you specifically change it to a single trace.

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.

This menu is the same as the Select Trace menu under Trace. The trace selected on that menu appears selected here, and selecting a trace here causes the same trace to be selected on the Select Trace menu. (That is, there is only one "selected trace".)

The next step in the Save process is to select the Save As key in the Export Data menu.

Key Path	<b>Save, Data, Trace</b>
Notes	auto return
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.
Preset	Not part of Preset, but is reset to TRACE1 by Restore Mode Defaults; survives shutdown
State Saved	The current trace number is saved in instrument state.
Initial S/W Revision	Prior to A.02.00

## Limit

Pressing this key selects Limit Lines as the data type to be exported. Pressing the key a second time brings up the Limit Menu that allows you to select which **Limit Line** to save.

See "[Limits File Contents](#)" on page 613.

See "[.csv file format](#)" on page 613

See "[.lim file format](#)" on page 614

Key Path	<b>Save, Data</b>
<b>Remote Command</b>	<b>:MMEMory:STORe:LIMit LLINE1 LLINE2,&lt;filename&gt;</b>
<b>Example</b>	:MMEM:STOR:LIM LLINE2, "myLimitLine2.csv" Saves the 2nd Limit Line to the file myLimitLine2.csv in the current path. The default path is My Documents\SA\data\limits
Notes	If the save is initiated via SCPI, and the file already exists, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade. Both single and double quotes are supported for any filename parameter over SCPI.



Dependencies	This key will only appear if you have the proper option installed in your instrument.
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.
Readback	selected Limit Line
Status Bits/OPC dependencies	Sequential - waits for previous measurement to complete
Initial S/W Revision	A.02.00

### Limits 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.

<b>Limit</b>	<i>Data file type name</i>
"FCC Part 15"	<i>File Description</i>
"Class B Radiated"	<i>Comment</i>
A.01.00.R0001.N9020A	<i>Instrument Version, Model Number</i>
P13 EA3 UK6 ,01	<i>Option List, File Format Version</i>

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.

<b>Type</b> , Upper	<i>Upper Lower</i>
<b>X Axis Unit</b> , MHz	<i>MHz S; other units should be converted; this also specifies the domain</i>
<b>Amplitude Unit</b> , dBm	<i>dBm V; all other units should be converted appropriately</i>
<b>Frequency Interpolation</b> , Linear	<i>Logarithmic Linear</i>
<b>Amplitude Interpolation</b> , Logarithmic	<i>Logarithmic Linear</i>
<b>X Control</b> , Fixed	<i>Fixed Relative; on input we consider only the first three characters</i>
<b>Y Control</b> , Fixed	<i>Fixed Relative; on input we consider only the first three characters</i>
<b>Margin</b> , 0	<i>Always in dB. A 0 margin is equivalent to margin off</i>
<b>X Offset</b> , 10	<i>Expressed in the X axis units</i>
<b>Y Offset</b> , 5	<i>Expressed in the Amplitude units</i>

The Amplitude Unit line in the limits file may contain an antenna factor unit, for example:

Amplitude Unit=dBuV/m

Antenna 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.

### Limit Selection

These keys let you pick which Limit Line to save. Once selected, the key returns back to the **Export Data** menu and the selected Limit Line number is annotated on the key.

The next step in the Save process is to select the Save As key in the Export Data menu.

Key Path	<b>Save, Data, Limit Line</b>
Notes	auto return
Preset	Not part of Preset, but is reset to LLINE1 by Restore Mode Defaults; survives shutdown
Initial S/W Revision	A.02.00

### Measurement Results

Pressing this key selects Meas Results as the data type to be exported. Pressing the key a second time brings up the Meas Results menu, which allows you to select which Meas Result to save. In the RT SA measurement, there are four types of Measurement Results files: Peak Table, Marker Table, Spectrogram and Density.

See ["Meas Results File Contents" on page 615](#)

See ["Marker Table" on page 615](#)

See "Peak Table" on page 618

See "Spectrogram" on page 621

See "Density" on page 622

Key Path	Save, Data
Initial S/W Revision	A.13.00

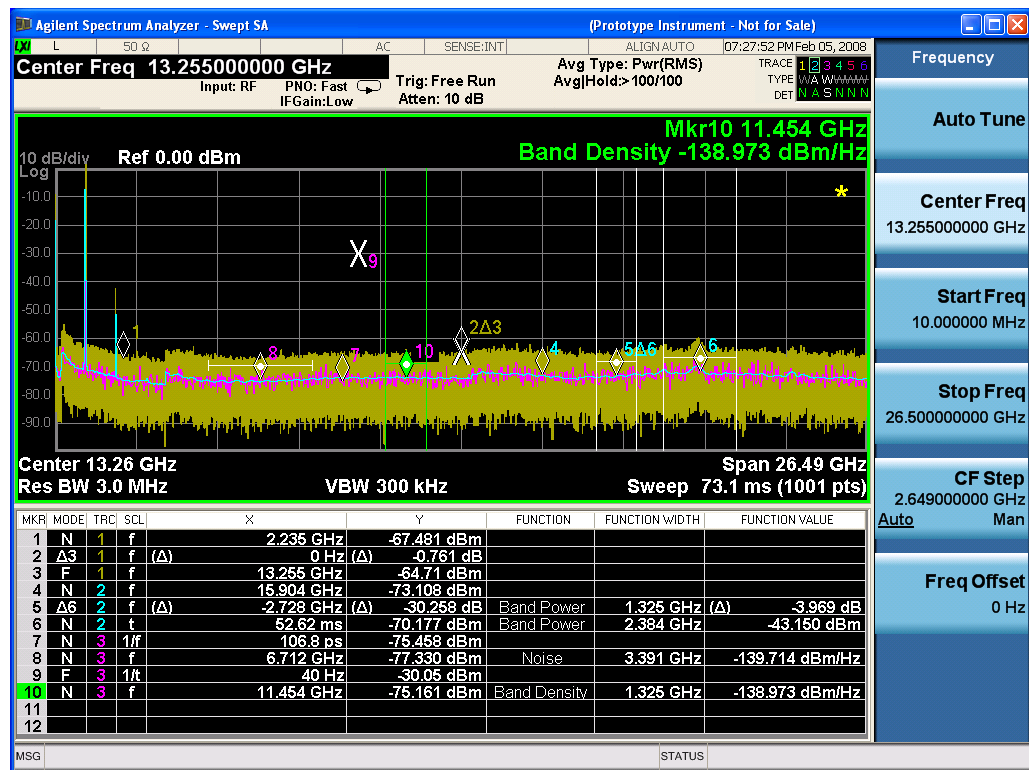
### Meas Results File Contents

All files are .csv files. The following section details the data in each file type.

### Marker Table

This section discusses the Marker Table Meas Results file format.

Imagine that, at the point where a Marker Table Meas Result is requested, the following screen is showing:



Then the Meas Results file, when opened, would show the following data:

MeasurementResult	
Swept SA	
A.01.40_	N9020A
R0017	
526 B25	1

PFR P26	
EA3	
Result Type	Marker Table
Ref Level	0
Number of Points	1001
Sweep Time	0.06626 6667
Start Frequency	100000 00
Stop Frequency	265000 00000
Average Count	0
Average Type	LogPow er (Video)
RBW	300000 0
RBW Filter	Gaussia n
RBW Filter BW	3dB
VBW	300000 0
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 Optimizatio n	Fast

Swept If Gain	Low								
FFT If Gain	Autorange								
RF Coupling	AC								
FFT Width	411900								
Ext Ref	1000000								
Input	RF								
RF Calibrator	Off								
Attenuation	10								
Ref Level Offset	0								
External Gain	0								
X Axis Units	Hz								
Y Axis Units	dBm								
DATA									
MKR	MODE	T R C	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	FUNCTION UNIT
1	Normal	1	Frequency	2.2350 E+09	- 67.481	Off	0.0000 E+00	0	None
2	Delta3	1	Frequency	0.0000 E+00	- 0.761	Off	0.0000 E+00	0	None
3	Fixed	1	Frequency	1.3255 E+10	- 64.71	Off	0.0000 E+00	0	None
4	Normal	2	Frequency	1.5904 E+10	- 73.108	Off	0.0000 E+00	0	None
5	Delta7	2	Frequency	- 2.7280 E+09	- 30.258	Band Power	1.3250 E+06	- 3.969	dB
6	Normal	2	Time	5.2620 E-02	- 70.17	Band Power	2.3840 E+06	- 43.15	dBm

7									
7	Normal	3	Period	1.0680 E-10	- 75. 45 8	Off	0.0000 E+00	0	None
8	Normal	3	Frequency	6.7120 E+09	- 77. 33	Noise	3.3910 E+06	- 139.7 14	dBm/ Hz
9	Fixed	3	Inverse Time	4.0000 E+01	- 30. 05	Off	0.0000 E+00	0	None
10	Normal	3	Frequency	1.1454 E+10	- 75. 16 1	Band Density	1.3250 E+06	- 138.9 73	dBm/ Hz
11	Off	1	Frequency	0.0000 E+00	0	Off	0.0000 E+00	0	None
12	Off	1	Frequency	0.0000 E+00	0	Off	0.0000 E+00	0	None

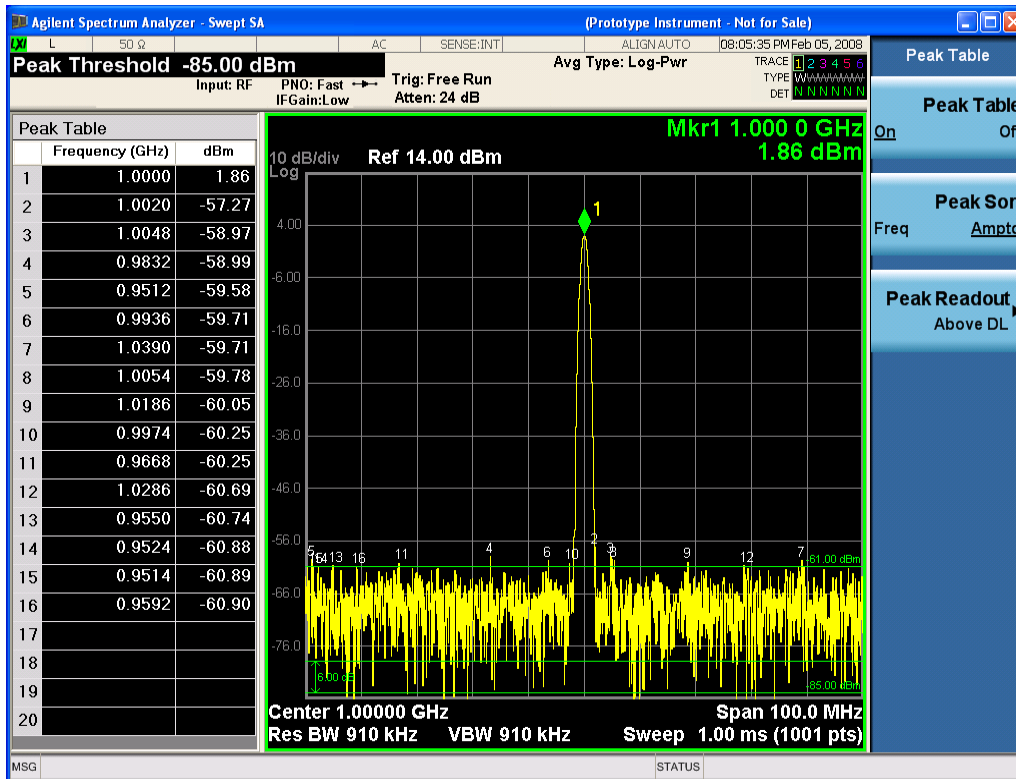
The numbers appear in the file exactly as they appear onscreen.

### Peak Table

This section discusses the Peak Table Meas Results file format.

See also, "[Store Peak Search Results](#)" on page 943 remote command.

Imagine that, at the point where a Marker Table Meas Result is requested, the following screen is showing:



Then 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
t
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	2650000000 0
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		

### Spectrogram

The Spectrogram View allows you to view a history of 10,000 traces, with up to 600 traces being displayed at any one time. In the Spectrogram View, each horizontal line in the spectrogram display represents one historical trace, which is the summary of an accumulation over an acquisition time interval. The data streams upwards from newest to oldest; the latest trace displays on the bottom and the oldest trace on the top.

Note that whenever you do a save state while in Spectrogram, and then recall the state, Spectrogram comes back with all the settings just as they were when you saved the state, but not including the Spectrogram data itself. If you want to save the Spectrogram data, you can Export it using Meas Results, and import it into a PC, although you cannot load it back into the analyzer.

See ["Spectrogram" on page 712](#) for more information.

See also, ["Save Spectrogram Results" on page 944](#) remote command.

## Density

This section discusses the Density results file format.

See also, ["Store Density Results" on page 944](#) and ["Fetch Density Results" on page 625](#) remote commands.

The Density result file has the same metadata as the other Meas Results files with the additional meta data #FFT's, Sample Rate and Acquisition Time. The meta data is followed by a row marked DATA, then all the density values for the bitmap of the last acquisition.

The format of the data will be a series of frequency/amplitude points with the value at each point representing the density percentage, in the range 0–1. Therefore a frequency/amplitude point that is hit 50% of the time during an acquisition will be represented by 0.5. The location of the frequency/amplitude point within the bitmap will correspond to the row/column point in the .csv file.

8 Spectrum Measurement  
Save

Trace	
Real Time SA	
A.13.00_R1005	N9030A
503 508 513 526 ALV	1
Scale Per Div	10
Segment	0
Result Type	Density
Measurement Type	Spectrum
Number of Points	821
Pvt Number of Poi	1024
Acquisition Time	0.030000775
Start Frequency	2370000000
Stop Frequency	2530000000
Average Count	0
Average Type	Voltage
RBW	765417.2251
RBW Filter	Gaussian
RBW Filter BW	3dB
Trigger Source	Free
Trigger Level	1.2
Trigger Slope	Positive
Trigger Delay	0
PreAmp State	Off
PreAmp Band	Low
Phase Noise Optim	Fast
If Gain	Low
RF Coupling	AC
Ext Ref	10000000
Input	RF
RF Calibrator	Off
External Gain	0
Attenuation	6
Ref Level Offset	0
X Axis Units	Hz
Pvt X Axis Units	Sec
Y Axis Units	dBm
Trace Name	Spectrum Trace
Trace Type	Clearwrite
Detector	Peak
Pvt Detector	
Trace Math	Off
Trace Math Oper1	Trace5
Trace Math Oper2	Trace6
Trace Math Offset	0

DATA	2370000000 Hz	2370195121.95122 Hz	2370390243.90244 Hz	2370585365.85366 Hz	2370780487.80488 Hz
Freq/Ampl	0.000538963	0.000808444	0.000943184	0.001212666	0.00062879
-110 dBm	0.000853357	0.000449135	0.000808444	0.000943184	0.000718617
-109.5556 dBm	0.001077925	0.001122838	0.001302493	0.001077925	0.000898271
-109.1111 dBm	0.001077925	0.000898271	0.001077925	0.001033011	0.000988098
-108.6667 dBm	0.00139232	0.001302493	0.000898271	0.001661801	0.001706715
-108.2222 dBm	0.001212666	0.001616888	0.001706715	0.001482147	0.001302493
-107.7778 dBm	0.001302493	0.00152706	0.001482147	0.001437233	0.001482147
-107.3333 dBm	0.001437233	0.001661801	0.002245677	0.001796542	0.001976196
-106.8889 dBm	0.001751094	0.001500938	0.001751094	0.001626016	0.001459245
-106.4444 dBm	0.002084636	0.002251407	0.002042944	0.002459871	0.003168647
-106 dBm	0.002501563	0.0022931	0.002918491	0.002793413	0.00275172
-105.5556 dBm	0.001751094	0.001876173	0.002168022	0.002459871	0.001917865
-105.1111 dBm	0.001959558	0.002584949	0.002126329	0.002543256	0.003293725
-104.6667 dBm	0.002835105	0.003293725	0.003627267	0.003877423	0.004336043
-104.2222 dBm	0.002793413	0.002835105	0.002710027	0.003752345	0.00321034
-103.7778 dBm	0.004044194	0.004669585	0.004252658	0.004210965	0.004294351
-103.3333 dBm	0.003835731	0.003335418	0.004294351	0.005128205	0.004836356
-102.8889 dBm	0.004878049	0.004210965	0.003877423	0.005253283	0.005545132
-102.4444 dBm	0.003752345	0.003794038	0.004085887	0.004752971	0.00550344
-102 dBm					

## Marker Table Results

<b>Remote Command</b>	:MMEMory:STORe:RESuLts:MTABle <filename>
<b>Example</b>	:MMEM:STOR:RES:MTAB "myResults.csv" saves the results from the current marker table to the file myResults.csv in the current path. The default path is My Documents\RTSA\data\results
<b>Notes</b>	If the save is initiated via SCPI, and the file already exists, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade. Both single and double quotes are supported for any filename parameter over SCPI.
<b>Dependencies</b>	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
<b>Preset</b>	Not part of Preset, but is reset to Peak Table by Restore Mode Defaults. Survives a shutdown.
<b>Initial S/W Revision</b>	A.13.00

## Store Peak Search Results

<b>Remote Command</b>	:MMEMory:STORe:RESuLts:PTABle <filename>
<b>Example</b>	:MMEM:STOR:RES:PTAB "myResults.csv" saves the results from the current peak table to the file myResults.csv in the current path. The default path is My Documents\RTSA\data\results
<b>Notes</b>	If the save is initiated via SCPI, and the file already exists, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade. Both single and double quotes are supported for any filename parameter over SCPI.
<b>Dependencies</b>	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

Preset	Not part of Preset, but is reset to Peak Table by Restore Mode Defaults. Survives a shutdown.
Initial S/W Revision	A.13.00

### Save Spectrogram Results

<b>Remote Command</b>	<b>:MMEMemory:STORe:RESuLts:SPECTrogram &lt;filename&gt;</b>
<b>Example</b>	:MME:STOR:RES:SPEC "SpecResults.csv" saves the results from the current Spectrogram display to the file SpecResults.csv in the current path. Default path is My Documents\RTSA\data\results
Notes	If the save is initiated via SCPI, and the file already exists, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade. Both single and double quotes are supported for any filename parameter over SCPI.
Dependencies	If a save of Spectrogram results is requested and the Spectrogram is not on, no file is saved and a message is generated.
Preset	Not part of Preset, but is reset to Peak Table by Restore Mode Defaults. Survives a shutdown.
Initial S/W Revision	A.13.00

### Store Density Results

<b>Remote Command</b>	<b>:MMEMemory:STORe:RESuLts:DENSity &lt;filename&gt;</b>
<b>Example</b>	:MME:STOR:RES:DENS "myResults.csv" saves the results from the current Density display to the file myResults.csv in the current path. The default path is My Documents\RTSA\data\results
Notes	If the save is initiated via SCPI, and the file already exists, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade. Both single and double quotes are supported for any filename parameter over SCPI.
Dependencies	If a save of Density results is requested and the Density view is not on, no file is saved and a message is generated.
Preset	Not part of Preset, but is reset to Peak Table by Restore Mode Defaults. Survives a shutdown.
Initial S/W Revision	A.13.00

### Fetch Density Results

In addition to the file storage of density results, the measurement can also return the data directly as a data block.

The returned data is a single array with values representing the fractional density at each pixel. The array is an implicit two-dimensional array, with lowest numbered scan lines stored first. Thus a general formula to retrieve the density for a specific x,y location is:

$$\text{Density}(x,y) = x + (\text{SweepPoints} * y)$$

where both x and y are zero-based indexes.

<b>Remote Command</b>	<code>:CALCulate:DATA:RTDensity?</code>
<b>Example</b>	<code>:CALCulate:DATA:RTDensity?</code> reads the results from the current Density display via a SCPI block data transfer. This query honors the current byte order and data format settings.
Initial S/W Revision	A.14.00

## Frequency Acquisition Time

The frequency acquisition time is the time the user wants to use to generate a single trace or bitmap in the Density view. This trace will be a combination of multiple, overlapped Fast Fourier Transformations (FFTs).

The Auto setting for this parameter is simply the default value.

This parameter is the acquisition time parameter used when in the Spectrum measurement.

Key Path	<b>Sweep/Control</b>
<b>Remote Command</b>	<code>[ :SENSe]:ACQuisition:TIME &lt;time&gt;</code> <code>[ :SENSe]:ACQuisition:TIME?</code> <code>[ :SENSe]:ACQuisition:TIME:AUTO OFF ON 0 1</code> <code>[ :SENSe]:ACQuisition:TIME:AUTO?</code>
<b>Example</b>	ACQ:TIME 500 ms ACQ:TIME:AUTO OFF
Dependencies	Set to Auto when Auto Couple is pressed or sent remotely
Couplings	This parameter is context sensitive. It will be used when any of the Frequency Measurement views are the active view.
Preset	30 ms ON
State Saved	Saved in instrument state
Min	The minimum Acquisition Time depends on the currently selected View. For Density View, the minimum Acquisition Time will be 30 ms. For Density/Spectrogram View, the minimum Acquisition Time will be 70 ms. For all other Spectrum Measurement views the minimum Acquisition Time is 100 us.
Max	40 s
Status Bits/OPC dependencies	Meas Uncal is Bit 0 in the STATus:QUESTionable:INTegrity:UNCalibrated register
Initial S/W Revision	A.13.00
Note	For any hardware setup, only certain discrete values are settable. Thus, any value entered for this parameter will be rounded to the nearest valid value.

### Save FMT to File

Allows you to export a mask to a file. Selecting this key will select the save type as FMT and bring up the Save As dialog box.

Key Path	Save, Data (Export), FMT
Remote Command	:MMEMory:STORe:FMT <filename>
Example	:MMEM:STOR:FMT "MYFMT.CSV" saves the FMT mask data to the file myFmt.csv in the current directory.
Notes	The default path is My Documents\<Mode>\data\FMT If the save is initiated via SCPI, and the file already exists, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade. Both single and double quotes are supported for any filename parameter over SCPI.
Initial S/W Revision	A.13.00

### Save As . . .

When you press "Save As", the analyzer brings up a Windows dialog and a menu entitled "**Save As.**" This menu allows you to navigate to the various fields in the Windows dialog without using a keyboard or mouse. The **Tab** and **Arrow** keys can also be used for dialog navigation.

See "[To File . . .](#)" on page 911 in **Save, State** for a full description of this dialog and menu.

The default path for saving files is:

For all of the Trace Data Files:

- My Documents\<mode name>\data\traces

For all of the Limit Data Files:

- My Documents\<mode name>\data\limits

For all of the Measurement Results Data Files:

- My Documents\<mode name>\data\<measurement name>\results

For all of the Capture Buffer Data Files:

- My Documents\<mode name>\data\captureBuffer

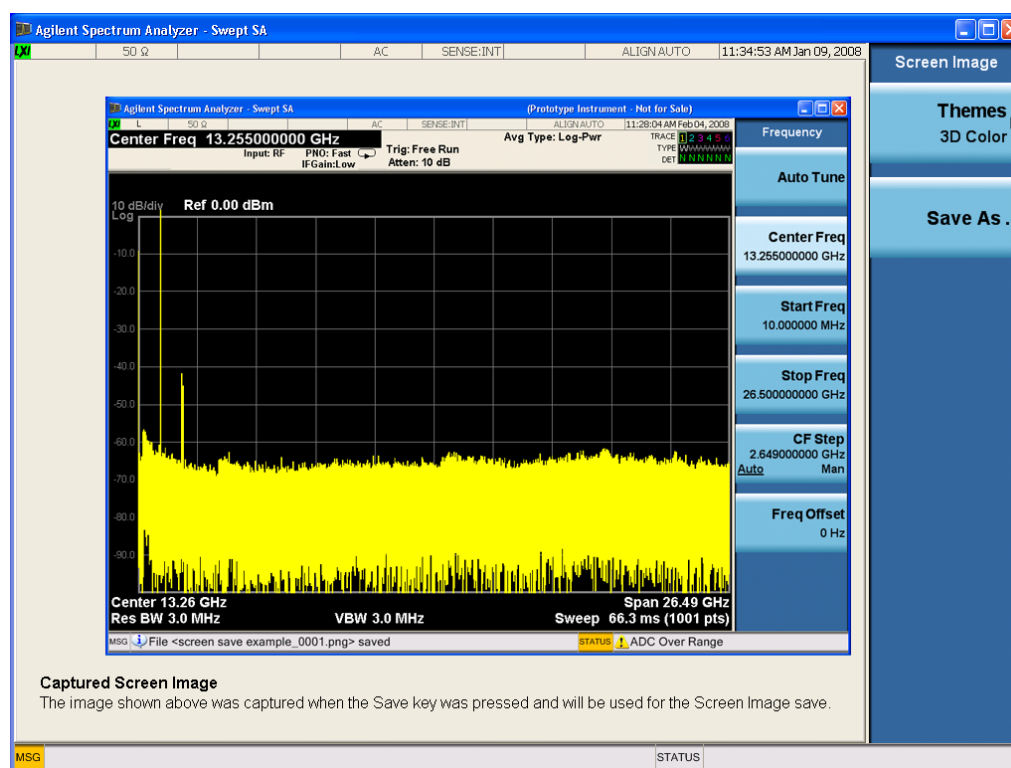
Key Path	Save, Data
Mode	All
Notes	The key location is mode-dependent and will vary. Brings up the Save As dialog for saving a <mode specific> Save Type. The save is performed immediately and does not wait until the measurement is complete.
Initial S/W Revision	Prior to A.02.00

## Screen Image

Pressing Screen Image accesses a menu of functions that enable you to specify a format and location for the saved screen image. It brings up a menu that allows you to specify the color scheme of the Screen Image (Themes) or navigate to the Save As dialog to perform the actual save.

Screen Image files contain an exact representation of the analyzer display. They cannot be loaded back onto the analyzer, but they can be loaded into your PC for use in many popular applications.

The image to be saved is actually captured when the **Save** front panel key is pressed, and kept in temporary storage to be used if you ask for a Screen Image save. When the Screen Image key is pressed, a "thumbnail" of the captured image is displayed, as shown below:



When you continue on into the **Save As** menu and complete the Screen Image save, the image depicted in the thumbnail is the one that gets saved, showing the menus that were on the screen before going into the **Save** menus. The save is performed immediately and does not wait until the measurement is complete.

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 the current screen data.



**NOTE**

For versions previous to A.01.55, if you initiate a screen image save by navigating through the Save menus, the image that is saved will contain the Save menu softkeys, not the menus and the active function that were on the screen when you first pressed the Save front panel key.

Key Path	Save
Mode	All
<b>Remote Command</b>	:MMEMory:STORe:SCReen <filename>
<b>Example</b>	:MMEM:STOR:SCR "myScreen.png" This stores the current screen image in the file MyScreenFile.png in the default directory.
<b>Backwards Compatibility SCPI</b>	HCOPY:SDUMP:DATA? returns the screen image in a <DEFINITE LENGTH ARBITRARY RESPONSE DATA> element. The response data is IEEE Block format; the controlling computer can strip the header and store the result as a .png file.
Initial S/W Revision	Prior to A.02.00

### Themes

Accesses a menu of functions that enable you to choose the theme to be used when saving the screen image.

The **Themes** option is the same as the **Themes** option under the **Display** and **Page Setup** dialogs. It allows you to choose between themes to be used when saving the screen image.

Key Path	Save, Screen Image
<b>Remote Command</b>	:MMEMory:STORe:SCReen:THEME TDColor   TDMonochrome   FCOLOR   FMONochrome :MMEMory:STORe:SCReen:THEMe?
<b>Example</b>	:MMEM:STOR:SCR:THEM TDM
Preset	3D Color; Is not part of Preset, but is reset by Restore Misc Defaults or Restore System Defaults All and survives subsequent running of the modes.
Readback	3D Color   3D Mono   Flat Color   Flat Mono
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 "Flat Color" theme available in X-Series. Also, if you selected Reverse Bitmap AND a black & white screen image, that would be much like "Flat Monochrome". In other words, each of the X-Series themes has a similar screen image type in ESA/PSA. But they are not identical.
Initial S/W Revision	Prior to A.02.00

### 3D Color

Selects a standard color theme with each object filled, shaded and colored as designed.

Key Path	Save, Screen Image, Themes
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<b>Example</b>	MMEM:STOR:SCR:THEM TDC
Readback	3D Color
Initial S/W Revision	Prior to A.02.00

### 3D Monochrome

Selects a format that is like 3D color but shades of gray are used instead of colors.

Key Path	<b>Save, Screen Image, Themes</b>
<b>Example</b>	MMEM:STOR:SCR:THEM TDM
Readback	3D Mono
Initial S/W Revision	Prior to A.02.00

### Flat Color

Selects a format that is best when the screen is to be printed on an ink printer.

Key Path	<b>Save, Screen Image, Themes</b>
<b>Example</b>	MMEM:STOR:SCR:THEM FCOL
Readback	Flat Color
Initial S/W Revision	Prior to A.02.00

### Flat Monochrome

Selects a format that is like Flat Color. But only black is used (no colors, not even gray), and no fill.

Key Path	<b>Save, Screen Image, Themes</b>
<b>Example</b>	MMEM:STOR:SCR:THEM FMON
Readback	Flat Mono
Initial S/W Revision	Prior to A.02.00

### Save As...

When you press "Save As", the analyzer brings up a Windows dialog and a menu entitled "**Save As.**" This menu allows you to navigate to the various fields in the Windows dialog without using a keyboard or mouse. The **Tab** and **Arrow** keys can also be used for dialog navigation.

See "[To File . . .](#)" on page 911 in **Save, State** for a full description of this dialog and menu.

The default path for Screen Images 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).

Key Path	<b>Save, Screen Image</b>
Notes	Brings up Save As dialog for saving a Screen Image Save Type
Initial S/W Revision	Prior to A.02.00

### Mass Storage Catalog (Remote Command Only)

Key path	<b>SCPI Only</b>
<b>Remote Command</b>	<b>:MMEMory:CATalog? [&lt;directory_name&gt;]</b>
Notes	<p>The string must be a valid logical path.</p> <p>Queries disk usage information (drive capacity, free space available) and obtains a list of files and directories in a specified directory in the following format:</p> <p>&lt;numeric_value&gt;,&lt;numeric_value&gt;,{&lt;file_entry&gt;}</p> <p>It returns two numeric parameters and as many strings as there are files and directories. The first parameter indicates the total amount of storage currently used in bytes. The second parameter indicates the total amount of storage available, also in bytes. The &lt;file_entry&gt; is a string. Each &lt;file_entry&gt; indicates the name, type, and size of one file in the directory list:</p> <p>&lt;file_name&gt;,&lt;file_type&gt;,&lt;file_size&gt;</p> <p>As the windows file system has an extension that indicates file type, &lt;file_type&gt; is always empty. &lt;file_size&gt; provides the size of the file in bytes. For directories, &lt;file_entry&gt; is surrounded by square brackets and both &lt;file_type&gt; and &lt;file_size&gt; are empty</p>
Initial S/W Revision	Prior to A.02.00

### Mass Storage Change Directory (Remote Command Only)

Key path	<b>SCPI Only</b>
<b>Remote Command</b>	<b>:MMEMory:CDIRectory [&lt;directory_name&gt;]</b> <b>:MMEMory:CDIRectory?</b>
Notes	<p>The string must be a valid logical path.</p> <p>Changes the default directory for a mass memory file system. The &lt;directory_name&gt; parameter is a string. If no parameter is specified, the directory is set to the *RST value.</p> <p>At *RST, this value is set to the default user data storage area, that is defined as System.Environment.SpecialFolder.Personal.</p> <p>Query returns full path of the default directory.</p>
Initial S/W Revision	Prior to A.02.00

### Mass Storage Copy (Remote Command Only)

Key path	<b>SCPI Only</b>
<b>Remote Command</b>	<b>:MMEMory:COpy &lt;string&gt;,&lt;string&gt;[,&lt;string&gt;,&lt;string&gt;]</b>
Notes	<p>The string must be a valid logical path.</p> <p>Copies an existing file to a new file or an existing directory to a new directory.</p> <p>Two forms of parameters are allowed. The first form has two parameters. In this form, the first parameter specifies the source, and the second parameter specifies the destination.</p>

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The second form has four parameters. In this form, the first and third parameters specify the source. The second and fourth parameters specify the directories. The first pair of parameters specifies the source. The second pair specifies the destination. An error is generated if the source doesn't exist or the destination file already exists.

This command will generate an "access denied" error if the destination is a restricted folder (e.g., C:\Windows) and the current user does not have Power User or Administrator privileges.

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## Mass Storage Device Copy (Remote Command Only)

This command transfers data to/from a file and a peripheral device.

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Key path	SCPI Only
<b>Remote Command</b>	:MMEMory:COpy:DEvIce <source_string>,<dest_string>
Notes	<p>The strings must be a valid logical path or a valid device keyword. If the dest_string is a device keyword, the data is copied from the source file to the device. If the source_string is a device keyword, the data is copied to the source file from the device.</p> <p>Valid device keywords are:</p> <p>SNS (smart noise source)</p> <p>An error is generated if the file or device is not found.</p>

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## Mass Storage Delete (Remote Command Only)

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Key path	SCPI Only
<b>Remote Command</b>	:MMEMory:DELEte <file_name>[,<directory_name>]
Notes	<p>The string must be a valid logical path.</p> <p>Removes a file from the specified directory. The &lt;file_name&gt; parameter specifies the file name to be removed. This command will generate an "access denied" error if the file is in a restricted folder (e.g., C:\Windows) and the current user does not have Power User or Administrator privileges.</p>
Initial S/W Revision	Prior to A.02.00

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## Mass Storage Data (Remote Command Only)

Creates a file containing the specified data OR queries the data from an existing file.

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Key path	SCPI Only
<b>Remote Command</b>	:MMEMory:DATA <file_name>, <data> :MMEMory:DATA? <file_name>
Notes	<p>The string must be a valid logical path.</p> <p>The command form is MMEMory:DATA &lt;file_name&gt;,&lt;data&gt;. It loads &lt;data&gt; into the file &lt;file_name&gt;. &lt;data&gt; is in 488.2 block format. &lt;file_name&gt; is string data.</p> <p>The query form is MMEMory:DATA? &lt;file_name&gt; with the response being the associated &lt;data&gt; in block format.</p>
Initial S/W Revision	Prior to A.02.00

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## Mass Storage Make Directory (Remote Command Only)

Key path	SCPI Only
<b>Remote Command</b>	<b>:MMEMory:MDIRectory &lt;directory_name&gt;</b>
Notes	The string must be a valid logical path. Creates a new directory. The <directory_name> parameter specifies the name to be created. This command will generate an “access denied” error if the new directory would be in a restricted folder (e.g., C:\Windows) and the current user does not have Power User or Administrator privileges.
Initial S/W Revision	Prior to A.02.00

## Mass Storage Move (Remote Command Only)

Key path	SCPI Only
<b>Remote Command</b>	<b>:MMEMory:MOVE &lt;string&gt;,&lt;string&gt;[,&lt;string&gt;,&lt;string&gt;]</b>
Notes	The string must be a valid logical path. Moves an existing file to a new file or an existing directory to a new directory. Two forms of parameters are allowed. The first form has two parameters. In this form, the first parameter specifies the source, and the second parameter specifies the destination. The second form has four parameters. In this form, the first and third parameters specify the source. The second and fourth parameters specify the directories. The first pair of parameters specifies the source. The second pair specifies the destination. An error is generated if the source doesn't exist or the destination file already exists. This command will generate an “access denied” error if the destination is a restricted folder (e.g., C:\Windows) and the current user does not have Power User or Administrator privileges.
Initial S/W Revision	Prior to A.02.00

## Mass Storage Remove Directory (Remote Command Only)

Key path	SCPI Only
<b>Remote Command</b>	<b>:MMEMory:RDIRectory &lt;directory_name&gt;</b>
Notes	The string must be a valid logical path. Removes a directory. The <directory_name> parameter specifies the directory name to be removed. All files and directories under the specified directory shall also be removed. This command will generate an “access denied” error if the folder is a restricted folder (e.g., C:\Windows) or is in a restricted folder and the current user does not have Power User or Administrator privileges.
Initial S/W Revision	Prior to A.02.00

## Mass Storage Determine Removable Media (Remote Command Only)

This command is used to determine if any removable media devices are connected to the instrument. Primarily, these are USB memory devices plugged-in to the front panel or rear panel USB ports. On instruments with PC6 or PC7 CPU's, one SD card

slot is available for removable media. The instrument's primary disk drive is not a removable media device.

Key Path	SCPI Only
<b>Remote Command</b>	<b>:MMEMory:RMEDia:LIST?</b>
Notes	The return value is a string containing a list of partition identifiers that are removable media devices. Each identifier is separated by a comma. If no removable media is present, an empty string is returned. Examples: <ul style="list-style-type: none"> <li>- One removable device present results in a return string of "F:".</li> <li>- Two removable devices present results in a return string of "F:,G:".</li> <li>- No removable devices present results in a return string of "".</li> </ul>
Initial S/W Revision	x.15.00

### Mass Storage Determine Removable Media Label (Remote Command Only)

This command is used to set or query a removable media device's label.

Key Path	SCPI Only
<b>Remote Command</b>	<b>:MMEMory:RMEDia:LABel &lt;partition&gt;,&lt;string&gt;</b> <b>:MMEMory:RMEDia:LABel? &lt;partition&gt;</b>
<b>Example</b>	MMEM:RMED:LAB "F:","My Device"
Notes	If the <partition> specified does not exist or is not a removable media device, the error - 252,"Missing Media" is generated. Setting the removable media label requires Administrative privileges. If the currently logged in user does not have appropriate privileges the error "-221.9900,Settings conflict;Administrator privileges required" is generated.
Initial S/W Revision	x.15.00

### Mass Storage Determine Removable Media Write-protect status (Remote Command Only)

This command is used to query a removable media device's write-protect status.

Key Path	SCPI Only
<b>Remote Command</b>	<b>:MMEMory:RMEDia:WPRotect? &lt;partition&gt;</b>
<b>Example</b>	MMEM:RMED:WPR? "F:"
Notes	The return value is 1 if the device is write-protected, or 0 if the device is write-enabled. If the <partition> specified does not exist or is not a removable media device the error - 252,"Missing Media" is generated.
Preset	The return value will be depending on SD card installed.
Initial S/W Revision	x.15.00

## Mass Storage Determine Removable Media size (Remote Command Only)

This command is used to query a removable media device's total memory size (not available memory size).

Key Path	SCPI Only
<b>Remote Command</b>	<b>:MMEMory:RMEDia:SIZE? &lt;partition&gt;</b>
<b>Example</b>	MMEM:RMED:SIZE? "F:"
Notes	The return value is integer value in GBytes. Any device that is less than 1 GB returns 0 GB. If the <partition> specified does not exist or is not a removable media device, the error - 252, "Missing Media" is generated.
Initial S/W Revision	x.15.00

## :SYSTem:SET (Remote Command Only)

Remote command that allows the user to obtain the state of the currently active mode in a form that can then be loaded back into the instrument quickly.

<b>Remote Command</b>	<b>SYSTem:SET &lt;instrument state in IEEE Block&gt;</b> <b>SYSTem:SET?</b>
Notes	SYST:SET? returns current instrument state of the active mode in IEEE Block data format. The state is in a machine readable format only. Sending the query returns the following format: <syst set preamble><state block data> Where: <syst set preamble> is the format: #NMMM N=number of digits that comprise MMM MMM=length in bytes of following data <state block data> is machine readable state data Example response: #42016<state data> The state is recalled by sending the SYST:SET? Response data to the instrument. From example above: SYST:SET #42016<state data>
Initial S/W Revision	x.17.00

## Single (Single Measurement/Sweep)

Sets the analyzer for Single measurement operation. The single/continuous state is Meas Global, so the setting will affect all the measurements. If you are Paused, pressing **Single** does a Resume.

See "[More Information](#)" on page 636

Key Path	Front-panel key
<b>Example</b>	:INIT:CONT OFF
Notes	See <b>Cont</b> key description.
Backwards Compatibility Notes	<p>For Spectrum Analysis mode in ESA and PSA, the <b>Single</b> hardkey and the INITiate:IMM switched from continuous measurement to single measurement and restarted sweeps and averages (displayed average count reset to 1), but did not restart <b>Max Hold</b> and <b>Min Hold</b>. In the X-Series, the <b>Single</b> hardkey and the INITiate:IMM command initiate a sweep/ measurement/ average sequence/hold sequence including <b>MaxHold</b> and <b>MinHold</b>.</p> <p>For Spectrum Analysis mode in ESA and PSA, the <b>Single</b> hardkey restarted the sweep regardless of whether or not you were in an active sweep or sweep sequence. In the X-Series, <b>Restart</b> does this but <b>Single</b> only restarts the sweep or sweep sequence if you are in the idle state.</p> <p>INIT[:IMM] in ESA &amp; PSA Spectrum Analysis Mode does an implied ABORt. In some other PSA Modes, INIT[:IMM] is ignored if not in the idle state. . The X-Series follows the ESA/PSA SA Mode model, which may cause some Modes to have compatibility problems.</p>
Initial S/W Revision	Prior to A.02.00

### More Information

See "[Restart](#)" on page 908 for details on the INIT:IMMEDIATE (Restart) function.

If you are already in single sweep, the INIT:CONT OFF command has no effect.

If you are already in Single Sweep, then pressing the **Single** key in the middle of a sweep does not restart the sweep or sequence. Similarly, pressing the **Single** key does not restart the sweep or sequence if the sweep is not in the idle state (for example, if you are taking a very slow sweep, or the analyzer is waiting for a trigger). Instead, it results in a message. "Already in Single, press Restart to initiate a new sweep or sequence". Even though pressing the **Single** key in the middle of a sweep does not restart the sweep, sending INIT:IMMEDIATE does reset it.

To take one more sweep without resetting the average count, increment the average count by 1, by pressing the step up key while **Average/Hold Number** is the active function, or sending the remote command CALC:AVER:TCON UP.



## Source

There is no Source functionality in RTSA. If this key is pressed, a blank menu will be displayed.

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Key Path	<b>Front-panel key</b>
Initial S/W Revision	A.13.00

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## Span

Activates the Span function and displays a menu of span functions. This key also allows control of the X Scale display when the Power vs Time window is selected.

Key Path	<b>SPAN X Scale</b>
Initial S/W Revision	A.13.00

### Span

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

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**.

While discussing the Span function we make the distinction between “swept spans” and “zero span”. We use the term “swept spans” to mean spans other than zero; recognizing that, because of this terminology, the user can be in what we call a “swept span” even while performing an FFT “sweep”.

While in swept spans, setting the span to 0 Hz through SCPI or the front panel numeric key pad puts the analyzer into zero span. However, using the Step keys and the RPG in swept spans, the Span can only go as far down as 10 Hz and cannot be set to zero.

While in zero span, setting the Span to a non-zero value through SCPI or Front Panel puts the analyzer in swept spans.

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

See ["Span Presets" on page 639](#)

Key Path	<b>SPAN X Scale</b>
<b>Remote Command</b>	[ :SENSe ] :FREQuency:SPAN <freq> [ :SENSe ] :FREQuency:SPAN?
<b>Example</b>	FREQ:SPAN 2GHz sets the span to 2GHz FREQ:SPAN 0 Hz Sets the span to 0 Hz and puts the instrument in Zero Span
Dependencies	If the electrical attenuator is enabled, any attempt to set Span such that the Stop Frequency would be >3.6 GHz results in an error.  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 analyzers 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 key description for details of this limitation.
Couplings	Span affects RBW, sweep time, FFT & Sweep choice (including FFT Width, Phase Noise Optimization and ADC Dither auto couplings.) When operating in "swept span": <ul style="list-style-type: none"> <li>- Any value of the Center Frequency or Span that is within the frequency range of the analyzer 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 analyzer's frequency range</li> <li>- When using the knob or the step up/down keys or the UP  DOWN keywords in SCPI, the value that is being changed i.e. the Center Frequency or Span, is limited so that the other parameter is not forced to a new value</li> <li>- 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.</li> </ul>
Preset	Depends on instrument maximum frequency, mode, measurement, and selected input. See " <a href="#">Span Presets</a> " on page 639
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. In the Swept SA measurement, in Trace Zoom, Zero Span is not allowed, so the Span may not go below 10 Hz. In the Swept SA measurement, in Zone Span, Zero Span is not allowed in the top window, so the Span may not go below 10 Hz in the top window.
Max	Depends on instrument maximum frequency, mode, measurement, and selected input. See " <a href="#">Span Presets</a> " on page 639 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.
Default Unit	Hz
Status Bits/OPC dependencies	Overlapped if Signal Track is on (OPC shouldn't return or clear until the zooming has completed for the new span)
Initial S/W Revision	Prior to A.02.00

### Span Presets

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

<b>Freq Option</b>	<b>Span after Mode Preset</b>	<b>Max Span (can't set higher than this)</b>
503 (all but N9000A)	3.59 GHz	3.7 GHz
503 (N9000A)	2.99 GHz	3.08 GHz
507 (all but N9000A)	6.99 GHz	7.1 GHz
507 (N9000A)	7.49 GHz	7.58 GHz
508 (all but N9038A)	8.39 GHz	8.5 GHz
508 (N9038A)	3.59 GHz	8.5 GHz
513	13.59 GHz	13.8 GHz
526 (all but N9000A and N9038A)	26.49 GHz	27.0 GHz
526 (N9038A)	3.59 GHz	27.0 GHz
526 (N9000A)	26.49 GHz	26.55 GHz
543	42.99 GHz	TBD
544	43.99 GHz	44.5 GHz
550	49.99 GHz	51 GHz

Input 2:

<b>Model</b>	<b>Span after Mode Preset</b>	<b>Max Span (can't set higher than this)</b>
N9000A opt C75	1.499 GHz	1.58 GHz
N9038A	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.

## Full Span

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

The span is dependent on the currently selected Input (see the Section “Input/Output”). For example, when using external mixing, it changes the frequency to the Preset frequency range specified for the selected external mixing band.

Pressing this key while in zero span puts the analyzer back in swept span.

Key Path	<b>SPAN X Scale</b>
<b>Remote Command</b>	[ :SENSe ] :FREQuency :SPAN :FULL
<b>Example</b>	FREQ:SPAN:FULL Sets the span to full frequency range of the analyzer
Notes	n /a
Couplings	Turns off signal tracking (span zoom). It does NOT turn off the markers, nor the current active function.
Backwards Compatibility Notes	In the past, the <b>Full Span</b> function turned off all markers. In the X-Series this is not the case.
Initial S/W Revision	Prior to A.02.00

## Last Span

Changes the displayed frequency span to the previous span setting. If it is pressed immediately after Signal Track is turned off, then the span setting returns to the span that was in effect before Signal Track was turned on.

If this key is pressed while in a nonzero span, and the previous value of span was 0, it will put the analyzer back in Zero Span. And if it is pressed while in zero span, it will set the analyzer back to its last nonzero span.

Pressing Last Span places the analyzer in Center/Span frequency entry mode.

Key Path	<b>SPAN X Scale</b>
<b>Remote Command</b>	[ :SENSe ] :FREQuency :SPAN :PREVious
<b>Example</b>	FREQ:SPAN:PREV Sets the span to the previous value
Notes	n /a
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.
Initial S/W Revision	Prior to A.02.00

## Power vs Time Reference Value

Sets the horizontal scale reference value for the Power vs Time window. Changing the reference level does not restart the measurement because it is a display function only; instead, it horizontally ‘pans’ all display traces and markers to the new value. This value will change if Auto Scaling is on and the Ref Position is changed.

Key Path	<b>SPAN X Scale</b>
Mode	RTSA

Couplings	If the Auto Scaling is set to On, this value is automatically determined by the measurement result and Ref Position. When set manually, Auto Scaling automatically changes to Off.
Preset	0.000 s
State Saved	Saved in instrument state.
Min	-1.00 s
Max	57 s ! Determined by the Pvt Acq Time max value
Initial S/W Revision	A.13.00

## Power vs Time Scale/Div

Sets the horizontal scale in the Power vs Time window by changing the time value per division. There are ten graticule division for the x scale. The default value for Power vs Time Scale/Div is 10% of the Reference value. By decreasing the Scale/Div value, you will be able to zoom in on a selected portion of the trace.

Key Path	<b>SPAN X Scale</b>
Mode	RTSA
Couplings	If the Auto Scaling is set to On, this value is automatically determined by the measurement result. When set manually, Auto Scaling automatically changes to Off. When Auto Scaling is changed from Off to On, then it is set
Preset	3 ms
State Saved	Saved in instrument state.
Min	1.000 ns
Max	5.7 s ! Determined by the Max Ref value / 10
Initial S/W Revision	A.13.00

## Power vs Time Reference Position

Sets the X scale reference position in the Power vs Time window to Left, Ctr (center) or Right.

When Auto Scaling is on, changing the reference position will show the current Reference value at the specified position. For instance, when the reference position is set to Left, the Reference value will show the left most value (typically 0[s]) of the display grid. When the reference position is changed from Left → Ctr, then the Reference value changes and will show the current value of the center point of the grid which will be half the value of the Pvt acq time. If the reference position is further toggled and set to Right, then the Reference value changes and will show the current value of the right most point of the grid which will be the Pvt acq time.

When Auto Scaling is off, then changing the reference position will set the display grid to the current Reference value. For instance, if the Reference value is set to 0[s] and the Reference position is changed from Left → Ctr, then the display grid shifts and the center of the grid will now become 0[s]. If the reference position is further

toggled and set to Right, then the display grid shifts and the right most point of the grid now becomes 0[s].

Key Path	<b>SPAN X Scale</b>
Mode	RTSA
Preset	LEFT
State Saved	Saved in instrument state.
Range	Left   Ctr   Right
Initial S/W Revision	A.13.00

### Power vs Time Auto Scaling

Allows toggling of the Auto Scaling function in the Power vs Time window between On and Off. When Auto Scaling is turned on, the left most portion of the display grid will be set to the start of the trace (usually 0[s]) and the right most portion of the display grid will be set to the Pvt Acq Time value. The values of the Reference Level and Scale/Div are dependent on the current Reference position setting, which does not change when Auto Scaling is toggled.

Key Path	<b>SPAN X Scale</b>
Mode	RTSA
Couplings	Upon pressing the Restart front-panel key, this function automatically determines the scale per division and reference values based on the measurement results. When a value is set manually to either Scale/Div or Ref Value parameters, Auto Scaling automatically changes to Off.
Preset	ON
State Saved	Saved in instrument state.
Range	On   Off
Initial S/W Revision	A.13.00

## Sweep/Control

Accesses a menu that enables you to configure the Sweep and Control functions of the analyzer, such as Sweep Time and Gating.

Key Path	Front-panel key
Initial S/W Revision	Prior to A.02.00

### Frequency Acquisition Time

The frequency acquisition time is the time the user wants to use to generate a single trace or bitmap in the Density view. This trace will be a combination of multiple, overlapped Fast Fourier Transformations (FFTs).

The Auto setting for this parameter is simply the default value.

This parameter is the acquisition time parameter used when in the Spectrum measurement.

Key Path	Sweep/Control
<b>Remote Command</b>	[:SENSe]:ACQuisition:TIME <time> [:SENSe]:ACQuisition:TIME? [:SENSe]:ACQuisition:TIME:AUTO OFF ON 0 1 [:SENSe]:ACQuisition:TIME:AUTO?
<b>Example</b>	ACQ:TIME 500 ms ACQ:TIME:AUTO OFF
Dependencies	Set to Auto when Auto Couple is pressed or sent remotely
Couplings	This parameter is context sensitive. It will be used when any of the Frequency Measurement views are the active view.
Preset	30 ms ON
State Saved	Saved in instrument state
Min	The minimum Acquisition Time depends on the currently selected View. For Density View, the minimum Acquisition Time will be 30 ms. For Density/Spectrogram View, the minimum Acquisition Time will be 70 ms. For all other Spectrum Measurement views the minimum Acquisition Time is 100 us.
Max	40 s
Status Bits/OPC dependencies	Meas Uncal is Bit 0 in the STATus:QUEStionable:INTegrity:UNCalibrated register
Initial S/W Revision	A.13.00
Note	For any hardware setup, only certain discrete values are settable. Thus, any value entered for this parameter will be rounded to the nearest valid value.



## Pause

Pauses all measurements after the current data acquisition is complete.

When Paused, the label on the key changes to Resume. Pressing Resume un-pauses the measurement. When you are Paused, pressing **Single** or **Cont** also does a Resume.

Key Path	<b>Sweep/Control</b>
<b>Remote Command</b>	<b>:INITiate:PAUSE</b>
Couplings	<p>When Averaging is On, if the measurement is paused no more updates will occur until either a Resume or Restart occurs.</p> <p>If the measurement is resumed, the averaging will continue using the traces from before the Pause occurred and continue using the traces from the point where the Resume occurred. This will still provide real-time traces but they will no longer be gap free.</p> <p>In Spectrogram view, when the measurement is paused the Spectrogram will stop updating. When resume is selected the spectrogram will retain the existing traces and continue updating using traces from the point at which Resume was selected. The time stamp of the individual Spectrogram traces will show the time from the beginning of the measurement the trace relates therefore showing there was a gap in the Spectrogram capture.</p> <p>In Density view, when the measurement is paused the Density Display will stop updating. When the measurement is resumed, if Persistence is on the persistence fading will continue from the point when the measurement was paused. For additional details on Persistence refer to section "<a href="#">Persistence</a>" on page 705.</p> <p>If a restart occurs, the average counter is reset and all results are discarded. The measurement begins again using traces after the Restart occurred.</p>
Initial S/W Revision	A.13.00

Key Path	<b>Sweep/Control</b>
<b>Remote Command</b>	<b>:INITiate:RESume</b>
Couplings	See Couplings in the Pause parameter table.
Initial S/W Revision	A.13.00

## Abort (Remote Command Only)

This command is used to stop the current measurement. It aborts the current measurement as quickly as possible, resets the sweep and trigger systems, and puts the measurement into an "idle" state. If the analyzer is in the process of aligning when ABORT is sent, the alignment finishes before the abort function is performed. So ABORT does not abort an alignment.

If the analyzer is set for Continuous measurement, it sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the analyzer is set for Single measurement, it remains in the "idle" state until an :INIT:IMM command is received.

<b>Remote Command</b>	<b>:ABORt</b>
<b>Example</b>	:ABOR
Notes	If :INITiate:CONTinuous is ON, then a new continuous measurement will start immediately; with sweep (data acquisition) occurring once the trigger condition has been met. If :INITiate:CONTinuous is OFF, then :INITiate:IMMediate is used to start a single measurement; with sweep (data acquisition) occurring once the trigger condition has been met.
Dependencies	For continuous measurement, ABORt is equivalent to the Restart key. Not all measurements support the abort command.
Status Bits/OPC dependencies	The STATus:OPERation register bits 0 through 8 are cleared. The STATus:QUESTionable register bit 9 (INTEgrity sum) is cleared. Since all the bits that feed into OPC are cleared by the ABORt, the ABORt will cause the *OPC query to return true.
Initial S/W Revision	Prior to A.02.00

### Spectrum Acquisition Points (Remote Command Only)

Returns the number of points of the Spectrum trace. This is a query only command and the number of points of the Spectrum trace cannot be changed.

<b>Remote Command</b>	<b>[ :SENSe ] :ACQuisition :POINts?</b>
<b>Example</b>	ACQ:POIN?
Preset	821
State Saved	Saved in instrument state
Min	821
Max	821
Initial S/W Revision	A.13.00

### Minimum Signal Duration for 100 % POI (Remote Query Only)

Returns the minimum signal duration to achieve 100 % probability of intercept. This is a query only and what affects this value is Span and Rbw.

<b>Remote Command</b>	<b>[ :SENSe ] :ACQuisition :MSDuration?</b>
<b>Example</b>	ACQ:MSD?
Couplings	Span, RBW and Filter Type will cause this value to change. Max Span and narrowest window length from RBW6 gives the min value. Max value occurs at narrowest Span and widest window length of RBW1.
Preset	5.97 usec
State Saved	Saved in instrument state
Min	3.57 usec
Max	8.192 sec
Initial S/W Revision	A.13.00

## System

See "[System](#)" on page 252

## Trace/Detector

Key Path	Front-panel key
Remote Command	:TRACe[1]   2   ...   12:TYPE WRITe   AVERAge   MAXHold   MINHold :TRACe[1]   2   ...   12:TYPE?
Example	:TRAC1:TYPE MAXH Sets Spectrum Trace1 trace type to MAXHold.
Notes	WRITe = Clear Write AVERAge = Trace Average MAXHold = Maximum Hold MINHold = Minimum Hold Trace index 1–6 corresponds to Spectrum Trace 1–6 and index 7–12 corresponds to Pvt Trace1–6.
Couplings	Sending a trace command does not cause the specified trace to become selected. Selecting a trace type (pressing any of the four keys or sending a TRAC:TYPE command) puts <b>Update in On</b> and <b>Display in On</b> , even if that trace type was already selected. Spectrogram Trace1 only supports WRITe. Thus, if anything other than WRITe is specified for a Spectrogram Trace1, then the error “–221, Settings conflict. Feature not available for this trace” is generated. Similarly, all Pvt traces only support WRITe. Thus, if anything other than WRITe is specified for any trace index 7–12, then the error “–221, Settings conflict. Feature not available for this trace” is generated.
Preset	During normal operation of the instrument (that is, other than at powerup), after a mode preset is performed, all active traces are cleared. This is so their domains and initial x values will match the current X Axis of the analyzer. Inactive traces are not cleared after a preset, so a trace which is in <b>Update=On</b> before a preset, and in <b>Update=Off</b> after the preset, will still have the data that it had before the preset.
State Saved	The type of each trace is saved in Instrument State
Initial S/W Revision	A.13.00

## Select Trace

Determines which trace the type control keys will affect. When you select a trace, it makes that trace the current trace, so it displays on top of all of the other traces.

Key Path	Trace/Detector
Dependencies	When Signal ID is on, Traces 3-6 are grayed out in Image Shift Mode.
Couplings	<ul style="list-style-type: none"> <li>– In Image Suppress mode when you select a trace it becomes the active trace, and the formerly active trace goes into View</li> <li>– When you turn on Image Suppress, Update turns off for all traces except the selected trace</li> </ul>
Preset	Trace 1
State Saved	The number of the selected trace is saved in Instrument State
Initial S/W Revision	Prior to A.02.00

## Clear Write

In **Clear Write** type each trace update replaces the old data in the trace with new data. Pressing the **Clear Write** key for the selected trace, or sending the TRAC:TYPE WRIT command for the specified 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.

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, and 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, a new sweep is initiated but the trace is not cleared.

Key Path	<b>Trace/Detector</b>
<b>Example</b>	TRAC:TYPE WRIT
Notes	See "Trace/Detector".
Dependencies	When Signal ID is on, this key is grayed out for Traces 2-6 in Image Suppress mode and for Traces 3-6 in Image Shift Mode.
Couplings	Whenever you press <b>Clear Write</b> or send the equivalent SCPI command, <b>Update</b> is set to <b>On</b> and <b>Display</b> is set to <b>On</b> . Automatic detector selection and the VBW:RBW ratio auto rules both depend on the trace type selections
Preset	After a Preset, any trace that is in <b>Clear Write</b> is cleared (all trace points set to mintracevalue).
State Saved	The type for each trace is saved in Instrument State
Backwards Compatibility Notes	Previous to the X-Series, pressing <b>Clear Write</b> while already in <b>Clear Write</b> (or doing so remotely) had no effect. Now it will clear the trace and restart the sweep
Initial S/W Revision	Prior to A.02.00

## 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. Details of the averaging calculations may be found under Average/Hold Number and Average Type in the Meas Setup Section.

See "[Trace Averaging: More Information](#)" on page 650.

Key Path	<b>Trace/Detector</b>
<b>Example</b>	TRAC2:TYPE AVER
Notes	See Trace/Detector.
Dependencies	When Signal ID is on, this key is grayed out for Traces 2-6 in Image Suppress mode and for Traces 3-6 in Image Shift Mode.
Couplings	Affected by <b>Average Type</b> and <b>Average/Hold Number</b>

	Whenever you press <b>Trace Average</b> or send the equivalent SCPI command, <b>Update</b> is set to <b>On</b> and <b>Display</b> is set to <b>On</b> . Automatic detector selection and the VBW:RBW ratio auto rules both depend on the trace type selections.
Preset	After a Preset, any trace that is in Trace Average is cleared (all trace points set to mintracevalue).
State Saved	The type for each trace is saved in instrument state
Initial S/W Revision	Prior to A.02.00

### Trace Averaging: More Information

Pressing the **Trace Average** key (for the selected trace), or sending the TRAC:TYPE AVER command (for the specified trace), sets the trace type to **Trace Average** and causes the average to be restarted.

When in **Trace Average**, if a measurement-related instrument setting is changed, 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.

Pressing the **Max Hold** key for the selected trace, or sending the :TRAC:TYPE MAXH command for the specified 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, 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.

Key Path	<b>Trace/Detector</b>
<b>Example</b>	TRAC4:TYPE MAXH
Notes	See "Trace/Detector".
Dependencies	<p>When Signal ID is on, this key is grayed out for Traces 2-6 in Image Suppress mode and for Traces 3-6 in Image Shift Mode.</p> <p>When the Average/Hold switch in the Mode Setup, Legacy Compatibility menu is in the "Legacy" position, the following is true for traces in Max Hold:</p> <ul style="list-style-type: none"> <li>- 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</li> <li>- 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).</li> </ul>
Couplings	<p>Affected by <b>Average Type</b> and <b>Average/Hold Number</b></p> <p>Whenever you press <b>Max Hold</b> or send the equivalent SCPI command, <b>Update</b> is set to <b>On</b> and <b>Display</b> is set to <b>On</b>.</p> <p>Automatic detector selection and the VBW:RBW ratio auto rules both depend on the trace type selections.</p>
Preset	After a Preset, any trace that is in <b>Max Hold</b> is cleared (all trace points set to mintracevalue).
State Saved	The type for each trace is saved in instrument state
Backwards Compatibility Notes	<p>In the X-Series, unlike earlier analyzers, Max Hold and Min Hold now obey the Average Number and counts up to a terminal value as Average always has.</p> <p>As the <b>Average/Hold Number</b> now affects <b>Min Hold</b> and <b>Max Hold</b>, the things that restart Averaging (e.g., the Restart key) now also restart <b>Min Hold</b> and <b>Max Hold</b>.</p> <p>As a result of these changes, users who used to restart averaging while retaining a running Max Hold will find that they need to rewrite their code, because the Max Hold will restart when the Average does.</p> <p>Also, previous to the X-Series,</p> <ul style="list-style-type: none"> <li>- pressing <b>Max Hold</b> while already in <b>Max Hold</b> (or doing so remotely) had no effect. Now it will clear the trace and restart the sweep and the Max Hold sequence..</li> <li>- changing the vertical scale (Log/Lin or dB/div) of the display restarted <b>Max Hold</b> and <b>Min Hold</b>. This is no longer the case in the X-Series.</li> </ul>
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.11.00

## 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 Average/Hold Number in the Meas Setup Section.

Pressing the **Min Hold** key for the selected trace, or sending the TRAC:TYPE MINH command for the specified 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, 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.

Key Path	Trace/Detector
<b>Example</b>	TRAC3:TYPE MINH
Notes	See "Trace/Detector".
Dependencies	<p>When Signal ID is on, this key is grayed out for Traces 2-6 in Image Suppress mode and for Traces 3-6 in Image Shift Mode.</p> <p>When the Average/Hold switch in the Mode Setup, Legacy Compatibility menu is in the "Legacy" position, the following is true for traces in Min Hold:</p> <ul style="list-style-type: none"> <li>– They pay no attention to the Average/Hold number; "Single" for 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</li> <li>– They don't clear the Min Hold on a Restart or Single or INIT:IMM (changing a measurement parameter like frequency or bandwidth etc. would still restart the min hold).</li> </ul>
Couplings	<p>Affected by <b>Average Type</b> and <b>Average/Hold Number</b>.</p> <p>Whenever you press <b>Min Hold</b> or send the equivalent SCPI command, <b>Update</b> is set to <b>On</b> and <b>Display</b> is set to <b>On</b>.</p> <p>Automatic detector selection and the VBW:RBW ratio auto rules both depend on the trace type selections.</p>
Preset	After a Preset, any trace that is in <b>Min Hold</b> is cleared (all trace points set to maxtracevalue).
State Saved	The type for each trace is saved in instrument state
Backwards	In the X-Series, unlike earlier analyzers, Max Hold and Min Hold now obey the Average Number



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Compatibility Notes	<p>and counts up to a terminal value as Average always has.</p> <p>As the <b>Average/Hold Number</b> now affects <b>Min Hold</b> and <b>Max Hold</b>, the things that restart Averaging (e.g., the Restart key) now also restart <b>Min Hold</b> and <b>Max Hold</b>.</p> <p>As a result of these changes, users who used to restart averaging while retaining a running Min Hold will find that they need to rewrite their code, because the Min Hold will restart when the Average does.</p> <p>Also, previous to the X-Series,</p> <ul style="list-style-type: none"> <li>- pressing <b>Min Hold</b> while already in <b>Min Hold</b> (or doing so remotely) had no effect. Now it will clear the trace and restart the sweep and the Min Hold sequence.</li> <li>- changing the vertical scale (Log/Lin or dB/div) of the display restarted <b>Max Hold</b> and <b>Min Hold</b>. This is no longer the case in the X-Series.</li> </ul>
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Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.11.00

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## View/Blank

This key lets you set the state of the two trace variables, Update and Display. The four choices available in this 1-of-N menu are:

- Trace On: Update and Display both On
- View: Update Off and Display On
- Blank: Update Off and Display Off
- Background: Update On, Display Off (this allows a trace to be blanked and continue to update "in the background", which was not possible in the past)

See ["Trace Update State On/Off" on page 654](#)

See ["Trace Display State On/Off" on page 654](#)

See ["More Information" on page 654](#)

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Key Path	<b>Trace/Detector</b>
Notes	<p>The four states of this 1-of-N actually set two variables, Update and Display, to their four possible combinations:</p> <ul style="list-style-type: none"> <li>- Trace On: Update and Display both On</li> <li>- View: Update Off and Display On</li> <li>- Blank: Update Off and Display Off</li> <li>- Background: Update On, Display Off</li> </ul> <p>See tables below for detail on the SCPI to control these two variables.</p>
Dependencies	When Signal ID is on, this key is grayed out.

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Couplings	<p>Selecting a trace type (Clear Write, Trace Average, Max Hold, Min Hold) for a trace (pressing the key or sending the equivalent SCPI command) puts the trace in Trace On (Update On and Display On), even if that trace type was already selected.</p> <p>Selecting a detector for a trace (pressing the key or sending a [:SENS]:DET:TRAC command) puts the trace in Trace On (Update On and Display On), even if that detector was already selected.</p> <p>Selecting a math mode other than Off for a trace (pressing the key or sending the equivalent SCPI command) puts the trace in Trace On (Update On and Display On), even if that math mode was already selected.</p> <p>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.</p>
Initial S/W Revision	Prior to A.02.00

### Trace Update State On/Off

Key Path	Trace/Detector
<b>Remote Command</b>	:TRACe[1] 2 ... 12:UPDate[:STATe] ON OFF 0 1 :TRACe[1] 2 ... 12:UPDate[:STATe]?
<b>Example</b>	TRAC2:UPD 0 Makes Spectrum Trace 2 trace inactive (stops updating)
Notes	Trace index 1–6 corresponds to Spectrum Trace 1–6 and index 7–12 corresponds to Pvt Trace1–6
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 0 0 0 0 0 0 (On for Trace 1; Off for 2–12)
State Saved	Saved in Instrument State
Initial S/W Revision	A.13.00

### Trace Display State On/Off

Key Path	Trace/Detector
<b>Remote Command</b>	:TRACe[1] 2 ... 12:DISPlay[:STATe] ON OFF 0 1 :TRACe[1] 2 ... 12:DISPlay[:STATe]?
<b>Example</b>	TRAC2:DISP 1 Makes trace 2 visible TRAC3:DISP 0 Blanks trace 3
Notes	Trace index 1–6 corresponds to Spectrum Trace 1–6 and index 7–12 corresponds to Pvt Trace1–6
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 0 0 0 0 0 0 (On for Trace 1; Off for 2–12)
State Saved	Saved in instrument state
Initial S/W Revision	A.13.00

### More Information

When a trace becomes inactive, the following things happen:

- Any update from the SENSE system (detectors) immediately stops (does not wait for end of sweep)
- the trace is displayed at half intensity (as long as it stays inactive)

Inactive traces 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.

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)

When a trace becomes active (Update=On), the trace is cleared, the average count is reset, and a new sweep is initiated.

Traces which are blanked (Display=off) do not display nor appear on printouts but are otherwise unaffected. They may be queried and markers may be placed on them.

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.

Note also that whenever you set **Update** to **On** for any trace, **Display** is set to **On** for that trace.

### View/Blank

This key lets you set the state of the two trace variables, Update and Display. The four choices available in this 1-of-N menu are:

- Trace On: 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. So 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 656.

See "Trace Display State On/Off" on page 657.

See "More Information" on page 657.

Key Path	Trace/Detector
Notes	<p>The four states of this 1-of-N actually set two variables, Update and Display, to their four possible combinations:</p> <ul style="list-style-type: none"> <li>- Trace On: Update and Display both On</li> <li>- View: Update Off and Display On</li> <li>- Blank: Update Off and Display Off</li> <li>- Background: Update On, Display Off</li> </ul> <p>See tables below for detail on the SCPI to control these two variables.</p>
Dependencies	When Signal ID is on, this key is grayed out.
Couplings	<p>Selecting a trace type (Clear Write, Trace Average, Max Hold, Min Hold) for a trace (pressing the key or sending the equivalent SCPI command) puts the trace in Trace On (<b>Update On and Display On</b>), even if that trace type was already selected.</p> <p>Selecting a detector for a trace (pressing the key or sending a [:SENS]:DET:TRAC command) puts the trace in Trace On (<b>Update On and Display On</b>), even if that detector was already selected.</p> <p>Selecting a math mode other than Off for a trace (pressing the key or sending the equivalent SCPI command) puts the trace in Trace On (<b>Update On and Display On</b>), even if that math mode was already selected.</p> <p>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 <b>Copy</b> or a participant in an <b>Exchange</b>.</p>
Initial S/W Revision	Prior to A.02.00

### Trace Update State On/Off

Key Path	Trace/Detector
<b>Remote Command</b>	<pre>:TRACe[1] 2 ... 6:UPDate[:STATe] ON OFF 0 1 :TRACe[1] 2 ... 6:UPDate[:STATe]?</pre>
<b>Example</b>	TRAC2:UPD 0 Makes trace 2 inactive (stops updating)
Couplings	Whenever you set <b>Update</b> to <b>On</b> for any trace, the <b>Display</b> is set to <b>On</b> for that trace.
Preset	1 0 0 0 0 0 ( <b>On</b> for Trace 1; <b>Off</b> for 2-6)
State Saved	Saved in instrument state

<b>Backwards Compatibility SCPI</b>	<b>:TRACe:MODE VIEW</b> sets :TRACe:UPDate OFF, :TRACe:DISPlay ON, for the selected trace. In earlier analyzers, View and Blank were trace modes, set by TRACe:MODE command. In the X-Series, View and Blank are two of the states set by the :TRACe:UPDate and :TRACe:DISPlay commands. The TRACe:MODE VIEW command will yield its new equivalent, which is Update=Off, Display=On
Initial S/W Revision	Prior to A.02.00

### Trace Display State On/Off

Key Path	Trace/Detector
<b>Remote Command</b>	<b>:TRACe[1] 2 ... 6:DISPlay[:STATe] ON OFF 0 1</b> <b>:TRACe[1] 2 ... 6:DISPlay[:STATe]?</b>
<b>Example</b>	TRAC2:DISP,1 Makes trace 2 visible TRAC3:DISP,0 Blanks trace 3
Couplings	Whenever you set <b>Update</b> to <b>On</b> for any trace, the <b>Display</b> is set to <b>On</b> for that trace.
Preset	1 0 0 0 0 0 (On for Trace 1; Off for 2-6)
State Saved	Saved in instrument state
<b>Backwards Compatibility SCPI</b>	<b>:TRACe:MODE BLANK</b> sets :TRACe:UPDate OFF, :TRACe:DISPlay OFF, for the selected trace. In earlier analyzers, View and Blank were trace modes, set by TRACe:MODE command. In the X-Series, View and Blank are two of the states set by the :TRACe:UPDate and :TRACe:DISPlay commands. The TRACe:MODE BLANK command will yield its new equivalent, which is Update=Off, Display=Off
Initial S/W Revision	Prior to A.02.00

### More Information

When a trace becomes inactive, the following things happen:

- Any update from the SENSE system (detectors) immediately stops (does not wait for end of sweep)
- the trace is displayed at half intensity (as long as it stays inactive)

Inactive traces 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.

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)

When a trace becomes active (Update=On), the trace is cleared, the average count is reset, and a new sweep is initiated.

Traces which are blanked (Display=off) do not display nor appear on printouts but are otherwise unaffected. They may be queried and markers may be placed on them.

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.

Note also that whenever you set **Update** to **On** for any trace, **Display** is set to **On** for that trace.

## Detector

Selects a detector. The detector selected is then applied to the selected trace.

For the SCPI UI, two commands are provided. One is a legacy command, which affects all traces. There is also a command which is new for the X-Series, which uses a subopcode to specify to which trace the specified detector is to be applied.

The three detectors on the second page 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.

### NOTE

The analyzer can typically provide 3 different detectors simultaneously. Occasionally the analyzer 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.

See "[More Information](#)" on page 660

Key Path	Trace/Detector
<b>Remote Command</b>	[ :SENSe]:DETECTOR:TRACe[1]   2   ...   6 AVERage   NEGative   NORMal   POSitive   SAMPle   QPEak   EAVerage   RAVerage  [:SENSe]:DETECTOR:TRACe[1] 2 ... 6?
<b>Example</b>	DET:TRAC AVER -- Sets trace 1's detector to average DET:TRAC1 AVER -- Sets trace 1's detector to average DET:TRAC2 SAMP -- Sets trace 2's detector to sample
Notes	When a detector selection is made, the menu returns to the previous menu. Selecting any CISPR detector on any active trace sets the EMI Standard to CISPR.
Notes	The query returns a name that corresponds to the detector type as shown below, and indicates the setting for Trace 1. String ReturnedDefinition NORM =Normal AVER =Average / RMS POS =Positive peak SAMP =Sample NEG =Negative peak

	<p>QPE =Quasi Peak EAV =EMI Average RAV =RMS Average</p>
Dependencies	<p>When Tune &amp; Listen is turned on, or Demod Audio is the selected Analog Output:</p> <ul style="list-style-type: none"> <li>- all active traces are forced to use the same detector.</li> <li>- CISPR detectors (QPD, EMI Avg, RMS Avg) are unavailable</li> </ul> <p>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.</p> <p>When Signal ID is on, the Detector key is grayed out for Traces 2-6 in Image Suppress mode and for Traces 3-6 in Image Shift Mode.</p> <p>If the grayed out key is pressed, an advisory message is generated. If the equivalent SCPI command is sent, this same message is generated as part of a “-221, Settings conflict” warning. It is never possible to have more than 3 simultaneous detectors, and sometimes fewer than three. If the analyzer has to enforce this limit a message is generated, “Detector n changed due to physical constraints” where “n” is the detector number.</p>
Couplings	<p>The auto detector rules depend upon marker type, averaging state and type, trace state writing mode, and trace active state.</p> <p>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.</p> <p>In Tracking Source mode, if a stepped source is used (for example, an external source using option ESC), the best detector is Average, as this gives optimal sensitivity. Therefore, when operating a source in Tracking Source mode, Auto selection is Average. All other detector selections are allowed, but in most cases the user will want to stick with the Auto selection, which gives optimal sensitivity.</p>
Preset	Preset returns all traces to “auto”, which will result in Normal (Rosenfell) detection for all traces.
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00
<b>Remote Command</b>	<pre>[ :SENSe]:DETECTOR[:FUNCTION] NORMAl   AVERAge   POSitive   SAMPlE   NEGative   QPEak   EAVERage   EPOSitive   MPOSitive   RMS  [:SENSe]:DETECTOR[:FUNCTION]?</pre>
<b>Example</b>	<p>DET AVER Sets detector to average for all traces</p> <p>DET:FUNC? Returns trace 1’s detector setting</p>
Notes	<p>This is a SCPI only legacy command to preserve the classic functionality wherein all traces are affected when a detector is selected (in the X-Series, the detector is set on a per-trace basis). The query returns a name that corresponds to the detector type as shown below, and indicates the setting for Trace 1.</p> <p>The RMS selection sets the detector type to AVERAge and the Average Type to RMS. Therefore if RMS has been selected, the query will return the “AVER” string.</p>

	<p>The EPOS selection sets the detector type to Peak and the EMI Standard to CISPR. A query will then return POS</p> <p>The MPOS selection sets the detector type to Peak and the EMI Standard to MIL Impulse. A query will then return POS</p> <p>The RAV parameter is not included in the command because this is not a legacy detector; nonetheless, if it happens to be the detector on Trace 1 then RAV will be returned.</p> <p>String ReturnedDefinition</p> <p>NORM =Normal</p> <p>AVER =Average / RMS</p> <p>POS =Positive peak</p> <p>SAMP =Sample</p> <p>NEG =Negative peak</p> <p>QPE =Quasi Peak</p> <p>EAV =EMI Average</p> <p>RA =RMS Average</p>
Preset	NORMal
State Saved	Saved in instrument state
Backwards Compatibility Notes	<p>19. In ESA and E7400, selecting QPD or EMI Average sets the Amplitude Scale Type to Linear and performs an auto-ranging function resulting in the Reference Level being adjusted such that the highest level of the trace is near (but below) the Reference Level. Subsequent selection of Peak, Negative Peak, Sample, or Average (the 'non-EMI Detectors') will return the Reference Level and Amplitude Scale Type to their pre-EMI Detector values. The X-Series does not perform this scale and reference level change because the digital IF makes it unnecessary..</p> <p>20. The commands which select the CISPR detectors are not generally compatible with pre-PSA instruments, because the CISPR detectors are now part of the overall detector set, rather than a separate set. However, the basic behavior of coupling the resolution bandwidth to the selected detector is similar to the behavior of previous EMI analyzers, like the E4400B series.</p> <p>21. In the past, selecting Auto Couple All did not change the selected CISPR detector. Now, since the CISPR detectors are part of the full set of detectors, pressing Auto Couple All will switch from the selected CISPR detector to an auto coupled detector according to the Auto Detector rules in the Detector, Auto key description below.</p> <p>22. The following ESA/E7400 detector commands are no longer accepted: [:SENSe]:DETEctor[:FUNction]:EMI QPD AVERage OFF[:SENSe]:POWer-:QPGain[:STATE][:SENSe]:ARDT</p>
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

### More Information

The available detectors are:



- The Sample detector indicates the instantaneous level of the signal at the center of the bucket represented by each display point.
- The Normal detector determines the peak of CW-like signals, and it yields alternating maximums and minimums of noise-like signals. This is also referred to as Rosenfell detection.
- The Average detector determines the average of the signal within the bucket. The averaging method depends upon Average Type selection (voltage, power or log scales).
- The Peak detector determines the maximum of the signal within the bucket.
- The Negative Peak detector determines the minimum of the signal within the bucket.
- The Quasi-Peak detector is a fast-rise, slow-fall detector used in making CISPR compliant EMI measurements.
- The EMI-Average detector 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 standard.
- The RMS Average detector is a frequency dependent RMS or Averaging filter, used in making CISPR compliant EMI measurements, which performs 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". This filter conforms to the 2007 revision of the CISPR 16-1-1 standard.

Because they may not find a spectral component's true peak, neither average nor sample detectors measure amplitudes of CW signals as accurately as peak or normal, but they do measure noise without the biases of peak detection.

When 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 analyzer settings.

### Multiple Detectors

The analyzer always provides the requested detector on the specified trace. Depending on the detectors requested the analyzer 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 analyzers 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.

### Power Versus Time Detector Auto

This sets the detector to Auto. This will immediately apply the auto rules to determine a new detector value.

Key Path	Trace/Detector, Detector
Remote Command	[ :SENSe ] :DETECTOR:TRACe:PVTIme:AUTO ON OFF 1 0 [ :SENSe ] :DETECTOR:TRACe:PVTIme:AUTO?
Example	:DET:TRACe:PVT:AUTO ON sets pvt detection to automatic.
Dependencies	The auto detector rules depend upon marker type, trace state writing mode, and trace active state.
Couplings	Selecting AUTO, whether by pressing the softkey or sending the equivalent SCPI command, will turn trace math to Off for the selected/specified trace.
Preset	Auto (On) for all detectors.
State Saved	Saved in instrument state
Initial S/W Revision	A.13.00

### Power Versus Time Detector

Selects the detector for PVT.

Key Path	Trace/Detector
Remote Command	[ :SENSe ] :DETECTOR:TRACe:PVTIme AVERAge   NEGAtive   POSitive   SAMPle [ :SENSe ] :DETECTOR:TRACe:PVTIme?
Example	:DET:TRAC:PVT AVER -- Sets PVT detector to average
Notes	When a detector selection is made, the menu returns to the previous menu. The same detector is applied to all PVT traces
Notes	The query returns a name that corresponds to the detector type as shown below. String ReturnedDefinition AVER =Average / RMS POS =Positive peak

	SAMP =Sample
	NEG =Negative peak
Couplings	The auto detector rules depend upon marker type, trace state writing mode, and trace active state. The Pvt detectors and non-Pvt detectors are independent.
Preset	Preset returns all traces to “auto”, which will result in POS detection for Pvt detectors.
State Saved	Saved in instrument state
Initial S/W Revision	A.13.00

## Clear Trace

Clears the selected trace (from the front panel) or the specified trace (from SCPI). Does not affect the state of any function or variable in the instrument. Loads mintracevalue into all of the points in the selected trace, unless the trace is in Min Hold in which case it loads maxtracevalue. It does this even if Update=Off.

Key Path	Trace/Detector
<b>Remote Command</b>	:TRACe:CLEAr TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6   TRACE7   TRACE8   TRACE9   TRACE10   TRACE11   TRACE12
<b>Example</b>	TRAC:CLE TRACE1 Clears trace 1
Notes	TRACE1, TRACE2, TRACE3, TRACE4, TRACE5, TRACE6 corresponds to the Spectrum Trace 1–6. TRACE7 TRACE8 TRACE9 TRACE10 TRACE11 TRACE12 corresponds to the Pvt Trace1–6.
Initial S/W Revision	A.13.00

## Clear All Traces

Clears all traces. Does not affect the state of any function or variable in the instrument. Loads mintracevalue into all of the points all traces, except traces in Min Hold in which case it loads maxtracevalue. Does so even if Update=Off.

Key Path	Trace/Detector
<b>Remote Command</b>	:TRACe:CLEAr:ALL
<b>Example</b>	TRAC:CLE:ALL Clears all traces in both Spectrum and Pvt measurements
Initial S/W Revision	A.13.00

## 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.

Key Path	Trace/Detector
<b>Remote Command</b>	:TRACe:PRESet:ALL When Signal ID is on, this key is grayed out.
<b>Example</b>	TRAC:PRES:ALL
Initial S/W Revision	A.08.01

## Math

This menu lets you turn on trace math functions. 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** key.

See ["Math: More Information" on page 665](#).

Key Path	Trace/Detector
<b>Remote Command</b>	:CALCulate:MATH TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6, PDIFference   PSUM   LOFFset   LDIFference   OFF, TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6, TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6, <real>, <real>  :CALCulate:MATH? TRACE1 TRACE2 TRACE3 TRACE4 TRACE5 TRACE6
Notes	The lower level menu, which contains an embedded 1-of-N, does not auto-return when a selection is made.
Notes	<p>The Trace Math Function command has 6 main set of parameters:</p> <ul style="list-style-type: none"> <li>- Set 1 defines the "result trace": TRACE1 TRACE2 TRACE3 TRACE4 TRACE5 TRACE6</li> <li>- Set 2 defines the "function": PDIFference PSUM LOFFset LDIFference OFF</li> <li>- Set 3 is a "trace operand" (1): TRACE1 TRACE2 TRACE3 TRACE4 TRACE5 TRACE6</li> <li>- Set 4 is a "trace operand" (2): TRACE1 TRACE2 TRACE3 TRACE4 TRACE5 TRACE6</li> <li>- Set 5 defines the "Log Offset" (in dB).</li> <li>- Set 6 defines the "Log Difference Reference" (in dBm).</li> </ul> <p>Note that the trace math mode is an enumeration; that is, when a math function is set for a trace it turns off any math function that is on for that trace and sets the new math function.</p> <p>The parameters sent in the command are reflected in the values in the softkey menu. There is no default for any parameter; all 6 parameters must be sent to satisfy the parser. Failure to specify a parameter will result in a missing parameter message.</p> <p>Note that for some of the math modes some of the parameters are not relevant. For those modes, the parameters are ignored, and sending ".,," is sufficient for those parameters.</p> <p>The query returns the math mode, the operand traces, the offset and the reference for the specified trace, all separated by commas. The return value of irrelevant parameters is undefined;</p>

	empty fields (“,”) would be desirable. Remote command examples are included in each section below.
Dependencies	Trace Math is not available if <b>Normalize</b> 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 is turned on 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.
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
Backwards Compatibility Notes	The legacy TRACE:MATH:ADD and TRACE:MATH:SUBtract commands have been eliminated.
Initial S/W Revision	Prior to A.02.00

### Math: 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 analyzer. 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:

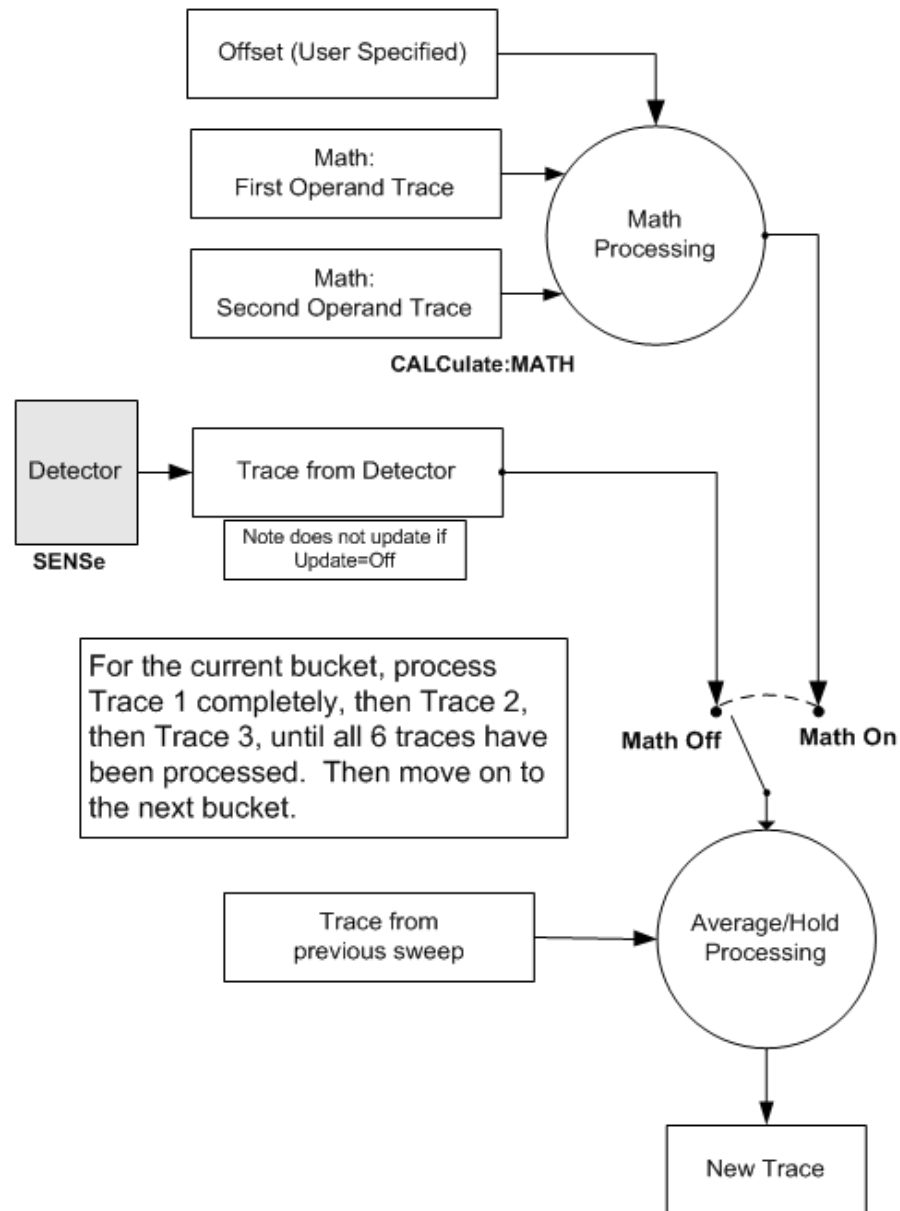
- A trace clear taking place
- A trace being loaded from the file system
- Trace data being sent in from the remote interface
- A copy or exchange of trace data

You should try to avoid these occurrences during a sweep, as they will tend to invalidate the math result being accumulated.

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 to the user as trace data, consists of several functional blocks, as shown below:



**NOTE ABOUT OFFSETS:** When either External Gain or Ref Level Offset is on, an offset is applied to the trace operands, and when Trace Math is on this offset is applied before any math processing is performed. Since the operands have already been offset the result trace should NOT be offset. Therefore when any Trace Math operation is performed, the sum of (External Gain - Ref Level Offset) is added to the result before it is stored in the result trace.

For each active trace, the current trace point is processed for Trace 1, then Trace 2, then Trace 3, etc. Trace data is taken from either the detector for that trace, or from the mathematical result of up to two other traces and an offset, depending on whether trace math is on or not. The resultant data is then fed to the Average/Hold processing block, where (if the trace type is Average, Max Hold, or Min Hold) it is

processed with previous trace data. The new trace data resulting from this process is then available for display, storage or remote output.

When the processing is complete for Trace 1, Trace 2 is processed, and so on until all six traces have been processed. This allows a downstream trace to use as one of its math components a fully processed upstream trace. In other words, if math is on for Trace 4, and its operand traces are Trace 2 and Trace 3, all detector, math, average and hold processing for traces 2 and 3 is complete before the math is performed for trace 4. When the current trace point is completed for all traces, the analyzer moves on to the next trace point.

### Select Trace

Determines which trace the type control keys will affect. When you select a trace, it makes that trace the current trace, so it displays on top of all of the other traces.

Key Path	<b>Trace/Detector</b>
Dependencies	When Signal ID is on, Traces 3-6 are grayed out in Image Shift Mode.
Couplings	<ul style="list-style-type: none"> <li>- In Image Suppress mode when you select a trace it becomes the active trace, and the formerly active trace goes into View</li> <li>- When you turn on Image Suppress, Update turns off for all traces except the selected trace</li> </ul>
Preset	Trace 1
State Saved	The number of the selected trace is saved in Instrument State
Initial S/W Revision	Prior to A.02.00

### 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:

$$\text{DestinationTrace} = 10 \log(10(1/10)(\text{FirstTrace}) - 10(1/10)(\text{SecondTrace}))$$

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.

Key Path	<b>Trace/Detector, Math</b>
<b>Example</b>	:CALC:MATH TRACE1,PDIF,TRACE4,TRACE5,, Sets Trace 1 to <b>Power Diff</b> trace math function, and sets the <b>First Trace</b> operand (for Trace 1) to Trace 4 and the <b>Second Trace</b> operand (for Trace 1) to Trace 5.
Couplings	Selecting a math mode other than Off for a trace (pressing the key or sending the equivalent SCPI command) puts the trace in View ( <b>Update On and Display On</b> ), even if that math mode was

	already selected.
Initial S/W Revision	Prior to A.02.00

### 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.:

$$\text{DestinationTrace} = 10 \log(10(1/10)(\text{FirstTrace}) + 10(1/10)(\text{SecondTrace}))$$

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.

Key Path	<b>Trace/Detector, Math</b>
<b>Example</b>	:CALC:MATH TRACE1,PSUM,TRACE4,TRACE5,, Sets Trace 1 to <b>Power Sum</b> trace math function and sets the <b>First Trace</b> operand (for Trace 1) to Trace 4 and the <b>Second Trace</b> operand (for Trace 1) to Trace 5.
Couplings	Selecting a math mode other than Off for a trace (pressing the key or sending the equivalent SCPI command) puts the trace in View ( <b>Update On and Display On</b> ), even if that math mode was already selected.
Initial S/W Revision	Prior to A.02.00

### 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 analyzers. The offset is entered as the active function. 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.:

$$\text{DestinationTrace} = \text{FirstTrace} + \text{Offset}$$

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.



Key Path	Trace/Detector, Math
<b>Example</b>	:CALC:MATH TRACE1,LOFF,TRACE4,,-6.00, Sets Trace 1 to <b>Log Offset</b> trace math function, sets the <b>First Trace</b> operand (for Trace 1) to Trace 4, leaves the <b>Second Trace</b> operand (for Trace 1) unchanged (it is irrelevant for this function) and sets the Log Offset (for Trace 1) to -6 dB.
Couplings	Selecting a math mode other than Off for a trace (pressing the key or sending the equivalent SCPI command) puts the trace in View ( <b>Update On and Display On</b> ), even if that math mode was already selected.
State Saved	The Log Offset value for each trace is saved in Instrument State
Min	-100 dB
Max	100 dB
Initial S/W Revision	Prior to A.02.00

### 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 analyzers. The reference is entered as the active function. 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:

$$\text{DestinationTrace} = (\text{FirstTrace} - \text{SecondTrace}) + \text{Reference}$$

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 trace 1 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.

See "[More Information](#)" on page 670.

Key Path	Trace/Detector, Math
<b>Example</b>	:CALC:MATH TRACE1, LDIF, TRACE4, TRACE5, , -6.00 Sets Trace 1 to <b>Log Diff</b> trace math function, sets the <b>First Trace</b> operand (for Trace 1) to Trace 4, sets the <b>Second Trace</b> operand (for Trace 1) to Trace 5, and sets the Log Difference reference for Trace 1 to -6 dBm.
Couplings	Selecting a math mode other than Off for a trace (pressing the key or sending the equivalent SCPI command) puts the trace in View ( <b>Update On and Display On</b> ), even if that math mode was already selected.
State Saved	The Log Difference reference value for each trace is saved in instrument state
Min	Same as reference level
Max	Same as reference level

Default Unit	depends on the current selected Y axis unit
Initial S/W Revision	Prior to A.02.00

### More Information

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.

### Off

Turns off Trace Math.

Key Path	<b>Trace/Detector, Math</b>
<b>Example</b>	CALC:MATH TRACE1 OFF Turns off trace math for trace 1.
Notes	See Trace "Math".
State Saved	The current trace math function is saved in Instrument State
Readback	Off
Initial S/W Revision	Prior to A.02.00

### Trace Operands

Selects the trace operand(s) to be used for the trace math functions for the destination trace.

Key Path	<b>Trace/Detector, Math</b>
Notes	The operands of the trace math commands specify the trace operands. Since the operands are common to all math functions for a given trace, the most recently sent math function command sets the operands for each trace and are reflected on the trace operand keys.
Dependencies	The destination trace cannot be an operand.
Readback line	In square brackets, the First Trace operand, new line, and the second trace operand, as: [Op1=Trace 1, Op2=Trace2] where Trace 1 is operand 1 and Trace 2 is operand 2.
Initial S/W Revision	Prior to A.02.00

## Operand 1

Selects the first trace operand to be used for the trace math functions for the destination trace.

Key Path	Trace/Detector, Math, Trace Operands
Dependencies	The First Trace cannot be the same as the destination trace. The destination trace number is gray on the key, and the underline skips that number when selecting the trace.
Preset	Trace number – 2 (wraps at 1). For example, for Trace 1, the First Trace presets to Trace 5; for Trace 6, it presets to Trace 4.
State Saved	The First Trace operand for each trace is stored in instrument state.
Readback	Trace <trace number>
Initial S/W Revision	Prior to A.02.00

## Operand 2

Selects the second trace operand to be used for the trace math functions for the destination trace.

Key Path	Trace/Detector, Math, Trace Operands
Dependencies	The Second Trace cannot be the same as the destination trace. The destination trace number is gray on the key, and the underline skips that number when selecting the trace.
Preset	Trace number – 1 (wraps at 1). For example, for Trace 1, the Second Trace presets to Trace 6; for Trace 6, it presets to Trace 5.
State Saved	The Second Trace operand for each trace is stored in instrument state
Readback	Trace <trace number>
Initial S/W Revision	Prior to A.02.00

## Copy/Exchange

This menu lets you copy any trace to any other trace, or exchange any trace with any other trace. The action is performed once, it is not an “every sweep” type of thing.

The X-Axis settings and domain of a trace go with it when it is copied or exchanged.

Key Path	Trace/Detector
<b>Remote Command</b>	:TRACe:COPIY TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6, TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6 :TRACe:COPIY?
<b>Example</b>	TRAC:COPIY TRACE1, TRACE3 Copies Trace 1 to Trace 3 and puts Trace 3 in <b>Update=Off, Display=On</b>
Notes	The TRACe:COPIY command is of the form: :TRACe:COPIY <source_trace>,<dest_trace>
Notes	In the case of a <b>Copy</b> , the destination trace is put in <b>Update=Off, Display=On</b> after the copy. In the case of an <b>Exchange</b> , both traces are put into <b>Update=Off, Display=On</b> after the exchange.
Dependencies	When Signal ID is on, this key is grayed out.

Preset	<b>TRACE1, TRACE2</b>
Backwards Compatibility Notes	The copy and exchange operations menu in ESA and PSA is replaced with the more general purpose <b>Copy/Exchange</b> 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 <b>Trace, Math</b> menu
Initial S/W Revision	Prior to A.02.00

<b>Remote Command</b>	<b>:TRACe:EXCHange TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6, TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6</b> <b>:TRACe:EXCHange?</b>
<b>Example</b>	TRAC:EXCH TRACE1, TRACE2 Exchanges Trace 1 and Trace 2 and puts both traces in <b>Update=Off, Display=On</b> .
Notes	The <b>TRACe:EXCHange</b> command is of the form: <b>:TRACe:EXCHange &lt;trace_1&gt;,&lt;trace_2&gt;</b>
Preset	<b>TRACE1, TRACE2</b>
Backwards Compatibility Notes	The copy and exchange operations menu in ESA and PSA is replaced with the more general purpose <b>Copy/Exchange</b> menu. The remote commands are unaffected, as they were already general.
Initial S/W Revision	Prior to A.02.00

### From Trace

Selects the trace to be copied to or exchanged with the **To Trace**

Key Path	<b>Trace/Detector, Copy/Exchange</b>
Notes	See "Copy/Exchange".
Preset	1
Initial S/W Revision	Prior to A.02.00

### To Trace

Selects the trace to be copied from or exchanged with the **From Trace**

Key Path	<b>Trace/Detector, Copy/Exchange</b>
Notes	See "Copy/Exchange".
Preset	2
Initial S/W Revision	Prior to A.02.00

### Copy Now

Executes the Copy operation and puts the destination trace in **Update=Off, Display=On**.

Key Path	Trace/Detector, Copy/Exchange
Notes	See "Copy/Exchange".
Initial S/W Revision	Prior to A.02.00

### Exchange Now

Executes the Exchange operation and puts both traces in **Update=Off, Display=On**.

Key Path	Trace/Detector, Copy/Exchange
Notes	See "Copy/Exchange".
Initial S/W Revision	Prior to A.02.00

### Normalize

Displays menu keys that let you normalize trace data.

Key Path	Trace/Detector
Dependencies	When Signal ID is on, this key is grayed out.
Readback	[On] or [Off]
Initial S/W Revision	Prior to A.02.00

### Normalize On/Off

Normalize (On) activates the normalize function. 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.

See ["More Information" on page 674](#).

See ["Normalize Block Diagram" on page 675](#).

Key Path	Trace/Detector, Normalize
<b>Remote Command</b>	:CALCulate:NTData[:STATE] OFF ON 0 1 :CALCulate:NTData[:STATE]?
<b>Example</b>	CALC:NTD ON CALC:NTD?
Dependencies	<ul style="list-style-type: none"> <li>- If Normalize (On) is pressed before Store Ref (1→3), an error message is generated. Normalize remains off in this case.</li> <li>- Normalize is not available (grayed out) if any Trace Math function is on.</li> <li>-</li> </ul>

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.
Initial S/W Revision	Prior to A.02.00

### 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 analyzer 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 analyzer. 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:

$$\text{Trace 1} = (\text{Trace 1D} - \text{Normalized Trace})$$

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  $0 \text{ dBm} - 10 \text{ dBm} = -10 \text{ dB}$  (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 Posn 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 Posn 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 Posn and Norm Ref Lvl affect the data in the trace.

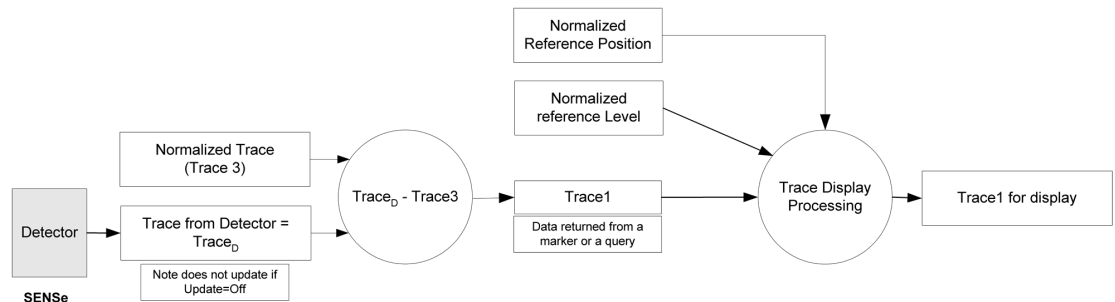
As Normalize displays a ratio between two traces (a difference, in dB) the Y-Axis Unit while in Normalize is dB in Log Amplitude and dimensionless in Linear. The Y Axis Unit chosen in the Y Axis Unit menu is unaffected by Normalize. When you leave Normalize the Y Axis Unit returns to the value set in 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).

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 Posn 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

A block diagram showing how Normalize works is presented below:



### Store Ref (1 -> 3)

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).

Key Path	<b>Trace/Detector, Normalize</b>
Notes	There is no remote command for this function, however 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.
Initial S/W Revision	Prior to A.02.00

### Show Ref Trace (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.

Key Path	<b>Trace/Detector, Normalize</b>
<b>Example</b>	TRAC3:DISP 1 Shows the reference trace.
Notes	Use the TRAC3:DISP command to show or blank the reference trace Trace 3 is always the reference trace by definition.
State Saved	Saved in instrument state.
Initial S/W Revision	Prior to A.02.00

### Norm Ref Lvl

Sets the level (in dB) of the normalized reference.

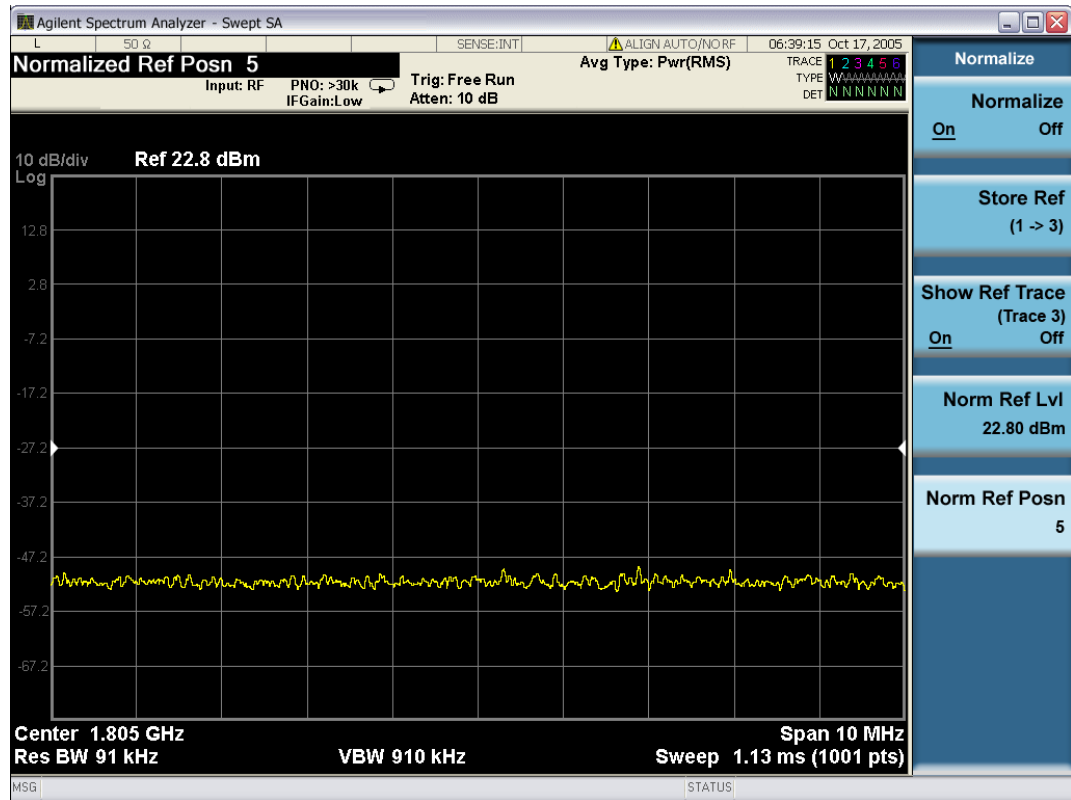
Key Path	<b>Trace/Detector, Normalize</b>
<b>Remote Command</b>	:DISP:WINDow[1]:TRACe:Y[:SCALE]:NRLevel <rel_amp1> :DISP:WINDow[1]:TRACe:Y[:SCALE]:NRLevel?
<b>Example</b>	DISP:WIND:TRAC:Y:NRL .10 dB DISP:WIND:TRAC:Y:NRL?
Preset	0 dB
State Saved	Saved in instrument state.
Min	-327.6 dB
Max	327.6 dB
Initial S/W Revision	Prior to A.02.00

### Norm Ref Posn

Offsets the displayed trace without affecting the instrument gain or attenuation settings. This allows the displayed trace to be moved without decreasing measurement accuracy. The normalized reference position is indicated with a right



arrow on the left side of the display and a left arrow on the right side of the display, just inside the graticule. See picture below:



Key Path	Trace/Detector, Normalize
Remote Command	:DISP:WIND:W[1]:TRAC:Y[:SCALE]:NRPosition <integer> :DISP:WIND:W[1]:TRAC: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
Initial S/W Revision	Prior to A.2.00

### Open/Short Cal

Performs a guided open/short calibration, while providing step-by-step instructions to the user. This is the most accurate way to make the return loss measurement on the X-series analyzers. 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.

Key Path	Trace/Detector, Normalize
Mode	SA
Notes	Does not auto return
Dependencies	Key is grayed out unless Source Mode is Tracking, and control returns to the Normalize menu.
Initial S/W Revision	A.06.01

## Open/Short Guided Cal

On pressing the Open/Short Cal softkey in the Normalize menu, the Open Calibration Form is displayed. The form shows a diagrammatic representation of how to connect the external source to the spectrum analyzer 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 “Done Cal” and “Cancel” is displayed. When you press “Done Cal” the resulting trace is stored to Trace 3. If the Cancel button is pressed, the Open/Short Cal is cancelled and the Normalize menu is returned.

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.

## Continue

This soft key paces the user through an open/short calibration.

Key Path	Trace/Detector, Normalize, Open/Short Cal
Mode	SA
Notes	Does not auto return
Couplings	Key is grayed out unless Source Mode is Tracking, and control returns to the Normalize menu.
Initial S/W Revision	A.06.01

## Cancel

This soft key cancels an open/short calibration.

Key Path	Trace/Detector, Normalize, Open/Short Cal
Mode	SA
Notes	Does not auto return
Couplings	Key is grayed out unless Source Mode is Tracking, and control returns to the Normalize menu.
Initial S/W Revision	A.06.01

## Send Trace Data

Parameter Name	Send Trace Data
<b>Remote Command</b>	:TRACe[:DATA] TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6   TRACE7   TRACE8   TRACE9   TRACE10   TRACE11   TRACE12, <data>
Notes	<p>The TRACe[:DATA] command is of the form: :TRACe:DATA &lt;trace&gt;,&lt;data&gt;</p> <p>where &lt;trace&gt; can be one of the following parameters: TRACE1,TRACE2,TRACE3,TRACE4,TRACE5,TRACE6,TRACE7,TRACE8,TRACE9,TRACE10,TRACE11,TRACE12 <b>TRACE1,TRACE2,TRACE3,TRACE4,TRACE5,TRACE6</b> corresponds to the Spectrum Trace 1-6. <b>TRACE7 TRACE8 TRACE9 TRACE10 TRACE11 TRACE12</b> corresponds to the Pvt Trace 1-6.</p> <p>&lt;data&gt; can be</p> <ul style="list-style-type: none"> <li>- ASCII data, which consists of a string of values separated by comma</li> </ul> <p>or</p> <ul style="list-style-type: none"> <li>- <b>REAL</b> or <b>INT</b>eger sent as a definite length block, with a header describing the data to follow.</li> </ul>
Couplings	<p>Acquisition points will affect the amount of data</p> <p>The FORMat:DATA command describes the different types of data formats that can be used with trace data.</p> <p>Use the FORMat:BORDer command to set the byte order.</p>
Initial S/W Revision	A.13.00

## Query Trace Data

Parameter Name	Query Trace Data
<b>Remote Command</b>	:TRACe[:DATA]? TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6   TRACE7   TRACE8   TRACE9   TRACE10   TRACE11   TRACE12
<b>Example</b>	TRAC? TRACE2 queries the analyzer for the contents of trace 2.
Initial S/W Revision	A.13.00

## Identify Trace (Remote Command Only)

The TRACe node index is from 1 to 12. Index 1–6 is for the Spectrum traces 1–6. Index 7–12 is for the Power vs Time traces 1–6. This command allows you to query which trace indexes are for Spectrum traces and which are for Power vs Time traces.

<b>Remote Command</b>	<code>:TRACe[1] 2 ... 12:IDENtify?</code>
<b>Example</b>	<pre>:TRAC3:IDEN? TRACe3 is a Spectrum trace and thus returns SPEC :TRAC7:IDEN? TRACe7 is a PVT trace and thus returns PVT</pre>
<b>Notes</b>	<p>Return types are either SPEC or PVT.</p> <p>SPEC = Spectrum trace</p> <p>PVT = Power vs Time trace</p> <p>Trace index 1–6 will return SPEC and index 7–12 and index will return PVT.</p>
<b>Preset</b>	SPEC SPEC SPEC SPEC SPEC SPEC PVT PVT PVT PVT PVT PVT
<b>Initial S/W Revision</b>	A.13.00

## Trigger

See ["Trigger" on page 348](#)

### Free Run

See ["Free Run " on page 356](#)

### Trigger Level

See ["Trigger Level " on page 357](#)

### Line

See ["Line" on page 357](#)

### Trig Slope

See ["Trig Slope" on page 358](#)

### Trig Delay

See ["Trig Delay" on page 358](#)

### X Axis Relative to Trigger

See ["X Axis Relative to Trigger" on page 381](#)

### External 1

See ["External 1" on page 375](#)

### Trigger Level

See ["Trigger Level" on page 376](#)

### Trig Slope

See ["Trig Slope" on page 376](#)

### Trig Delay

See ["Trig Delay" on page 361](#)

### X Axis Relative to Trigger

See ["X Axis Relative to Trigger" on page 381](#)

### External 2

See ["External 2 " on page 377](#)

### Trigger Level

See ["Trigger Level" on page 378](#)

### **Trig Slope**

See ["Trig Slope" on page 378](#)

### **Trig Delay**

See ["Trig Delay " on page 364](#)

### **X Axis Relative to Trigger**

See ["X Axis Relative to Trigger" on page 381](#)

### **RF Burst**

See ["RF Burst" on page 378](#)

### **Absolute Trigger**

See ["Absolute Trigger Level" on page 379](#)

### **Relative Trigger**

See ["Relative Trigger Level" on page 367](#)

### **Trig Slope**

See ["Trigger Slope" on page 380](#)

### **Trig Delay**

See ["Trig Delay" on page 369](#)

### **X Axis Relative to Trigger**

See ["X Axis Relative to Trigger" on page 381](#)

### **Periodic Timer**

See ["Periodic Timer \(Frame Trigger\)" on page 370](#)

### **Period**

See ["Period" on page 372](#)

### **Offset**

See ["Offset" on page 372](#)

### **Offset Adjust (Remote Command Only)**

See ["Offset Adjust \(Remote Command Only\)" on page 373](#)

### **Reset Offset Display**

See ["Reset Offset Display" on page 374](#)

### **Sync Source**

See ["Sync Source" on page 374](#)

### **Off**

See ["Off" on page 375](#)

### **External 1**

See ["External 1" on page 375](#)

### **Trigger Level**

See ["Trigger Level" on page 376](#)

### **Trig Slope**

See ["Trig Slope" on page 376](#)

### **External 2**

See ["External 2 " on page 377](#)

### **Trigger Level**

See ["Trigger Level" on page 378](#)

### **Trig Slope**

See ["Trig Slope" on page 378](#)

### **RF Burst**

See ["RF Burst" on page 378](#)

### **Absolute Trigger**

See ["Absolute Trigger Level" on page 379](#)

### **Trig Slope**

See ["Trigger Slope" on page 380](#)

### **Trig Delay**

See ["Trig Delay" on page 381](#)

### **X Axis Relative to Trigger**

See ["X Axis Relative to Trigger" on page 381](#)

### **Time 1**

See ["Time 1" on page 382](#)

## Time 2

See ["Time 2" on page 382](#)

## Time Criteria

See ["Time Criteria" on page 383](#)

## Disabled

See ["Disabled" on page 383](#)

## Time1

See ["< Time1" on page 383](#)

## Time1

See ["> Time1 " on page 384](#)

## T1 and T2

See ["> T1 and < T2" on page 384](#)

## T1 or T2

See ["< T1 or > T2" on page 384](#)

## Frequency Mask Trigger FMT

See ["Frequency Mask Trigger \(FMT\)" on page 385](#)

## FMT Editor

See ["FMT Editor" on page 385](#)

## Navigate

See ["Navigate" on page 385](#)

## Frequency

See ["Frequency" on page 385](#)

## Amplitude

See ["Amplitude" on page 386](#)

## Insert Point Below

See ["Insert Point Below" on page 387](#)

## Delete Point

See ["Delete Point" on page 387](#)



### **New Mask**

See ["New Mask" on page 387](#)

### **Mask Type**

See ["Mask Type" on page 387](#)

### **Trigger Setup**

See ["Trigger Setup" on page 388](#)

### **Trigger Criteria**

See ["Trigger Criteria" on page 388](#)

### **Trigger Mask**

See ["Trigger Mask" on page 388](#)

### **Trig Delay**

See ["Trig Delay" on page 389](#)

### **Number of Acquisitions Per Trigger**

See ["Number of Acquisitions Per Trigger" on page 390](#)

### **Mask Setup**

See ["Mask Setup" on page 390](#)

### **Build Mask from Trace**

See ["Build Mask from Trace" on page 391](#)

### **Import Mask From File**

See ["Import Mask From File" on page 391](#)

### **Export Mask to File**

See ["Export Mask to File" on page 391](#)

### **Offsets**

See ["Offsets" on page 392](#)

### **X Offset**

See ["X Offset" on page 392](#)

### **Y Offset**

See ["Y Offset" on page 392](#)

### **Fixed Relative**

See ["Fixed / Relative" on page 393](#)

### **X Relative to CF**

See ["X Relative to CF" on page 393](#)

### **Y Relative to RL**

See ["Y Relative to RL" on page 394](#)

### **Mask Name**

See ["Mask Name" on page 394](#)

### **Mask Color**

See ["Mask Color" on page 395](#)

### **Mask Hue**

See ["Mask Hue" on page 395](#)

### **Mask Opacity**

See ["Mask Opacity" on page 396](#)

### **Mask Opacity Preview**

See ["Mask Opacity Preview " on page 396](#)

### **Delete Mask**

See ["Delete Mask" on page 397](#)

### **Delete All Masks**

See ["Delete All Masks" on page 397](#)

### **Time 1**

See ["Time 1" on page 397](#)

### **Time 2**

See ["Time 2" on page 398](#)

### **Time Criteria**

See ["Time Criteria" on page 398](#)

### **Disabled**

See ["Disabled" on page 399](#)

### **Time1**

See "< Time1" on page 399

### **Time1**

See "> Time1" on page 399

### **T1 and T2**

See "> T1 and < T2" on page 399

### **T1 or T2**

See "< T1 or > T2" on page 400

### **Trig Holdoff**

See "Trig Holdoff" on page 400

### **Holdoff Type**

See "Holdoff Type" on page 401

## User Preset

Accesses a menu that gives you the following three choices:

- **User Preset** – recalls a state previously saved using the Save User Preset function.
- **User Preset All Modes** – presets all of the modes in the analyzer
- **Save User Preset**– saves the current state for the current mode

Key Path	Front-panel key
Backwards Compatibility Notes	<p>User Preset is actually loading 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.</p> <p>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.</p> <p>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.</p> <p>User Preset recalls mode state which can now include data like traces; whereas on ESA and PSA, User Preset did not affect data.</p>
Initial S/W Revision	Prior to A.02.00

## User Preset

User Preset sets the state of the currently active mode back to the state that was previously saved for this mode using the Save User Preset menu key or the SCPI command, **SYST:PRES:USER:SAV**. **It not only recalls the** Mode Preset settings, but it also recalls all of the mode persistent settings, and the Input/Output system setting that existed at the time Save User Preset was executed.

If a Save User Preset has not been done at any time, User Preset recalls the default user preset file for the currently active mode. The default user preset files are created if, at power-on, a mode detects there is no user preset file. There will never be a scenario when there is no user preset file to restore. For each mode, the default user preset state is the same state that would be saved if a Save User Preset is performed in each mode right after doing a Restore Mode Default and after a Restore Input/Output Defaults.

The User Preset function does the following:

- Aborts the currently running measurement.
- Sets the mode State to the values defined by Save User Preset.

- Makes the saved measurement for the currently running mode the active measurement.
- Brings up the saved menu for the power-on mode.
- Clears the input and output buffers.
- Sets the Status Byte to 0.

Key Path	User Preset
<b>Remote Command</b>	:SYSTem:PRESet:USER
<b>Example</b>	:SYST:PREs:USER:SAVE:SYST:PREs:USER
Notes	:SYST:PREs:USER:SAVE is used to save the current state as the user preset state. Clears all pending OPC bits. The Status Byte is set to 0. Pressing the User Preset front-panel key while already in the User Preset menu will cause the User Preset to get executed
Couplings	A user preset will cause the currently running measurement to be aborted and cause the saved measurement to be active. Recalling a User Preset file has the same issues that recalling a Save State file has. Some settings may need to be limited and therefore re-coupled, since the capabilities of the mode may have changes when the User Preset file was last saved.
Initial S/W Revision	Prior to A.02.00

## 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.

**NOTE**

**When the instrument is secured, all of the user preset files are converted back to their default user preset files.**

The User Preset function does the following:

- Aborts the currently running measurement.
- Switches the Mode to the power-on mode.
- Restores the User Preset files for each mode.
- Makes the saved measurement for the power-on mode the active measurement.
- Brings up the saved menu for the power-on mode.
- Clears the input and output buffers.
- Sets the Status Byte to 0.

Key Path	User Preset
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<b>Remote Command</b>	:SYSTem:PRESet:USER:ALL
<b>Example</b>	:SYST:PRES:USER:SAVE:SYST:PRES:USER:ALL
Notes	Clears all pending OPC bits. The Status Byte is set to 0. :SYST:PRES:USER:SAVE is used to save the current state as the user preset state.
Couplings	A user preset will cause the currently running measurement to be aborted, cause a mode switch to the power-on mode, and cause the saved measurement to be active in the power-on mode. Recalling a User Preset file has the same issues that recalling a Save State file has. Some settings may need to be limited and therefore re-coupled, since the capabilities of the mode may have changes when the User Preset file was last saved.
Initial S/W Revision	Prior to A.02.00

## Save User Preset

Saves the currently active mode and its State. You can recall this User Preset file by pressing the User Preset menu key or sending the SYST:PRES:USER remote command. This same state is also saved by the Save State function.

Key Path	<b>User Preset</b>
<b>Remote Command</b>	:SYSTem:PRESet:USER:SAVE
<b>Example</b>	:SYST:PRES:USER:SAVE
Notes	:SYST:PRES:SAVE creates the same file as if the user requested a *SAV or a MMEM:STOR:STAT, except User Preset Save does not allow the user to specify the filename or the location of the file.
Initial S/W Revision	Prior to A.02.00

## View/Display

The View/Display key opens the Display Menu (common to most measurements) and the View menu (an embedded 1-of-N menu) for the current measurement.

Some measurements have simple View menus, or even no View menu, others provide many different Views.

Views are different ways of looking at data, usually different ways of looking at the same data, often when the data represents a time record that is being digitally processed with an FFT and/or other digital signal processing algorithms.

The View menu is meas local. So the "views" that are available are specific to the current measurement selected under the Meas key.

Key Path	<b>Front-panel key</b>
Initial S/W Revision	A.13.00

## Display

The Display menu is common to most measurements, and is used for configuring items on the display. Some Display menu settings apply to all the measurements in a mode, and some only to the current measurement. Those under the **System Display Settings** key apply to all measurements in all modes.

Key Path	<b>Display</b>
Key Path	<b>View/Display</b>
Initial S/W Revision	Prior to A.02.00

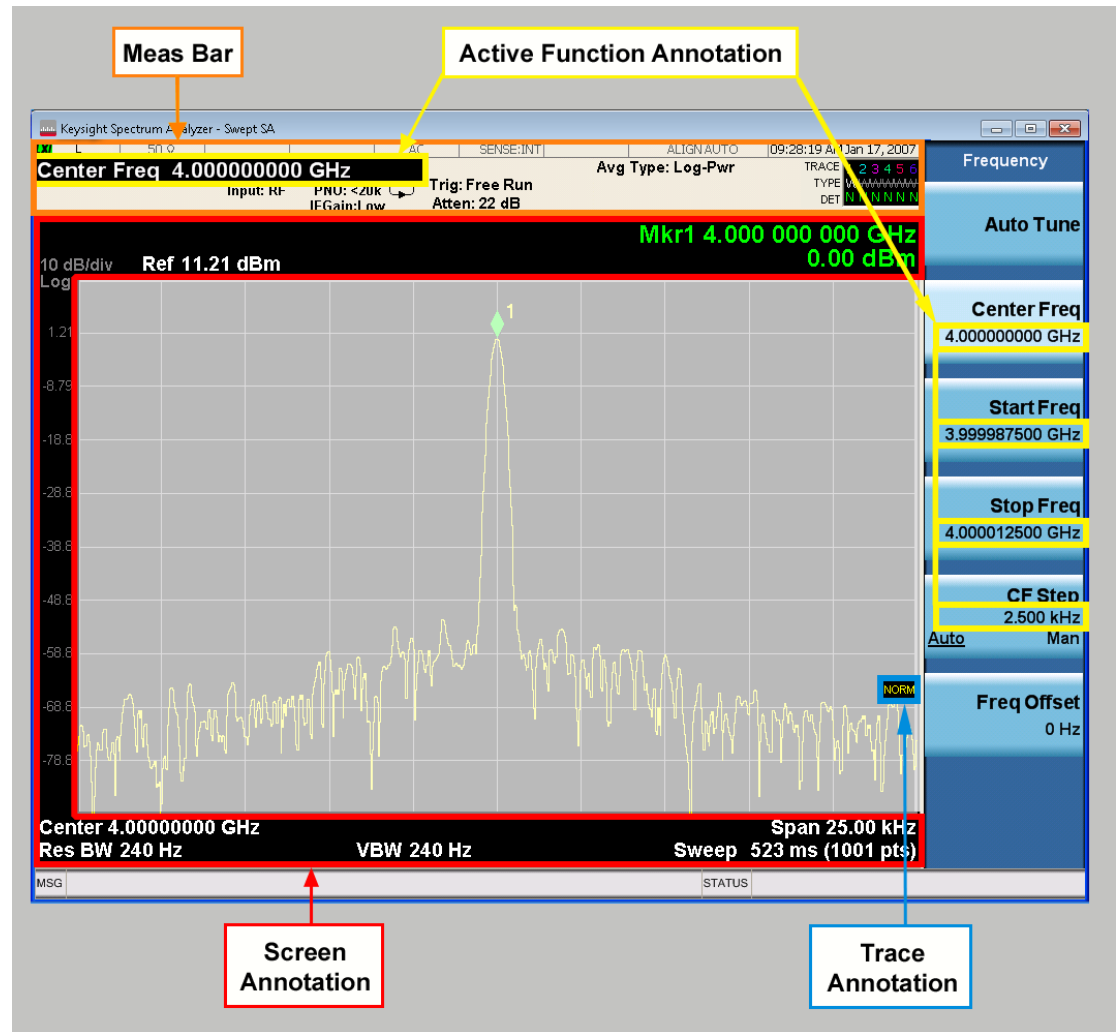
## Annotation

Turns on and off various parts of the display annotation. The annotation is divided up into four categories:

13. Meas Bar: This is the measurement bar at the top of the screen. It does not include the settings panel or the Active Function. Turning off the Meas Bar turns off the settings panel and the Active Function. When the Meas Bar is off, the graticule area expands to fill the area formerly occupied by the Meas Bar.
14. Screen Annotation: this is the annotation and annunciation around the graticule, including any annotation on lines (such as the display line, the threshold line, etc.) This does NOT include the marker number or the N dB result. When off, the graticule expands to fill the entire graticule area.
15. Trace annotation: these are the labels on the traces, showing their detector (or their math mode).

16. Active Function annotation: this is the active function display in the meas bar, and all of the active function values displayed on softkeys.

See the figure below. Each type of annotation can be turned on and off individually.



Key Path	View/Display, Display
Initial S/W Revision	Prior to A.02.00

### Meas Bar On/Off

This function turns the Measurement Bar on and off, including the settings panel. When off, the graticule area expands to fill the area formerly occupied by the Measurement Bar.

Key Path	View/Display, Display, Annotation
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<b>Remote Command</b>	:DISPlay:ANNotation:MBAR[:STATe] OFF ON 0 1 :DISPlay:ANNotation:MBAR[:STATe]?
<b>Example</b>	DISP:ANN:MBAR OFF
Dependencies	Grayed out and forced to OFF when <b>System Display Settings, Annotation</b> is set to Off.
Preset	On This should remain Off through a Preset when <b>System DisplaySettings, Annotation</b> is set to Off.
State Saved	Saved in instrument state.
Initial S/W Revision	Prior to A.02.00

### Screen

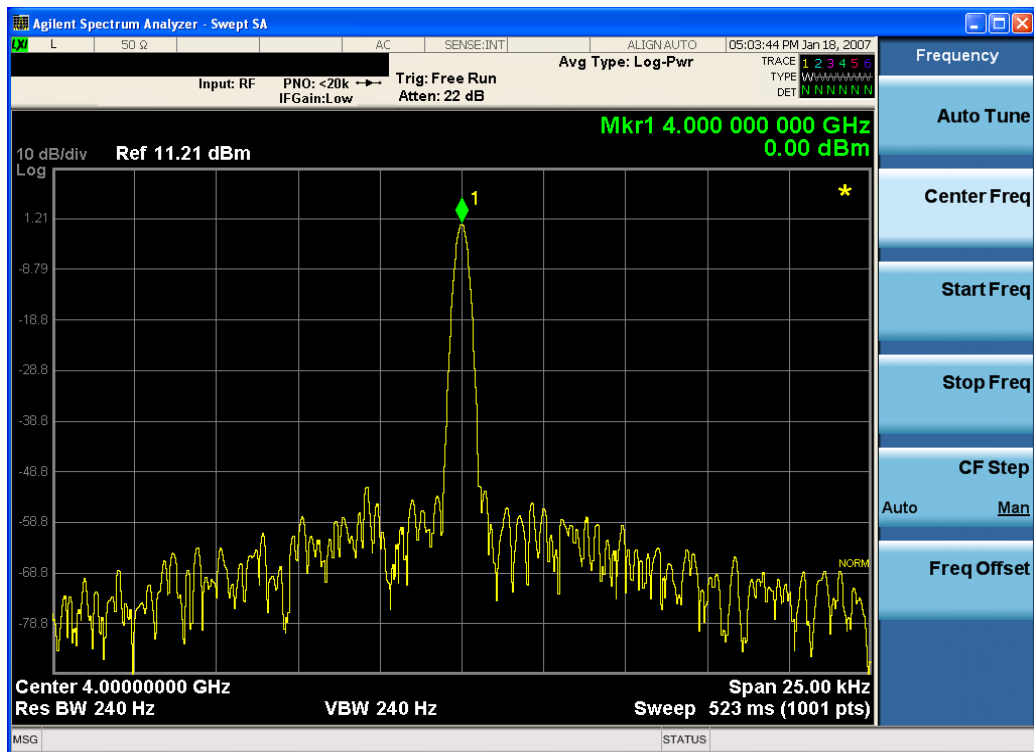
This controls the display of the annunciation and annotation around the graticule, including any annotation on lines (such as the display line, the threshold line, etc.) and the y-axis annotation. This does NOT include marker annotation (or the N dB result). When off, the graticule expands to fill the entire graticule area, leaving only the 1.5% gap above the graticule as described in the Trace/Detector chapter.

Key Path	View/Display, Display, Annotation
<b>Remote Command</b>	:DISPlay:ANNotation:SCReen[:STATe] OFF ON 0 1 :DISPlay:ANNotation:SCReen[:STATe]?
<b>Example</b>	DISP:ANN:SCR OFF
Dependencies	Grayed-out and forced to OFF when <b>System Display Settings, Annotation</b> is set to Off.
Preset	On This should remain Off through a Preset when <b>System DisplaySettings, Annotation</b> is set to Off
State Saved	Saved in instrument state.
Initial S/W Revision	Prior to A.02.00

### Active Function Values On/Off

Turns on and off the active function display in the Meas Bar, and all of the active function values displayed on the softkeys.

Note that all of the softkeys that have active functions have these numeric values blanked when this function is on. This is a security feature..



Key Path	View/Display, Display, Annotation
Remote Command	:DISPlay:ACTivefunc[:STATE] ON OFF 1 0 :DISPlay:ACTivefunc[:STATE]?
Example	DISP:ACT OFF
Dependencies	Grayed out and forced to OFF when <b>System Display Settings, Annotation</b> is set to Off.
Preset	On This should remain Off through a Preset when <b>System DisplaySettings, Annotation</b> is set to Off
State Saved	Saved in instrument state.
Initial S/W Revision	Prior to A.02.00

### Title

Displays menu keys that enable you to change or clear a title on your display.

Key Path	View/Display, Display
Initial S/W Revision	Prior to A.02.00

### Change Title

Writes a title into the "measurement name" field in the banner, for example, "Swept SA".

Press Change Title to enter a new title through the alpha editor. Press Enter or Return to complete the entry. Press ESC to cancel the entry and preserve your existing title.

The display title will replace the measurement name. It remains for this measurement until you press **Change Title** again, or you recall a state, or a Preset is performed. A title can also be cleared by pressing **Title**, **Clear Title**.

**NOTE**

Notice the inclusion of the <measurement> parameter in the command below. Because each measurement remembers the Display Title, the command must be qualified with the measurement name. For the Swept SA measurement this is not the case; no <measurement> parameter is used when changing the Display Title for the Swept SA measurement.

Key Path	View/Display, Display, Title
Mode	All
Remote Command	:DISPlay:<measurement>:ANNotation:TITLe:DATA <string> :DISPlay:<measurement>:ANNotation:TITLe:DATA?
Example	DISP:ANN:TITL:DATA "This Is My Title" This example is for the Swept SA measurement in the Spectrum Analyzer mode. The SANalyzer <measurement> name is not used. DISP:ACP:ANN:TITL:DATA "This Is My Title" This example is for Measurements other than Swept SA. Both set the title to: This Is My Title
Notes	Pressing this key cancels any active function. When a title is edited the previous title remains intact (it is not cleared) and the cursor goes at the end so that characters can be added or BKSP can be used to go back over previous characters.
Preset	No title (measurement name instead)
State Saved	Saved in instrument state.
Initial S/W Revision	Prior to A.02.00

### Clear Title

Clears a title from the front-panel display. Once cleared, the title cannot be retrieved. After the title is cleared, the current Measurement Name replaces it in the title bar.

Key Path	View/Display, Display, Title
Example	The following commands clear the title and restore the measurement's original title: DISP:ANN:TITL:DATA "" This example is for the Swept SA measurement in the Spectrum Analyzer mode. The SANalyzer <measurement> name is not used. DISP:ACP:ANN:TITL:DATA "" This example is for ACP; in measurements other than Swept SA the measurement name is

	required.
Notes	Uses the :DISPlay:<measurement>:ANNotation:TITLe:DATA <string> command with an empty string (in the Swept SA, the <measurement> is omitted).
Preset	Performed on Preset.
Initial S/W Revision	Prior to A.02.00

## Graticule

Pressing Graticule turns the display graticule On or Off. It also turns the graticule y-axis annotation on and off.

Key Path	View/Display, Display
<b>Remote Command</b>	:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATE] OFF ON 0 1 :DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATE]?
<b>Example</b>	DISP:WIND:TRAC:GRAT:GRID OFF
Notes	The graticule is the set of horizontal and vertical lines that make up the grid/divisions for the x-axis and y-axis.
Preset	On
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00

## Display Line

This key allows you to control the Display Line, or for measurements which support multiple Display Lines, it allows you to control Display Line 1. See the key description for **Display Line 1|2|3|4** for detailed information and the SCPI command.

Key Path	View/Display, Display
Initial S/W Revision	Prior to A.02.00

## Display Lines

This key appears in measurements which support multiple display lines, and opens up a menu which lets you control all the display lines.

Key Path	View/Display, Display
Initial S/W Revision	A.17.50

## Select Display Line

This key allows you to select the display line currently being controlled by the **Display Line 1|2|3|4** key.

Key Path	View/Display, Display, Display Lines
Preset	1
Initial S/W Revision	A.17.50

## Display Line 1|2|3|4

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 key controls 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. 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.

Key Path	View/Display, Display
<b>Remote Command</b>	:DISPlay:WINDow[1]:TRACe:Y:DLINe[1] 2 ... 4 <amp1> :DISPlay:WINDow[1]:TRACe:Y:DLINe[1] 2 ... 4? :DISPlay:WINDow[1]:TRACe:Y: DLINe[1] 2 ... 4:STATe OFF   ON   0   1 :DISPlay:WINDow[1]:TRACe:Y: DLINe[1] 2 ... 4:STATe?
<b>Example</b>	DISP:WIND:TRAC:Y:DLIN:STAT ON Turns on Display Line; if multiple display lines, turns on Display Line 1 DISP:WIND:TRAC:Y:DLIN2 -32 dBm Adjust Display Line 2
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	$-\infty$ (minus infinity) in current units
Max	$+\infty$ (plus infinity) in current units
Default Unit	Depends on the current selected Y axis unit
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.17.50

## Select Freq Line

This key allows you to select the display line currently being controlled by the **Freq Line 1|2|3|4** key.

Key Path	<b>View/Display, Display, Display Lines</b>
Preset	1
Initial S/W Revision	A.17.50

## Freq Line 1|2|3|4

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 key controls 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. 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.

Control Path	Display, Meas Display
Control Type	Binary Active Function
<b>Remote Command</b>	<pre>:DISP:WIND:W[1]:TRAC:X:FLINE[1] 2 ... 4 &lt;amp;1&gt; :DISP:WIND:W[1]:TRAC:X:FLINE[1] 2 ... 4? :DISP:WIND:W[1]:TRAC:X:FLINE[1] 2 ... 4:STATe OFF ON 0 1 :DISP:WIND:W[1]:TRAC:X:FLINE[1] 2 ... 4:STATe?</pre>
<b>Example</b>	<pre>DISP:WIND:TRAC:X:FLIN:STAT ON Turn Freq Line 1 on DISP:WIND:TRAC:X:FLIN3 1 GHz Set Freq line 3 to 1 GHz</pre>
Preset	Freq Line 1 selected, Off, and set to 1 GHz

	Off
Dependencies	Freq Lines only display in Swept Spans
Couplings	When a value is set for the Freq Line, turn it On, if in Zero Span. 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.
State Saved	Saved in instrument state.
Initial S/W Revision	A.17.50

### Select Time Line

This key allows you to select the display line currently being controlled by the **Time Line 1|2|3|4** key.

Key Path	<b>View/Display, Display, Display Lines</b>
Preset	1
Initial S/W Revision	A.17.50

### Time Line 1|2|3|4

Activates an adjustable vertical line that is used as a visual reference line. The line's horizontal position corresponds to its time value. The value of the time line (for example, 1 ms) 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 "TL1" for Time Line 1, "TL2" for time line 2, etc.

This key controls whichever Time Line has been selected by the **Select Time Line** key.

The Time Line can be adjusted using the step keys, knob, or numeric keypad. If more than one window has a Time Line, the Time Line of the selected window is controlled.

If the Time 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 Time Line is unaffected by Auto Couple.

Control Path	Display, Meas Display
Control Type	Numeric Toggle
<b>Remote Command</b>	:DISPlay:WINDow[1]:TRACe:X:TLINE[1] 2 ... 4 <amp;1> :DISPlay:WINDow[1]:TRACe:X:TLINE[1] 2 ... 4? :DISPlay:WINDow[1]:TRACe:X:TLINE[1] 2 ... 4:STATe OFF ON 0 1 :DISPlay:WINDow[1]:TRACe:X:TLINE[1] 2 ... 4:STATe?
<b>Example</b>	DISP:WIND:TRAC:X:TLINE:STAT ON Turn Time Line 1 on

	DISP:WIND:TRAC:X:TLIN3 1.2 ms Set Time Line 3 to 1.2 ms
Preset	Time Line 1 selected, Off, and set to 1 ms Off
Dependencies	Time Lines and this control only display in Zero Span
Couplings	When a value is set for the Time Line, turn it On, if in Zero Span. When the Time 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 Time Line's value does not change when it is turned off.
State Saved	Saved in instrument state.
Initial S/W Revision	A.17.50

## System Display Settings

These settings are "Mode Global" – they affect all modes and measurements and are reset only by **Restore Misc Defaults** or **Restore System Defaults** under System.

Key Path	<b>View/Display, Display</b>
Initial S/W Revision	Prior to A.02.00

## Annotation Local Settings

This is a Mode Global override of the meas local annotation settings. When it is **All Off**, it forces **ScreenAnnotation, Meas Bar, Trace, and Active Function Values** settings to be **OFF** for all measurements in all modes. This provides the security based "annotation off" function of previous analyzers; hence it uses the legacy SCPI command.

When it is **All Off**, the **Screen, Meas Bar, Trace, and Active Function Values** keys under the **Display, Annotation** menu are grayed out and forced to **Off**. When **Local Settings** is selected, you are able to set the local annotation settings on a measurement by measurement basis.

Key Path	<b>View/Display, Display, System Display Settings</b>
<b>Remote Command</b>	<b>:DISPlay:WINDow[1]:ANNotation[:ALL] OFF ON 0 1</b> <b>:DISPlay:WINDow[1]:ANNotation[:ALL]?</b>
<b>Example</b>	:DISP:WIND:ANN OFF
Preset	On (Set by Restore Misc Defaults)
State Saved	Not saved in instrument state.
Backwards Compatibility Notes	The WINDow parameter and optional subopcode is included for backwards compatibility but ignored – all windows are equally affected.
Initial S/W Revision	Prior to A.02.00



## Themes

Accesses a menu of functions that enable you to choose the theme to be used when saving the screen image.

The **Themes** option is the same as the **Themes** option under the **Display and Page Setup** dialogs. It allows you to choose between themes to be used when saving the screen image.

Key Path	Save, Screen Image
Remote Command	:MMEMory:STORe:SCReem:THEMe TDCoLor   TDMonochrome   FCOLor   FMONochrome :MMEMory:STORe:SCReem:THEMe?
Example	:MMEM:STOR:SCR:THEM TDM
Preset	3D Color; Is not part of Preset, but is reset by Restore Misc Defaults or Restore System Defaults All and survives subsequent running of the modes.
Readback	3D Color   3D Mono   Flat Color   Flat Mono
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 "Flat Color" theme available in X-Series. Also, if you selected Reverse Bitmap AND a black & white screen image, that would be much like "Flat Monochrome". In other words, each of the X-Series themes has a similar screen image type in ESA/PSA. But they are not identical.
Initial S/W Revision	Prior to A.02.00

### 3D Color

Selects a standard color theme with each object filled, shaded and colored as designed.

Key Path	Save, Screen Image, Themes
Example	MMEM:STOR:SCR:THEM TDC
Readback	3D Color
Initial S/W Revision	Prior to A.02.00

### 3D Monochrome

Selects a format that is like 3D color but shades of gray are used instead of colors.

Key Path	Save, Screen Image, Themes
Example	MMEM:STOR:SCR:THEM TDM
Readback	3D Mono
Initial S/W Revision	Prior to A.02.00

### Flat Color

Selects a format that is best when the screen is to be printed on an ink printer.

Key Path	<b>Save, Screen Image, Themes</b>
<b>Example</b>	MMEM:STOR:SCR:THEM FCOL
Readback	Flat Color
Initial S/W Revision	Prior to A.02.00

### Flat Monochrome

Selects a format that is like Flat Color. But only black is used (no colors, not even gray), and no fill.

Key Path	<b>Save, Screen Image, Themes</b>
<b>Example</b>	MMEM:STOR:SCR:THEM FMON
Readback	Flat Mono
Initial S/W Revision	Prior to A.02.00

### Backlight

Accesses the display backlight on/off keys. 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 will turn backlight on and could potentially perform the action as well.

Key Path	<b>View/Display, Display, System Display Settings</b>
<b>Remote Command</b>	:DISPlay:BACKlight ON OFF :DISPlay:BACKlight?
Preset	ON (Set by Restore Misc Defaults)
Initial S/W Revision	Prior to A.02.00

### Backlight Intensity

An active function used to set the backlight intensity. It goes from 0 to 100 where 100 is full on and 0 is off. This value is independent of the values set under the Backlight on/off key.

Key Path	<b>View/Display, Display, System Display Settings</b>
<b>Remote Command</b>	:DISPlay:BACKlight:INTensity <integer> :DISPlay:BACKlight:INTensity?
<b>Example</b>	DISP:BACK:INT 50
Preset	100 (Set by Restore Misc Defaults)
Min	0

Max	100
Initial S/W Revision	Prior to A.02.00

## View

The RTSA measurements have the following views, which let you look at the trace data in different ways.

- "Normal (Real Time SA)" on page 706
- "Density" on page 707
- "Spectrogram" on page 712
- Trace Zoom
- Zone Span
- "Density / Spectrogram" on page 725
- "Power vs Time" on page 1012
- "Power vs Time / Spectrum" on page 1013
- "Power vs Time / Spectrogram" on page 1014

The views are separated by the measurement they apply to;

	Spectrum Measurement	Power vs Time Measurement
Single Window View	Normal <b>Density</b>	<b>Power vs Time</b>
Multi Window View	<b>Spectrogram</b> Trace Zoom Zone Span Density/Spectrogram	<b>Power vs Time / Spectrum</b> Power vs Time / Spectrogram

### NOTE

The view names in bold in the table above are the default views for the Multi Window toggle key described below.

The Multi Window toggle key allows the user to toggle between a single window view and a multi window view of the measurement.

When the current view is a Single Window View, then pressing the Multi Window toggle key sets the view to the previous Multi Window View. If there was no Multi Window View previously set, then the default Multi Window View will be set. Similarly, when the current view is a Multi Window View, then pressing the Multi Window toggle key sets the view to the previous Single Window View. If there was

no Single Window View previously set, then the default Single Window View will be set.

For example, when the Real Time Spectrum mode is selected for the first time, the Density view of the Spectrum measurement will be set. Pressing the Multi Window toggle key will set the view to a Multi Window View. Since there was no previous Multi Window View selected, the default Multi Window View (Spectrogram view) will be set. Pressing the Multi Window toggle key again will set the view to a Single Window View. Since the previous Single Window View was the Density view, this view will be set. Pressing the Multi Window toggle key in this state will toggle the view between Density view and Spectrogram view until a different view is selected.

When in a multi window layout, the Next Window key or the `:DISPlay:WINDow[:SElect] <number>` command can be used to switch windows.

Key Path	View/Display
<b>Remote Command</b>	<code>:DISPlay:VIEW NORMal   DENSity   SPECTrogram   TZOm   ZSPan   PVTIme   PSPectrum   PSGRam</code> <code>:DISPlay:VIEW?</code>
<b>Example</b>	<code>:DISP:VIEW NORM</code> sets the Normal view in Real Time Spectrum Meas
Notes	If a window that is not currently active is selected, the window layout will be updated to a layout that accommodates the selected window, setting any new unspecified windows to their default view.  Density view is only available in a single window layout and will be disabled in any other window layout. If any window other than window 1 is selected for density view the error message "Settings Conflict: Density View is only available is single window layout" will be generated.
Preset	DENSity
State Saved	Saved in instrument state
Initial S/W Revision	A.13.00

## Display Trace

You can specify which spectrogram trace to display in the trace window by using the Display Trace parameter. This function determines which of the 10,000 traces stored in the Spectrogram is currently being viewed in the trace window.

The selection of the display trace can be by trace number or by trace time. Display Trace 0 shows the latest trace.

This key only appears in the Spectrogram View. If the SCPI command is sent to any other View, it is accepted without error but you won't see the result until you go back to the Spectrogram View.

Key Path	View/Display
<b>Remote Command</b>	<code>:TRACe:DISPlay:VIEW:SPECTrogram:POSition &lt;integer&gt;</code> <code>:TRACe:DISPlay:VIEW:SPECTrogram:POSition?</code>
<b>Example</b>	<code>:TRAC:DISP:VIEW:SPEC:POS 146</code>
Dependencies	This key only appears in the Spectrogram View. If the SCPI command is sent to any other View, it

	is accepted without error but you won't see the result until you go back to the Spectrogram View.
Couplings	The input to this parameter can be trace number or trace time. See section "Trace Selection" on page 1018 for more details on Trace Selection. When Spectrogram occupies a Window that has half vertical size, only 300 traces can be displayed in the trace window at any one time.
Preset	Unaffected by Mode Preset, but set to 0 by Restore Mode Defaults. The value is remembered when you go in and out of Spectrogram View.
State Saved	Saved in instrument state
Min	0
Max	10,000*
Default Unit	Enter
Initial S/W Revision	A.13.00

### Persistence

Persistence allows the user to specify how long the frequency amplitude points displayed in the bitmap should take to fade. The persistence refers to the intensity of a pixel. Adding persistence controls the length of time it will take for a point to go from 100% intensity to 0% intensity, i.e. transparent, assuming the point does not get hit again during the persistence time. The amount the intensity will decrease is calculated using the following algorithm;

$$\text{Intensity Reduction Value} = \text{Update Rate} / \text{Total Persistence Time}$$

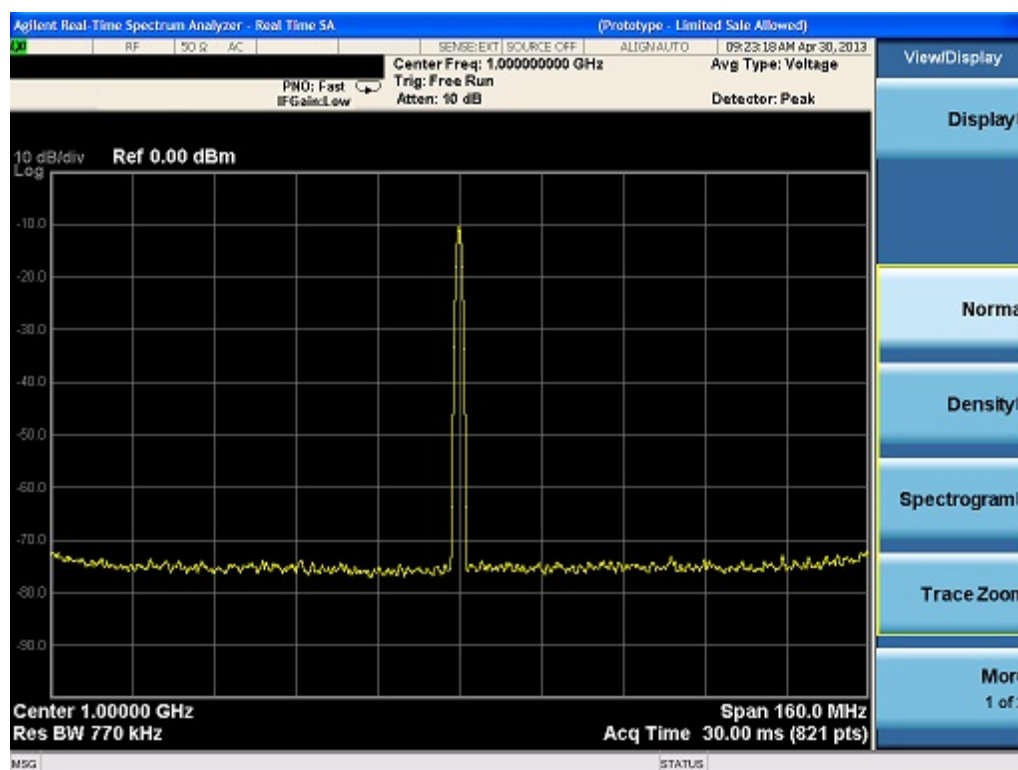
All points in the bitmap not hit during an update will have their intensity reduced by the Intensity Reduction Value and continue to do so until they reach 0% intensity, i.e. transparent. If the point is hit again, the new density value will be used to represent the particular frequency amplitude point, even if the density value is less, and it will be displayed at 100% intensity. Subsequent updates will repeat the process.

Persistence has two modes. A finite mode where the user defines the persistence time and an infinite mode, which allows the user to see the density of each point over the entire measurement time. Infinite mode shows the total number of times a frequency and amplitude point is hit during all the capture intervals since starting the measurement. This is the total time a signal spends at each frequency and amplitude point as a percentage of the complete measurement time, i.e. the averaged time. In infinite mode the intensity for all frequency amplitude points hit at any time since the measurement started will be 100%, i.e. there will be no fading.

Key Path	View/Display
Remote Command	:DISPlay:VIEW:DENSity:PERSiStence <time> :DISPlay:VIEW:DENSity:PERSiStence? :DISPlay:VIEW:DENSity:PERSiStence:INFinite OFF ON 0 1 :DISPlay:VIEW:DENSity:PERSiStence:INFinite?
Example	DISP:VIEW:DENS:PERS 5
Notes	When in Infinite mode, the active function is cleared and the infinity symbol ∞ will be displayed on

	the softkey where the time value is shown
Dependencies	This key only appears in the Density View. If the SCPI command is sent to any other View, it is accepted without error but you won't see the result until you go back to the Density View.
Couplings	The colors used by persistence are coupled to the Density Hue parameter settings. See section <a href="#">"Highest Density Hue" on page 708</a> and <a href="#">"Lowest Density Hue" on page 709</a> .
Preset	300 ms OFF
State Saved	Saved in instrument state
Min	0s
Max	10s
Initial S/W Revision	A.13.00

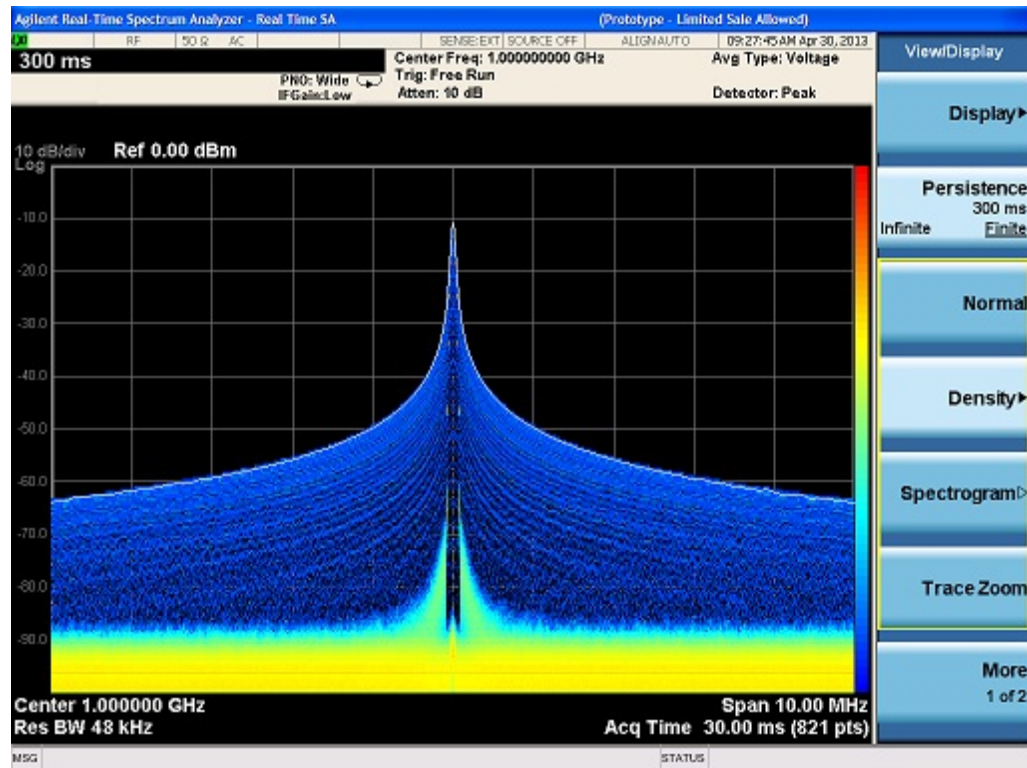
### Normal (Real Time SA)



Single window view showing Real Time, Gap Free Frequency vs. Amplitude, with Frequency on the X-axis and Amplitude on the Y-axis.

Key Path	<b>View/Display</b>
<b>Example</b>	:DISP:VIEW NORM
Couplings	If Spectrogram view is active at the same time as Normal view, the active trace in the Normal view will be determined by the Display Trace parameter. See section <a href="#">"Display Trace" on page 1010</a> .
Initial S/W Revision	A.13.00

## Density



The Density view uses a bitmap to represent the signal density at each frequency and amplitude point determined by the current analyzer settings. The density is defined as the number of times a frequency and amplitude point is hit during a capture interval, which is therefore simply the time a signal spends at each frequency and amplitude point in a given time period.

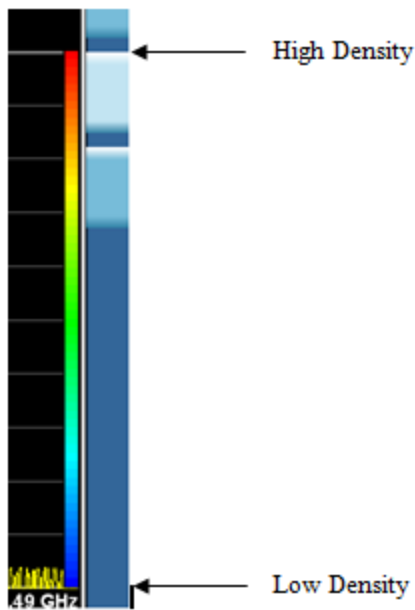
In this view, the X axis represents frequency, the Y axis represents amplitude and the Z axis represents number of hits. This view therefore displays three dimensional data on a two dimensional display, using color to represent the third dimension.

The view will also display a white trace over the bitmap. This trace shows the real time spectrum for the latest capture interval. The white trace is Trace 1 with detectors Peak, Negative Peak and Average derived from the density values and Sample being the last FFT that was used by the density bitmap.

The format of the data will be a series of frequency/amplitude points with the value at each point representing the density percentage, in the range 0–1. Therefore a frequency/amplitude point that is hit 50% of the time during an acquisition will be represented by 0.5. The location of the frequency/amplitude point within the bitmap will correspond to the row/column point in the .csv file.

The key to these colors is displayed as a color bar on the right hand side of the graphical display, as opposed to the right hand side of the display where Spectrogram and Powergram show the color bar. This is to avoid confusion that the color bar represents amplitude, as it does in the other views.

In Density view, high density is represented by the color at the top of the color bar and low density by the color at the bottom of the color bar.



Key Path	View/Display
<b>Example</b>	DISP:VIEW DENS
Dependencies	Density view is only available in a Single layout. In all other layouts Density view will be grayed out. Marker2: Marker functionality will be limited to the white trace (Trace 1) only. Trigger Delay: Only positive trigger delay is supported.
Initial S/W Revision	A.13.00

### Highest Density Hue

This control lets you adjust where, as a percentage of the density range, the Highest Density Hue appears. Above the Highest Density Hue, any density points simply map as black.

Key Path	View/Display, Density
<b>Remote Command</b>	:DISP:VIEW:DENS:HDHue <real> :DISP:VIEW:DENS:HDHue?
<b>Example</b>	:DISP:VIEW:DENS:HDH 60
Notes	We send 60 to set 60%, although 60% is, strictly speaking, 0.6. This is inconsistent with the way percentages read back but, I think, more intuitive when you are setting a value.
Preset	100.0
State Saved	Saved in State
Min	Lowest Density Hue + Resolution



**NOTE**

Highest Density Hue is not allowed to go any lower than or equal to Lowest Density Hue.

Max	100.0
Initial S/W Revision	A.13.00

### Lowest Density Hue

This control lets you adjust where, as a percentage of the density range, the bottom of the color bar appears.

Key Path	View/Display, Density
<b>Remote Command</b>	:DISPlay:VIEW:DENSity:LDHue <real> :DISPlay:VIEW:DENSity:LDHue?
<b>Example</b>	:DISP:VIEW:DENS:LDH 40
Notes	We send 40 to set 40%, although 40% is, strictly speaking, 0.4. This is inconsistent with the way percentages read back but, I think, more intuitive when you are setting a value.
Preset	0.0
State Saved	Saved in instrument state
Min	0.0
Max	Highest Density Hue - Resolution Note: Lowest Density Hue is not allowed to go any higher than or equal to Highest Density Hue.
Initial S/W Revision	A.13.00

### Curve Nonlinearity

Within the color range specified by the minimum and maximum density, this control allows a smooth weighting towards the higher or lower ends of the color gradient for the same density data. Larger values for curve nonlinearity will compress the colors used towards the higher end of the color bar, and smaller values will compress the colors towards the bottom.

Key Path	View/Display, Density
<b>Remote Command</b>	:DISPlay:VIEW:DENSity:CNONlinear <real> :DISPlay:VIEW:DENSity:CNONlinear?
<b>Example</b>	:DISP:VIEW:DENS:CNON 50
Preset	0.0
State Saved	Saved in instrument state
Min	-100.0
Max	100.0
Initial S/W Revision	A.13.00

## Color Palettes

Allows the selection of different color palettes which allows optimization of visibility and contrast for different signal environments

Key Path	View/Display, Density
<b>Remote Command</b>	:DISPlay:VIEW:DENSity:CPALettes COOL   WARM   GRAY   RADar   FIRE   FROSt :DISPlay:VIEW:DENSity:CPALettes?
<b>Example</b>	DISP:VIEW:DENS:CPAL COOL
Preset	WARM
State Saved	Saved in instrument state
Range	Cool Warm Grayscale Radar Fire Frost
Initial S/W Revision	A.13.00

### Cool

Selects Cool as the Color Palette.

Key Path	View/Display, Density, Color Palette
<b>Example</b>	DISP:VIEW:DENS:CPAL COOL
State Saved	Saved in instrument state.
Readback	Cool
Initial S/W Revision	A.13.00

### Warm

Selects Warm as the Color Palette.

Key Path	View/Display, Density, Color Palette
<b>Example</b>	DISP:VIEW:DENS:CPAL WARM
State Saved	Saved in instrument state.
Readback	Warm
Initial S/W Revision	A.13.00

### Grayscale

Selects Grayscale as the Color Palette.

Key Path	View/Display, Density, Color Palette
<b>Example</b>	DISP:VIEW:DENS:CPAL GRAY
State Saved	Saved in instrument state.
Readback	Grayscale
Initial S/W Revision	A.13.00

## Radar

Selects Radar as the Color Palette.

Key Path	<b>View/Display, Density, Color Palette</b>
<b>Example</b>	DISP:VIEW:DENS:CPAL RAD
State Saved	Saved in instrument state.
Readback	Radar
Initial S/W Revision	A.13.00

## Fire

Selects Fire as the Color Palette.

Key Path	<b>View/Display, Density, Color Palette</b>
<b>Example</b>	DISP:VIEW:DENS:CPAL FIRE
State Saved	Saved in instrument state.
Readback	Fire
Initial S/W Revision	A.13.00

## Frost

Selects Frost as the Color Palette.

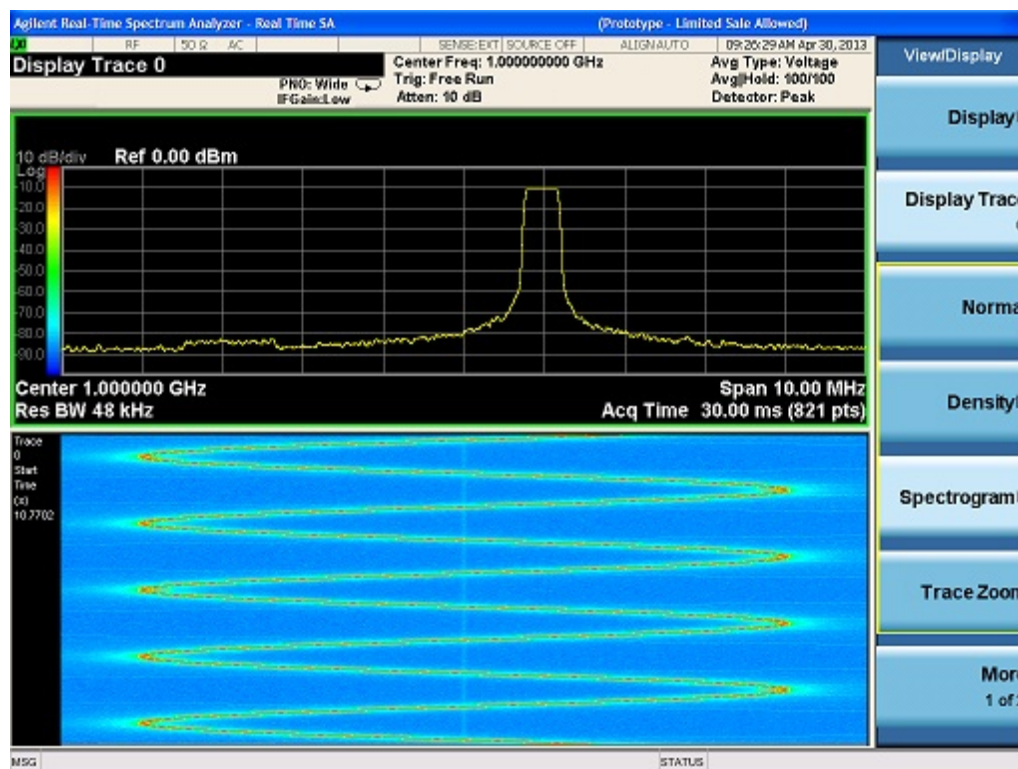
Key Path	<b>View/Display, Density, Color Palette</b>
<b>Example</b>	DISP:VIEW:DENS:CPAL FROS
State Saved	Saved in instrument state.
Readback	Frost
Initial S/W Revision	A.13.00

## Auto Adjust Density Levels

Sets the "[Highest Density Hue](#)" on page 708 to the value of the highest density value found in the current density bitmap and sets the "[Lowest Density Hue](#)" on page 709 to the lowest non-zero density value.

Key Path	<b>View/Display, Density</b>
<b>Remote Command</b>	<b>:DISP:VIEW:DENSity:AADJust</b>
<b>Example</b>	DISP:VIEW:DENSity:AADJ
Initial S/W Revision	A.13.00

## Spectrogram



The Spectrogram View allows the user to view a history of 10,000 traces, with up to 600 traces being displayed at any one time. In the Spectrogram View, each horizontal line in the spectrogram display represents one historical trace, which is the summary of an accumulation over an acquisition time interval. The data streams upwards from newest to oldest; the latest trace displays on the bottom and the oldest trace on the top.

Note that whenever you save state while in Spectrogram, and then recall the state, Spectrogram comes back with all the settings just as they were when you saved the state, but not including the Spectrogram data itself. If you want to save the Spectrogram data, you can Export it using Meas Results, and import it into a PC, although you cannot load it back into the analyzer.

See ["More Information" on page 713](#)

See ["Representation of Time" on page 715](#)

Key Path	View/Display
<b>Example</b>	DISP:VIEW SPEC
Couplings	If Spectrogram view is active at the same time as Normal view, the active trace in the Normal view will be determined by the Display Trace parameter. See section <a href="#">"Display Trace" on page 1010</a>
Initial S/W Revision	A.13.00

## More Information

In the Spectrogram View, the spectrogram window allows the user to view a history of the last 10,000 traces. If Spectrogram view is active at the same time as Normal View in a multi window layout the two views will be coupled together. The Normal window shows the trace indicated by the **Display Trace** parameter in the Spectrogram menu. The **Display Trace** key determines which of the traces in the Spectrogram window is currently being viewed in the Normal window. A white line across the Spectrogram window shows the current position of the Display Trace. Display Trace can be selected as a Trace Number or Time. For details on using time as the Trace Selection, refer to section "[Trace Selection](#)" on page 1018. We will use Trace Number to describe the functionality in this section. On entry to the Spectrogram view, Display Trace has a value of 0; which means it is set to the latest trace to be acquired.

Every time an acquisition completes, the latest trace is displayed at the bottom of the Spectrogram and the historical traces are moved up one position. If active, the data displayed in the Normal window is the extracted trace from the Spectrogram data determined by the Display Trace value. Once the trace data has been written into the Spectrogram, it is immutable.

The Spectrogram can hold 10,000 traces. When Spectrogram occupies a Window that has full vertical size, 600 traces can be displayed in the trace window at any one time. The Display Trace will be used to determine which traces are to be displayed. Navigating through the Spectrogram will be the same as navigating through any window, with the Display Trace being the equivalent of the cursor and the scroll bar used to indicate and control where in the 10,000 trace range is currently being displayed.

When the user selects a Display Trace that causes scrolling down through the Spectrogram traces, i.e. a Display Trace value less than the current Display Trace value, the lower value of the Spectrogram window will be the new Display Trace value. When the user requests a Display Trace that causes scrolling up, i.e. a Display Trace value greater than the current Display Trace value, the upper value of the Spectrogram window will be the new Display Trace value.

For example, if the user has Display Trace set to 100, the lower value of the Spectrogram window will be 0 and the upper value 600. If the user then sets the Display Trace to 1000, this is scrolling up therefore the upper value of the Spectrogram window will be 1000 and the lower value 400. If the user then sets the Display Trace to 200 this is scrolling down therefore the lower value of the Spectrogram window will be 200 and the upper value 800.

If the Spectrogram display window has not yet filled with 600 traces, the oldest trace is the highest numbered trace that has data in it. The value of Display Trace is announced in the upper left hand corner of the bottom window, along with the start time of that trace.

If the user selects a historical trace that has not yet been acquired, both the trace window and spectrogram window will remain blank until such time as the trace the user requested is available. The Spectrogram window will then be populated one trace at a time as the subsequent traces are acquired, with the trace window

showing the trace corresponding to the Display Trace value the user requested. If the user selects a historical trace that has been acquired, the Spectrogram window will be populated with the available historical traces and the trace window will show the trace corresponding to the Display Trace value the user requested.

Any variable change that restarts an acquisition will clear out the spectrogram and start it over, unless you are in the idle state (single mode or waiting for a trigger), in which case it will be cleared out when you start an acquisition again. The Restart key will clear out all spectrogram traces and start over. The spectrogram display is also cleared on exit from the Spectrogram View, so every time you enter the Spectrogram View, the spectrogram window is empty.

The user can Pause and Resume the spectrogram at any time. Pausing the spectrogram will cause the accumulation of traces to stop and allow adjustment of the Display Trace parameter to view any historical traces. On resume the existing historical trace data will not be cleared, and subsequent captures will be added to the historical data. Although this will result in a gap in the spectrogram data, the data captured will still be done so in real time. The time stamp of each trace will identify that the spectrogram data is not gap free after a pause and resume.

The colors in the Spectrogram represent signal amplitude. The key to these colors is displayed next to the Y Axis in the upper window. By changing the Y Axis parameters you can change the scaling; that is, by changing the Ref Level or Scale/Div, the colors will get remapped to new Amplitude values. Note that this will, however, restart the Spectrogram.

Each horizontal line in the spectrogram represents a single trace, and the vertical axis represents time. For all values of Display Trace, the trace in the trace window will be updated on completion of an acquisition. To freeze the spectrogram, put Trace into View, or put the analyzer into Single mode (note that unless the Average/Hold Number=1, putting the analyzer into Single will not freeze the Spectrogram until the number of traces specified by the Average/Hold Number have been taken).

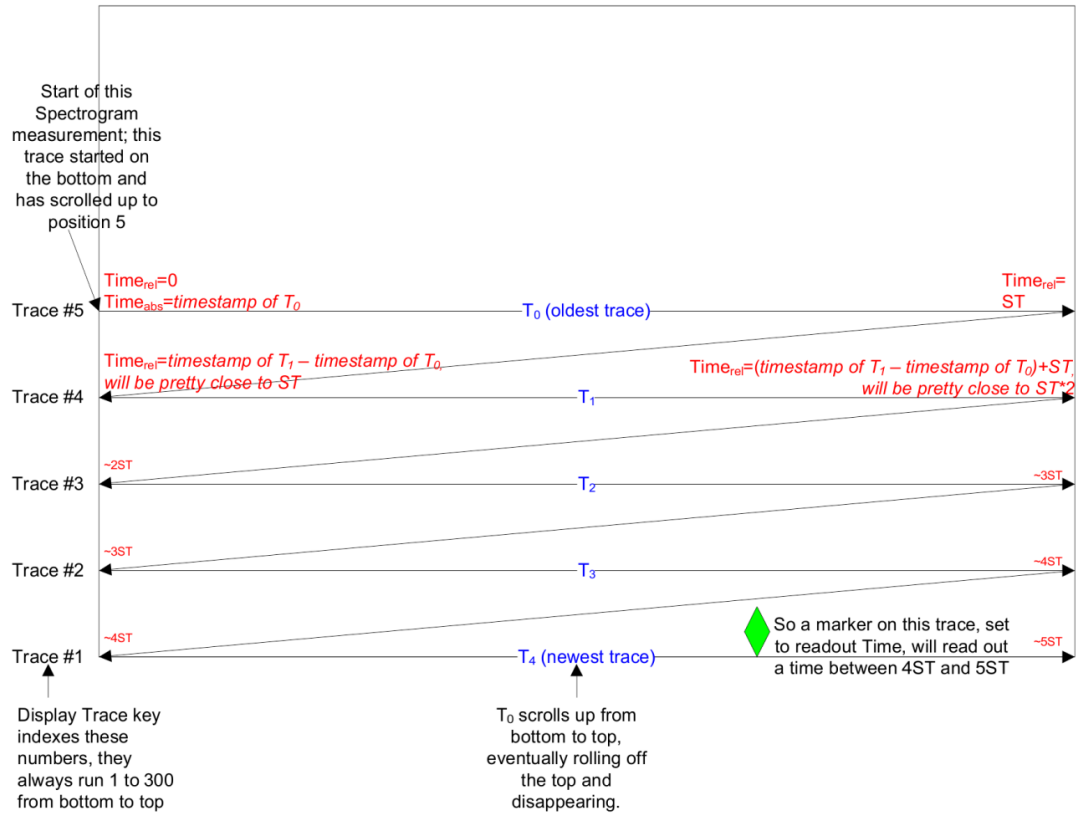
While in Spectrogram View, all functions and settings work as normal, except as noted below.

- The **Single** key causes a specified number of traces to be read into the spectrogram, after which the acquisition stops. The number of traces to be read into the spectrogram is controlled with the “Average/Hold Number” key in the Meas Setup menu. For example, if you set the “Average/Hold Number” to 5, then every time you press Single, it will take 5 acquisitions and put the 5 traces into the Spectrogram; then it will stop the acquisition. Note that you can set the “Average/Hold Number” to 1 to capture a single trace into the Spectrogram when the Single key is pressed.
- In the Spectrogram View, if the Trace is saved, exported or queried, the data that gets saved or returned is the data from the Display Trace in the spectrogram.

- Selecting or moving a marker which is turned on but not on the current Display Trace will NOT move the marker to the current Display Trace; it will select it, and/or move it, but it will stay on the Trace it is currently on.
- Turning on a marker which is turned off will turn it on in the center of the current Display Trace.
- When a Peak Search is performed, if the selected marker is turned on but is not on the current Display Trace, it is first moved to the center of the current Display Trace before performing the search.

### Representation of Time

In the Spectrogram view, zero time is the point where the first trace started, meaning that each subsequent trace point is at a positive time that represents when that point was gathered, relative to the start point. Each trace is time stamped as it starts, and this time is remembered for each trace. As successive traces appear their start times get successively larger, relative to the start time of the oldest trace. If a marker is placed on the live trace and its readout is set to Time, the time of this marker will increment by about the acquisition time for every new acquisition. If the measurement is paused the Spectrogram will stop updating. When resume is selected the spectrogram will retain the existing traces and continue updating using traces from the point at which Resume was selected. The time stamp of the individual Spectrogram traces will show the time from the beginning of the measurement the trace relates therefore showing there was a gap in the Spectrogram capture. See the diagram below for a graphical representation of how this will appear to the user:



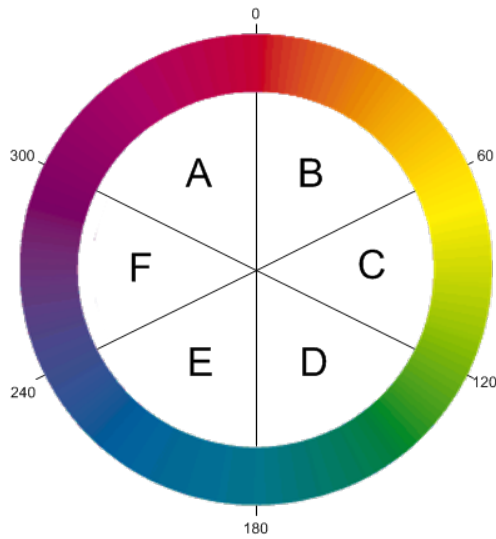
The `:TRACe:DISPlay:VIEW:SPECTrogram:TIME?` Command can be used to determine the time that the current trace in the spectrogram started.

### Ref Hue

This key allows you to adjust the Hue at the top of the spectrogram color bar. The Spectrogram color bar is the bar placed next to the trace display to map colors into the Spectrogram window.

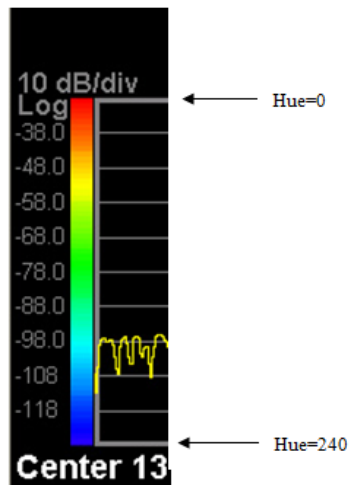
To understand how this works we need to understand the concept of “Hue”. The Hues of the colors run from 0 to 359 (360 is the same as 0) and are shown on the color wheel below:



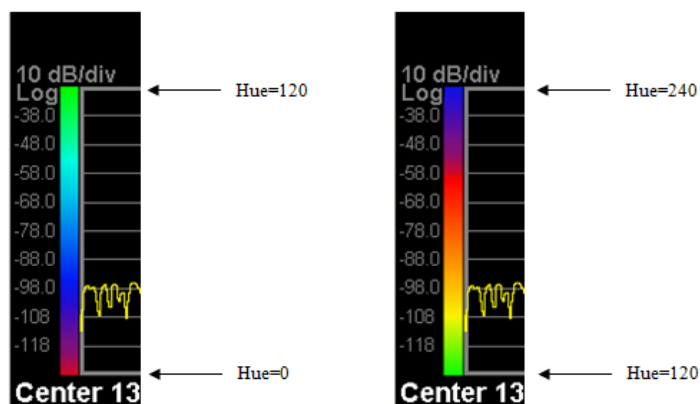


Hue 0 is Red (255,0,0), Hue 120 is Green (0,255,0) and Hue 240 is Blue (0,0,255). Hue 60 is Yellow (255,255,0), Hue 180 is Cyan (0,255,255) and Hue 300 is Magenta (255,0,255). In region A-B, the red value is constant (255), in C-D, the green value is constant (255), and in E-F, the blue value is constant (255). There is no green in region F-A, there is no Red in E-D, and there is no Blue in B-C.

When you adjust the Reference Hue, you are adjusting the Hue at the top of the color bar. The bottom of the color bar shows the Hue that is 240 degrees clockwise from the Ref Hue. Thus, in the normal case, the color bar appears like this:



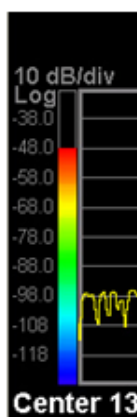
Here are other examples of Ref Hue settings:



Key Path	View/Display, Spectrogram
<b>Remote Command</b>	:DISPlay:VIEW:SPECTrogram:HUE <real> :DISPlay:VIEW:SPECTrogram:HUE?
<b>Example</b>	:DISP:VIEW:SPEC:HUE 120
Preset	0
State Saved	Saved in instrument state
Min	0, but the next decrement takes you to 359
Max	359.9, but the next increment takes you back to 0
Initial S/W Revision	A.13.00

### Ref Hue Position

This control lets you adjust where, as a percentage of the graticule, the Ref Hue appears. Above the Ref Hue Position, any amplitudes simply map as black. As an example, here is what the color bar looks like when the Ref Hue Position is set to 80%:



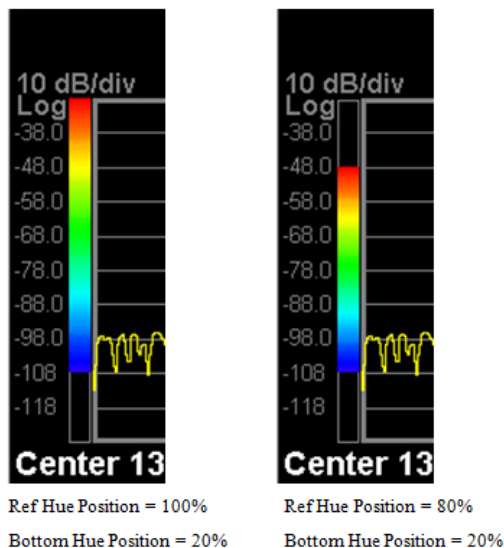
Key Path	View/Display, Spectrogram
<b>Remote Command</b>	:DISPlay:VIEW:SPECTrogram:REFerence <integer> :DISPlay:VIEW:SPECTrogram:REFerence?

<b>Example</b>	:DISP:VIEW:SPEC:REF 60
Notes	We send 60 to set 60%, although 60% is, strictly speaking, 0.6. This is inconsistent with the way percentages read back but, I think, more intuitive when you are setting a value.
Preset	100
State Saved	Saved in instrument state
Min	Ref Hue Position is not allowed to go any lower than 10% or Bottom Hue Position + 10, whichever is higher.
Max	100
Initial S/W Revision	A.13.00

### Bottom Hue Position

This control lets you adjust where, as a percentage of the graticule, the bottom of the color bar appears. Below the color bar is black, and any amplitudes in this region simply map as black.

Examples:



Key Path	View/Display, Spectrogram
<b>Remote Command</b>	:DISPlay:VIEW:SPECTrogram:BOTTom <integer> :DISPlay:VIEW:SPECTrogram:BOTTom?
<b>Example</b>	:DISP:VIEW:SPEC:BOTT 40
Notes	We send 40 to set 40%, although 40% is, strictly speaking, 0.4. This is inconsistent with the way percentages read back but, I think, more intuitive when you are setting a value.
Preset	0
State Saved	Saved in instrument state
Min	0
Max	Bottom Hue Position is not allowed to go any higher than 90% or Ref Position - 10, whichever is

	lower.
Initial S/W Revision	A.13.00

### Auto Adjust Hue Positions

Sets the Ref Hue Position (see section "Ref Hue Position" on page 1016"Ref Hue" on page 1014) to the highest amplitude value found in the Spectrogram and sets the Bottom Hue Position (see section "Bottom Hue Position" on page 1017) to the lowest amplitude value found in the Spectrogram.

Key Path	View/Display, Spectrogram
<b>Remote Command</b>	:DISPlay:VIEW:SPECTrogram:AADJust
<b>Example</b>	DISP:VIEW:SPECTrogram:AADJ
Initial S/W Revision	A.13.00

### Trace Selection

Allows the user to determine how they will select the trace they want to display in the trace window. This can be either trace number or time. Each trace will have a time value associated with it which represents the time it occurred in the acquisition. This can be computed using Trace Time = Trace Number \* Acquisition Time

Key Path	View/Display, Spectrogram
<b>Remote Command</b>	:DISPlay:VIEW:SPECTrogram:TRACe:SELECTION TIME TNUMBER :DISPlay:VIEW:SPECTrogram:TRACe:SELECTION?
<b>Example</b>	:DISP:VIEW:SPEC:TRAC:SEL TIME
Couplings	Changing Trace Selection will change the value represented by Display Trace
Preset	TNUMBER
State Saved	Saved in instrument state
Range	Time Trace #
Initial S/W Revision	A.13.00

### Couple Marker To Trace

Allows you to couple the maker to the selected Display Trace. When turned Off, this allows you to fix the marker to the Display Trace that was active when the marker was turned on. When turned On the Marker will stay with the selected Display Trace as it is changed.

Key Path	View/Display, Spectrogram
<b>Remote Command</b>	:DISPlay:VIEW:SPECTrogram:TRACe:COUPlE ON OFF 1 0 :DISPlay:VIEW:SPECTrogram:TRACe:COUPlE?
<b>Example</b>	DISP:VIEW:SPEC:TRAC:COUP ON
Preset	OFF

State Saved	Saved in instrument state
Initial S/W Revision	A.13.00

### Display Trace Time Query

Can be used to determine the time that the current trace in the spectrogram started or set the display trace to the approximate start time of the entered time.

Key Path	View/Display
<b>Remote Command</b>	TRACe:DISPlay:VIEW:SPECTrogram:TIME <time> TRACe:DISPlay:VIEW:SPECTrogram:TIME?
<b>Example</b>	:TRAC:DISP:VIEW:SPEC:TIME 1.0 Sets the display trace to be at the given start time. If the time is not exact, the approximate start will be calculated. :TRAC:DISP:VIEW:SPEC:TIME? Returns the start time of the Display Trace relative to the start time of the "live" trace (Spectrogram Trace 1)
Dependencies	This key only available in the Spectrogram View. If the command is sent in any other View, an error is generated
Couplings	The key input to this parameter can be trace number or trace time. See section " <a href="#">Trace Selection</a> " on page 1018 for more details.
Preset	0 s
Initial S/W Revision	A.12.00

### Markers

In the Spectrogram View, you can put Markers on any trace in the spectrogram window. To put a Marker on a particular trace in the spectrogram window, set the Display Trace to the trace upon which you want the marker, and then position the marker as desired on the trace in the trace window. When you turn a Marker on, or do any kind of Peak Search, the marker will appear on the current Display Trace. Then when you move the Display Trace to other traces in the Spectrogram Window, the Marker will stay on the spectrogram trace it is on.

Markers are displayed in the Spectrogram Window as little crosses, with one bar sitting on the trace in question and the other bar perpendicular to it. The selected marker's cross is green; the others are white.

Example: Set Display Trace to spectrogram trace number 125. Turn on Marker 1. Marker 1 appears on the Spectrum trace, which is spectrogram trace number 125. A green diamond appears on trace 1 in the trace window, and a little cross appears on spectrogram trace number 125 in the spectrogram window. Now set Display Trace to 200. The trace window now shows spectrogram trace number 200; Marker 1 disappears out of that window because it is still on spectrogram trace number 125. You can still see the little cross sitting on spectrogram trace number 125 in the spectrogram window.

The selected marker displays in the upper right corner of the top window display, as always. If a delta marker is referenced to a marker on another Spectrogram Trace, then when the Marker X-Axis Scale is time, you will see the delta which represents

the Y-axis delta between the two markers, as always; but in this case the X-axis delta now includes the time between the two traces.

When you leave the Spectrogram View, all markers that were not on Display Trace 0 are turned OFF.

### Trace Zoom

In the Trace Zoom view, the screen is split into two windows. The top window is a normal spectrum analyzer window, and the bottom window (“Zoomed Trace”) shows a “zoomed” representation of the traces in the top window. The data in both windows is identical, but the bottom window typically shows fewer data points, spread across the whole display, which allows you to see the data in those points more clearly, particularly when the trace data in the top window is very dense (sweep points much greater than 1000).

The zoom region is indicated by a blue shading. In the top window, this indicates which subset of the data is zoomed in the bottom window. In Swept Span, you set the span of the bottom window using the Zoom Span control (in the Span menu) and you set the Center Frequency of the bottom window using the Zoom Center key (in the Frequency menu). In Zero Span, you set the width of the bottom window using the Zoom Sweep Time control and the center using the Zoom Center key (both in the Sweep menu).

It is important to emphasize that the data and state in the two windows is IDENTICAL. The Zoom Window is simply a close-up view of a region of the top windows’ traces. Therefore all traces and markers are the same in both windows; and any state changes you make affect both windows.

You set the number of sweep points shown in the Zoom Window separately from the top window. Changing the number of points in the top window does not change the Zoom Span; hence the number of points in the bottom window will change by the same proportion as the change in the top window. Conversely, changing the number of points in the bottom window WILL change the Zoom Span and does NOT change the number of points in the top window, because the more points you show in the bottom window, the greater is the percentage of the top window which you are showing in the bottom.

Two functions in Trace Zoom depend on which window is selected (the selected window has a thick green border around it). When the Zoom Window (bottom window) is selected, the Points key in the Sweep/Control menu changes to Zoom Points and adjusts the number of points in the bottom window. Also, for all Peak Search functions, if 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.

#### NOTE

If you have just switched to the Zoom Window via SCPI (using the :DISP:WIND function) you should wait at least one second before performing a Peak Search, to ensure that SCPI will direct the Peak Search command to the correct window.

When you are in Zero Span in Trace Zoom, both the top and bottom window are in Zero Span, but the bottom window will have a different sweep time reflecting how much it is zoomed. When you go between Swept Span and Zero Span (either direction), the blue bar in the top window remains fixed in position and size, and the number of points in the top window does not change. So on the Swept Span to Zero Span transition, this determines the number of points in the bottom window.

Key Path	<b>View/Display</b>
<b>Example</b>	DISP:VIEW TZO
Dependencies	Because Trace Zoom is a split-screen View, no other split screen views are available in Trace Zoom. These include Peak Table, Marker Table, and the Limit and Ampcor editors. The keys that access these functions are grayed out while in Trace Zoom.
Initial S/W Revision	A.07.01
Modified at S/W Revision	A.18.01 (zero span support added)

### Transition Rules

When you enter the Trace Zoom view, the top window of Trace Zoom takes on all of the traces, markers and settings that were present in the Normal View. The Zoom Center is the same as the analyzer Center Frequency, and the Zoom Span is 10 % of the analyzer Span. When you leave the Trace Zoom View, the top window traces and settings carry over to the next view.

When you enter the Trace Zoom view, the focus is always in the zoom window. To change the focus (switch between windows), press the Next Window key located below the display. The window which has the focus is distinguished by a green border.

### Zone Span

In the Zone Span view, the screen is split into two windows. The top window is a normal spectrum analyzer window, and the bottom window (“Zone Window”) shows a window whose span represents a region (zone) within the top window. The data in the two windows represents two completely separate sweeps; each window sweeps ONLY when the focus (thick green border) is on that window. It is important to understand that the data in the window without the focus remains unchanged until the focus is moved to that window.

In the top window, the zone region is indicated by a light orange shading and solid orange boundary lines. The Zone Window is not shaded orange; this emphasizes the fact that, unlike Trace Zoom, the data in the Zone Window does not match the top window but is from a separate sweep. You can set the span of the Zone Window using the Zone Span key (in the Span menu) and you can set the Center Frequency of the Zoom Window using the Zone Center key (in the Frequency menu).

Note that in Zone Span, the Span of the top window cannot go below 10 Hz. The Zero Span key is grayed out when the top window is active. The Last Span key will do nothing if the last span was zero span. If, on entry to Zone Span, the Span is 0 Hz, the Span will revert to the last nonzero span. Also, if the Span of the top window is

between 10 Hz and 100 Hz on transition, the Zone Span will initialize to 10 Hz, not 10% of Span.

Key Path	<b>View/Display</b>
<b>Example</b>	DISP:VIEW ZSP
Dependencies	Because Zone Span is a split-screen View, no other split screen views are available in Zone Span. These include Peak Table, Marker Table, and the Limit and Ampcor editors. The keys that access these functions are grayed out while in Zone Span.  Also in the Zone Span View, Signal Track is not allowed and is grayed out
Backwards Compatibility SCPI Notes	Zone Span is a View in the X-Series, whereas in the ESA it was under the Span menu. There were no remote commands associated with Zone Span in the past so there are no code compatibility issues.
Initial S/W Revision	A.07.01

### More Information

In Zone Span, the window with the focus (the selected window) is the window which updates. You can tell which window is selected because the selected window has a thick green border around it. When you enter the Zone Span view, the focus is always in the Zone Window, so it is the window which is updating. To change the focus (switch between windows), press the Next Window key located below the display. Single and Continuous settings apply, so if the analyzer is in Single, no sweep actually happens until it is initiated or you go to Continuous.

#### NOTE

**The selected window is the window to which virtually all key presses and SCPI commands are directed. Most key functions like Center Frequency, Ref Level, etc., apply only to the selected window. Similarly, any traces which are exported or queried while in Zone Span will return the data from the currently active window. Because of this dependency, it is important to allow the SCPI system to synchronize after switching windows. Therefore, if you have just switched windows via SCPI (using the :DISP:WIND function) you should wait at least one second before sending any window-dependent command, to ensure that SCPI will direct the command to the correct window.**

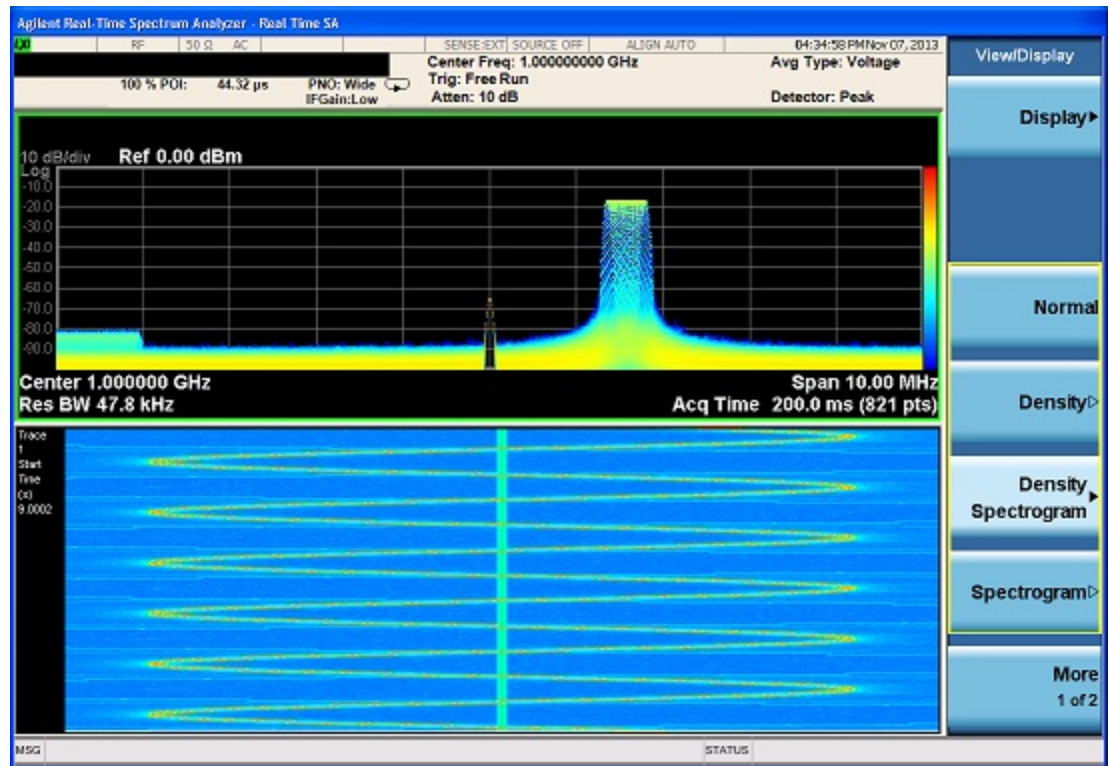
### Transition Rules

When you enter the Zone Span view, the top window of Zone Span takes on all of the traces, markers and settings that were present in the Normal View. The Zone Center is the same as the analyzer Center Frequency, and the Zone Span is 10 % of the analyzer Span.

When you leave the Zone Span View, the current window traces and settings carry over to the next view. The traces from the other window will all now be gone. To mitigate this fact, we note that whenever you save state while in Zone Span, and then recall the state, Zone Span comes back just as it was when you saved the state, including all trace data and settings for both windows (of course, any traces that were updating when you did the save will load in an updating state, so their data will be erased after the first sweep). So if the data in both windows is important to preserve, make sure you put the traces in View and save the state before you exit.



### Density / Spectrogram



Dual view with the top window showing the Density trace and the bottom window showing the Spectrogram trace.

In this view, the top window X axis represents frequency, the Y axis represents amplitude and the Z axis represents number of hits. This view therefore displays three dimensional data on a two dimensional display, using color to represent the third dimension. The X axis for the bottom window represents frequency and the Y represents the Spectrogram trace history and the Z axis colors represent the signal amplitude.

Contrary to the Density view, the top window will display a not a white trace but a yellow trace over the bitmap. This trace shows the Spectrogram trace specified by the Display Trace parameter. The default will show the most current Spectrogram trace.

Key Path	View/Display
<b>Example</b>	DISP:VIEW HSG
Initial S/W Revision	A.14.50

# 9 Power vs Time Measurement

The Power vs Time measurement provides analysis for data in the time domain.

Key Path	<b>Meas</b>
Mode	RTSA
Initial S/W Revision	A.13.00

## AMPTD Y Scale

The Amplitude front-panel key activates the Amplitude menu and selects Reference Level or Reference Value (depending on the measurement) as the active function.

Some features in the Amplitude menu apply to multiple measurements; others apply only to specific measurements. Keys that only apply to some measurements are blanked or grayed out in measurements that are not supported.

Key Path	<b>Front-panel key</b>
Initial S/W Revision	Prior to A.02.00

### Power vs Time Reference Value

The Power vs Time Reference Value specifies the amplitude represented by the topmost graticule line.

Changing the Power vs Time Reference Value does not restart the measurement, because it is a display function only; instead it vertically 'pans' all displayed traces and markers to the new value.

Key Path	<b>AMPTD Y Scale</b>
Mode	RTSA
Couplings	The Ref Level key is context sensitive. When in a spectral window, the Spectral Ref Level parameter is shown. When in a PVT window, the PVT Ref Level is shown.
Preset	0 dBm
State Saved	Saved in instrument state.
Min	-170 dBm
Max	30 dBm
Initial S/W Revision	A.13.00

### Attenuation

This menu 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 that controls all the attenuation functions. Different models in the X-Series come with different configurations.

See ["Dual Attenuator Configurations:" on page 728](#)

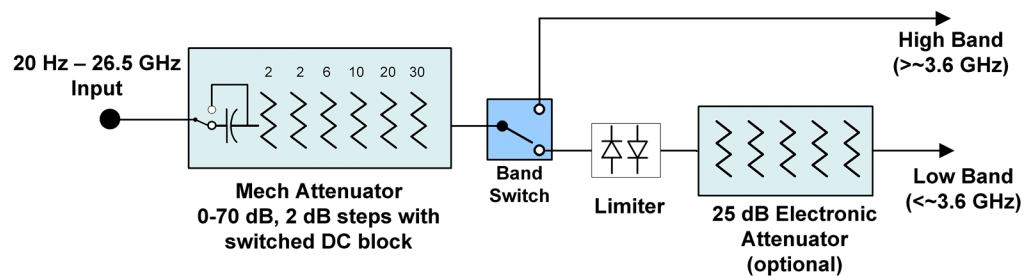
See ["Single Attenuator Configuration:" on page 728](#)

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.

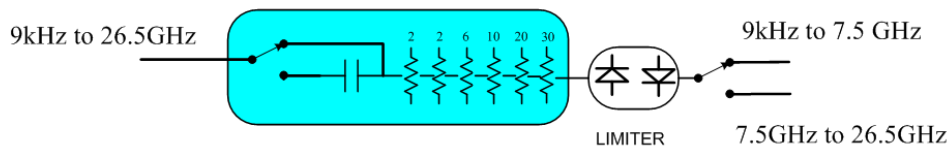
Key Path	AMPTD Y Scale
Scope	Meas Global
Dependencies	In measurements that support the I/Q inputs, this key is unavailable when I/Q is the selected input, and is replaced by the Range key in that case.
Readback Line	Contains a summary in [ ] brackets of the current total attenuation. See the descriptions of the , " <a href="#">(Mech) Atten</a> " on page 729, and " <a href="#">Enable Elec Atten</a> " on page 731 keys for more detail on the contributors to the total attenuation.  Note that when "Pre-Adjust for Min Clip" is on, this value can change at the start of every measurement.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

### Dual Attenuator Configurations:

Configuration 1: Mechanical attenuator + optional electronic attenuator

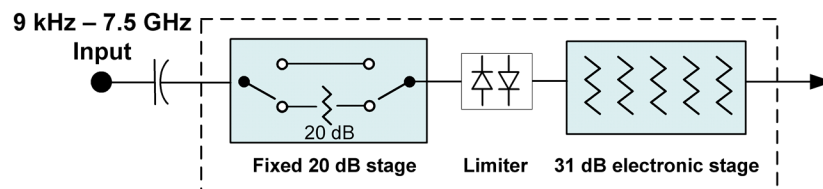


Configuration 2: Mechanical attenuator, no optional electronic attenuator

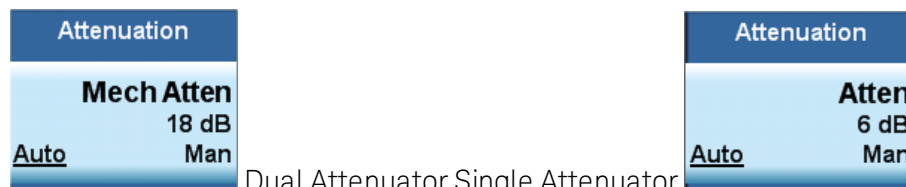


(note that Configuration 2 is not strictly speaking a dual-section attenuator, since there is no electronic section available. However, it behaves exactly like Configuration 1 without the Electronic Attenuator option EA3, therefore for the sake of this document it is grouped into the "Dual Attenuator"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

### Single Attenuator Configuration:



You can tell which attenuator configuration you have by pressing the Attenuation key, which (in most Modes) opens the Attenuation menu. If the first key in the Attenuation menu says **Mech Atten** you have the dual attenuator configuration. If the first key says **Atten** you have the single attenuator configuration.



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

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

### (Mech) Atten

This key is labeled **Mech Atten** in dual attenuator models and **Atten** in single attenuator models. In the dual attenuator configuration, this key only affects the mechanical attenuator.

This key 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 730](#)

Key Path	AMPTD Y Scale, Attenuation
Remote Command	<pre>[ :SENSe]:POWer[:RF]:ATTenuation &lt;rel_amp1&gt; [:SENSe]:POWer[:RF]:ATTenuation? [:SENSe]:POWer[:RF]:ATTenuation:AUTO OFF ON 0 1 [:SENSe]:POWer[:RF]:ATTenuation:AUTO?</pre>
Example	<p>POW:ATT 20</p> <p>Dual attenuator configuration: sets the mechanical attenuator to 20 dB</p> <p>Single attenuator mode: sets the main attenuation to 20 dB (see below for definition of "main" attenuation).</p> <p>If the attenuator was in Auto, it sets it to Manual.</p>
Dependencies	<p>Some measurements do not support the Auto setting of <b>(Mech) Atten</b>. In these measurements, the Auto/Man selection is not available, and the Auto/Man line on the key disappears.</p> <p>In dual attenuator configurations, when the electronic attenuator is enabled, the mechanical attenuator has no auto setting and the Auto/Man line on the key disappears. The state of Auto/Man is remembered and restored when the electronic attenuator is once again disabled. This is described in more detail in the <a href="#">"Enable Elec Atten" on page 731</a> key description.</p>

	See " <a href="#">Attenuator Configurations and Auto/Man</a> " on page 730 for more information on the Auto/Man functionality of Attenuation.
Couplings	<p>When <b>(Mech) Atten</b> is in Auto, it uses the following algorithm to determine a value:            If the USB Preamp is connected to USB, use 0 dB.            Otherwise, <math>\text{Atten} = \text{ReferenceLevel} + \text{PreAmpGain} + \text{ExternalGain} - \text{RefLevelOffset} - \text{MaxMixerLevel} + \text{IF Gain}</math>.            Limit this value to be between 6 dB and the Max value. No value below 6 dB can ever be chosen by Auto.            The resulting value is rounded up to the largest value possible given the attenuation step setting. That is, 50.01 dB would change to 60 dB (for a 10 dB attenuation step).            The "IF Gain" term in the equation above is either 0 dB or +10 dB, depending on the settings of FFT IF Gain, Swept IF Gain, max Ref Level and the Auto/Man setting of Mech Atten.            In External Mixing and BBIQ, where the Attenuator is not in the signal path, the Attenuator setting changes as described above when <b>(Mech) Atten</b> is in Auto, but no changes are made to the actual attenuator hardware setting until the input is changed back to the RF Input.</p>
Preset	<p>The preset for Mech Attenuation is "Auto."            The Auto value of attenuation is:            CXA, EXA, MXA and PXA: 10 dB</p>
State Saved	Saved in instrument state
Min	<p>0 dB            The attenuation set by this key cannot be decreased below 6 dB with the knob or step keys. To get to a value below 6 dB it has to be directly entered from the keypad or via SCPI. This protects from adjusting the attenuation to a dangerously small value which can put the instrument at risk of damage to input circuitry. However, if the current mechanical attenuation is below 6 dB it can be increased with the knob and step keys, but not decreased.</p>
Max	<p>CXA N9000A-503/507: 50 dB            CXA N9000A-513/526: 70dB            EXA: 60 dB            MXA and PXA: 70 dB            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.</p>
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

## Attenuator Configurations and Auto/Man

As described in the Attenuation key description, 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 the **(Mech) Atten** key (or POW:ATT SCPI) as the "main" attenuation; and the attenuation that is set by the SCPI command

POW:EATT as the “soft” attenuation (the POW:EATT command is honored even in the single attenuator configuration, for compatibility purposes). Then the current total attenuation is the sum of the main + soft attenuation. See the **Elec Atten** key description for more on “soft” attenuation.

In the dual attenuator configuration, when the electronic attenuator is enabled, there is no Auto/Man functionality for the mechanical attenuator, and the third line of the key label (the Auto/Man line) disappears:

<b>Mech Atten</b>
0 dB
<u>Auto</u> Man

<b>Mech Atten</b>
0 dB

Mech Atten when elec atten disabled
--

Mech Atten when elec atten enabled
---------------------------------------

vsd05

### Enable Elec Atten

Enables the Electronic Attenuator.

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 733](#) 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 730](#)

See [Error! Reference source not found.](#)

Key Path	AMPTD Y Scale, Attenuation
Remote Command	[ :SENSe ] : POWer [ :RF ] : EATTenuation : STATe OFF   ON   0   1 [ :SENSe ] : POWer [ :RF ] : EATTenuation : STATe ?
Example	POW:EATT:STAT ON
Dependencies	<p>This key only appears in Dual Attenuator models with an Electronic Attenuator installed. It does not appear in models with the Single Attenuator configuration, as in the single attenuator configuration there is no “electronic attenuator” there is only a single integrated attenuator (which has both a mechanical and electronic stage). However, in the single attenuator configuration, EATT SCPI commands are accepted for compatibility with other X-series instruments and set a “soft” attenuation as described in <a href="#">"Attenuator Configurations and Auto/Man" on page 730</a>.</p> <p>The electronic attenuator (and the “soft” attenuation function provided in single attenuator configurations) is unavailable above 3.6 GHz. Therefore, if the Stop Frequency of the analyzer is &gt; 3.6 GHz then the <b>Enable Elec Atten</b> key will be OFF and grayed out.</p> <p>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 <b>Enable Elec Atten</b> key will be OFF and grayed out.</p> <p>If either of the above is true, if the SCPI command is sent, an error indicating that the electronic</p>

	attenuator is unavailable will be sent. If the electronic/soft Attenuator is enabled, then the Stop Freq of the analyzer is limited to 3.6 GHz and the Internal Preamp is unavailable. The SCPI-only "soft" electronic attenuation for the single-attenuator configuration is not available in all measurements; in particular, it is not available in the Swept SA measurement.
Couplings	Enabling and disabling the Electronic Attenuator affects the setting of the Mechanical Attenuator (in dual attenuator configurations). This is described in more detail below this table.
Preset	OFF for Swept SA measurement; ON for all other measurements that support the electronic attenuator
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

### 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 line on the (Mech) Atten key 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 key 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 analyzer 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 analyzer calibration

#### **Elec Atten**

Controls the Electronic Attenuator in dual attenuator configurations. This key 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** key.

<b>Remote Command</b>	<code>[ :SENSe]:POWer[:RF]:EATTenuation &lt;rel_amp1&gt;</code> <code>[ :SENSe]:POWer[:RF]:EATTenuation?</code>
Notes	Electronic Attenuation's specification is defined only when Mechanical Attenuation is 6 dB.
Dependencies	This key only appears in Dual Attenuator models with an Electronic Attenuator installed. It does not appear in models with the Single Attenuator configuration, as in the single attenuator configuration there is no "electronic attenuator" there is only a single integrated attenuator (which has both a mechanical and electronic stage). However, in the single attenuator configuration, EATT SCPI commands are accepted for compatibility with other X-series instruments and set a "soft" attenuation as described in " <a href="#">Attenuator Configurations and Auto/Man</a> " on page 730. The "soft" attenuation is treated as an addition to the "main" attenuation value set by the Atten softkey or the POW:ATT SCPI command and affects the total attenuation displayed on the Attenuation key and the Meas Bar.  When <b>Enable Elec Atten</b> is off or grayed out, the <b>Elec Atten</b> key is grayed out.
Preset	0 dB
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
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

### (Mech) Atten Step

This controls the step size used when making adjustments to the input attenuation.

This key is labeled **Mech Atten Step** in dual attenuator models and **Atten Step** in single attenuator models. In the dual attenuator configuration, this key only affects the step size of the mechanical attenuator.

Key Path	<b>AMPTD Y Scale, Attenuation</b>
<b>Remote Command</b>	<code>[ :SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement] 10 dB   2 dB</code> <code>[ :SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement]?</code>
<b>Example</b>	POW:ATT:STEP 2
Notes	Note this feature works like a 1-N 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 CXA and EXA if option FSA (2 dB steps) is not present. If blanked, attempts to set it via SCPI will 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	PXA and MXA: 2 dB

	EXA and CXA: 10 dB (2 dB with option FSA)
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

### Max Mixer Level

Controls the limitation on the Ref Level for a given attenuation setting, and therefore also interacts with the Auto rules for selecting the attenuation as a coupling from the reference level.

Key Path	AMPTD Y Scale, Attenuation
Remote Command	[ :SENSe ] : POWer [ : RF ] : MIXer : RANGe [ : UPPer ] <real> [ :SENSe ] : POWer [ : RF ] : MIXer : RANGe [ : UPPer ] ?
Example	POW:MIX:RANG -15 dBm
Preset	-10 dBm
State Saved	Saved in instrument state
Min	-50 dBm
Max	0 dBm
Default Unit	Depends on the current selected Y axis unit, see Swept SA discussion of Y Axis Unit
Initial S/W Revision	Prior to A.02.00

### Max Mixer Lvl Rule

This function is available only in the Swept SA measurement of the SA Mode, and in all measurements of the RTSA Mode.

The **Max Mixer Level Rule** key allows you to optimize the Max Mixer Level setting for certain kinds of measurements.

- **Normal** – Normal is 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 cause ADC overloads. At this mixer level the scale fidelity will be within specifications, thus compression will be negligible.
- **TOI** – Choosing the setting “TOI-limited dynamic range” allows a range of settings of the Max Mixer Level, –50 to –10 dBm, that can be optimum for measurements limited by the analyzer 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** – Choosing the setting “Compression-limited dynamic range” 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 analyzer 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

Key Path	AMPTD Y Scale, Attenuation
Remote Command	[ :SENSe ] :POWer [ :RF ] :MIXer :RULEs NORMa1   TOI   COMPRESSion [ :SENSe ] :POWer [ :RF ] :MIXer :RULEs ?
Example	POW:MIX:RULE:COMP
Preset	NORM
Initial S/W Revision	A.19.00

## Power vs Time Scale/Div

Sets the units per vertical graticule division on the display when in a PVT window. This function is only available when Scale Type (Log) is selected and the vertical scale is power. When Scale Type (Lin) is selected, Scale/Div is grayed out.

Key Path	AMPTD Y Scale
Dependencies	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.
Couplings	The Scale/Div key is context sensitive. When in a spectral window, the Spectral Scale/Div parameter is shown. When in a PVT window, the PVT Scale/Div is shown.

	When Spectral Scale/Div Auto State is On, this parameter is coupled to the Power vs Time Scale/Div parameter and Freq v Time Scale/Div parameter.
Preset	10.00 dB / Div
State Saved	Saved in instrument state
Min	0.10 dB
Max	20 dB
Initial S/W Revision	A.13.00

## Scale Type

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

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

When Scale Type (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 analyzer remembers separate Y Axis Unit settings for both Log and Lin.

Key Path	AMPTD Y Scale
Remote Command	:DISP:WIND:W[1]:TRAC:Y[:SCALE]:SPACING LINear   LOGarithmic :DISP:WIND:W[1]:TRAC:Y[:SCALE]:SPACING?
Example	DISP:WIND:TRAC:Y:SPAC LOG DISP:WIND:TRAC:Y:SPAC?
Dependencies	If Normalize is on, Scale Type forced to Log and is grayed out.
Couplings	Changing the Scale Type always sets the Y Axis unit to the last unit specified for the current amplitude scale. In other words, we restore the Y Axis unit setting appropriate per log/lin.
Preset	LOG
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00

## Presel Center

When this key is pressed, the centering of the preselector filter is adjusted 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 analyzer will turn on the selected marker, perform a peak search, and then perform centering on the marker's center frequency. If the selected marker is already on and between the start and stop frequencies of the analyzer, the analyzer 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 analyzer will first

perform a peak search, and then perform centering on the marker's center frequency.

The value displayed on the **Presel Adjust** key will change to reflect the new preselector tuning (see **Presel Adjust**).

A number of considerations should be observed to ensure proper operation. See "[Proper Preselector Operation](#)" on page 738.

Key Path	AMPTD Y Scale
Remote Command	[ :SENSe ] :POWer [ :RF ] :PCENter
Example	POW:PCEN
Notes	Note that the rules outlined above under the key description apply for the remote command as well as the key. The result of the command is dependent on marker position, and so forth. Any message shown by the key press is also shown in response to the remote command.
Dependencies	<ul style="list-style-type: none"> <li>- Grayed out if the microwave preselector is off. )</li> <li>- If the selected marker's frequency is below Band 1, advisory message 0.5001 is generated and no action is taken.</li> <li>- Grayed out if entirely in Band 0.</li> <li>- Blank in models that do not include a preselector, such as option 503. If the SCPI is sent in these instruments, it is accepted without error, and the query always returns 0.</li> <li>- Grayed out in the Spectrogram View.</li> </ul>
Couplings	<p>The active marker position determines where the centering will be attempted.</p> <p>If the analyzer is in a measurement such as averaging when centering is initiated, the act of centering the preselector will restart averaging but the first average trace will not be taken until the centering is completed.</p>
Status Bits/OPC dependencies	<p>When centering the preselector, *OPC will not return true until the process is complete and a subsequent measurement has completed, nor will results be returned to a READ or MEASure command.</p> <p>The Measuring bit should remain set while this command is operating and should not go false until the subsequent sweep/measurement has completed.</p>
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

### Proper Preselector Operation

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

3. If the selected marker is off, the analyzer will turn on a marker, perform a peak search, and adjust 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.

4. If the selected marker is already on, the analyzer will attempt the centering at that marker's frequency. There is no preselector for signals below about 3.6 GHz, therefore if the marker is on a signal below 3.6 GHz, no centering will be attempted and an advisory message generated
5. In some models, the preselector can be bypassed. If it is bypassed, no centering will be attempted in that range and a message will be generated.

## Preselector Adjust

Allows you to manually adjust the preselector filter frequency to optimize its response to the signal of interest. This function is only available when "[Presel Center](#)" on page 737 is available.

For general purpose signal analysis, using Presel Center is recommended. Centering the filter minimizes the impact of long-term preselector drift. Presel 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.

Key Path	<b>AMPTD Y Scale</b>
Scope	Meas Global
<b>Remote Command</b>	[ :SENSe]:POWer[:RF]:PADJust <freq> [ :SENSe]:POWer[:RF]:PADJust?
<b>Example</b>	POW:PADJ 100KHz POW:PADJ?
Notes	The value on the key reads out to 0.1 MHz resolution.
Dependencies	<ul style="list-style-type: none"> <li>- Grayed out if microwave preselector is off. )</li> <li>- Grayed out if entirely in Band 0.</li> <li>- Blank in models that do not include a preselector, such as option 503. If the SCPI is sent in these instruments, it is accepted without error, and the query always returns 0.</li> <li>- Grayed out in the Spectrogram View.</li> </ul>
Preset	0 MHz
State Saved	The <b>Presel Adjust</b> value set by <b>Presel Center</b> , or by manually adjusting <b>Presel Adjust</b> , is not saved in instrument state, and does not survive a Preset or power cycle.
Min	-500 MHz
Max	500 MHz

Default Unit	Hz
<b>Backwards Compatibility SCPI</b>	<code>[ :SENSe ] :POWer [ :RF ] :MW :PADJust</code> <code>[ :SENSe ] :POWer [ :RF ] :MMW :PADJust</code> PSA had multiple preselectors, but the X-Series has only one. These commands simply alias to <code>[ :SENSe ] :POWer [ :RF ] :PADJust</code>
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

<b>Remote Command</b>	<code>[ :SENSe ] :POWer [ :RF ] :PADJust :PRESelector MWAVE   MMWave   EXTERNAL</code> <code>[ :SENSe ] :POWer [ :RF ] :PADJust :PRESelector?</code>
Notes	PSA had multiple preselectors, and you could select which preselector to adjust. Since the X-Series has only one mm/uW preselector, the preselector selection softkey is no longer available. However, to provide backward compatibility, we accept the legacy remote commands. The command form has no effect, the query always returns MWAVE
Initial S/W Revision	Prior to A.02.00

## Y Axis Unit

Displays the menu keys that enable you to change the vertical (Y) axis amplitude unit. The analyzer retains the entered Y Axis Unit separately for both Log and Lin amplitude scale types. For example, if Scale Type has been set to Log, and you set Y Axis Unit to dBm, pressing Scale Type (Log) sets the Y Axis Unit to dBm. If Scale Type has been set to Lin and you set Y Axis Unit to V, pressing Scale Type (Lin) sets the Y Axis Unit to V. Pressing Scale Type (Log) again sets the Y axis unit back to dBm.

### NOTE

The units of current (A, dBmA, dBuA) are calculated based on 50 ohms input impedance.

All four of the EMI units (dB $\mu$ A/m, dB $\mu$ V/m, dBG, dBpT) are treated by the instrument exactly as though they were dBuV. The user must load an appropriate correction factor using Amplitude Corrections for accurate and meaningful results.

If a SCPI command is sent to the analyzer that uses one of the EMI units as a terminator, the analyzer treats it as though DBUV had been sent as the terminator.

Key Path	AMPTD Y Scale
Mode	SA
Scope	Meas Global
<b>Remote Command</b>	<code>:UNIT:POWer DBM   DBMV   DBMA   V   W   A   DBUV   DBUA   DBPW   DBUVM   DBUAM   DBPT   DBG</code> <code>:UNIT:POWer?</code>
<b>Example</b>	UNIT:POW dBmV UNIT:POW?



Notes	The Y axis unit has either logarithmic or linear characteristics. The set of units that is logarithmic consists of dBm, dBmV, dBmA, dB $\mu$ V, dB $\mu$ A, dB $\mu$ V/m, dB $\mu$ A/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.
Notes	<p>The settings of Y Axis Unit and Scale Type, affect how the data is read over the remote interface. When using the remote interface no unit is returned, so you must know what the Y axis unit is to interpret the results:</p> <p>Example 1, set the following: Scale Type (Log) Y Axis Unit, dBm Scale/Div, 1 dB Ref Level, 10 dBm</p> <p>This sets the top line to 10 dBm with each vertical division representing 1 dB. Thus, if a point on trace 1 is on the fifth graticule line from the top, it represents 5 dBm and will read out remotely as 5.</p> <p>Example 2, set the following: Scale Type (Lin) Y Axis Unit, Volts Ref Level, 100 mV (10 mV/div)</p> <p>This sets the top line to 100 mV and the bottom line to 0 V, so each vertical division represents 10 mV. Thus, if a point on trace 1 is on the fifth graticule line from the top, it represents 50 mV and will read out remotely as 50.</p>
Dependencies	<p>If an amplitude correction with an Antenna Unit other than <b>None</b> is applied and enabled, then that antenna unit is forced and the key with that unit is the only Y Axis Unit available. All other Y Axis Unit keys are grayed out.</p> <p>If an amplitude correction with an Antenna Unit other than <b>None</b> is applied and enabled, and you then turn off that correction or set <b>Apply Corrections</b> to <b>No</b>, the Y Axis Unit that existed before the Antenna Unit was applied is restored.</p>
Couplings	The analyzer retains the entered Y Axis Unit separately for both Log and Lin amplitude scale types
Preset	dBm for log scale, V for linear. The true 'preset' value is dBm, since at preset the Y Scale type is set to logarithmic.
State Saved	Saved in instrument state
Readback line	1-of-N selection
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00, A.04.00, A.11.00

### dBm

Sets the amplitude unit for the selected amplitude scale (log/lin) to dBm.

Key Path	<b>AMPTD Y Scale, Y Axis Unit</b>
<b>Example</b>	UNIT:POW DBM

Dependencies	Grayed out if an Amplitude Correction with an Antenna Unit is ON.
Readback	dBm
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

### dBmV

Sets the amplitude unit for the selected amplitude scale (log/lin) to dBmV.

Key Path	<b>AMPTD Y Scale, Y Axis Unit</b>
<b>Example</b>	UNIT:POW DBMV
Dependencies	Grayed out if an Amplitude Correction with an Antenna Unit is ON.
Readback	dBmV
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

### dBmA

Sets the amplitude unit for the selected amplitude scale (log/lin) to dBmA.

Key Path	<b>AMPTD Y Scale, Y Axis Unit</b>
<b>Example</b>	UNIT:POW DBMA
Dependencies	Grayed out if an Amplitude Correction with an Antenna Unit is ON.
Readback	dBmA
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

### W

Sets the amplitude unit for the selected amplitude scale (log/lin) to watt.

Key Path	<b>AMPTD Y Scale, Y Axis Unit</b>
<b>Example</b>	UNIT:POW W
Dependencies	Grayed out if an Amplitude Correction with an Antenna Unit is ON.
Readback	W
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

### V

Sets the amplitude unit for the selected amplitude scale (log/lin) to volt.

Key Path	<b>AMPTD Y Scale, Y Axis Unit</b>
<b>Example</b>	UNIT:POW V
Dependencies	Grayed out if an Amplitude Correction with an Antenna Unit is ON.
Readback	V
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

### A

Sets the amplitude unit for the selected amplitude scale (log/lin) to Ampere.

Key Path	<b>AMPTD Y Scale, Y Axis Unit</b>
<b>Example</b>	UNIT:POW A
Dependencies	Grayed out if an Amplitude Correction with an Antenna Unit is ON.
Readback	A
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

### dB $\mu$ V

Sets the amplitude unit for the selected amplitude scale (log/lin) to dB $\mu$ V.

Key Path	<b>AMPTD Y Scale, Y Axis Unit</b>
<b>Example</b>	UNIT:POW DBUV
Dependencies	Grayed out if an Amplitude Correction with an Antenna Unit is ON.
Readback	dB $\mu$ V
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

### dB $\mu$ A

Sets the amplitude unit for the selected amplitude scale (log/lin) to dB $\mu$ A.

#### NOTE

The unit dBuA can also appear as an Antenna Unit. This will be used by customers using current probes, because current probes are often supplied with conversion tables that provide the transducer factors. When dBuA is used as an Antenna Unit the normal conversion from power to amps for dBuA (based on the analyzer input impedance) is not done, but instead the conversion is based solely on the Correction that contains the transducer factors. This is what distinguishes dBuA as a normal unit from dBuA as an antenna unit. When querying the Y-Axis unit, you can query the Antenna Unit to distinguish between regular dBuA and the dBuA antenna unit. If :CORR:CSET:ANT? returns NOC (for No Conversion), you are using a normal Y Axis dBuA. If it returns UA you are using an Antenna Unit dBuA.

Key Path	<b>AMPTD Y Scale, Y Axis Unit</b>
<b>Example</b>	UNIT:POW DBUA
Dependencies	Grayed out if an Amplitude Correction with an Antenna Unit is ON.
Readback	dB $\mu$ A
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

### dBpW

Sets the amplitude unit for the selected amplitude scale (log/lin) to dBpW.

Key Path	<b>AMPTD Y Scale, Y Axis Unit</b>
<b>Example</b>	UNIT:POW DBPW
Dependencies	Grayed out if an Amplitude Correction with an Antenna Unit is ON.
Readback	dB $\mu$ A
Initial S/W Revision	A.11.00

### Antenna Unit

When a Correction is turned on that uses an Antenna Unit, the Y Axis Unit changes to that Antenna Unit. All of the keys in the Y-Axis Unit menu are then greyed out, except the Antenna Unit key. The unit being used is shown on this key and is shown as selected in the submenu.

Key Path	<b>AMPTD Y Scale, Y Axis Unit</b>
Dependencies	Grayed out if no Amplitude Correction with an Antenna Unit is on.
Readback line	Currently selected unit
Initial S/W Revision	A.11.00

### dB $\mu$ V/m

Sets the amplitude unit for the selected amplitude scale (log/lin) to dB $\mu$ V/m. This is an antenna unit, and this key is grayed out unless a Correction with this Antenna Unit selected is ON. If this is the case, all of the other Antenna Units are grayed out.

Key Path	<b>AMPTD Y Scale, Y Axis Unit, Antenna Unit</b>
<b>Example</b>	UNIT:POW DBUVM
Dependencies	Grayed out if no Amplitude Correction with an Antenna Unit is on.
Readback	dB $\mu$ V/m
Initial S/W Revision	A.02.00

### dB $\mu$ A/m

Sets the amplitude unit for the selected amplitude scale (log/lin) to dB $\mu$ A/m. This is an antenna unit, and this key is grayed out unless a Correction with this Antenna Unit selected is ON. If this is the case, all of the other Antenna Units are grayed out.

Key Path	AMPTD Y Scale, Y Axis Unit, Antenna Unit
<b>Example</b>	UNIT:POW DBUAM
Dependencies	Grayed out if no Amplitude Correction with an Antenna Unit is on.
Readback	dB $\mu$ A/m
Initial S/W Revision	A.02.00

### dB $\mu$ A

Sets the amplitude unit for the selected amplitude scale (log/lin) to dB $\mu$ A. This is an antenna unit, and this key is grayed out unless a Correction with this Antenna Unit selected is ON. If this is the case, all of the other Antenna Units are grayed out.

Key Path	AMPTD Y Scale, Y Axis Unit, Antenna Unit
<b>Example</b>	UNIT:POW DBUAM
Dependencies	Grayed out if no Amplitude Correction with an Antenna Unit is on.
Readback	dB $\mu$ A
Initial S/W Revision	A.11.00

### dBpT

Sets the amplitude unit for the selected amplitude scale (log/lin) to dBpT. This is an antenna unit, and this key is grayed out unless a Correction with this Antenna Unit selected is ON. If this is the case, all of the other Antenna Units are grayed out.

Key Path	AMPTD Y Scale, Y Axis Unit, Antenna Unit
<b>Example</b>	UNIT:POW DBPT
Dependencies	Grayed out if no Amplitude Correction with an Antenna Unit is on.
Readback	dBpT
Initial S/W Revision	A.02.00

### dBG

Sets the amplitude unit for the selected amplitude scale (log/lin) to dBG. This is an antenna unit, and this key is grayed out unless a Correction with this Antenna Unit selected is ON. If this is the case, all of the other Antenna Units are grayed out.

Key Path	AMPTD Y Scale, Y Axis Unit, Antenna Unit
<b>Example</b>	UNIT:POW DBG
Dependencies	Grayed out if no Amplitude Correction with an Antenna Unit is on.
Readback	dBG
Initial S/W Revision	A.02.00

## None

This is selected if no Antenna Unit is currently on, however you cannot actually set this value, since it is always grayed out. The key is included simply to provide an indication on the Readback line of the Antenna Unit key when there is no Antenna Unit selected.

Key Path	AMPTD Y Scale, Y Axis Unit, Antenna Unit
Readback	"None"
Initial S/W Revision	A.11.00

## 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.

See ["More Information" on page 746](#)

Key Path	AMPTD Y Scale
Mode	SA
Scope	Meas Global
<b>Remote Command</b>	:DISP:WINDow[1]:TRACe:Y[:SCALe]:RLEVel:OFFSet <rel_amp1> :DISP:WINDow[1]:TRACe:Y[:SCALe]:RLEVel:OFFSet?
<b>Example</b>	DISP:WIND:TRAC:Y:RLEV:OFFS 12.7 Sets the Ref Level Offset to 12.7 dB. The only valid suffix is dB. If no suffix is sent, dB will be assumed.
Preset	0 dBm
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
Backwards Compatibility Notes	<ol style="list-style-type: none"> <li>6. In pre-X-Series instruments, Ref Level Offset could not be adjusted by the knob or step keys. That is no longer the case.</li> <li>7. In ESA and PSA, Ref Level Offset was applied to the data as it was acquired; thus if the Offset changed the new offset was not applied until new trace data was taken. In X-Series, the offset is applied as the data is displayed/queried, so if you change the offset, it will change the data immediately.</li> </ol>
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.04.00

## More Information

Offsets are used when gain or loss occurs between a device under test and the analyzer input. Thus, the signal level measured by the analyzer 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 analyzer 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.

## μW Path Control

The **μW Path Control** functions include the **μW Preselector Bypass** (Option MPB) and **Low Noise Path** (Option LNP) controls in the High Band path circuits.

When the μW Preselector is bypassed, the user has better flatness, but will be subject to spurs from out of band interfering signals. When the Low Noise Path is enabled, the analyzer automatically switches around certain circuitry in the high frequency bands which can contribute to noise, when it is appropriate based on other analyzer settings.

For most applications, the preset state is Standard Path, which gives the best remote-control throughput, minimizes acoustic noise from switching and minimizes the risk of wear out in the hardware switches. For applications that utilize the wideband IF paths, the preset state is the μW Preselector Bypass path, 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.

Users may choose Low Noise Path Enable. It gives 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 the Low Noise Path, however its compression threshold and third-order intercept are much poorer than that of the non-preamp Low Noise 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.

Key Path	<b>AMPTD Y Scale</b>
Mode	SA, BASIC, PNOISE, VSA , LTE, LTETDD
Scope	Meas Global
<b>Remote Command</b>	[ :SENSe ] :POWer [ :RF ] :MW:PATH STD   LNPath   MPBypass   FULL [ :SENSe ] :POWer [ :RF ] :MW:PATH?
<b>Example</b>	:POW:MW:PATH LNP Enables the Low Noise path
Notes	If a Presel Center is performed, the analyzer will momentarily switch to the Standard Path, regardless of the setting of <b>μW Path Control</b>  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 <b>Low Noise Path Enable</b> . In the case where the DC Block is switched in the analyzer is now AC coupled. However, if the user has selected DC coupling, the UI will still behave as though it were DC coupled, including all annunciation, warnings, status bits, and responses to SCPI queries. This is because, based on other settings, the analyzer 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	Unavailable in BBIQ and External Mixing
Preset	All modes other than IQ Analyzer mode and VXA: STD IQ Analyzer, VXA and WLAN mode: MPB option present and licensed: MPB MPB option not present and licensed: STD
State Saved	Save in instrument state
Readback	Value selected in the submenu
Initial S/W Revision	A.04.00
Modified at S/W Revision	A.10.00

### Standard Path

This path gives 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.

Key Path	<b>AMPTD Y Scale, μW Path Control</b>
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<b>Example</b>	:POW:MW:PATH STD
Readback Text	Standard Path
Initial S/W Revision	A.04.00

### μW Preselector Bypass

This key toggles the preselector bypass switch for band 1 and higher. When the microwave preselector 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 analyzer.

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 will appear lower in amplitude and have a much wider shape factor compared to the real signal.

Key Path	<b>AMPTD Y Scale, μW Path Control</b>
<b>Example</b>	:POW:MW:PATH MPB
Dependencies	Key is blanked if current mode does not support it. Key is grayed out if mode supports it but current measurement does not support it. Key is blank unless Option MPB is present and licensed. If SCPI command sent when MPB not present, error -241, "Hardware missing; Option not installed" is generated.
Readback Text	μW Preselector Bypass
Initial S/W Revision	A.04.00

<b>Remote Command</b>	<code>[ :SENSe]:POWer[:RF]:MW:PRESelector[:STATe] ON OFF 0 1</code> <code>[ :SENSe]:POWer[:RF]:MW:PRESelector[:STATe]?</code>
<b>Example</b>	<code>:POW:MW:PRES OFF</code> Bypasses the microwave preselector
Notes	The ON parameter sets the STD path (:POW:MW:PATH STD) The OFF parameter sets path MPB (:POW:MW:PATH MPB)
Preset	ON

## Internal Preamp

Accesses a menu of keys that control the internal preamps. Turning on the preamp gives a better noise figure, but a poorer 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 will always reflect 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".

Key Path	<b>AMPTD Y Scale</b>
Scope	Meas Global
<b>Remote Command</b>	<code>[ :SENSe]:POWer[:RF]:GAIN[:STATe] OFF ON 0 1</code> <code>[ :SENSe]:POWer[:RF]:GAIN[:STATe]?</code>
Dependencies	Preamp is not available on all hardware platforms. If the preamp is not present or is unlicensed, the key is not shown. The preamp is not available when the electronic/soft attenuator is enabled.
Couplings	The act of connecting the U7227A USB Preamplifier to one of the analyzer's USB ports will cause the Internal Preamp to be switched on. When this happens an informational message will be generated: "Internal Preamp turned on for optimal operation with USB Preamp." Note that if the Internal Preamp was already on, there will be no change to the setting, but if it was Off it will be switched On, to Full Range. Note that this same action occurs when the SA mode is selected while the USB Preamp is connected to one of the analyzer's USB ports, if it is the first time that the SA mode has run since powerup, or if the last time the SA mode was running the USB Preamp was NOT connected. Subsequently disconnecting the USB Preamp from USB does not change the Internal Preamp setting nor restore the previous setting.
Preset	OFF
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00
Modified at S/W	A.14.00

Revision	
Key Path	<b>AMPTD Y Scale, Internal Preamp</b>
Scope	Meas Global
<b>Remote Command</b>	<code>[ :SENSe ] :POWer [ :RF ] :GAIN :BAND LOW   FULL</code> <code>[ :SENSe ] :POWer [ :RF ] :GAIN :BAND ?</code>
Dependencies	Preamp is not available on all hardware platforms. If the preamp is not present or is unlicensed, the key is not shown. If a POW:GAIN:BAND FULL command is sent when a low band preamp is available, the preamp band parameter is to LOW instead of FULL, and an "Option not installed" message is generated.
Preset	LOW
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00

### Off

Turns the internal preamp off

Key Path	<b>AMPTD Y Scale, Internal Preamp</b>
<b>Example</b>	<code>:POW:GAIN OFF</code>
Readback	Off
Initial S/W Revision	Prior to A.02.00

### 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** key label.

Key Path	<b>AMPTD Y Scale, Internal Preamp</b>
<b>Example</b>	<code>:POW:GAIN ON</code> <code>:POW:GAIN:BAND LOW</code>
Readback	Low Band
Initial S/W Revision	Prior to A.02.00

### Full Range

Sets the internal preamp to use its full range. The low band (0–3.6 GHz or 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) preamp is displayed in square brackets on the **Full Range** key label. If the high band option is not installed the Full Range key does not appear.

Key Path	<b>AMPTD Y Scale, Internal Preamp</b>
<b>Example</b>	:POW:GAIN ON :POW:GAIN:BAND FULL
Readback	Full Range
Initial S/W Revision	Prior to A.02.00

## Auto Couple

The Auto Couple feature provides a quick and convenient way to automatically couple multiple instrument settings. This helps ensure accurate measurements and optimum dynamic range. When the Auto Couple feature is activated, either from the front panel or remotely, all parameters of the current measurement that have an Auto/Manual mode are set to Auto mode and all measurement settings dependent on (or coupled to) the Auto/Man parameters are automatically adjusted for optimal performance.

However, the Auto Couple keyactions are confined to the current measurement only. It does not affect other measurements in the mode, and it does not affect markers, marker functions, or trace or display attributes.

See "[More Information](#)" on page 753

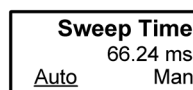
Key Path	Front-panel key
<b>Remote Command</b>	:COUPle ALL NONE
<b>Example</b>	:COUP ALL
Notes	:COUPle ALL puts all Auto/Man parameters in Auto mode (equivalent to pressing the <b>Auto Couple</b> key). :COUPLE NONE puts all Auto/Man parameters in manual mode. It decouples all the coupled instrument parameters and is not recommended for making measurements.
Initial S/W Revision	Prior to A.02.00

### More Information

There are two types of functions that have Auto/Manual modes.

#### Auto/Man Active Function keys

An Auto/Man toggle key controls the binary state associated with an instrument parameter by toggling between **Auto** (where the parameter is automatically coupled to the other parameters it is dependent upon) and **Man** (where the parameter is controlled independent of the other parameters), as well as making the parameter the active function. The current mode is indicated on the softkey with either **Auto** or **Man** underlined as illustrated below.



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#### Auto/Man 1-of-N keys

An Auto/Man 1-of-N key allows you to manually pick from a list of parameter values, or place the function in Auto, in which case the value is automatically selected (and indicated).

- If in Auto, Auto is underlined on the calling key.

- If in manual operation, manual is indicated on the calling key, but note that the calling key simply opens the menu and does **not** actually toggle the function.

## BW

Accesses a menu that enables you to select the filter type and the resolution bandwidth value. Filter Type controls the FFT windowing function to be used and the Res BW allows you to select from a pre-calculated selection of Resolution Bandwidth (RBW) values, which are computed using the following formula:

$RBW = \text{Span} / \text{Ratio}$ , where Ratio is the Span/RBW ratio determined by the selected Filter Type

Key Path	<b>Front-panel key</b>
Initial S/W Revision	A.13.00

### Res BW

This key displays the currently selected calculated resolution bandwidth value. Pressing this key accesses a menu of manual selections (Res BW 1 through Res BW 6) that can be used to change the Res BW value. The default selection is Res BW 2.

All values are calculated using the following formula:

$$RBW = \text{Span} / \text{Filter Type Ratio}$$

Therefore changing the Res BW selection, results in changing the Filter Type Ratio used by the FFT windowing function.

The SCPI command that returns the Res BW value is [:SENSe]:BANDwidth[:RESolution]?

Key Path	<b>BW</b>
<b>Remote Command</b>	[:SENSe]:BANDwidth BWIDth[:RESolution]:SElect RBW1   RBW2   RBW3   RBW4   RBW5   RBW6 [:SENSe]:BANDwidth BWIDth[:RESolution]:SElect?
<b>Example</b>	BAND:SEL RBW1
Preset	Auto Couple chooses the preset value
State Saved	Saved in instrument state
Readback line	1-of-N selection
Initial S/W Revision	A.13.00

### Auto

Activates the auto rules for the Res BW. Setting Auto to on selects the preset value for the Res BW.

Key Path	<b>BW, Res BW</b>
<b>Remote Command</b>	[:SENSe]:BANDwidth BWIDth[:RESolution]:SElect:AUTO[:STATe] OFF   ON   0   1 [:SENSe]:BANDwidth BWIDth[:RESolution]:SElect:AUTO[:STATe]?

<b>Example</b>	BAND:SEL:AUTO 1
Preset	ON
Initial S/W Revision	A.13.00

### Res BW 1

Selects the Res BW that is computed using the 1024 point FFT window function ratio.

Key Path	<b>BW, Res BW</b>
<b>Example</b>	BAND:SEL RBW1
Notes	Res BW 1 uses Filter Type Ratio of the 1024 point FFT window function size.
Couplings	The actual Res BW value is calculated using the algorithm $RBW = \text{Span} / \text{Filter Type Ratio}$ , therefore any changes to the Span or Filter Type may result in the computed Res BW value changing.
State Saved	Saved in instrument state.
Readback	Res BW 1 <computed Res BW value>
Initial S/W Revision	A.13.00

### Res BW 2

Selects the Res BW that is computed using the 512 point FFT window function ratio.

Key Path	<b>BW, Res BW</b>
<b>Example</b>	BAND:SEL RBW2
Notes	Res BW 2 uses Filter Type Ratio of the 512 point FFT window function size.
Couplings	The actual Res BW value is calculated using the algorithm $RBW = \text{Span} / \text{Filter Type Ratio}$ , therefore any changes to the Span or Filter Type may result in the computed Res BW value changing.  Not supported when Filter Type is RECTangular.
State Saved	Saved in instrument state.
Readback	Res BW 2 <computed Res BW value>
Initial S/W Revision	A.13.00

### Res BW 3

Selects the Res BW that is computed using the 225 point FFT window function ratio.

Key Path	<b>BW, Res BW</b>
<b>Example</b>	BAND:SEL RBW3
Notes	Res BW 3 uses Filter Type Ratio of the 225 point FFT window function size.



Couplings	The actual Res BW value is calculated using the algorithm $RBW = \text{Span} / \text{Filter Type Ratio}$ , therefore any changes to the Span or Filter Type may result in the computed Res BW value changing. Not supported when Filter Type is RECTangular.
State Saved	Saved in instrument state.
Readback	Res BW 3 <computed Res BW value>
Initial S/W Revision	A.13.00

### Res BW 4

Selects the Res BW that is computed using the 128 point FFT window function ratio.

Key Path	<b>BW, Res BW</b>
<b>Example</b>	BAND:SEL RBW4
Notes	Res BW 4 uses Filter Type Ratio of the 128 point FFT window function size.
Couplings	The actual Res BW value is calculated using the algorithm $RBW = \text{Span} / \text{Filter Type Ratio}$ , therefore any changes to the Span or Filter Type may result in the computed Res BW value changing. Not supported when Filter Type is RECTangular.
State Saved	Saved in instrument state.
Readback	Res BW 4 <computed Res BW value>
Initial S/W Revision	A.13.00

### Res BW 5

Selects the Res BW that is computed using the 64 point FFT window function ratio.

Key Path	<b>BW, Res BW</b>
<b>Example</b>	BAND:SEL RBW5
Notes	Res BW 5 uses Filter Type Ratio of the 64 point FFT window function size.
Couplings	The actual Res BW value is calculated using the algorithm $RBW = \text{Span} / \text{Filter Type Ratio}$ , therefore any changes to the Span or Filter Type may result in the computed Res BW value changing. Not supported when Filter Type is RECTangular.
State Saved	Saved in instrument state.
Readback	Res BW 5 <computed Res BW value>
Initial S/W Revision	A.13.00

### Res BW 6

Selects the Res BW that is computed using the 32 point FFT window function ratio.

Key Path	<b>BW, Res BW</b>
<b>Example</b>	BAND:SEL RBW6
Notes	Res BW 6 uses Filter Type Ratio of the 32 point FFT window function size.
Dependencies	The max Span and max Res BW allowed depends on the installed BW option.
Couplings	The actual Res BW value is calculated using the algorithm $RBW = \text{Span} / \text{Filter Type Ratio}$ , therefore any changes to the Span or Filter Type may result in the computed Res BW value changing. Not supported when Filter Type is RECTangular.
State Saved	Saved in instrument state.
Readback	Res BW 6 <computed Res BW value>
Initial S/W Revision	A.13.00

## Filter Type

Enables you to select the FFT Windowing function to use

Key Path	<b>BW</b>
<b>Remote Command</b>	<code>[ :SENSe]:BANDwidth BWIDth:SHAPE GAUSSian   FLATtop   BHARris   RECTangular   HANNing   KAISer</code> <code>[ :SENSe]:BANDwidth BWIDth:SHAPE?</code> Note: BAND:SEL RBW1 must be sent before using RECT filter type.
<b>Example</b>	BAND:SHAP GAUS
Notes	GAUSSian= Gaussian FLATtop = Flattop BHARris = Blackman-Harris RECTangular = Rectangular HANNing = Hanning KAISer = Kaiser We use SHAPe instead of TYPE (even though the key name uses Type) for backwards compatibility because TYPE is used in Swept SA measurement.
Couplings	Changing the Filter Type will change the RBW values based on the formula: $RBW = \text{Span} / \text{Filter Type Ratio}$ .
Preset	KAISer
State Saved	Saved in instrument state
Readback line	1-of-N selection
Initial S/W Revision	A.13.00

## Gaussian

Selects Gaussian as the FFT window function.

Key Path	<b>BW, Filter Type</b>
<b>Example</b>	BAND:SHAP GAUS
Couplings	The actual Res BW value is calculated using the algorithm $RBW = \text{Span} / \text{Filter Type Ratio}$ , therefore any changes to the Span or Filter Type may result in the computed Res BW value changing.
State Saved	Saved in instrument state.
Readback	Gaussian
Initial S/W Revision	A.13.00

### Flattop

Selects Flattop as the FFT window function.

Key Path	<b>BW, Filter Type</b>
<b>Example</b>	BAND:SHAP FLAT
Couplings	The actual Res BW value is calculated using the algorithm $RBW = \text{Span} / \text{Filter Type Ratio}$ , therefore any changes to the Span or Filter Type may result in the computed Res BW value changing.
State Saved	Saved in instrument state.
Readback	Flattop
Initial S/W Revision	A.13.00

### Blackman-Harris

Selects Blackman-Harris as the FFT window function.

Key Path	<b>BW, Filter Type</b>
<b>Example</b>	BAND:SHAP BHAR
Couplings	The actual Res BW value is calculated using the algorithm $RBW = \text{Span} / \text{Filter Type Ratio}$ , therefore any changes to the Span or Filter Type may result in the computed Res BW value changing.
State Saved	Saved in instrument state.
Readback	Blackman-Harris
Initial S/W Revision	A.13.00

### Rectangular

Selects Rectangular as the FFT window function.

Key Path	<b>BW, Filter Type</b>
<b>Example</b>	BAND:SHAP RECT
Couplings	Must send BAND:SEL RBW1 before using RECT filter type The actual Res BW value is calculated using the algorithm $RBW = \text{Span} / \text{Filter Type Ratio}$ , therefore any changes to the Span or Filter Type may result in the computed Res BW value changing.

State Saved	Saved in instrument state.
Readback	Rectangular
Initial S/W Revision	A.13.00

### Hanning

Selects Hanning as the FFT window function.

Key Path	<b>BW, Filter Type</b>
<b>Example</b>	BAND:SHAP HANN
Couplings	The actual Res BW value is calculated using the algorithm $RBW = \text{Span} / \text{Filter Type Ratio}$ , therefore any changes to the Span or Filter Type may result in the computed Res BW value changing.
State Saved	Saved in instrument state.
Readback	Hanning
Initial S/W Revision	A.13.00

### Kaiser

Selects Kaiser as the FFT window function.

Key Path	<b>BW, Filter Type</b>
<b>Example</b>	BAND:SHAP KAIS
Couplings	The actual Res BW value is calculated using the algorithm $RBW = \text{Span} / \text{Filter Type Ratio}$ , therefore any changes to the Span or Filter Type may result in the computed Res BW value changing.
State Saved	Saved in instrument state.
Readback	Kaiser
Initial S/W Revision	A.13.00

## Cont (Continuous Measurement/Sweep)

Sets the analyzer for Continuous measurement operation. The single/continuous state is Meas Global so the setting will affect all measurements. If you are Paused, pressing **Cont** does a Resume.

Key Path	Front-panel key
<b>Remote Command</b>	:INITiate:CONTinuous OFF ON 0 1 :INITiate:CONTinuous?
<b>Example</b>	:INIT:CONT 0 puts analyzer in Single measurement operation. :INIT:CONT 1 puts analyzer in Continuous measurement operation
Preset	ON (Note that SYST:PRESet sets INIT:CONT to ON but *RST sets INIT:CONT to OFF)
State Saved	Saved in instrument state
Backwards Compatibility Notes	For Spectrum Analysis mode in ESA and PSA, there is no <b>Cont</b> hardkey, instead there is a <b>Sweep Single/Cont</b> key. In these analyzers, switching the <b>Sweep Single/Cont</b> key from Single to Cont restarts averages (displayed average count reset to 1), but does not restart <b>Max Hold</b> and <b>Min Hold</b> .  The X-Series has <b>Single</b> and <b>Cont</b> keys in place of the <b>SweepSingleCont</b> key. In the X-Series, if in single measurement, the <b>Cont</b> key (and INIT:CONT ON ) switches to continuous measurement, but never restarts a measurement and never resets a sweep.
Initial S/W Revision	Prior to A.02.00

In Swept SA Measurement (Spectrum Analysis Mode):

The analyzer takes repetitive sweeps, averages, measurements, etc., when in Continuous mode. When the average count reaches the Average/Hold Number the count stops incrementing, but the analyzer keeps sweeping. See the Trace/Detector section for the averaging formula used both before and after the Average/Hold Number is reached. The trigger condition must be met prior to each sweep. The type of trace processing for multiple sweeps, is set under the Trace/Detector key, with choices of **Trace Average**, **Max Hold**, or **Min Hold**.

In Other Measurements/Modes:

With **Avg/Hold Num** (in the **Meas Setup** menu) set to **Off** or set to **On** with a value of 1, a sweep is taken after the trigger condition is met; and the analyzer continues to take new sweeps after the current sweep has completed and the trigger condition is again met. However, with **Avg/Hold Num** set to On with a value >1, multiple sweeps (data acquisitions) are taken for the measurement. The trigger condition must be met prior to each sweep. The sweep is not stopped when the average count k equals the number N set for Avg/Hold Num is reached, but the number k stops incrementing. A measurement average usually applies to all traces, marker results, and numeric results. But sometimes it only applies to the numeric results.

If the analyzer is in Single measurement, pressing the **Cont** key does not change  $k$  and does not cause the sweep to be reset; the only action is to put the analyzer into Continuous measurement operation.

If it is already in continuous sweep:

the INIT:CONT 1 command has no effect

the INIT:CONT 0 command will place the analyzer in Single Sweep but will have no effect on the current sequence until  $k = N$ , at which point the current sequence will stop and the instrument will go to the idle state.

## File

See "File" on page 247

## FREQ Channel

Accesses a menu of keys that allow you to control the Frequency and Channel parameters of the instrument.

Some features in the Frequency menu are the same for all measurements – 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.

Key Path	Front-panel key
Initial S/W Revision	Prior to A.02.00

### Center Freq

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, which means that both Start Frequency and Stop Frequency will change.

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**.

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 Settings** key in its **Mode Setup** menu.

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

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

See ["RF Center Freq" on page 768](#)

See [Ext Mix Center Freq](#)

See ["I/Q Center Freq" on page 769](#)

See ["Center Frequency Presets" on page 765](#)

Key Path	FREQ Channel
Scope	Meas Global
<b>Remote Command</b>	<b>[ :SENSE ] :FREQuency:CENTer &lt;freq&gt;</b>



[ :SENSe ] :FREQuency :CENTer?	
<b>Example</b>	FREQ:CENT 50 MHz FREQ:CENT UP changes the center frequency to 150 MHz if you use FREQ:CENT:STEP 100 MHz to set the center frequency step size to 100 MHz FREQ:CENT?
Notes	This command sets either the RF or I/Q Center Frequency depending on the selected input. For RF input it is equivalent to FREQ:RF:CENT For I/Q input it is equivalent to FREQ:IQ:CENT Preset and Max values are dependent on Hardware Options (5xx) If no terminator (e.g. MHz) is sent the terminator Hz is used. If a terminator with unit other than Frequency is used, an invalid suffix error message is generated.
Dependencies	The Center Frequency can be limited by Start or Stop Freq limits, if the Span is so large that Start or Stop reach their limit.
Couplings	When operating in "swept span", any value of the Center Frequency or Span that is within the frequency range of the analyzer 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 analyzer's frequency range
Preset	Depends on instrument maximum frequency, mode, measurement, and selected input. See "Center Frequency Presets" on page 765 and "RF Center Freq" on page 768 and Ext Mix Center Freq and "I/Q Center Freq" on page 769.
State Saved	Saved in instrument state
Min	Depends on instrument maximum frequency, mode, measurement, and selected input.. See "Center Frequency Presets" on page 765 and "RF Center Freq" on page 768 and "I/Q Center Freq" on page 769.
Max	Depends on instrument maximum frequency, mode, measurement, and selected input.. See "Center Frequency Presets" on page 765 and "RF Center Freq" on page 768 and "I/Q Center Freq" on page 769.
Default Unit	Hz
Status Bits/OPC Dependencies	Non-overlapped
Initial S/W Revision	Prior to A.02.00

### 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 N9000A)		1.805 GHz	3.6 GHz 3.7 GHz

<b>Freq Optio n</b>	<b>CF after Mode Prese t</b>	<b>Stop Freq after Mode Prese t</b>	<b>Max Freq (can't tune abov e)</b>	
503 (N9000A)		1.505 GHz	3.0 GHz	3.08 GHz
504 (M9420A)		1 GHz	3.8GHz	3.88 GHz
506 (M9420A)		1 GHz	6.0GHz	6.08 GHz
507 (all but N9000A)		3.505 GHz	7.0 GHz	7.1 GHz
507 (N9000A)		3.755 GHz	7.5 GHz	7.58 GHz
508 (all but N9038A)		1.805 GHz	3.6 GHz	8.5 GHz
508 (N9038A)		4.205 GHz	8.4 GHz	8.5 GHz
513		6.805 GHz	13.6 GHz	13.8 GHz
526 (all but N9000A and N9038A)		13.255 GHz	26.5 GHz	27.0 GHz
526 (N9000A)		13.255 GHz	26.5 GHz	26.5 5 GHz
526 (N9038A)		1.805 GHz	3.6 GHz	27.0 GHz
532	16.005 GHz		32.0 GHz	32.5 GHz
543	21.505 GHz		43.0 GHz	TBD
544	22.005 GHz		44.0 GHz	44.5 GHz
550	25.005 GHz		50.0 GHz	51 GHz

Input 2:

<b>Model</b>	<b>CF after Mode Preset</b>	<b>Stop Freq after Mode Preset</b>	<b>Max Freq (can't tune above)</b>
N9000A opt C75	0.7505GHz	1.5 GHz	1.58 GHz
N9038A	505 MHz	1 GHz	1.000025 GHz

Tracking Generator Frequency Limits (N9000A only):

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

Tracking Generator Frequency Limits(M9290A only):

<b>Tracking Generator Option</b>	<b>Min Freq (clips to this freq when turn TG on and can't tune below while TG on)</b>	<b>If above this Freq, Stop Freq clipped to this Freq when TG turned on</b>	<b>Max Freq (can't tune above) while TG on</b>
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

The following table shows the Center Frequency Presets for modes other than Spectrum Analyzer:

<b>Mode</b>	<b>CF Preset for RF</b>
WCDMA	1 GHz
WIMAXOFDMA,	1 GHz
BASIC	1 GHz
ADEMOD	1 GHz
VSA	1 GHz
TDSCDMA	1 GHz
PNOISE	1 GHz

Mode	CF Preset for RF
LTE	1 GHz
LTETDD	1 GHz
MSR	1 GHz
GSM	935.2 MHz
NFIGURE	1.505 GHz

### RF Center Freq

SCPI command for specifying the RF Center Frequency. This command will set the Center Frequency to be used when the RF input is selected, even if the RF input is not the input that is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Scope	Meas Global
<b>Remote Command</b>	<code>[ :SENSe ] :FREQuency:RF:CENTer &lt;freq&gt;</code> <code>[ :SENSe ] :FREQuency:RF:CENTer?</code>
<b>Example</b>	FREQ:RF:CENT 30 MHz
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode.
Dependencies	If the electronic/soft attenuator is enabled, any attempt to set Center Frequency such that the Stop Frequency would be >3.6 GHz fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a “-221, Settings conflict” warning.  If Source Mode is set to Tracking, and the Max or Min Center 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.
Preset	See table above
State Saved	Saved in instrument state.
Min	-79.999995 MHz, unless Source Mode is set to Tracking, in which case it is limited by the minimum frequency of the Source
Max	See table above. Basically instrument maximum frequency - 5 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, also depends on the value of the other three interdependent parameters Span, Start Frequency and Stop Frequency
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

### Ext Mix Center Freq

SCPI command for specifying the External Mixer Center Frequency. This command will set the Center Frequency to be used when the External Mixer is selected, even if the External Mixer input is not the input which is selected at the time the command is sent. Note that the **Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Scope	Meas Global
<b>Remote Command</b>	[ :SENSe ] :FREQuency:EMIXer:CENTer <freq> [ :SENSe ] :FREQuency:EMIXer:CENTer?
<b>Example</b>	:FREQ:EMIX:CENT 60 GHz :FREQ:EMIX:CENT?
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode.
Couplings	When returning to External Mixing after having been switched to one of the other inputs (e.g., RF), you will come back into the settings that you had when you left External Mixing. So you will come back to the band you were in with the Center Frequency that you had. However, Span is not an input-dependent parameter, therefore you will bring the span over from the other input. Therefore, the analyzer comes back with the span from the previous input, limited as necessary by the current mixer setup.
Preset	When a Mode Preset is performed while in External Mixing, the Start frequency of the current Mode is set to the nominal Min Freq of the lowest harmonic range in the Harmonic Table for the current mixer setup. Similarly, the Stop frequency of the current Mode is set to the nominal Max Freq of the highest harmonic range in the Harmonic Table. The Center Freq thus presets to the point arithmetically equidistant from these two frequencies.  If the current measurement has a limited Span available to it, and cannot achieve the Span shown in the table (Span=Stop Freq – Start Freq), the analyzer uses the maximum Span the measurement allows, and still sets the Center Freq to the midpoint of the Start and Stop Freq values in the Harmonic Table.  When Restore Input/Output Defaults is performed, the mixer presets to the 11970A, whose Start and Stop frequencies are 26.5 and 40 GHz respectively. The center of these two frequencies is 33.25 GHz.  Therefore, after a Restore Input/Output Defaults, if you go into External Mixing and do a Mode Preset while in the Spectrum Analyzer Mode, the resulting Center Freq is 33.25 GHz.
State Saved	Saved in instrument state.
Min	The minimum frequency in the currently selected mixer band + 5 Hz
Max	The maximum frequency in the currently selected mixer band - 5 Hz  If the knob or step keys are being used, also depends on the value of the other three interdependent parameters Span, Start Frequency and Stop Frequency
Initial S/W Revision	A.08.01

### I/Q Center Freq

SCPI command for specifying the I/Q Center Frequency. This command will set the Center Frequency to be used when the I/Q input is selected, even if the I/Q input is not the input which is selected at the time the command is sent. Note that the

**Center Freq** function in the **Frequency** menu on the front panel always applies to the currently selected input.

Scope	Meas Global
<b>Remote Command</b>	[ :SENSe ] :FREQuency:IQ:CENTer <freq> [ :SENSe ] :FREQuency:IQ:CENTer?
<b>Example</b>	FREQ:IQ:CENt: 30 MHz
Notes	This command is the same in all modes, but the parameter is Measurement Global. So the value is independent in each mode and common across all the measurements in the mode.
Preset	0 Hz
State Saved	Saved in instrument state.
Min	-40.049995 MHz
Max	40.049995 MHz
Initial S/W Revision	Prior to A.02.00

## 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**.

Key Path	<b>FREQ Channel</b>
<b>Remote Command</b>	[ :SENSe ] :FREQuency:STARt <freq> [ :SENSe ] :FREQuency:STARt?
<b>Example</b>	FREQ:STAR 200 MHz FREQ:STAR?
Notes	Max values depends on Hardware Options (5xx)
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 the equivalent SCPI command is sent, this same message is generated as part of a “-221, Settings conflict”

	<p>warning.</p> <p>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.</p>
Couplings	<p>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 key descriptions for those keys. These couplings also affect Start Freq and Stop Freq.</p> <p>You cannot set Start frequency = Stop frequency. You cannot select zero span by setting Start = Stop. The instrument will alter the value of the last setting to maintain a minimum value of 10 Hz for the difference between Start and Stop.</p>
Preset	<p>Start Freq does not preset. On Mode Preset, Span &amp; 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.</p> <p>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.</p> <p>If the current measurement has a limited Span available to it, and cannot achieve the Span shown in the table (Span=Stop Freq – Start Freq), the analyzer uses the maximum Span the measurement allows, and 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 <math>\frac{1}{2}</math> of the maximum Span.</p> <p>When Restore Input/Output Defaults is performed, the mixer presets to the 11970A, whose Start frequency is 26.5 GHz.</p> <p>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.</p>
State Saved	Saved in instrument state
Min	<p>-80 MHz, unless Source Mode is set to Tracking, in which case it is limited by the minimum frequency of the Source</p> <p>If the knob or step keys are being used, depends on the value of the other three interdependent parameters</p> <p>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.</p>
Max	<p>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.</p> <p>If the knob or step keys are being used, it depends on the value of the other three interdependent parameters.</p> <p>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. It can be queried with the SCPI command :FREQ:START? MAX.</p>
Default Unit	Hz
Status Bits/OPC	Non-overlapped

dependencies	
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

## 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**.

Key Path	FREQ Channel
Remote Command	[ :SENSe ] :FREQuency :STOP <freq> [ :SENSe ] :FREQuency :STOP?
Example	FREQ:STOP 220 MHz FREQ:STOP?
Notes	Preset and Max values are dependent on Hardware Options (5xx)
Dependencies	<p>By direct entry:</p> <p>You cannot set the Stop frequency &lt; 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.</p> <p>With the knob or step keys:</p> <p>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.</p> <p>The Stop Frequency can be limited by Span limits, if the Start Frequency is above its preset value.</p> <p>If the electronic/soft attenuator is enabled, any attempt to set the Stop Frequency &gt;3.6 GHz fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning.</p> <p>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.</p>
Couplings	<p>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 key descriptions for those keys. These couplings also affect Start Freq and Stop Freq.</p> <p>You cannot set Start frequency = Stop frequency. You cannot select zero span by setting Start = Stop. The instrument will alter the value of the last setting to maintain a minimum value of 10 Hz for the difference between Start and Stop.</p>



Preset	<p>On Mode Preset, Span &amp; CF preset, and Stop Freq is derived. See "<a href="#">Center Frequency Presets</a>" on <a href="#">page 765</a> for a table which shows the Stop Freq after Preset for various model and option numbers).</p> <p>On a Meas Preset only Span presets, CF does not, so Stop Freq will vary depending on CF.</p> <p>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.</p> <p>If the current measurement has a limited Span available to it, and cannot achieve the Span shown in the table (Span=Stop Freq – Start Freq), the analyzer uses the maximum Span the measurement allows, and 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 <math>\frac{1}{2}</math> of the maximum Span.</p> <p>When Restore Input/Output Defaults is performed, the mixer presets to the 11970A, whose Stop frequency is 40 GHz.</p> <p>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.</p>
State Saved	Saved in instrument state
Min	<p>-79.999999999 MHz, unless Source Mode is set to Tracking, in which case it is limited by the minimum frequency of the Source</p> <p>If the knob or step keys are being used, depends on the value of the other three interdependent parameters</p> <p>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. It can be queried with the SCPI command :FREQ:STOP? MIN.</p>
Max	<p>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.</p> <p>If the knob or step keys are being used, depends on the value of the other three interdependent parameters.</p> <p>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. It can be queried with the SCPI command :FREQ:STOP? MAX.</p>
Default Unit	Hz
Status Bits/OPC dependencies	Non-overlapped
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

## CF Step

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

size function is useful for finding harmonics and sidebands beyond the current frequency span of the analyzer.

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

Key Path	FREQ Channel
<b>Remote Command</b>	[ :SENSe ] :FREQuency :CENTer :STEP [ :INCRement ] <freq> [ :SENSe ] :FREQuency :CENTer :STEP [ :INCRement ] ? [ :SENSe ] :FREQuency :CENTer :STEP :AUTO OFF   ON   0   1 [ :SENSe ] :FREQuency :CENTer :STEP :AUTO ?
<b>Example</b>	FREQ:CENT:STEP:AUTO ON FREQ:CENT:STEP 500 MHz FREQ:CENT UP increases the current center frequency value by 500 MHz FREQ:CENT:STEP? FREQ:CENT:STEP:AUTO?
Notes	Preset and Max values are depending on Hardware Options (503, 507, 508, 513, 526)
Notes	Preset and Max values are dependent on Hardware Options (5xx)
Dependencies	Freq Offset is not available in External Mixing. In this case the Freq Offset key is grayed out and shows a value of zero. It will once again be available, and show the previously set value, when you return to the RF Input.
Dependencies	Span, RBW, Center frequency If the electronic/soft attenuator is enabled, any attempt to change the value of the center frequency >3.6 GHz by pressing the Up-arrow key, fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a “-221, Settings conflict” warning.
Couplings	When auto-coupled in a non-zero span, the center frequency step size is set to 10% of the span. When auto-coupled in zero span, the center frequency step size is set to the equivalent -3 dB RBW value.
Preset	Auto ADEMOD: 1 MHz 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.
Default Unit	Hz
Status Bits/OPC dependencies	non-overlapped

Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.03.00

## Freq Offset

Enables you to set a frequency offset value to account for frequency conversions outside of the analyzer. 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 analyzer 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.

See "[More Information](#)" on page 776.

Key Path	<b>FREQ Channel</b>
Scope	Meas Global
<b>Remote Command</b>	[ :SENSe ] :FREQuency:OFFSet <freq> [ :SENSe ] :FREQuency:OFFSet?
<b>Example</b>	FREQ:OFFS 10 MHz
Notes	Preset and Max values are dependent on Hardware Options (503, 507, 508, 513, 526)
Dependencies	Freq Offset is not available in External Mixing. In this case the Freq Offset key 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.
Preset	See " <a href="#">Center Frequency Presets</a> " on page 765
State Saved	Saved in instrument state
Min	-500 GHz
Max	500 GHz
Default Unit	Hz
Status Bits/OPC dependencies	Non-overlapped
<b>Backwards Compatibility SCPI</b>	<b>DISPlay:WINDow[1]:TRACe:X[:SCALE]:OFFSet</b> The DISPlay version of the command is in the instrument for compatibility across platforms and is not recommended for new development.
Backwards Compatibility Notes	<ol style="list-style-type: none"> <li>1. In pre-X-Series instruments, Frequency Offset could not be adjusted by the knob or step keys. That is no longer the case.</li> <li>2. Some previous spectrum analyzers did not adjust frequency counter results for the Frequency Offset. The X-Series does adjust the frequency counter for the offset.</li> </ol>
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.04.00, A.08.50

## More Information

This command does not affect any bandwidths or the settings of relative frequency parameters such as delta markers or span. It does not affect the current hardware settings of the analyzer, but only the displayed frequency values. Entering an offset does not affect the trace position or display, just the value of the start and stop frequency and the values represented by the trace data. The frequency values of exported trace data, queried trace data, markers, trace data used in calculations such as N dB points, trace math, etc., are all affected by Freq Offset. Changing the offset, even on a trace that is not updating will immediately change all of the above, without taking new data.

**NOTE**

If a trace is exported with a nonzero Freq Offset, the exported data will contain the trace data with the offset applied. Therefore, if that trace were to be imported back into the analyzer, you would want Freq Offset to be 0, or the offset would be applied again to data which is already offset. No such care need be taken when saving a State+Trace file because the data and state are saved together.

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## Input/Output

See ["Input/Output" on page 138](#)

## 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. The functions in this menu include a 1-of-N selection of the control mode Normal, Delta, Fixed, or Off for the selected marker.

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 and the green marker readout in the upper right corner of the display.

Programmatically, to set the Marker's X-Axis value use the `:CALCulate:MARKer [1]|2|3|4|5|6|7|8|9|10|11|12:X <freq|time>` command. To query the Marker's Y-Axis value, use the `:CALCulate:MARKer [1]|2|3|4|5|6|7|8|9|10|11|12:Y?` query. See ["Setting/Querying the Marker X Axis Value" on page 779](#) and ["Setting/Querying the Marker Y Axis Value" on page 781](#) for information on these functions.

When Marker is pressed, if the selected marker is Off, pressing Marker sets it to Normal and places it at the center of the screen on the trace determined by the Marker Trace rules. 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.

### NOTE

**Markers can be on and not be visible because 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 Peak Search.**

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.

The command in the table below selects the marker and sets the marker control mode as described under **Normal**, **Delta**, **Fixed** and **Off**, below. All interactions and dependencies detailed under the key description are enforced when the remote command is sent.

See ["Marker Control Mode" on page 779](#).

See ["Setting/Querying the Marker X Axis Value" on page 779](#).

See ["Setting the Marker X Position in Trace Points" on page 780](#).

See ["Setting/Querying the Marker Y Axis Value" on page 781](#).

See ["Marker Backwards Compatibility" on page 782](#)

Key Path	Front-panel key
<b>Remote Command</b>	<code>:CALCulate:MARKer[1] 2 ... 12:MODE POSition DELTA FIXed OFF</code> <code>:CALCulate:MARKer[1] 2 ... 12:MODE?</code>
Preset	OFF (all markers)

State Saved	The marker control mode is saved in instrument state
<b>Backwards Compatibility SCPI</b>	<b>:CALCulate:MARKer[1] 2 ... 12:MODE SPAN BAND</b> To support band function backwards compatibility, both of these legacy parameters are accepted and aliased to POSition. They are never returned to a query. See " <a href="#">Band Function Backwards Compatibility</a> " on page 798 for more information.
Initial S/W Revision	Prior to A.02.00

## Marker Control 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 whose 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.

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

In the Swept SA measurement, the Preset control mode is **Off** for all markers.

## Setting/Querying the Marker X Axis Value

The command below sets the marker X Axis value in the current marker X Axis Scale unit. In each case the marker that is addressed becomes the selected marker. It has no effect (other than to cause the marker to become selected) if the control mode is **Off**, but it is the SCPI equivalent of entering an X value if the control mode is **Normal**, **Delta**, or **Fixed**.

<b>Remote Command</b>	<b>:CALCulate:MARKer[1] 2 ... 12:X &lt;freq time&gt;</b> <b>:CALCulate:MARKer[1] 2 ... 12:X?</b>
Notes	If no suffix is sent it will use the fundamental units for the current marker X Axis Scale. If a suffix is sent that does not match the current marker X Axis Scale unit, an invalid suffix message will be generated.  If the specified marker is Fixed and a Marker Function is on, a message is generated. If the key is pressed, an advisory message is generated. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning.  The query returns the marker's absolute X Axis value if the control mode is <b>Normal</b> or <b>Fixed</b> . It returns the offset from the marker's reference marker if the control mode is <b>Delta</b> . The query is returned in the fundamental units for the current marker X Axis scale: Hz for <b>Frequency</b> and <b>Inverse Time</b> , seconds for <b>Period</b> and <b>Time</b> . If the marker is <b>Off</b> the response is not a number.

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
Default Unit	determined by X Axis Scale
<b>Backwards Compatibility SCPI</b>	<b>:CALCulate:MARKer[1] 2 ... 4:X:CENTer</b> This alias is provided for compatibility with the Band Power function in PSA and ESA. See details in the "Marker Function" section under " <a href="#">Band Function Backwards Compatibility</a> " on page 798
Backwards Compatibility Notes	In earlier Agilent analyzers, markers were position markers, which means that Normal and Delta markers stayed at the same screen position when X Axis parameters were changed. In the X-Series, markers are value markers, which means that when the analyzer's X Axis settings are changed, the marker's X Axis value in fundamental X Axis units remains unchanged. See " <a href="#">Marker Backwards Compatibility</a> " on page 782 for a full discussion of this change.
Initial S/W Revision	<b>Prior to A.02.00</b>

## Setting the Marker X Position in Trace Points

The command below sets the marker X position in trace points. It has no effect if the marker control mode is **Off**. But it is the SCPI equivalent of entering a value if the control mode is **Normal** or **Delta** or **Fixed** – except the setting is in trace points rather than X Axis Scale units.

### NOTE

The entered value in Trace Points is immediately translated into the current X Axis Scale units for setting the value of the marker. The marker's value in X Axis Scale Units, NOT trace points, will be preserved if a change is made to the X Axis scale settings. Thus, if you use this command to place a marker on bucket 500, which happens at that time to correspond to 13 GHz, and then you change the Start Frequency so that bucket 500 is no longer 13 GHz, the marker will stay at 13 GHz, NOT at bucket 500! This is important to realize as it differs from the behavior of past Agilent analyzers.

<b>Remote Command</b>	<b>:CALCulate:MARKer[1] 2 ... 12:X:POsition &lt;real&gt;</b> <b>:CALCulate:MARKer[1] 2 ... 12:X:POsition?</b>
Notes	If the specified marker is Fixed and a Marker Function is on, a message is generated. If the key is pressed, an advisory message is generated. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning.  The query returns the marker's absolute X Axis value in trace points if the control mode is <b>Normal</b> or <b>Fixed</b> . It returns the offset from the marker's reference marker in trace points if the control mode is <b>Delta</b> . The value is returned as a real number, not an integer, corresponding to the translation from X Axis Scale units to trace points
Preset	After a preset, if X is queried with no value sent first, the center of screen value will be returned. So if per default, the number of Trace points is 1001, the center value will be 500.
Min	0



Max	Number of trace points – 1
Default Unit	unitless
<b>Backwards Compatibility SCPI</b>	<b>:CALCulate:MARKer[1] 2 ... 4:X:POSition:CENTer</b> This alias is provided for compatibility with the Band Power function in PSA and ESA. See details in the “Marker Function” section under <a href="#">"Band Function Backwards Compatibility" on page 798</a>
Initial S/W Revision	Prior to A.02.00

## Setting/Querying the Marker Y Axis Value

The fundamental item of marker data accessed by users is the marker’s Y-Axis value. The query below is used to select the marker and read the marker’s Y-Axis value.

In the command form, it selects the marker and sets the marker Y Axis value; the default unit is the current Y Axis unit. The command form has no effect (other than selecting the marker) unless the marker control mode is **Fixed**.

<b>Remote Command</b>	<b>:CALCulate:MARKer[1] 2 ... 12:Y &lt;real&gt;</b> <b>:CALCulate:MARKer[1] 2 ... 12:Y?</b>
<b>Example</b>	CALC:MARK2:MODE POS turns on marker 2 as a normal marker. CALC:MARK2:X 20 GHZ moves marker 2 to 20 GHz if X Axis Scale is Frequency. If X Axis Scale is Time, an Invalid Suffix error is generated.
Notes	The command <b>:CALCulate:MARKer[1] 2 3 4 5 6 7 8 9 10 11 12:Y?</b> returns the marker Y-axis result, if the control mode is <b>Normal</b> , <b>Fixed</b> or <b>Delta</b> . If the marker is <b>Off</b> the response is 9.91e37 (“not a number”). If no suffix is sent it will use the current Y Axis unit. If a suffix is sent that does not have units of absolute amplitude, an invalid suffix error will be generated. If a marker function is on for the specified marker, a Settings Conflict message is generated.
Preset	Trace value at center of screen. There is no way to predict what this will be after a preset.
Min	–∞ (minus infinity)
Max	+∞ (plus infinity)
Backwards Compatibility Notes	As a result of the change from position markers to value markers (see below), 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. In the past, since markers could never be offscreen they always returned a valid result. In the X-Series, markers which are offscreen return not a number as a result; hence the potential now exists for not a number to be returned for a marker Y-Axis query. Also, in some previous analyzers linear ratios read out on the display in %. In the X-Series they display as dimensionless quantities. E.g., a quantity which used to display as 52% now displays as .52. The SCPI behavior is unaffected as it has always read out the ratio rather than the percentage.
Initial S/W Revision	<b>Prior to A.02.00</b>

## Querying the Marker Z Axis Value

The command below queries the marker Z Axis value in the Spectrogram View only. The Z Axis value of a marker represents the time value of the marker (see

“Representation of Time” under the Spectrogram View description). In each case the marker that is addressed becomes the selected marker.

<b>Remote Command</b>	<code>:CALCulate:MARKer[1] 2 ... 12:Z?</code>
Notes	The query returns the marker's absolute Z Axis value if the control mode is <b>Normal</b> or <b>Fixed</b> . It returns the offset from the marker's reference marker if the control mode is <b>Delta</b> . For Spectrogram, the Z Axis value represents the amount of time transpired since the start of the recording of traces.
Preset	9.91E+37
Min	-Infinity
Max	+Infinity

## Setting or Querying the Marker Z Position

The command below sets the Marker Z position in the Spectrogram View only. Setting the Z Position sets which of the 300 traces in the Spectrogram the selected marker will appear on. In each case the marker that is addressed becomes the selected marker. It has no effect (other than to cause the marker to become selected) if the control mode is **Off**, but it is the SCPI equivalent of making a Marker Z entry if the control mode is **Normal, Delta, or Fixed**.

<b>Remote Command</b>	<code>:CALCulate:MARKer[1] 2 ... 12:Z:POsition &lt;integer&gt;</code> <code>:CALCulate:MARKer[1] 2 ... 12:Z:POsition?</code>
Notes	The command sets or queries the Z Axis position. In the Spectrogram View, this value correlates to be one of the 300 stored traces. Each Z Axis position represents a different stored trace.
Preset	0
Min	0
Max	Number of traces stored is limited to 300.
Default Unit	unitless

## Marker Backwards Compatibility

In earlier Agilent 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 analyzer'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 analyzer, 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 analyzer. 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 which 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.

## Select Marker

Specifies the selected marker. The term “selected marker” is used throughout this document to specify which marker will be affected by the functions.

Key Path	<b>Marker</b>
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.
Initial S/W Revision	Prior to A.02.00

## Normal

Sets the control mode for the selected marker to **Normal** and turns on the active function for setting its value. 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.

**A Normal mode (POSITION type) 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.

Key Path	<b>Marker</b>
<b>Example</b>	:CALC:MARK:MODE POS sets Marker 1 to Normal.
Notes	See the description under the “ Marker” key.
Couplings	The marker addressed by this command becomes the selected marker on the front panel.
State Saved	The marker control mode (Normal, Delta, Fixed, Off) and X Axis value are saved in instrument state.
<b>Backwards Compatibility SCPI</b>	<b>:CALCulate:MARKer[1] 2 ... 12:STATe ON 1</b> Setting a marker which is OFF to ON or 1 selects the marker, puts it in Normal mode and places it at the center of the screen. Setting a marker which is not OFF to ON has no effect (does not change its control mode). Example: CALC:MARK2:STAT ON sets Marker 2 to Normal if it was off; otherwise it does nothing. The response to the query will be ON unless the marker is OFF.
Initial S/W Revision	Prior to A.02.00

<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 12:STATe OFF ON 0 1 :CALCulate:MARKer[1] 2 ... 12:STATe?
Preset	OFF
Initial S/W Revision	Prior to A.02.00

## Delta

Sets the control mode for the selected marker to Delta and turns on the active function for setting its delta value. 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.

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.

Key Path	<b>Marker</b>
<b>Example</b>	:CALC:MARK:MODE DELT sets marker 1 to Delta.
Notes	See the description under the "Marker" key.
State Saved	The marker control mode (Normal, Delta, Fixed, Off) and X Axis value are saved in instrument state
Backwards Compatibility Notes	Previously, pressing Delta (or sending the <b>CALC:MARK:MODE:DELTA</b> command) always moved the reference marker to the delta marker. Now it only does so if the marker was already a delta marker.
Initial S/W Revision	Prior to A.02.00

## Fixed

Sets the control mode for the selected marker to 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.

See ["Fixed Marker X Axis Value" on page 785](#).

See ["Fixed Marker Y Axis Value" on page 785](#).

See [Fixed Marker Z Axis Value](#)

### Fixed Marker X Axis Value

Key Path	<b>Marker, Fixed</b>
<b>Example</b>	:CALC:MARK:MODE FIX sets Marker 1 to Fixed.
Notes	See the description under the “Marker” key, above.
Dependencies	<ul style="list-style-type: none"> <li>– You cannot directly set the X or Y 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.</li> <li>– You cannot directly set the Y value of a Fixed marker while Normalize is turned on. If an attempt is made to do so while Normalize is on, a warning message is generated.</li> </ul>
State Saved	The marker control mode (Normal, Delta, Fixed, Off) and X and Y Axis values are saved in instrument state
Backwards Compatibility Notes	In legacy analyzers, only a Reference marker could be Fixed, and it was always Fixed. Additionally it could not be moved. In the X-Series, any marker can be set to Fixed and can be moved to any X or Y value.
Initial S/W Revision	Prior to A.02.00

### Fixed Marker Y Axis Value

Key Path	<b>Marker, Fixed</b>
<b>Example</b>	:CALC:MARK:MODE FIX sets Marker 1 to Fixed.
Notes	See the description under the <b>Marker</b> key.
Dependencies	You cannot directly set the X or Y 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.
State Saved	The marker control mode (Normal, Delta, Fixed, Off) and X and Y Axis values are saved in instrument state
Default Unit	depends on the current selected Y axis unit
Initial S/W Revision	Prior to A.02.00

### Fixed Marker Z Axis Value

The Marker Z position determines which of the 301 traces (0-300) the selected marker is on. It cannot be set above the maximum trace in the Spectrogram window and, unlike the Marker X position, will not move off screen in the Spectrogram Window if the storage size is smaller than the number of traces that can be viewed.

If Spectrogram is on, the marker result block has a third line displaying the time value of Marker Z. If the marker is a delta marker, the delta time value is displayed. Although the Z Marker position can be moved to trace 0, this is not recommended, as the current trace value is constantly being updated by new acquisitions and therefore the Z time value for trace 0 is not completely registered until the trace is completed.

Marker Z position is only available in the Spectrogram View

Key Path	<b>Marker, Fixed</b>
<b>Example</b>	:CALC:MARK2:MODE FIX sets Marker 2 to Fixed. :CALC:MARK2:Z:POS 150 puts Marker 2 on Trace 150
Dependencies	Only appears in the Spectrogram view, otherwise blanked
State Saved	The marker control mode (Normal, Delta, Fixed, Off) and X, Y and Z Axis values are saved in instrument state
Initial S/W Revision	A.07.01

## Off

Turns off the selected marker.

In addition, Off 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/Interval Span: 0
- Auto Trace: On

Off does not affect which marker is selected.

Key Path	<b>Marker</b>
<b>Example</b>	:CALC:MARK:MODE OFF sets Marker 1 to Off.
Notes	See the description under the “Marker” key.
State Saved	The marker control mode (Normal, Delta, Fixed, Off) is saved in instrument state
<b>Backwards Compatibility SCPI</b>	:CALCulate:MARKer[1] 2 ... 12:STATe OFF 0 The response to the query will be OFF unless the marker is ON.
Initial S/W Revision	Prior to A.02.00

## Properties

Opens a menu used to set certain properties of the selected marker.

Key Path	<b>Marker</b>
Initial S/W Revision	Prior to A.02.00

## Select Marker

Specifies the selected marker. The term “selected marker” is used throughout this document to specify which marker will be affected by the functions.

Key Path	<b>Marker</b>
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.
Initial S/W Revision	Prior to A.02.00

### Relative To

Selects the marker that the selected marker will be relative to (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.

Key Path	<b>Marker, Properties</b>
<b>Remote Command</b>	<code>:CALCulate:MARKer[1] 2 ... 12:REference &lt;integer&gt;</code> <code>:CALCulate:MARKer[1] 2 ... 12:REference?</code>
<b>Example</b>	CALC:MARK1:REF 2 sets the marker 1 reference marker to 2 and turns marker 1 on as a delta marker.
Notes	A marker cannot be relative to itself so that choice is grayed out. If the grayed out key is pressed, an advisory message is generated.
Notes	This command causes the marker specified with the subopcode to become selected. Range (for SCPI command): 1 to 12. If the range is exceeded the value is clipped.
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 <b>Fixed</b> 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 <b>Restore Mode Defaults</b> . This is not reset by <b>Marker Off, All Markers Off, or Preset</b> .
State Saved	Saved in instrument state. Not affected by Marker Off and hence not affected by Preset or power cycle.
Min	1
Max	12
Status Bits/OPC dependencies	none Default (selected when <b>Restore Mode Defaults</b> is pressed): next higher numbered marker or 1 if marker 12.
Initial S/W Revision	Prior to A.02.00

### Select Marker

Specifies the selected marker. The term “selected marker” is used throughout this document to specify which marker will be affected by the functions.

Key Path	<b>Marker</b>
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.
Initial S/W Revision	Prior to A.02.00

### X Axis Scale

Accesses a menu that enables you to affect 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 788.

Key Path	<b>Marker, Properties</b>
<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 12:X:READout FREQuency   TIME   ITIME   PERiod  :CALCulate:MARKer[1] 2 ... 12:X:READout?  :CALCulate:MARKer[1] 2 ... 12:X:READout:AUTO ON OFF 1 0  :CALCulate:MARKer[1] 2 ... 12:X:READout:AUTO?
<b>Example</b>	CALC:MARK3:X:READ TIME sets the marker 3 X Axis Scale to Time.
Notes	This command causes the specified marker to become selected.
Preset	AUTO  Marker Preset (selected when a marker is turned <b>Off</b> ): <b>Auto</b> (see below). In most measurements the Auto settings results in Frequency being the preset readout.
State Saved	Saved in instrument state
Backwards Compatibility Notes	The X Axis Scale of a marker ( <b>Readout</b> in legacy analyzers) now has only one value, not one value for frequency domain and another value for time domain. The value changes (if in Auto) when the domain of the trace it is on changes. This means that the default behaviors are identical, but if the user changes the readout manually in swept and expects the default to remain in zero span, there may be some backwards compatibility problems. As an example, in the old instruments, if the user set Readout to Period in a swept span, and the instrument was set to zero span, the readout changed to Time, the default for Zero Span. Now, it will stay in Period even in Zero Span until the user changes it or sets it back to Auto.  Additionally, all choices for X Axis Scale are now always allowed. In legacy analyzers the choices of X Axis Scale were restricted based on the domain the instrument was currently in. Since the new behavior is less restrictive this should not show up as a backwards compatibility issue.
Initial S/W Revision	Prior to A.02.00

### More Information

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.

### Auto

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.

Key Path	<b>Marker, Properties, X Axis Scale</b>
<b>Example</b>	CALC:MARK2:X:READ:AUTO ON sets the marker 2 X-axis scaling to automatically select the most appropriate units.
Initial S/W Revision	Prior to A.02.00

### Frequency

Sets the marker X Axis scale to Frequency, displaying the absolute frequency of a normal marker or the frequency of the delta marker relative to the reference marker. Frequency is the auto setting for frequency domain traces.

If Frequency is selected for a time domain trace, all of the 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.

Key Path	<b>Marker, Properties, X Axis Scale</b>
<b>Example</b>	CALC:MARK2:X:READ:FREQ sets the marker 2 X Axis scale to Frequency.
Notes	1-of-N readback is <b>Frequency</b>
State Saved	The X Axis Scale setting is saved in instrument state.
Initial S/W Revision	Prior to A.02.00

### Period

Sets the marker X Axis scale to Period, displaying 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 will be the reciprocal of 0,

which is infinitely large. The display will show “---” and a SCPI query will return infinity.

If Period is selected for a time domain trace, all of the 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.

Key Path	<b>Marker, Properties, X Axis Scale</b>
<b>Example</b>	CALC:MARK2:X:READ PER sets the marker 2 X Axis scale to Period.
Notes	1-of-N readback is <b>Period</b>
State Saved	The X Axis Scale setting is saved in instrument state.
Initial S/W Revision	Prior to A.02.00

### Time

Sets the marker X Axis scale to Time, displaying 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.

Key Path	<b>Marker, Properties, X Axis Scale</b>
<b>Example</b>	CALC:MARK2:X:READ TIME sets the marker 2 X Axis Scale to Time..
Notes	1-of-N readback is <b>Time</b>
Couplings	Frequency domain traces taken in FFT mode have no valid time data. Therefore when 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.
State Saved	The X Axis Scale setting is saved in instrument state
Initial S/W Revision	Prior to A.02.00

### Inverse Time

Sets the marker X Axis scale to Inverse Time, displaying 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 will show “---” and a SCPI query will return infinity.

Key Path	<b>Marker, Properties, X Axis Scale</b>
<b>Example</b>	:CALC:MARK2:X:READ ITIM sets the marker 2 X Axis scale to Inverse Time.
Notes	1-of-N readback is <b>Inverse Time</b>
Couplings	Frequency domain traces taken in FFT mode have no valid time data. Therefore when Inverse Time is selected for markers on such traces, the X Axis value is undefined, shows as “---” and returns not a number to a query.
State Saved	The X Axis Scale setting is saved in instrument state
Initial S/W Revision	Prior to A.02.00

### Marker Trace

Selects the trace that you want your marker to be placed on. 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.

Key Path	<b>Marker, Properties</b>
<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 12:TRACe 1   2   3   4   5   6   7   8   9   10   11   12 :CALCulate:MARKer[1] 2 ... 12:TRACe?
<b>Example</b>	CALC:MARK1:TRAC 2 Places marker 1 on trace 2.
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 key instead of a trace number.
Couplings	Traces 1–6 are Spectrum traces and Traces 7–12 are PvT traces. Thus, selecting Marker Trace 7 is equivalent to selecting Trace 1 of the PvT trace. The state of Marker Trace is not affected by the Auto Couple key. If a Marker Trace is chosen manually, Auto Init goes to Off for that marker. Sending the remote command causes the addressed marker to become selected.
Preset	Presets on 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
Readback line	[TraceN, Auto Init] or [TraceN, Manual] where N is the trace number to which the marker is currently assigned.
Initial S/W Revision	A.13.00

### Marker Trace

Selects the trace that you want your marker to be placed on. 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.

See ["Auto Init On" on page 792](#).

See ["Auto Init Rules Flowchart" on page 792](#).

See ["Auto Init OFF" on page 793](#).

Key Path	<b>Marker, Properties</b>
<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 12:TRACe 1 2 3 4 5 6 :CALCulate:MARKer[1] 2 ... 12:TRACe?

<b>Example</b>	CALC:MARK1:TRAC 2 places marker 1 on trace 2.
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 key instead of a trace number.
Couplings	The state of Marker Trace is not affected by the Auto Couple key. If a Marker Trace is chosen manually, Auto Init goes to Off for that marker. Sending the remote command causes the addressed marker to become selected.
Preset	Presets on Preset or All Markers Off
State Saved	The Marker Trace and state of <b>Auto Init</b> for each marker is saved in instrument state.
Min	1
Max	6
Readback line	[TraceN, Auto Init] or [TraceN, Manual] where N is the trace number to which the marker is currently assigned.
Initial S/W Revision	Prior to A.02.00

### Auto Init On

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

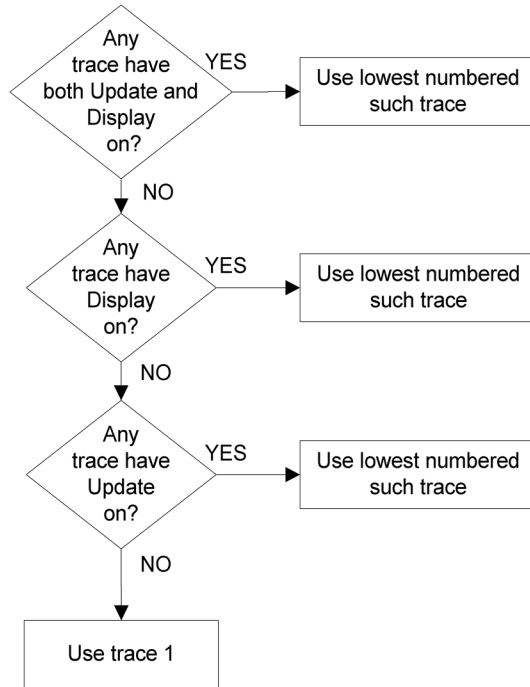
When the marker moves between traces the marker's X position in trace points is retained as it moves. For moving between active traces this generally means the x-axis value of the marker will not change. But for moving to or from an inactive trace, the x-axis value will take on that of the new trace 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!

Marker Trace is set to 1, and Auto Init is set to On, on a Preset or All Markers Off.

### 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.

### Auto Init OFF

This command associates the marker with the specified trace and turns Marker Trace, Auto Init 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.

The query returns the number of the trace on which the marker is currently placed, even if that marker is in Auto mode.

<b>Remote Command</b>	:CALCulate:MARKer[1]   2   ...   12:TRACe:AUTO OFF   ON   0   1 :CALCulate:MARKer[1]   2   ...   12:TRACe:AUTO?
Notes	Turning Marker Trace Auto Init off has no effect on the trace on which the marker is currently placed. The response to the query will be 0 if OFF, 1 if ON.
Couplings	The state of Auto Init is not affected by the Auto Couple key. 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. Sending the remote command causes the addressed marker to become selected.
Preset	ON
Backwards	The Marker Trace Auto function in legacy analyzers has been replaced by Marker Trace Auto Init,

Compatibility Notes	but the same SCPI command is used for the new function. This should work fine for most legacy users. See the sections on <a href="#">"Auto Init On" on page 792</a> , <a href="#">"Auto Init OFF" on page 793</a> and the <a href="#">"Auto Init Rules Flowchart" on page 792</a> for details.  The new auto functionality causes markers to automatically go to the appropriate trace when the marker is first turned on. Users who counted on markers changing traces when a trace was put in or out of View will have to modify their code.
Initial S/W Revision	Prior to A.02.00

## 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 off screen 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.

Key Path	<b>Marker, Properties</b>
<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 12:LINEs[:STATe] OFF ON 0 1 :CALCulate:MARKer[1] 2 ... 12:LINEs[:STATe]?
<b>Example</b>	:CALC:MARK2:LIN:ON turns Lines on for marker 2.
Couplings	Sending the remote command causes the addressed marker to become selected.
Preset	OFF
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00

## 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 the Marker Table on turns the Peak Table off and vice versa.

Key Path	<b>Marker</b>
<b>Remote Command</b>	:CALCulate:MARKer:TABLE[:STATe] OFF ON 0 1 :CALCulate:MARKer:TABLE[:STATe]?
<b>Example</b>	CALC:MARK:TABL ON turns on the marker table.
Preset	OFF
State Saved	The on/off state of the Marker Table is saved in instrument state
Initial S/W Revision	Prior to A.02.00

## 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.

Key Path	Marker
<b>Remote Command</b>	:CALCulate:MARKer:COUple[:STATe] OFF ON 0 1 :CALCulate:MARKer:COUple[:STATe]?
<b>Example</b>	:CALC:MARK:COUP ON sets Couple Markers on.
Preset	Off, presets on Mode Preset and All Markers Off
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00

## All Markers Off

Turns off all markers. See Marker, "Off" on page 786.

Key Path	Marker
<b>Remote Command</b>	:CALCulate:MARKer:AOFF
<b>Example</b>	CALC:MARK:AOFF turns off all markers.
Couplings	Sets the selected marker to 1.
Preset	n/a.
Initial S/W Revision	Prior to A.02.00

## Marker To

The Marker -> key accesses menu keys that can 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**.

Key Path	<b>Front-panel key</b>
Notes	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.  Consistent with other remote marker commands, sending a Marker To remote command will never change which marker is selected.
Initial S/W Revision	Prior to A.02.00

### 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 key is pressed, it will be turned on at the center of the screen as a normal type marker, and its amplitude applied to the reference level.

Key Path	<b>Marker -&gt;</b>
<b>Remote Command</b>	<b>:CALCulate:MARKer[1] 2 ... 12[:SET]:RLEVel</b>
<b>Example</b>	CALC:MARK2:RLEV sets the reference level of the analyzer to the amplitude of marker 2.
Notes	Sending this command selects the subopcoded marker  If specified marker is off, this command will turn it on at the center of the screen as a normal type marker.
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 the user 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.
Initial S/W Revision	Prior to A.02.00



## Marker Function

The Marker Function key opens up a menu of softkeys that allow you to control the Marker Functions of the instrument. Marker Functions perform post-processing operations on marker data. 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, marker 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 797](#).

See ["Fixed marker functions" on page 798](#).

See ["Interval Markers" on page 798](#).

Key Path	Front-panel key
Remote Command	:CALCulate:MARKer[1] 2 ... 12:FUNCTION NOISE   BPOWER   BDENSITY   OFF :CALCulate:MARKer[1] 2 ... 12:FUNCTION?
Notes	Sending this command selects the subopcoded marker The marker function result is queried in the same way as the Marker Result, as outlined in the Marker section, with the CALC:MARK:Y? command.
Dependencies	Fixed markers: It is not possible to change the Band Function for a Fixed marker; so all of the Band Function keys 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.
Preset	OFF
State Saved	The band function for each marker is saved in instrument state
Backwards Compatibility Notes	The introduction of adjustable-width Band Functions in the X-Series fundamentally changes the way Band Power markers are controlled. See the section entitled <a href="#">"Band Function Backwards Compatibility" on page 798</a> below for a complete discussion of programming Band Functions in a backwards compatible fashion.
Initial S/W Revision	Prior to A.02.00

### More Information

The units to be used for displaying Marker Function results in Delta mode vary depending on what is the reference marker and what it is referenced to.

Marker Functions are different from Measurements, which automatically perform complex sequences of setup, data acquisition, and display operations in order to measure specified signal characteristics. Marker Functions are specified for each individual marker and may be turned on individually for each marker.

The **Marker Fctn** menu controls which marker functions are turned on and allows you to adjust setup parameters for each function. The Marker Functions are **Marker Noise**, **Band/Interval Power**, and **Band/Interval Density**, only one of which can be on for a given marker.

If the selected marker is off, pressing Marker Fctn 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 will be 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.

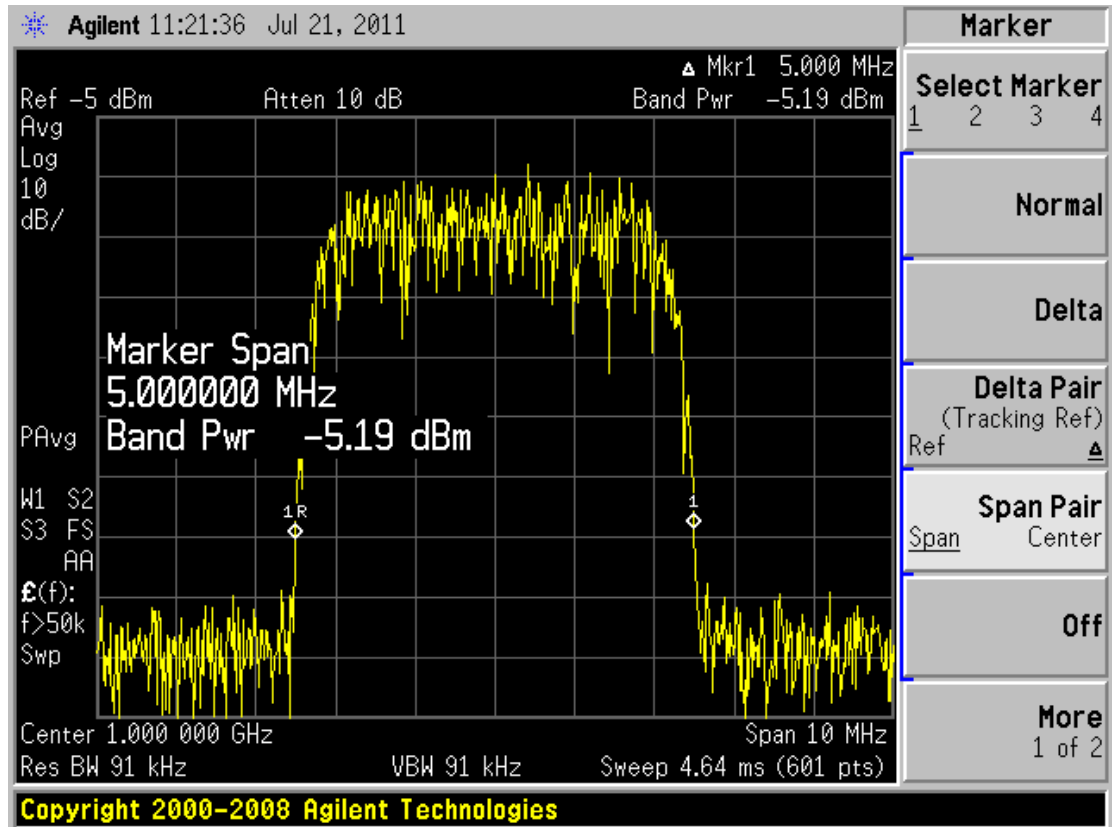
## Interval Markers

What is an interval marker? The band power marker computes the total power within a span in a nonzero span. The results computation must include the RBW. 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  $B_n$ .  $B_n$  is the noise bandwidth of the RBW filter, as noted and used within the Band Power computation.

## Band Function Backwards Compatibility

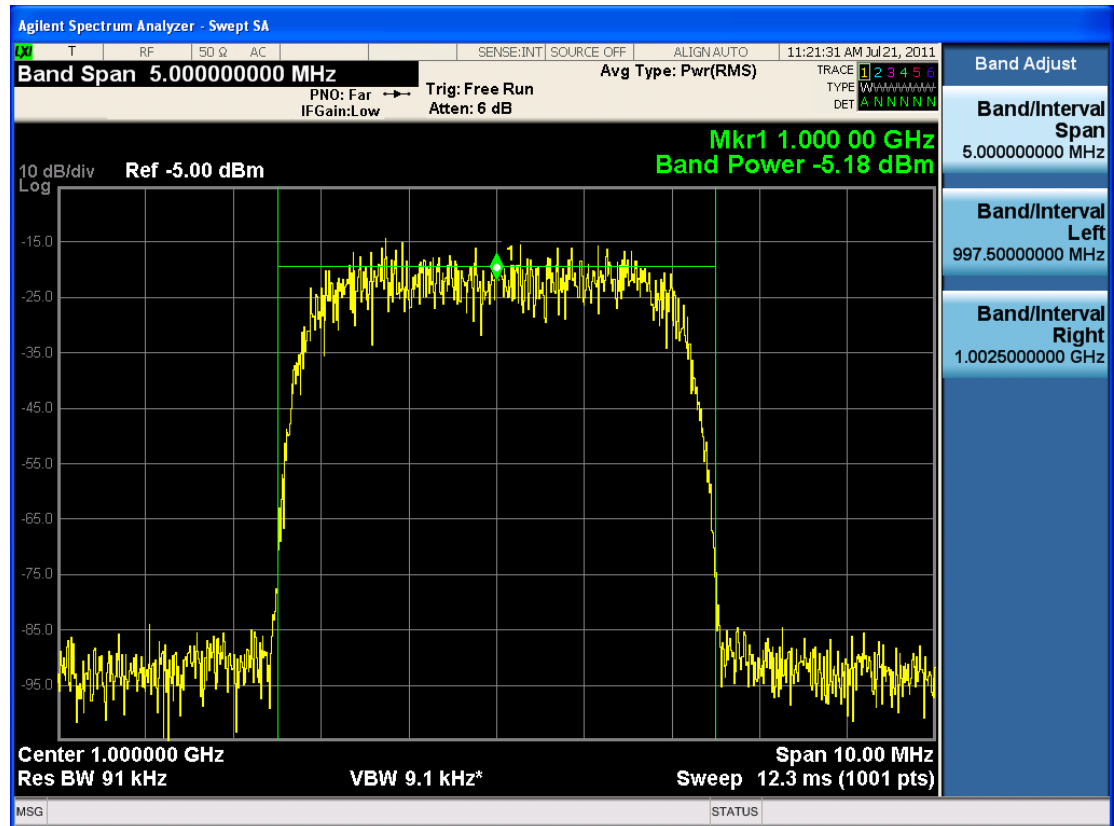
To define the Band Power function, the ESA and PSA analyzers used Delta Marker functionality with two markers, for example, Marker 1 and its Reference Marker, as shown below:



e

The marker modes known as Span Pair and Delta Pair (Band Pair in ESA) were used to set two markers for the primary purpose of defining the band of a Band Power function. The two markers were set by adjusting their span and centerpoint (Span Pair mode) or by adjusting their locations independently to directly define the Start and Stop edges of the band (Band Pair/Delta Pair modes).

In the X-Series, the introduction of adjustable-width Band Functions fundamentally changes the way Band Power markers are controlled, by using a single marker to completely define the function, as shown below:



In the X-Series the marker itself has a width attribute, which you set using the Band Span function. The marker shows “wings” that define the edges of the band in which the Band Power is being measured. You only need one marker, not a pair of markers, to completely define a Band Power function (making it possible to do Delta Band Power, which PSA and ESA could not do).

Additional control functions of Band Left and Band Right are provided for the case when you need to precisely set the band edges. Note that the marker itself always remains centered in the band.

To map the old Span Pair and Band Pair/Delta Pair functions to the X-Series for code compatibility, aliases and compatibility commands were added. Since Span Pair and Band Pair/Delta Pair were primarily used for making band power measurements, the aliases are provided for setting the parameters of a Band Function. If the user was using the old commands for anything other than Band Power these aliases will likely not yield compatible results.

For example, some users took advantage of the fact that the Band Pair commands let you arbitrarily set the frequency (time) of a delta marker and its non-fixed reference marker. In these cases, which had nothing to do with band Power, the new commands will not be compatible. For these use cases the user must use two markers and position each using the CALC:MARK:X commands, since “marker pairs” do not exist anymore.

Note that all of the alias commands described below cause the specified marker to become selected.

### Marker Mode compatibility

To setup Band Power measurements in the ESA and PSA, you had to send the :CALCulate:MARKer[1]2|3|4:MODE POSition|DELTA|BAND|SPAN|OFF

command with either the BAND or SPAN parameter, in order to turn on the marker control modes that let you use a pair of delta markers as Band Power markers. In the X-Series this is no longer necessary, as there are no special marker modes for Band power. So when this command is sent with either a BAND or SPAN parameter it is aliased to simply turn on Normal markers. Thus:

Old command	Aliased to
:CALCulate:MARKer[1]2 3 4:MODE:BAND	:CALCulate:MARKer[1]2 3 4:MODE:POSition
:CALCulate:MARKer[1]2 3 4:MODE:SPAN	:CALCulate:MARKer[1]2 3 4:MODE:POSition

### Span Pair Compatibility

In the past, the Span Pair function was used with a marker pair to set the band for Band Power. The following SCPI commands were used when performing this setup programmatically:

:CALCulate:MARKer[1]2|3|4:X:CENTer <param>

:CALCulate:MARKer[1]2|3|4:X:CENTer?

:CALCulate:MARKer[1]2|3|4:X:SPAN <param>

:CALCulate:MARKer[1]2|3|4:X:SPAN?

These commands are now aliased as follows to preserve the old functionality as much as possible:

Old command	Aliased to
:CALCulate:MARKer[1]2 3 4:X:CENTer	:CALCulate:MARKer[1]2 3 4:X
:CALCulate:MARKer[1]2 3 4:X:SPAN	:CALCulate:MARKer[1]2 3 4:FUNCTion:BAND:SPAN

### Delta Pair/Band Pair functionality

Another way to set the marker pair for Band Power was with the Delta Pair function (Band Pair in ESA). The following SCPI commands were used when performing this setup programmatically:

:CALCulate:MARKer[1]2|3|4:X:STARt <param>

:CALCulate:MARKer[1]2|3|4:X:STARt?

```
:CALCulate:MARKer[1]2[3]4:X:STOP <param>
```

```
:CALCulate:MARKer[1]2[3]4:X:STOP?
```

These commands are now aliased as follows to preserve the old functionality as much as possible:

Old command	Aliased to
:CALCulate:MARKer [1]2[3]4:X:START	:CALCulate:MARKer [1]2[3]4:FUNCTion:BAND:LEFT
:CALCulate:MARKer [1]2[3]4:X:STOP	:CALCulate:MARKer [1]2[3]4:FUNCTion:BAND:RIGHT

### Arbitrary Marker Pair functionality

Another use case was to use the START and STOP commands to arbitrarily set the frequency (time) of a delta marker and its reference marker without being in Band Power mode. This use case is not supported with a backwards compatibility command, but since in the X-Series you can arbitrarily set any marker's value and any reference marker's value, it is easy to fix this problem in code; but the user will have to change their code.

Old command	User must change to
:CALCulate:MARKer1:X:START <param>	:CALCulate:MARKer1:X <param> <param>
:CALCulate:MARKer1:X:STOP <param>	:CALCulate:MARKer2:X <param> <param>

(in the example marker 1 and marker 2 are used; in practice, use the reference marker number for the STOP marker number, which is usually marker number+1)

### Band changes with analyzer settings

In the past, when a marker pair was used to set the width of the band for Band Power, the markers held their screen positions when analyzer frequency settings such as Span changed. The result of this was that as the Span changed, the frequency difference and hence the width of the band changed as well. In the X-Series, as a result of the change from position markers to value markers, the width of the band remains constant as frequency settings of the analyzer change.

### Offscreen Markers

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 by setting Band Span to a high value in order to force Band Power markers to the left and right edges of the screen will have to rewrite their code.

Furthermore, since markers could never be offscreen, Band Power always returned a valid result. In the X-Series, if either edge of the Band is offscreen, Band Power returns not a number as a result.

### Direct Marker Positioning

The following commands were used in ESA and PSA to directly set the marker to a specific trace point (“bucket”) position when they were being used in Span Pair and Delta Pair/Band Pair modes:

- :CALCulate:MARKer[1]2|3|4:X:POSition:CENTer <param>
- :CALCulate:MARKer[1]2|3|4:X:POSition:CENTer?
- :CALCulate:MARKer[1]2|3|4:X:POSition:SPAN <param>
- :CALCulate:MARKer[1]2|3|4:X:POSition:SPAN?
- :CALCulate:MARKer[1]2|3|4:X:POSition:STARt <param>
- :CALCulate:MARKer[1]2|3|4:X:POSition:STARt?
- :CALCulate:MARKer[1]2|3|4:X:POSition:STOP <param>
- :CALCulate:MARKer[1]2|3|4:X:POSition:STOP?

They are aliased very similarly to the non-position commands (above) however a translation to/from trace points (buckets) is also performed:

Old command	Aliased to
:CALCulate:MARKer[1]2 3 4:X:POSition:CENTer	:CALCulate:MARKer[1]2 3 4:X:POSition
:CALCulate:MARKer[1]2 3 4:X:POSition:SPAN	:CALCulate:MARKer[1]2 3 4:FUNC:BAND:SPAN
:CALCulate:MARKer[1]2 3 4:X:POSition:STARt	:CALCulate:MARKer[1]2 3 4:FUNC:BAND:LEFT
:CALCulate:MARKer[1]2 3 4:X:POSition:STOP	:CALCulate:MARKer[1]2 3 4:FUNC:BAND:RIGHT

In each case but the first (:X:POSition:CENTer), the analyzer first converts the specified value in trace points to the current X Axis Scale Units (e.g., frequency or time) of the trace upon which the marker resides. Then, that value is used in the alias command to set the desired value.

The query form of the command returns the marker function span in trace points (buckets) by translating back based on the X Axis Scale settings at the time the query is sent.

**NOTE**

The value in Trace Points is translated into the current X Axis Scale units for the purpose of setting the value of the marker. However, the marker's span value, LEFT value, or RIGHT value in X Axis Scale Units, NOT trace points, will be preserved if a change is made to the X Axis scale settings. For example, if you use this command to set a marker function span of 500 buckets, which happens at that time to correspond to 13 GHz, and then you change the analyzer's Start Frequency so that 500 buckets is no longer 13 GHz, the span will stay at 13 GHz, NOT at 500 buckets! This is important to realize as it differs from the legacy behavior.

The UP/DOWN parameters will increment/decrement by one bucket. For this the analyzer performs a conversion to buckets and back.

### Select Marker

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

Key Path	Marker
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.
Initial S/W Revision	Prior to A.02.00

### Marker Noise

Turns on the Marker Noise function for the selected marker, making it a noise marker. If the selected marker is off, it is turned on in **Normal** mode and located at the center of the screen.

When **Marker Noise** is selected while in the **Marker Function Off** state, the **Band Span** or **Interval Span** is initialized to 5% of the screen width.

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.

See ["More Information" on page 805](#).

See ["Off-trace Markers" on page 805](#).

Key Path	Marker Function
<b>Example</b>	<p>CALC:MARK:FUNC NOIS turns on marker 1 as a noise marker.</p> <p>CALC:MARK:FUNC? returns the current marker function for the marker specified. In this case it returns the string: NOIS.</p> <p>CALC:MARK:Y? returns the y-axis value of the Marker Noise function for marker 1 (if Marker Noise is ON for marker 1). Note that the delta value when the Y axis unit is Watt is the square of the delta value when the Y axis unit is Volt. For example, when the percent ratio with Y axis unit in Volt is 0.2, the percent ratio with Y axis unit in Watt will be <math>0.2^2 = 0.04</math>. When you read the value out remotely you have to know whether your Y Axis Unit is log (dB), linear (V or A), or power</p>



	(W).
Notes	See the description under the <a href="#">"Marker Function" on page 797</a> key.
Dependencies	Fixed markers: It is not possible to change the Band Function for a Fixed marker; so all of the Band Function keys are grayed out for a Fixed marker.
Couplings	Average detector and Power Averaging auto selected when Marker Noise on If the selected (specified) marker is off, selecting Marker Noise via front panel or SCPI will turn the marker on.
Initial S/W Revision	Prior to A.02.00

### More Information

To guarantee accurate data for noise-like signals, a correction for equivalent noise bandwidth is made by the analyzer. 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.

### Off-trace Markers

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 trace, then it uses only that subset of the Band Width that is on-trace. If the marker itself is off-trace, its value becomes undefined.

Neither band/interval power nor band/interval density markers are defined if any part of the band is off-trace (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 analyzer or in the controlling computer, the result will still be considered valid.

### Band/Interval Power

Turns on the Band/Interval Power function for the selected marker. If the selected marker is off it is turned on in **Normal** marker and located at the center of the screen.

When **Band/Interval Power** is selected while in the **Marker Function Off** state, the **Band Span** or **Interval Span** is initialized to 5% of the screen width.

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 will usually cause measurement inaccuracy.

Key Path	<b>Marker Function</b>
<b>Example</b>	CALC:MARK:FUNC BPOW turns on marker 1 as a band power marker. CALC:MARK2:FUNC? returns the current setting of marker function for marker 2. In this case it

	<p>returns the string: BPOW.</p> <p>CALC:MARK:Y? returns the y-axis value of the Band Power function for marker 1. Note that the delta value when the Y axis unit is Watt is the square of the delta value when the Y axis unit is Volt. For example, when the percent ratio with Y axis unit in Volt is 0.2, the percent ratio with Y axis unit in Watt will be <math>0.22 = 0.04</math>. When you read the value out remotely you have to know whether your Y Axis Unit is log (dB), linear (V or A), or power (W).</p>
Notes	See the description under the " <a href="#">"Marker Function" on page 797</a> " key, above.
Dependencies	Fixed markers: It is not possible to change the Band Function for a Fixed marker, so all of the Band Function keys are grayed out for a Fixed marker.
Couplings	<p>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.</p> <p>If the selected (specified) marker is off, selecting Band Power via the front panel or SCPI will turn the marker on.</p>
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## Band/Interval Density

Turns on the Band/Interval Density function for the selected marker. If the selected marker is off it is turned on in **Normal** marker mode and located at the center of the screen.

When **Band/Interval Density** is selected while in the **Marker Function Off** state, the **Band Span** or **Interval Span** is initialized to 5% of the screen width.

See "[More Information](#)" on page 807.

See "[What is band/interval density?](#)" on page 807

Key Path	Marker Function
<b>Example</b>	<p>CALC:MARK:FUNC BDEN turns on marker 1 as a band density marker.</p> <p>CALC:MARK:FUNC? returns the current setting of band function for the marker specified. In this case it returns the string: BDEN.</p> <p>CALC:MARK:Y? returns the y-axis value of the Band Density function for marker 1. Note that the delta value when the Y axis unit is Watt is the square of the delta value when the Y axis unit is Volt. For example, when the percent ratio with Y axis unit in Volt is 0.2, the percent ratio with Y axis unit in Watt will be <math>0.22 = 0.04</math>. When you read the value out remotely you have to know whether your Y Axis Unit is log (dB), linear (V or A), or power (W).</p>
Notes	<p>The zero-width case is treated as one bucket wide although it shows a width of 0.</p> <p>When the trace the marker is on crosses domains, the width crosses domains as well, to remain the same percentage of the trace.</p>
Notes	See the description under the " <a href="#">"Marker Function" on page 797</a> " key.
Dependencies	Fixed markers: It is not possible to change the Band Function for a Fixed marker, so all of the Band Function keys are grayed out for a Fixed marker.
Couplings	<p>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.</p> <p>If the selected (specified) marker is off, selecting Band Density via front panel or SCPI will turn</p>

	the marker on.
State Saved	n/a.
Initial S/W Revision	Prior to A.02.00

### More Information

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 markers assume that the signal to be measured is noise-like. Based on this assumption, we can actually make reasonable measurements under very nonideal 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.

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 will usually cause measurement inaccuracy.

### What is band/interval density?

On frequency domain traces, the average density across a band is the total band power divided by the bandwidth over which it is measured.

On time domain traces, interval density is the average power in the interval divided by the noise bandwidth of the RBW of the trace.

### Marker Function Off

Turns off band functions for the selected marker.

Key Path	<b>Marker Function</b>
<b>Example</b>	:CALC:MARK:FUNC OFF turns off marker functions for marker 1
Notes	See the description under the " <a href="#">Marker</a> " on page 778 key, above.
Dependencies	Fixed markers: It is not possible to change the Band Function for a Fixed marker, so all of the Band Function keys are grayed out for a Fixed marker, including Off
Couplings	Turning off the marker function has no effect on the band span nor does it turn the marker off.
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### Band Adjust

Opens a menu that lets you set the width or left or right edges of the band.

It is legal to change the width of the band even if there is no marker function on. Generally this can only happen by sending the SCPI command since access to the menu is restricted if no marker function is on.

Key Path	<b>Marker Function</b>
Dependencies	If the marker is Fixed, Band Adjust is grayed out.

	If the marker function is Off, Band Adjust is grayed out.
Couplings	If any of the Band Adjust functions are the active function, the wings and arms of the selected marker display in green; otherwise they display in white.
Backwards Compatibility Notes	If any of the band adjust SCPI commands (including the legacy compatibility commands documented under " <a href="#">Band Function Backwards Compatibility</a> " on page 798) are sent while the marker function is off, they will be accepted and the value stored. If sent while the marker is off, they will be accepted and ignored.
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## Band/Interval Span

Sets the width of the span for the selected marker.

It is legal to change the width of the band even if there is no marker function on. Generally this can only happen by sending the SCPI command since access to the menu is restricted if no marker function is on.

In the table below,  $\text{sweep\_width} = \max(1, \text{sweep\_points} - 1)$  and  $\text{sweep\_points}$  is the number of sweep points, set in the **Sweep** menu.

Key Path	<b>Marker Function, Band Adjust</b>
<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 12:FUNCtion:BAND:SPAN <freq> :CALCulate:MARKer[1] 2 ... 12:FUNCtion:BAND:SPAN?
<b>Example</b>	:CALC:MARK12:FUNC:BAND:SPAN 20 MHz sets the band span of marker 12 to 20 MHz :CALC:MARK:FUNC:BAND:SPAN? queries the band span of Marker 1
Notes	Units are those of the trace's domain, Hz for frequency domain, s for time domain.
Notes	Sending this command selects the subcoded 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/Interval Span necessarily changes the Band/Interval Left and Band/Interval Right values Band/Interval Span is set to 0 when the marker is turned off Band/Interval 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, set to 5% of span, when a marker function is turned on
State Saved	Saved in instrument state
Min	0 Hz
Max	Infinity. Unlike legacy analyzers, where the markers were forced to be on screen, X-Series marker values are not limited and do not clip

<b>Backwards Compatibility SCPI</b>	:CALCulate:MARKer[1] 2 ... 4:X:SPAN See " <a href="#">Band Function Backwards Compatibility</a> " on page 798
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<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 4:X:POSition:SPAN <param> :CALCulate:MARKer[1] 2 ... 4:X:POSition:SPAN?
Preset	50
Backwards Compatibility Notes	The old command, :CALCulate:MARKer[n]:X:POSition:SPAN <param> was used to set the span between a delta marker and its reference marker in trace points (buckets) in Span Pair mode. There is no new command for setting the span of a Band Function in trace points. So, when this command is received, the analyzer first converts the specified span in trace points to the current X Axis Scale Units (e.g., frequency or time) of the trace upon which the marker resides. Then, that value is sent to the :CALC:MARKer[n]:FUNCtion:BAND:SPAN <param> command to set the span of the marker's Band Function. The query form of the command will return the marker function span in trace points (buckets) by translating back based on the X Axis Scale settings at the time the query is sent. ! See " <a href="#">Band Function Backwards Compatibility</a> " on page 798 for more information
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### Band/Interval Left

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

It is legal to change the width of the band even if there is no marker function on. Generally this can only happen by sending the SCPI command since access to the menu is restricted if no marker function is on.

In the table below,  $\text{sweep\_width} = \max(1, \text{sweep\_points} - 1)$  and  $\text{sweep\_points}$  is the number of sweep points, set in the **Sweep** menu.

Key Path	<b>Marker Function, Band Adjust</b>
<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 12:FUNcTion:BAND:LEFT <freq> :CALCulate:MARKer[1] 2 ... 12:FUNcTion:BAND:LEFT?
<b>Example</b>	:CALC:MARK12:FUNC:BAND:LEFT 20 GHz sets the left edge of the band span of marker 12 to 20 GHz :CALC:MARK:FUNC:BAND:LEFT? queries the band span of Marker 1
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.
Notes	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

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	<p>domain will be used (Hz for freq domain traces, s for time domain traces).</p> <p>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.</p>
Couplings	<p>Changing the Band/Interval Left necessarily changes the Band/Interval Span and Band/Interval Center values.</p> <p>Band/Interval Span is set to 0 when the marker is turned off so that means Band/Interval Left is set to the center value at this time.</p> <p>Band/Interval Span is set to 5% of span when any marker function is turned on if and only if it is zero at that time.</p>
Preset	If 0, Band/Interval Span is set to 5% of span, when a marker function is turned on, which affects Band/Interval Left.
State Saved	Saved in instrument state
Min	0 Hz
Max	Infinity. Unlike legacy analyzers, where the markers were forced to be on screen, X-Series marker values are not limited and do not clip
<b>Backwards Compatibility SCPI</b>	<p><b>:CALCulate:MARKer[1] 2 ... 4:X:START</b></p> <p>See <a href="#">"Band Function Backwards Compatibility" on page 798</a></p>
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<b>Remote Command</b>	<p><b>:CALCulate:MARKer[1] 2 ... 4:X:POSITION:START &lt;integer&gt;</b></p> <p><b>:CALCulate:MARKer[1] 2 ... 4:X:POSITION:START?</b></p>
Preset	0
<b>Backwards Compatibility SCPI</b>	<p>The legacy command,</p> <p><b>:CALCulate:MARKer[n]:X:POSITION:START &lt;param&gt;</b></p> <p>was used to control the Reference marker in trace points (buckets) in Band Pair/Delta Pair mode. There is no new command for setting the start of a Band Function in trace points. So, when this command is received, the analyzer first converts the specified span in trace points to the current X Axis Scale Units (e.g., frequency or time) of the trace upon which the marker resides.</p> <p><b>:CALC:MARKer[n]:FUNCTION:BAND:LEFT &lt;param&gt;</b></p> <p>command to set the start of the marker's Band Function.</p> <p>The query form of the command will return the marker function LEFT value in trace points (buckets) by translating back based on the current X Axis Scale settings at the time the query is sent.</p> <p>See <a href="#">"Band Function Backwards Compatibility" on page 798</a> for more information</p>
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## Band/Interval Right

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

In the table below,  $\text{sweep\_width} = \max(1, \text{sweep\_points} - 1)$  and  $\text{sweep\_points}$  is the number of sweep points, set in the **Sweep** menu.

It is legal to change the width of the band even if there is no marker function on. Generally this can only happen by sending the SCPI command since access to the menu is restricted if no marker function is on.

Key Path	<b>Marker Function, Band Adjust</b>
<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 12:FUNCtion:BAND:RIGHT <freq> :CALCulate:MARKer[1] 2 ... 12:FUNCtion:BAND:RIGHT?
<b>Example</b>	:CALC:MARK12:FUNC:BAND:RIGHT 20 GHz sets the right edge of the band span of marker 12 to 20 GHz :CALC:MARK:FUNC:BAND:RIGHT? queries the band span of Marker 1
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.
Notes	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/Interval Right necessarily changes the Band/Interval Span and Band/Interval Center values Band/Interval 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/Interval Span is set to 5% of span, when a marker function is turned on, which affects Band/Interval Right
State Saved	Saved in instrument state
Min	0 Hz
Max	Infinity. Unlike legacy analyzers, where the markers were forced to be on screen, X-Series marker values are not limited and do not clip
<b>Backwards Compatibility SCPI</b>	:CALCulate:MARKer[1] 2 ... 4:X:STOP See " <a href="#">Band Function Backwards Compatibility</a> " on page 798
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<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 4:X:POSition:STOP <integer> :CALCulate:MARKer[1] 2 ... 4:X:POSition:STOP?
Preset	1000, the actual value is dependent on the selected number of sweep points.
<b>Backwards Compatibility SCPI</b>	The legacy command, :CALCulate:MARKer[n]:X:POSition:STOP <param>

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was used to control the Delta marker in trace points (buckets) in Band Pair/Delta Pair mode. There is no new command for setting the stop of a Band Function in trace points. So, when this command is received, the analyzer first converts the specified span in trace points to the current X Axis Scale Units (e.g., frequency or time) of the trace upon which the marker resides. Then, that value is sent to the

**:CALC:MARKer[n]:FUNction:BAND:RIGHT <param>**

command to set the stop of the marker's Band Function.

The query form of the command will return the marker function RIGHT value in trace points (buckets) by translating back based on the current X Axis Scale settings at the time the query is sent.

See "[Band Function Backwards Compatibility](#)" on page 798 for more information

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## Meas

The information in this section is common to all measurements. For key and remote command information for a specific measurement, refer to the section that describes the measurement of interest.

Measurements available under the Meas key are specific to the current Mode.

When viewing Help for measurements, note the following:

**NOTE**

**Operation for some keys differs between measurements. The information displayed in Help pertains to the current measurement. To see how a key operates in a different measurement, exit Help (press the Cancel Esc key), select the measurement, then reenter Help (press the Help key) and press that key.**

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Key Path	Front-panel key
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## Remote Measurement Functions

This section contains the following topics:

["Measurement Group of Commands" on page 814](#)

["Current Measurement Query \(Remote Command Only\)" on page 817](#)

["Limit Test Current Results \(Remote Command Only\)" on page 817](#)

["Data Query \(Remote Command Only\)" on page 817](#)

["Calculate/Compress Trace Data Query \(Remote Command Only\)" on page 817](#)

["Calculate Peaks of Trace Data \(Remote Command Only\)" on page 823](#)

["Hardware-Accelerated Fast Power Measurement \(Remote Command Only\)" on page 824](#)

["Format Data: Numeric Data \(Remote Command Only\)" on page 838](#)

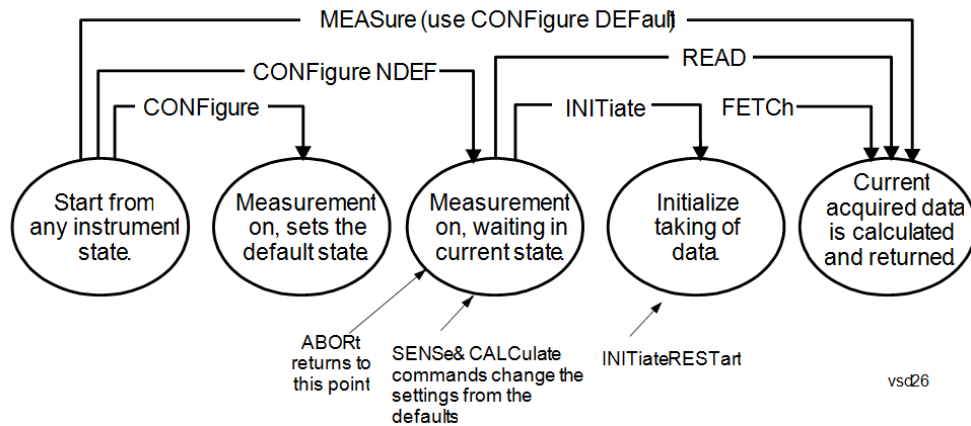
["Format Data: Byte Order \(Remote Command Only\)" on page 839](#)

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## Measurement Group of Commands



## Measure Commands:

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:MEASure:<measurement>[n]?
```

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 use 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 with the CONFigure command. Use the commands in the SENSe:<measurement> and CALCulate:<measurement> subsystems to change the settings. Then you can use the READ? command to initiate the measurement and query the results.

---

If you need to repeatedly make a given measurement with settings other than the factory defaults, you can use the commands in the SENSE:<measurement> and CALCulate:<measurement> subsystems to set up the measurement. Then use the READ? command to initiate the measurement and query results.

Measurement settings persist if you initiate a different measurement and then return to a previous one. Use READ:<measurement>? if you want to use those persistent settings. If you want to go back to the default settings, use MEASure:<measurement>?.

---

Configure Commands:

:CONFigure:<measurement>

This command stops the current measurement (if any) and sets up the instrument for the specified measurement 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.

In the Swept SA measurement in Spectrum Analyzer mode the CONFigure command also turns the averaging function on and sets the number of averages to 10 for all measurements.

:CONFigure: <measurement>: NDEFault stops the current measurement and changes to the specified measurement. It does not change the settings to the defaults. It does not initiate the taking of measurement data unless INIT:CONTinuous is ON.

The CONFigure? query returns the current measurement name.

The CONFigure:CATalog? query returns a quoted string of all licensed measurement names in the current mode. For example, "SAN, CHP, OBW, ACP, PST, TXP, SPUR, SEM, LIST".

---

Fetch Commands:

:FETCh:<measurement>[n]?

This 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 several types of data (different [n] values, for example, both scalars and trace data) from a single measurement. FETCh saves you the time of re-making the measurement. 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 an INITiate followed by a FETCh.

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. 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)

FETCh may be used to return results other than those specified with the original READ or MEASure command that you sent.

---

INITiate Commands:

:INITiate:<measurement>

This command is not available for measurements in all the instrument modes:

- 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

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measurement other than the current one is specified, the instrument will switch to that measurement and then initiate it.

- For example, suppose you have previously initiated the ACP measurement, but now 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.
- Does not change any of the measurement settings. For example, if you have previously started 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 your selected measurement is currently active (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. It also holds off additional commands on GPIB until the acquisition is complete.

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READ Commands:

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:READ:<measurement>[n]?

- Does not preset the measurement to the factory default settings. For example, if you have previously initiated the ACP measurement and you send READ:ACP? it will initiate a new measurement using the same instrument settings.
  - Initiates the measurement and puts valid data into the output buffer. If a measurement other than the current one is specified, the instrument will switch to that measurement before it initiates the measurement and returns results.
  - For example, suppose you have previously initiated the ACP measurement, but now you are running the channel power measurement. Then 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.
  - Blocks other SCPI communication, waiting until the measurement is complete before returning the results
  - If the optional [n] value is not included, or is set to 1, the scalar measurement results will be returned. 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. The binary data formats should be used when handling large blocks of data since they are smaller and faster than the ASCII format. (FORMat:DATA)
-

### Current Measurement Query (Remote Command Only)

This command returns the name of the measurement that is currently running.

<b>Remote Command</b>	:CONFigure?
<b>Example</b>	CONF?
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### Limit Test Current Results (Remote Command Only)

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.

<b>Remote Command</b>	:CALCulate:CLIMits:FAIL?
<b>Example</b>	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.
Initial S/W Revision	Prior to A.02.00

### Data Query (Remote Command Only)

Returns the designated measurement data for the currently selected measurement and subopcode.

n = any valid subopcode for the current measurement. See the measurement command results table for your current measurement, for information about what data is returned for the subopcodes.

This command uses the data setting specified by the FORMat:BORDER and FORMat:DATA commands and can return real or ASCII data. (See the format command descriptions under Input/Output in the Analyzer Setup section.)

<b>Remote Command</b>	:CALCulate:DATA[n]?
Notes	The return trace depends on the measurement. In CALCulate:<meas>:DATA[n], n is any valid subopcode for the current measurement. It returns the same data as the FETCH:<measurement>? query where <measurement> is the current measurement.
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### Calculate/Compress Trace Data Query (Remote Command Only)

Returns compressed data for the currently selected measurement and sub-opcode [n].

n = any valid sub-opcode for that measurement. See the MEASure:<measurement>? command description of your specific measurement for information on the data that can be returned.

The data is returned in the current Y Axis Unit of the analyzer. The command is used with a sub-opcode <n> (default=1) to specify the trace. With trace queries, it is best if the analyzer is not sweeping during the query. Therefore, it is generally advisable to be in Single Sweep, or Update=Off.

This command is used to compress or decimate a long trace to extract and return only the desired data. A typical example would be to acquire N frames of GSM data and return the mean power of the first burst in each frame. The command can also be used to identify the best curve fit for the data.

<b>Remote Command</b>	:CALCulate:DATA<n>:COMPRESS? BLOCK   CFIT   MAXimum   MINimum   MEAN   DMEan   RMS   RMSCubed   SAMPLE   SDEVIation   PPHase [,<soffset> [,<length>[,<roffset>[,<rlimit>]]]]
<b>Example</b>	To query the mean power of a set of GSM bursts: Supply a signal that is a set of GSM bursts. Select the IQ Waveform measurement (in IQ Analyzer Mode). Set the sweep time to acquire at least one burst. Set the triggers such that acquisition happens at a known position relative to a burst. Then query the mean burst levels using, CALC:DATA2:COMP? MEAN, 24e-6, 526e-6 (These parameter values correspond to GSM signals, where 526e-6 is the length of the burst in the slot and you just want 1 burst.)
<b>Notes</b>	The command supports 5 parameters. Note that the last 4 (<soffset>, <length>, <roffset>, <rlimit>) are optional. But these optional parameters must be entered in the specified order. For example, if you want to specify <length>, then you must also specify <soffset>. See details below for a definition of each of these parameters.  This command uses the data in the format specified by FORMat:DATA, returning either binary or ASCII data.
<b>Initial S/W Revision</b>	Prior to A.02.00

- BLOCK or block data - returns all the data points from the region of the trace data that you specify. For example, it could be used to return the data points of an input signal over several timeslots, excluding the portions of the trace data that you do not want. (This is x,y pairs for trace data and I,Q pairs for complex data.)
- CFIT or curve fit - applies curve fitting routines to the data. <soffset> and <length> are required to define the data that you want. <roffset> is an optional parameter for the desired order of the curve equation. The query will return the following values: the x-offset (in seconds) and the curve coefficients ((order + 1) values).

MIN, MAX, MEAN, DME, RMS, RMSC, SAMP, SDEV and PPH return one data value for each specified region (or <length>) of trace data, for as many regions as possible until you run out of trace data (using <roffset> to specify regions). Or they return the number of regions you specify (using <rlimit>) ignoring any data beyond that.

- MINimum - returns the minimum data point (y value) for the specified region (s) of trace data. For I/Q trace data, the minimum magnitude of the I/Q pairs is returned.
- MAXimum - returns the maximum data point (y value) for the specified region(s) of trace data. For I/Q trace data, the maximum magnitude of the I/Q pairs is returned.
- MEAN - returns a single value that is the arithmetic mean of the data point values (in dB/ dBm) for the specified region(s) of trace data. For I/Q trace data, the mean of the magnitudes of the I/Q pairs is returned. See the following equations.

**NOTE**

If the original trace data is in dB, this function returns the arithmetic mean of those log values, not log of the mean power which is a more useful value. The mean of the log is the better measurement technique when measuring CW signals in the presence of noise. The mean of the power, expressed in dB, is useful in power measurements such as Channel Power. To achieve the mean of the power, use the RMS option.

---

Equation 1

Mean Value of Data Points for Specified Region(s)

$$\text{MEAN} = \frac{1}{n} \sum_{X_i \in \text{region}(s)} X_i$$

where  $X_i$  is a data point value, and  $n$  is the number of data points in the specified region(s).

Equation 2

Mean Value of I/Q Data Pairs for Specified Region(s)

$$\text{MEAN} = \frac{1}{n} \sum_{X_i \in \text{region}(s)} |X_i|$$

where  $|X_i|$  is the magnitude of an I/Q pair, and  $n$  is the number of I/Q pairs in the specified region(s).

- DMEan - returns a single value that is the mean power (in dB/ dBm) of the data point values for the specified region(s) of trace data. See the following

equation:

Equation 3

DMEan Value of Data Points for Specified Region(s)

$$\text{DME} = 10 \times \log_{10} \left( \frac{1}{n} \sum_{X_i \in \text{region}(s)} 10^{\frac{X_i}{10}} \right)$$

- RMS - returns a single value that is the average power on a root-mean-squared voltage scale (arithmetic rms) of the data point values for the specified region(s) of trace data. See the following equation.

**NOTE**

For I/Q trace data, the rms of the magnitudes of the I/Q pairs is returned. See the following equation.

This function is very useful for I/Q trace data. However, if the original trace data is in dB, this function returns the rms of the log values which is not usually needed.

Equation 4

RMS Value of Data Points for Specified Region(s)

$$\text{RMS} = \sqrt{\frac{1}{n} \sum_{X_i \in \text{region}(s)} X_i^2}$$

where  $X_i$  is a data point value, and  $n$  is the number of data points in the specified region(s).

Equation 5

RMS Value of I/Q Data Pairs for Specified Region(s)

$$\text{RMS} = \sqrt{\frac{1}{n} \sum_{X_i \in \text{region}(s)} X_i X_i^*}$$

where  $X_i$  is the complex value representation of an I/Q pair,  $X_i^*$  its conjugate complex number, and  $n$  is the number of I/Q pairs in the specified region(s).

Once you have the rms value for a region of trace data (linear or I/Q), you may want to calculate the mean power. You must convert this rms value (peak volts) to power in dBm:

$$10 \times \log[10 \times (\text{rms value})^2]$$



- SAMPLe - returns the first data value (x,y pair) for the specified region(s) of trace data. For I/Q trace data, the first I/Q pair is returned.
- SDEVIation - returns a single value that is the arithmetic standard deviation for the data point values for the specified region(s) of trace data. See the following equation.
- For I/Q trace data, the standard deviation of the magnitudes of the I/Q pairs is returned. See the following equation.

Equation 6

Standard Deviation of Data Point Values for Specified Region(s)

$$SDEV = \sqrt{\frac{1}{n} \sum_{X_i \in \text{region}(s)} (X_i - \bar{X})^2}$$

where  $X_i$  is a data point value,  $\bar{X}$  is the arithmetic mean of the data point values for the specified region(s), and  $n$  is the number of data points in the specified region(s).

$$SDEV = \sqrt{\frac{1}{n} \sum_{X_i \in \text{region}(s)} (|X_i| - \bar{X})^2}$$

where  $|X_i|$  is the magnitude of an I/Q pair,  $\bar{X}$  is the mean of the magnitudes for the specified region(s), and  $n$  is the number of data points in the specified region(s).

- PPHase - returns the x,y pairs of both rms power (dBm) and arithmetic mean phase (radian) for every specified region and frequency offset (Hz). The number of pairs is defined by the specified number of regions. This parameter can be used for I/Q vector (n=0) in Waveform (time domain) measurement and all parameters are specified by data point in PPHase.

The rms power of the specified region may be expressed as:

$$\text{Power} = 10 \times \log [10 \times (\text{RMS I/Q value})] + 10.$$

The RMS I/Q value (peak volts) is:

$$\sqrt{\frac{1}{n} \sum_{X_i \in \text{region}} X_i X_i^*}$$

where  $X_i$  is the complex value representation of an I/Q pair,  $X_i^*$  its conjugate complex number, and  $n$  is the number of I/Q pairs in the specified region.

The arithmetic mean phase of the specified region may be expressed as:

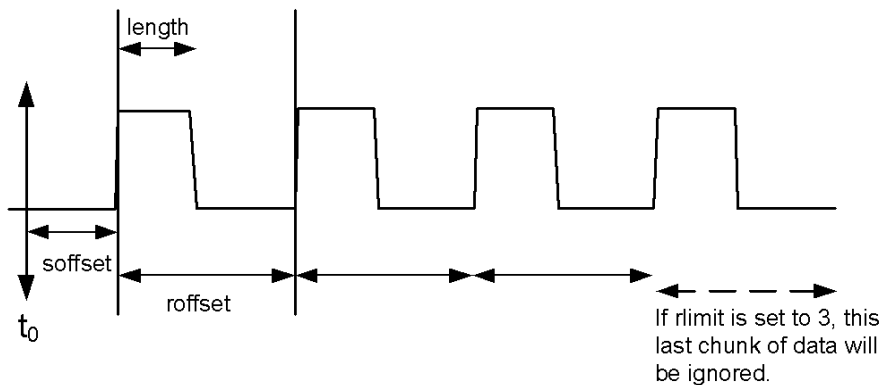
$$\frac{1}{n} \sum_{Y_i \in \text{region}} Y_i$$

where  $Y_i$  is the unwrapped phase of I/Q pair with applying frequency correction and  $n$  is the number of I/Q pairs in the specified region.

The frequency correction is made by the frequency offset calculated by the arithmetic mean of every specified region's frequency offset. Each frequency offset is calculated by the least square method against the unwrapped phase of I/Q pair.

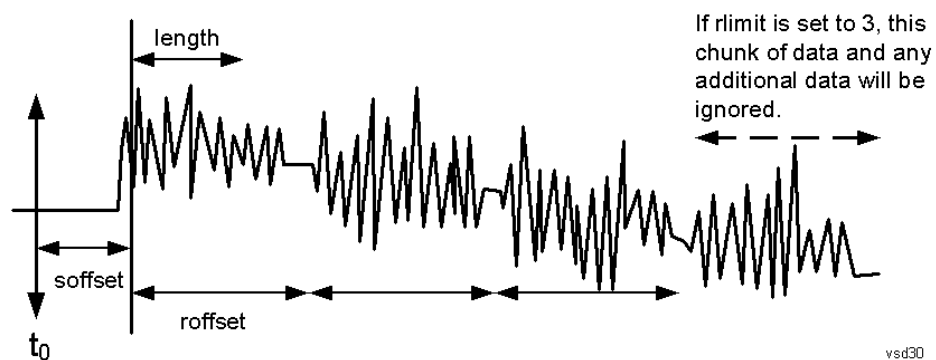
### Sample Trace Data - Constant Envelope

(See below for explanation of variables.)



### Sample Trace Data - Not Constant Envelope

(See below for explanation of variables.)



<offset> - start offset is an optional real number. (It is in seconds for time-domain traces, and is a dimensionless index 0 to Npoints - 1, for frequency-domain traces). It specifies the amount of data at the beginning of the trace that will be ignored before the decimation process starts. It is the time or frequency change from the start of the trace to the point where you want to start using the data. The default value is zero.

<length> - is an optional real number. (It is in seconds for time-domain traces, and is a dimensionless index 0 to Npoints - 1, for frequency-domain traces). It defines how much data will be compressed into one value. This parameter has a default value equal to the current trace length.

<roffset> - repeat offset is an optional real number. (It is in seconds for time-domain traces, and is a dimensionless index 0 to Npoints - 1, for frequency-domain traces). It defines the beginning of the next field of trace elements to be compressed. This is relative to the beginning of the previous field. This parameter has a default value equal to the <length> variable. Note that this parameter is used for a completely different purpose when curve fitting (see CFIT above).

<rlimit> - repeat limit is an optional integer. It specifies the number of data items that you want returned. It will ignore any additional items beyond that number. You can use the Start offset and the Repeat limit to pick out exactly what part of the data you want to use. The default value is all the data.

### Calculate Peaks of Trace Data (Remote Command Only)

Returns a list of all the peaks for the currently selected measurement and sub-opcode [n]. The peaks must meet the requirements of the peak threshold and excursion values.

n = any valid sub-opcode for the current measurement. See the MEASure:<measurement> command description of your specific measurement for information on the data that can be returned.

The command can only be used with specific sub-opcodes with measurement results that are trace data. Both real and complex traces can be searched, but complex traces are converted to magnitude in dBm. In many measurements the sub-opcode n=0, is the raw trace data which cannot be searched for peaks. And Sub-opcode n=1, is often calculated results values which also cannot be searched for peaks.

This command uses the data setting specified by the FORMat:BORDER and FORMat:DATA commands and can return real or ASCII data. If the format is set to INT,32, it returns REAL,32 data.

The command has four types of parameters:

- Threshold (in dBm)
- Excursion (in dB)
- Sorting order (amplitude, frequency, time)
- Optional in some measurements: Display line use (all, > display line, < display line)

---

**Remote Command**

For Swept SA measurement:

```
:CALCulate:DATA[1]|2|...|6:PEAKS? <threshold>,<excursion>[,AMPLitude  
| FREQuency | TIME[,ALL | GTDLine | LTDLine]]
```

For most other measurements:

---

	<pre>:CALCulate:DATA[1] 2 ... 6:PEAKs? &lt;threshold&gt;,&lt;excursion&gt;[,AMPLitude   FREQuency   TIME]</pre>
<b>Example</b>	<p>Example for Swept SA measurement in Spectrum Analyzer Mode:</p> <p>CALC:DATA4:PEAK? -40, 10, FREQ, GTDL This will identify the peaks of trace 4 that are above -40 dBm, with excursions of at least 10 dB. The peaks are returned in order of increasing frequency, starting with the lowest frequency. Only the peaks that are above the display line are returned.</p> <p>Query Results 1:</p> <p>With FORMat:DATA REAL, 32 selected, it returns a list of floating-point numbers. The first value in the list is the number of peak points that are in the following list. A peak point consists of two values: a peak amplitude followed by its corresponding frequency (or time).</p> <p>If no peaks are found the peak list will consist of only the number of peaks, (0).</p>
<b>Notes</b>	<p>&lt;n&gt; - is the trace that will be used</p> <p>&lt;threshold&gt; - is the level below which trace data peaks are ignored. Note that the threshold value is required and is always used as a peak criterion. To effectively disable the threshold criterion for this command, provide a substantially low threshold value such as -200 dBm. Also note that the threshold value used in this command is independent of and has no effect on the threshold value stored under the Peak Criteria menu.</p> <p>&lt;excursion&gt; - is the minimum amplitude variation (rise and fall) required for a signal to be identified as peak. Note that the excursion value is required and is always used as a peak criterion. To effectively disable the excursion criterion for this command, provide the minimum value of 0.0 dB. Also note that the excursion value used in this command is independent of and has no effect on the excursion value stored under the Peak Criteria menu.</p> <p>Values must be provided for threshold and excursion. The sorting and display line parameters are optional (defaults are AMPLitude and ALL).</p> <p>Note that there is always a Y-axis value for the display line, regardless of whether the display line state is on or off. It is the current Y-axis value of the display line which is used by this command to determine whether a peak should be reported</p> <p>Sorting order:</p> <p>AMPLitude - lists the peaks in order of descending amplitude, with the highest peak first (default if optional parameter not sent)</p> <p>FREQuency - lists the peaks in order of occurrence, left to right across the x-axis.</p> <p>TIME - lists the peaks in order of occurrence, left to right across the x-axis.</p> <p>Peaks vs. Display Line:</p> <p>ALL - lists all of the peaks found (default if optional parameter not sent).</p> <p>GTDLLine (greater than display line) - lists all of the peaks found above the display line.</p> <p>LTDLine (less than display line) - lists all of the peaks found below the display line.</p>
Initial S/W Revision	Prior to A.02.00

### Hardware-Accelerated Fast Power Measurement (Remote Command Only)

The Fast Power option (FP2) enables very fast channel power measurements for instruments with the prerequisite hardware (DP2 and/or B40). It accomplishes this by performing real-time overlapped FFTs at the hardware layer, using software for basic post-processing before returning the result to the user. The upshot of this

approach is improved throughput for user applications that require many sequential power measurements.

The analysis bandwidth of FP2 is limited by the licenses in the instrument, but its maximum overall analysis bandwidth per acquisition is 40 MHz.

FP2 is remote-only, which means the instrument does not switch to any particular mode or measurement. FP2 commands can be sent while another application is in use on the front panel.

Each Fast Power measurement can be predefined using an array index, and up to 1,000 measurements can be stored. In the following documentation, instances of [1,2,...,999] can be substituted with a particular measurement index, e.g. CALC:FPOW:POW1?, CALC:FPOW:POW2?, CALC:FPOW:POW134?. In this way, power measurements can be defined one time in a batch, and then executed multiple times without having to redefine them, similar to “list mode” on other measurements.

In addition to basic channel power measurements, there are a number of other measurement “functions” for each channel, including peak power, peak frequency, and power spectral density. See the Function parameter for more information.

### Reset Fast Power Measurement (Remote Command Only)

Resets the measurement configuration to the defaults.

Mode	All
<b>Remote Command</b>	:CALCulate:FPOWer:POWer[1,2,...,999]:RESet
<b>Example</b>	:CALC:FPOW:POW1:RES
Notes	Option FP2 is required.
Initial S/W Revision	A.14.00

### Define Fast Power Measurement (Remote Command Only)

Fast Power acquisitions are configured using the DEFine command. This command accepts a comma-delimited string of configuration parameters and their appropriate values, which are all specified in the subsection below.

Mode	All
<b>Remote Command</b>	:CALCulate:FPOWer:POWer[1,2,...,999]:DEFine "configuration string"
<b>Example</b>	:CALC:FPOW:POW1:DEF "CenterFrequency=2e9, AcquisitionTime=0.005"
Notes	See below for a list of measurement variables that can be defined in the configuration string.
Initial S/W Revision	A.14.00

## Acquisition Time

Example	CALC:FPOW:POW1:DEF "AcquisitionTime=0.002"
Notes	The acquisition time parameter sets the time in which the entire spectrum is measured. An increase in the acquisition time yields an improvement in measurement repeatability.
Preset	0.001 s
Range	0 s to 1 s
Default Unit	Time (s)
Initial S/W Revision	A.14.00

## Center Frequency

Example	CALC:FPOW:POW1:DEF "CenterFrequency=2e9"
Notes	The center frequency parameter sets the frequency in which the measurement is centered around. The OffsetFrequency parameter is calculated relative to the center frequency.
Preset	1 GHz
Range	0 Hz to maximum instrument frequency
Default Unit	Frequency (Hz)
Initial S/W Revision	A.14.00

## DC Coupled

Example	CALC:FPOW:POW1:DEF "DCCoupled=True"
Notes	The DC coupled parameter allows the user to specify whether the DC blocking capacitor is utilized. Set parameter to true when measuring frequencies below 10 MHz.
Preset	False
Range	True (DC Coupled) or False (AC Coupled)
Default Unit	Boolean
Initial S/W Revision	A.14.00

## DetectorType

Example	CALC:FPOW:POW1:DEF "DetectorType=Peak"
Notes	Option FP2 is required. The detector type parameter allows the user to choose whether a RMS average or peak value is used during the measurement.
Preset	RmsAverage
Range	RmsAverage, Peak
Initial S/W Revision	A.14.00

## Do Noise Correction

Example	CALC:FPOW:POW1:DEF "DoNoiseCorrection=True"
Notes	<p>When noise correction is enabled, the linear noise power contributed by the analyzer is subtracted from all measurements. This effectively lowers the noise floor of the analyzer.</p> <p>When noise correction is enabled, the first measurement for a given set of input parameters will take extra time. This is because the analyzer takes an extra acquisition with the RF input disconnected from the analyzer's front end to measure the noise of just the analyzer. The measured noise floor is stored in a cache so the noise acquisition will occur only once for the same state settings. In other words, if noise correction was turned on and the analyzer made an acquisition at frequency A, then frequency B, and back again to frequency A, the hidden initial noise floor acquisition would only occur for the first acquisition at frequency A and the cached noise floor would be used the second time frequency A was measured.</p>
Preset	False
Range	True (enable noise correction) or False (disable noise correction)
Default Unit	Boolean
Initial S/W Revision	A.14.00

## Do Spur Suppression

Example	CALC:FPOW:POW1:DEF "DoSpurSuppression=True"
Notes	<p>When measuring very low level signals, or when large out-of-band inputs are input into the analyzer, sometimes unwanted spurs and residuals can appear in the measured spectrum. Spur suppression is a method to help minimize the levels of these internally generated spurs and residuals.</p> <p>When spur suppression is enabled, the analyzer will automatically take two acquisitions using two different internal analog LO frequencies. The FFT spectrums from both acquisitions are combined by taking the minimum power between both traces on a per FFT bin basis. External signals will have the same amplitude for both traces and therefore will return the expected amplitudes. However, low level spurs and residuals generated internally to the analyzer tend to move to different FFT bins depending on the internal analog LO frequency used, and therefore tend to be suppressed using this spur suppression method.</p> <p>Because two acquisitions, rather than a single acquisition, are made when spur suppression is enabled, the measurement time will always be slower when spur suppression is enabled.</p>
Preset	False
Range	True (enable spur suppression) or False (disable spur suppression)
Default Unit	Boolean
Initial S/W Revision	A.14.00

## Electronic Attenuator Bypass

Example	CALC:FPOW:POW1:DEF "ElecAttBypass =False"
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Notes	The electronic attenuation bypass parameter allows the user to either utilize or bypass the electronic attenuator. The electronic attenuator is only available for frequencies up to 3.6 GHz. Set parameter to true when using frequencies above 3.6 GHz and set the parameter to false when using the preamp.
Preset	True
Range	True (bypass electronic attenuator) or False (use electronic attenuator)
Default Unit	Boolean
Initial S/W Revision	A.14.00

### Electronic Attenuation

Example	CALC:FPOW:POW1:DEF "ElecAttenuation=10"
Notes	Option EA3 is required. The electronic attenuation value parameter sets the amount of electrical attenuation from 0 to 24 dB (1 dB steps). Set "ElecAttBypass=False" to make sure the electronic attenuator path is enabled.
Preset	0 dB
Range	0 – 24 dB (1 dB steps)
Default Unit	dB
Initial S/W Revision	A.14.00

### IF Gain

Example	CALC:FPOW:POW1:DEF "IFGain=10"
Notes	The IF gain parameter allows the user to specify the gain at the IF stage anywhere from -6 to 16 dB (1 dB steps). This is an advanced feature, and for most cases this should remain at its default value of 0 dB.
Preset	0 dB
Range	-6 – 16 dB (1 dB steps)
Default Unit	dB
Initial S/W Revision	A.14.00

### IF Type

Example	CALC:FPOW:POW1:DEF "IFType=B25M"
Notes	The IF type parameter allows the user to select between different IF paths. For example, if the signal is less than 25 MHz wide, then the user can select the B25M path to take advantage of additional filtering on this analog IF path.



Preset	B40M
Range	B10M, B25M, B40M
Initial S/W Revision	A.14.00

### Include Power Spectrum

Example	CALC:FPOW:POW1:DEF "IncludePowerSpectrum=True"
Notes	The power spectrum parameter allows the user to read data on the entire spectrum for diagnostic purposes. It is not recommended for production use. See CALC:FPOW:POW[n]:READ2? for details on the binary format of the response.
Preset	False
Range	True (return both channel power and full power spectrum) or False (returns only channel power)
Default Unit	Boolean
Initial S/W Revision	A.14.00

### Mechanical Attenuation

Example	CALC:FPOW:POW1:DEF "MechAttenuation=10"
Notes	The mechanical attenuation value parameter sets the amount of mechanical attenuation anywhere from 0 to 70 dB (2 dB steps).
Preset	0 dB
Range	0 – 70 dB (2 dB steps)
Default Unit	dB
Initial S/W Revision	A.14.00

### Preamp Mode

Example	CALC:FPOW:POW1:DEF "PreAmpMode=Low"
Notes	The license for the appropriate preamp is required. The preamp mode parameter specifies whether the preamps are being utilized. Low allows any preamps up to 3.6 GHz, and Full allows all licensed preamps. Set "ElecAttBypass=True" in order to utilize any preamps.
Preset	Off
Range	Off, Low, Full
Initial S/W Revision	A.14.00

## Resolution Bandwidth Mode

Example	CALC:FPOW:POW1:DEF "PreAmpMode=Low"
Notes	The resolution bandwidth mode parameter allows the user to choose whether the RBW filter is automatically or manually set. The BestSpeed value minimizes measurement time, while the Narrowest value minimizes RBW size (minimum of two FFT bins per RBW). To manually specify an RBW, set this parameter to Explicit, and set the ResolutionBW parameter to the desired value.
Preset	BestSpeed
Range	BestSpeed, Narrowest, Explicit
Initial S/W Revision	A.14.00

## Resolution Bandwidth

Example	CALC:FPOW:POW1:DEF "ResolutionBW=25e3"
Notes	The resolution bandwidth parameter sets the 3-dB bandwidth of the RBW filter. The ResolutionBWMode parameter must be set to Explicit in order to manually set the RBW.
Preset	0 Hz
Default Unit	Hz
Initial S/W Revision	A.14.00

## Trigger Delay

Example	CALC:FPOW:POW1:DEF "TriggerDelay=0.025"
Notes	The trigger delay parameter sets the time after an external trigger is detected until the measurement is performed.
Preset	0 s
Range	0 – 1 s
Default Unit	Seconds
Initial S/W Revision	A.14.00

## Trigger Level

Example	CALC:FPOW:POW1:DEF "TriggerLevel=2"
Notes	The trigger level parameter sets the voltage value at which an external trigger is detected.
Preset	1.2 V
Range	-5 to 5 V
Default Unit	Volts
Initial S/W Revision	A.14.00

### Trigger Slope

Example	CALC:FPOW:POW1:DEF "TriggerSlope=Negative"
Notes	The trigger slope parameter indicates the direction of the edge trigger voltage for detection.
Preset	Positive
Range	Positive, Negative
Initial S/W Revision	A.14.00

### Trigger Source

Example	CALC:FPOW:POW1:DEF "TriggerSource=Ext1"
Notes	The trigger source parameter allows the user to choose between measurement's triggering freely or controlled by an external input. Ext1 and Ext2 correspond to Trigger 1 In and Trigger 2 In, respectively.
Preset	Free
Range	Free, Ext1, Ext2
Initial S/W Revision	A.14.00

### Trigger Timeout

Example	CALC:FPOW:POW1:DEF "TriggerTimeout=0.1"
Notes	The trigger timeout parameter sets the time in which the analyzer will wait for a trigger before automatically performing the measurement.
Preset	1 s
Range	0 – 1 s
Default Unit	Seconds
Initial S/W Revision	A.14.00

### Signal Input

Example	CALC:FPOW:POW1:DEF "SignalInput=Fp50MHzCW"
Notes	The signal input parameter allows the user to select between using the main RF input or the internal analyzer reference CW signal of 50 MHz.
Preset	FpMainRf
Range	FpMainRf, Fp50MHzCW
Initial S/W Revision	A.14.00

## Use Preselector

Example	CALC:FPOW:POW1:DEF "UsePreSelector=True"
Notes	The preselector parameter allows the user to either utilize or bypass the front end tunable filter at frequencies above 3.6 GHz. For frequencies below 3.6 GHz, the preselector is automatically bypassed, so you do not need to set this parameter to False in those cases.
Preset	False
Range	True (use preselector above 3.6 GHz), or False (preselector bypassed)
Default Unit	Boolean
Initial S/W Revision	A.14.00

## Channel Bandwidth Array

Example	CALC:FPOW:POW1:DEF "Bandwidth=[3.84e6, 5e6, 3.84e6]"
Notes	The bandwidth parameter array defines the bandwidth of each channel that will be measured. All array parameters should have the same number of elements. Alternatively, if all the elements are the same value, a single number with no square brackets can be used to define the parameter.
Preset	[1e6]
Range	0 to 40 MHz
Default Unit	Hz
Initial S/W Revision	A.14.00

## Channel Filter Type Array

Example	CALC:FPOW:POW1:DEF "FilterType=[RRC, IBW, RRC]"
Notes	The filter type parameter allows the user to choose between an integration bandwidth (IBW) filter or a root-raised-cosine (RRC) filter. The integration bandwidth filter weighs all frequencies within the bandwidth equally. The root-raised-cosine filter has an associated shape parameter, defined by the FilterAlpha parameter. All array parameters should have the same number of elements. Alternatively, if all the elements are the same value, a single value with no square brackets can be used to define the parameter.
Preset	[IBW]
Range	IBW, RRC
Initial S/W Revision	A.14.00

## Channel Filter Alpha Array

Example	CALC:FPOW:POW1:DEF "FilterAlpha=[0.5, 0.0, 0.5]"
Notes	The filter alpha parameter allows the user to adjust the alpha value associated with the root-

	raised-cosine (RRC) filter type. Set FilterType to RRC in order to utilize this parameter. All array parameters should have the same number of elements. Alternatively, if all the elements are the same value, a single number with no square brackets can be used to define the parameter.
Preset	[0.22]
Range	0.0 – 1.0
Initial S/W Revision	A.14.00

### Channel Measurement Function Array

Example	CALC:FPOW:POW1:DEF "Function=[BandPower, PeakPower, BandPower]"
Notes	This parameter array defines what measurement is being made for each individually-specified channel: BandPower: Total power within the specified bandwidth of the channel (dBm) BandDensity: Total power density within the specified bandwidth of the channel (dBm/Hz) PeakPower: The peak power value within the specified bandwidth of the channel (dBm) PeakFrequency: The frequency which corresponds to the peak power value within the specified bandwidth of the channel. This frequency is relative to the center frequency (Hz) XdBBandwidth: The half power (-3.01 dB) bandwidth of the highest amplitude signal that resides within the channel (Hz), dB is configurable using XdBBandwidth parameter OccupiedBandwidth: The bandwidth at which 99% of the total power resides within the channel (Hz), percentage configurable using OccupiedBandwidthPercent parameter All array parameters should have the same number of elements. Alternatively, if all the elements are the same value, a single value with no square brackets can be used to define the parameter.
Preset	[BandPower]
Range	BandPower, BandDensity, PeakPower, PeakFrequency, XdBBandwidth, OccupiedBandwidth
Initial S/W Revision	A.14.00

### Channel Offset Frequency Array

Example	CALC:FPOW:POW1:DEF "OffsetFrequency=[-5e6, 0, 5e6]"
Notes	The offset frequency parameter array defines the difference between the center frequency to the center frequency of each channel. All array parameters should have the same number of elements.
Preset	[0]
Range	0 to 20 MHz
Default Unit	Hz
Initial S/W Revision	A.14.00

### Channel Occupied Bandwidth Percent Array

Example	CALC:FPOW:POW1:DEF "OccupiedBandwidthPercent =[0.95, 0.95, 0.95]"
Notes	This parameter only applies for channels whose Function is set to OccupiedBandwidth. The occupied bandwidth percent parameter specifies the percent of total power in these channels. The valid range for this parameter is 0.0 to 1.0, where 1.0 represents 100%. The default for this parameter is 0.99, which will return the bandwidth that contains 99% of the total channel power.
Preset	[0.99]
Range	0 – 1.0
Initial S/W Revision	A.14.00

### Channel x-dB Bandwidth Array

Example	CALC:FPOW:POW1:DEF "XdBBandwidth =[-6.02, -3.01, -1.0]"
Notes	This parameter only applies for channels whose Function is set to XdBBandwidth. The X dB bandwidth parameter is used to specify the power relative to the peak channel power over which the bandwidth is calculated. The parameter value must be a negative number.
Preset	[-3.01]
Range	-200 to 0 dB
Default Unit	dB
Initial S/W Revision	A.14.00

### Define Fast Power Measurement Query (Remote Command Only)

The DEFine? command is used to retrieve a list of all defined parameters in an ASCII string format

M	All
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d	
e	
R	:CALCulate:FPOWer:POWer[1,2,...,999]:DEFine?
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m	
o	
t	
e	
C	
o	
m	
m	
a	
n	

---

**d**

**E** :CALC:FPOW:POW1:DEF?

**x  
a  
m  
p  
l  
e**

---

**N** This command query is used to retrieve a list of all defined parameters in an ASCII format.

**O** The following is an example of the returned results:

**t** "DCCoupled=False,ElecAttBypass=True,ElecAttenuation=0,IFGain=0,MechAttenuation=0,PreAmpMode=Off,PreSelectorOf  
**e** fset=0,UsePreSelector=False,ExternalReferenceFrequency=10000000,FrequencyReferenceSource=AutoExternalFrequenc  
**s** yReference,IFType=B40M,LOMode=SLW,SignalInput=FpMainRf,AcquisitionTime=0.001,CenterFrequency=1000000000,Re  
solutionBW=0,ResolutionBWMode=BestSpeed,DetectorType=RmsAverage,Bandwidth=[1000000],OffsetFrequency=  
[0],Function=[BandPower],FilterType=[BW],FilterAlpha=[0.22],OccupiedBandwidthPercent=[0.99],XdBBandwidth=[-  
3.01],DoNoiseCorrection=False,DoSpurSuppression=False,MeasurementMethod=HardwareFFT,IncludePowerSpectrum=F  
alse,TriggerDelay=0,TriggerLevel=1.2,TriggerSlope=Positive,TriggerSource=Free,TriggerTimeout=1"

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**I** A.14.00

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### Configure Fast Power Measurement (Remote Command Only)

The configure command begins hardware setup and returns immediately, with no acquisition made. This can be used in parallel with other hardware operations to effectively hide the hardware setup time.

---

Mode	All
<b>Remote Command</b>	:CALCulate:FPOWer:POWer[1,2,...,999]:CONFigure
<b>Example</b>	:CALC:FPOW:POW1:CONF

---

Notes	Option FP2 is required.
Initial S/W Revision	A.14.00

### Initiate Fast Power Measurement (Remote Command Only)

The INITiate command begins an acquisition and returns immediately. The results of the measurement can be retrieved using FETCh.

Mode	All
<b>Remote Command</b>	:CALCulate:FPOWer:POWer[1,2,...,999]:INITiate
<b>Example</b>	:CALC:FPOW:POW1:INIT
Notes	Option FP2 is required.
Initial S/W Revision	A.14.00

### Fetch Fast Power Measurement (Remote Command Only)

The FETCh command query is used to retrieve the results of an acquisition initiated by the INIT command. The returned results are in ASCII string format. The string begins and ends with quotation marks.

Mode	All
<b>Remote Command</b>	:CALCulate:FPOWer:POWer[1,2,...,999]:FETCh?
<b>Example</b>	:CALC:FPOW:POW1:FETC?
Notes	Option FP2 is required. Returns m comma-separated ASCII values, where m corresponds to the number of bandwidths defined. 1. Declared function return in the 1st specified channel 2. Declared function return in the 2nd specified channel ... m. Declared function return in the last specified channel The INIT and FETC? command sequence performs the same functionality of a single CALC:FPOW:POW[n]? query. Units of the returned values are dependent on the Function parameter for each channel.
Initial S/W Revision	A.14.00

### Execute Fast Power Measurement (Remote Command Only)

This command query is used as shorthand for an INIT command immediately followed by a FETC? command. The returned results are in ASCII string format. The string begins and ends with quotation marks.



Mode	All
<b>Remote Command</b>	:CALCulate:FPOWer:POWer[1,2,...,999]?
<b>Example</b>	:CALC:FPOW:POW1?
Notes	Option FP2 is required. See notes for Fast Power Fetch for return format.
Initial S/W Revision	A.14.00

### Binary Read Fast Power Measurement (Remote Command Only)

This command query is used as shorthand for an INIT command immediately followed by a FETC? command. The returned results are in a binary format.

Mode	All
<b>Remote Command</b>	:CALCulate:FPOWer:POWer[1,2,...,999]:READ? :CALCulate:FPOWer:POWer[1,2,...,999]:READ1?
<b>Example</b>	:CALC:FPOW:POW1:READ? :CALC:FPOW:POW1:READ1?
Notes	Option FP2 is required. Returns m 4 byte floating point binary values (Little-Endian), where m corresponds to the number of bandwidths defined.
Initial S/W Revision	A.14.00

### Diagnostic Binary Read Fast Power Measurement (Remote Command Only)

This command query is used as shorthand for an INIT command immediately followed by a FETC? command. The returned results are in a binary format. This command is used primarily for diagnostic purposes to test for ADC overloads and to visibly inspect the spectrum.

Mode	All
<b>Remote Command</b>	:CALCulate:FPOWer:POWer[1,2,...,999]:READ2?
<b>Example</b>	:CALC:FPOW:POW1:READ2?
Notes	Option FP2 is required. <div style="display: flex; align-items: flex-start; margin-top: 10px;"> <div style="background-color: #cccccc; padding: 2px 5px; margin-right: 10px;"><b>NOTE</b></div> <div> <p><b>Spectrum data is only returned if the IncludePowerSpectrum parameter is set to True. If IncludePowerSpectrum is False, the number of spectrum points will be zero (0).</b></p> <p>Units of the returned values are dependent on the Function parameter per channel (e.g. dBm for BandPower, Hz for PeakFrequency). Returns binary data (Little-Endian) that contains information on m amount of channels, along with ADC over range and full spectrum data.</p> </div> </div>

---

The following is the binary format of the response.

Bandwidth Return Value

1. Number of channels specified, m [4 byte int]
2. Declared function result for the 1st specified channel [4 byte float]
3. Declared function result for the 2nd specified channel [4 byte float]
- ...
- (m + 1). Declared function result for the last (mth) specified channel [4 byte float]

ADC Over Range

1. ADC over-range occurred (1: true, 0: false) [2 byte short]

Spectrum Data

1. Number of points in the spectrum data, k [4 byte int]
2. Start frequency of spectrum data (Hz) [8 byte double]
3. Step frequency of spectrum data (Hz) [8 byte double]
4. FFT bin at 1st point (dBm) [4 byte float]
5. FFT bin at 2nd point (dBm) [4 byte float]
- ...
- (k + 3). FFT bin at last (kth) point (dBm) [4 byte float]

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Initial S/W Revision      A.14.00

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### Format Data: Numeric Data (Remote Command Only)

This command specifies the format of the trace data input and output. It specifies the formats used for trace data during data transfer across any remote port. It affects only the data format for setting and querying trace data for the :TRACe[:DATA], TRACe[:DATA]?, :CALCulate:DATA[n]? and FETCh:SANalyzer[n]? commands and queries.

---

<b>Remote Command</b>	<b>:FORMat[:TRACe][:DATA] ASCii INTEger,32 REAL,32  REAL,64</b> <b>:FORMat[:TRACe][:DATA]?</b>
-----------------------	---

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Notes	<p>The query response is:</p> <p>ASCii: ASC,8</p> <p>REAL,32: REAL,32</p> <p>REAL,64: REAL,64</p> <p>INTEger,32: INT,32</p> <p>When the numeric data format is REAL or ASCii, data is output in the current Y Axis unit. When the data format is INTEger, data is output in units of m dBm (.001 dBm).</p> <p>The INT,32 format returns binary 32-bit integer values in internal units (m dBm), in a definite length block.</p>
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Dependencies	<p>Sending a data format spec with an invalid number (for example, INT,48) generates no error. The analyzer simply uses the default (8 for ASCii, 32 for INTEger, 32 for REAL).</p> <p>Sending data to the analyzer which does not conform to the current FORMat specified, results in an error. Sending ASCII data when a definite block is expected generates message -161 "Invalid</p>
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	Block Data" and sending a definite block when ASCII data is expected generates message -121 "Invalid Character in Number".
Preset	AScii
Backwards Compatibility Notes	Note that the INT,32 format is only applicable to the command, TRACe:DATA. This preserves backwards compatibility for the Swept SA measurement. For all other commands/queries which honor FORMat:DATA, if INT,32 is sent the analyzer will behave as though it were set to REAL,32.
Initial S/W Revision	Prior to A.02.00

The specs for each output type follow:

AScii - Amplitude values are in ASCII, in the current Y Axis Unit, one ASCII character per digit, values separated by commas, each value in the form:

SX.YYYYYEsZZ

Where:

S = sign (+ or -)

X = one digit to left of decimal point

Y = 5 digits to right of decimal point

E = E, exponent header

s = sign of exponent (+ or -)

ZZ = two digit exponent

REAL,32 - Binary 32-bit real values in the current Y Axis Unit, in a definite length block.

REAL,64 - Binary 64-bit real values in the current Y Axis Unit, in a definite length block.

### Format Data: Byte Order (Remote Command Only)

This command selects the binary data byte order for data transfer and other queries. It controls whether binary data is transferred in normal or swapped mode. This command affects only the byte order for setting and querying trace data for the :TRACe[:DATA], TRACe[:DATA]? , :CALCulate:DATA[n]? and FETCh:SANalyzer[n]? commands and queries.

By definition any command that says it uses FORMat:DATA uses any format supported by FORMat:DATA.

The NORMal order is a byte sequence that begins with the most significant byte (MSB) first, and ends with the least significant byte (LSB) last in the sequence: 1|2|3|4. SWAPped order is when the byte sequence begins with the LSB first, and ends with the MSB last in the sequence: 4|3|2|1.

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**Remote Command**      :FORMat:BORDER NORMa1 | SWAPPed

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	<b>:FORMat:BORDER?</b>
Preset	NORMal
Initial S/W Revision	Prior to A.02.00

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## Meas Setup

The Meas Setup key opens a menu of softkeys that allow you to control the most important parameters for the current measurement.

**NOTE**

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

Key Path	Front-panel key
Initial S/W Revision	Prior to A.02.00

### 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 841](#).

See ["AVER:CLE command" on page 842](#).

Key Path	Meas Setup
<b>Remote Command</b>	[ :SENSe]:AVERage:COUNT <integer> [ :SENSe]:AVERage:COUNT?
Couplings	Restarting any of these functions (Average, Max Hold or Min Hold) restarts all of them, as there is only one count. When in Density View, averaging only affects the Real Time Spectrum (White) Trace, not the Density Bitmap.
Preset	100
State Saved	Saved in instrument state
Min	1
Max	10000
Initial S/W Revision	A.13.00

### More Information

When in Single, the trace update stops when N is reached. You can add more trace updates 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, 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 trace holding in Cont, the value of N is irrelevant. But for averaging, each new trace update is exponentially averaged in with a weighting equal to N.

The Average/Hold Number is not affected by Auto Couple.

## AVER:CLE command

The AVER:CLE command (below) resets the average/hold count and does an INIT:IMM, which begins another set of trace updates when trigger conditions are satisfied. It only does this if an active trace is in Average or Hold type.

Parameter Name	Restart & Reset Average Counter
<b>Remote Command</b>	[ :SENSe ] :AVERage :CLEar
<b>Example</b>	AVER:COUN 100 AVER:CLE Sets the current count (k and K) to 1 and restarts the averaging process.
Notes	When the instrument receives this command it performs an INIT:IMM, if and only if there is an active trace in Max Hold, Min Hold, or Average type.
Default Unit	Enter
Initial S/W Revision	A.13.00

## Limits

The limits key opens a menu of softkeys to control the limits for the current measurement. Limits arrays can be entered by the user, sent over SCPI, or loaded from a file.

Key Path	<b>Meas Setup</b>
Dependencies	This key will only appear 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 analyzer application, which means they will survive a power cycle.
Initial S/W Revision	A.02.00

## 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.

Key Path	<b>Meas Setup, Limits</b>
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.
Initial S/W Revision	A.02.00

## Limit

Selects whether the limit and margin are displayed. If Test Limits is on, this also determines whether the test trace (see ["Test Trace" on page 844](#)) 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 849). 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 (All Limits)** is on (see "Test Limits" on page 855). If the trace is not tested, no report of the trace passing or failing is seen on the graticule. Note that the SCPI queries of Limit Pass/Fail are independent of these conditions; the test is always performed when queried over SCPI.

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 analyzer X-axis. Traces which are not updating (in View, for example) will not change color if the analyzer 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.

Key Path	Meas Setup, Limits
<b>Remote Command</b>	:CALCulate:LLINe[1] 2 ... 6:DISPlay OFF ON 0 1 :CALCulate:LLINe[1] 2 ... 6:DISPlay?
<b>Example</b>	:CALC:LLIN2:DISP ON turns on the display for limit line 2.
Dependencies	This command will generate an “Option not available” error message unless you have the proper option installed in your instrument.
Couplings	Limit display ON selects the limit. Testing is done on all displayed limits if <b>Test Limits (All Limits)</b> is ON. Entering the limit menu from the GUI turns on the selected limit.
Preset	OFF
State Saved	Saved in instrument state.
<b>Backwards Compatibility SCPI</b>	:CALCulate:LLINe[1] 2:STATe OFF ON 0 1 In the past you had to send the DISP command as well as the STATe command in order to get a limit on and testing. Now, the DISP command is sufficient, but we accept the state command and map it to DISP

Initial S/W Revision	A.02.00
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## Properties

Accesses a menu which lets you set the properties of the selected limit.

Key Path	<b>Meas Setup, Limits</b>
----------	---------------------------

Initial S/W Revision	A.02.00
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## 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.

Key Path	<b>Meas Setup, Limits, Properties</b>
----------	---------------------------------------

Notes	The selected limit is remembered even when not in the Limit Menu.
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Preset	Limit 1, not affected by Mode Preset, preset by Restore Mode Defaults.
--------	--

State Saved	Saved in instrument state.
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## Test Trace

Selects the trace you want the limit to test. A limit is applied to one and only one trace; each trace can have both an upper and a lower limit. When executing Limit Test, the limit is applied only to the specified trace.

A trace can have multiple limit lines simultaneously; in that case, only one upper and one lower limit line will affect the color of the trace. Other limit lines will be displayed, and will affect the pass/fail status, but the trace will not turn red if it crosses a secondary limit line.

Key Path	<b>Meas Setup, Limits, Properties</b>
----------	---------------------------------------

<b>Remote Command</b>	<b>:CALCulate:LLINE[1] 2 ... 6:TRACe 1 2 3 4 5 6</b> <b>:CALCulate:LLINE[1] 2 ... 6:TRACe?</b>
-----------------------	---

<b>Example</b>	:CALC:LLIN3:TRAC 2 applies limit 3 to trace 2.
----------------	--

Notes	When the trace display is off, the trace is not tested. The trace is tested only when the trace display is on and Test Limits (see <a href="#">"Test Limits" on page 855</a> ) is on.
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Couplings	This matters when testing a trace or limit line for failure, via <b>:CALC:LLIN3:FAIL?</b> or <b>:CALC:TRAC2:FAIL?</b>
-----------	---

Preset	Limits 1 and 2 preset to 1, Limits 3 and 4 preset to 2, Limits 5 and 6 preset to 3 Not affected by Mode Preset, preset by Restore Mode Defaults.
--------	---

State Saved	Saved in instrument state.
-------------	----------------------------

Min	1
-----	---

Max	6
-----	---



Readback	Trace 1 2 3 4 5 6
Initial S/W Revision	A.02.00

### 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.

Key Path	<b>Meas Setup, Limits, Properties</b>
<b>Remote Command</b>	:CALCulate:LLINe[1] 2 ... 6:TYPE UPPER LOWER :CALCulate:LLINe[1] 2 ... 6:TYPE?
<b>Example</b>	:CALC:LLIN2:TYPE LOW sets limit line 2 to act as a lower limit.
Couplings	If a margin has already been set for this limit line, and this key is used to change the limit type, then the margin value will reverse 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.
Initial S/W Revision	A.02.00

### Interpolation

Accesses a menu which lets you set the frequency and amplitude interpolation of the selected limit.

Key Path	<b>Meas Setup, Limits, Properties</b>
Readback	[Lin Log Frequency, Lin Log Amplitude]
Initial S/W Revision	A.02.00

### Frequency Interpolation

This key is grayed out if Time is the selected X Axis Units. Sets the interpolation between frequency points, allowing you to determine how limit trace values are computed between points in a limit table. The available interpolation modes are linear and logarithmic. If frequency interpolation is logarithmic (Log), frequency values between limit points are computed by first taking the logarithm of both the table values and the intermediate value. A linear interpolation is then performed in this logarithmic frequency space. An exactly analogous manipulation is done for logarithmic amplitude interpolation.

Note that the native representation of amplitude is in dB.

For linear amplitude interpolation and linear frequency interpolation, the interpolation is computed as:

$$y = 20 \log\left(\frac{10^{\frac{y_{i+1}}{20}} - 10^{\frac{y_i}{20}}}{f_{i+1} - f_i} (f - f_i) + 10^{\frac{y_i}{20}}\right)$$

For linear amplitude interpolation and log frequency interpolation, the interpolation is computed as:

$$y = 20 \log \left( \frac{10^{\frac{y_{i+1}}{20}} - 10^{\frac{y_i}{20}}}{\log f_{i+1} - \log f_i} (\log f - \log f_i) + 10^{\frac{y_i}{20}} \right)$$

For log amplitude interpolation and linear frequency interpolation, the interpolation is computed as:

$$y = \frac{y_{i+1} - y_i}{f_{i+1} - f_i} (f - f_i) + y_i$$

For log amplitude interpolation and log frequency interpolation, the interpolation is computed as:

$$y = \frac{y_{i+1} - y_i}{\log f_{i+1} - \log f_i} (\log f - \log f_i) + y_i$$

**NOTE**

Interpolation modes determine how limit values are computed between points in the limit table. The appearance of a limit trace is also affected by the amplitude scale, which may be linear or logarithmic.

Key Path	Meas Setup, Limits, Properties, Interpolation
Remote Command	:CALCulate:LLINE[1] 2 ... 6:CONTROL:INTERpolate:TYPE LOGarithmic   LINear :CALCulate:LLINE[1] 2 ... 6:CONTROL:INTERpolate:TYPE?
Example	:CALC:LLIN:CONT:INT:TYPE LIN sets limit line 1 frequency interpolation to linear.
Preset	Linear, not affected by Mode Preset, preset by Restore Mode Defaults.
State Saved	Saved in instrument state.
Initial S/W Revision	A.02.00

### Amplitude Interpolation

Sets the interpolation to linear or logarithmic for the specified limiting points set, allowing you to determine how limit trace values are computed between points in a limit table. See Frequency Interpolation for the equations used to calculate limit values between points.

Key Path	Meas Setup, Limits, Properties, Interpolation
Remote Command	:CALCulate:LLINE[1] 2 ... 6:AMPLitude:INTERpolate:TYPE LOGarithmic   LINear :CALCulate:LLINE[1] 2 ... 6:AMPLitude:INTERpolate:TYPE?
Example	:CALC:LLIN:AMPL:INT:TYPE LIN sets limit line 1 amplitude interpolation to linear.
Preset	Logarithmic, not affected by Mode Preset, preset by Restore Mode Defaults.

State Saved	Saved in instrument state.
Initial S/W Revision	A.02.00

### Fixed / Relative

Opens a menu which will allow you to specify that the selected limit is relative to either Center Frequency or Reference level.

Key Path	<b>Meas Setup, Limits, Properties</b>
Readback	Fixed Rel to CF Rel to RL Rel to CF + RL (square brackets)
Backwards Compatibility Notes	You can now set relative amplitude and relative frequency independently for each limit line. :CALC:LLIN:CMOD REL makes all limit lines relative to the center frequency and reference level. :CALC:LLIN:CMOD? returns 1 if Limit Line 1 is set Relative to CF, and returns 0 otherwise.
Initial S/W Revision	A.02.00

### Relative to CF

Chooses whether the limit line frequency points are coupled to the instrument center frequency, and whether the frequency points are expressed as an offset from the instrument center frequency. If the limit lines are specified with time, this has no effect. The limit table must in this case support negative frequencies.

For example, assume you have a frequency limit line, and the analyzer center frequency is at 1 GHz. If Relative to CF is “Off”, entering a limit line segment with a frequency coordinate of 300 MHz displays the limit line segment at 300 MHz, and the limit line segment will not change frequency if the center frequency changes. If Relative to CF is “On”, entering a limit line segment with a frequency coordinate of 300 MHz displays the limit line segment at CF + 300 MHz, or 1.3 GHz. Furthermore, if the center frequency changes to 2 GHz, the limit line segment will be displayed at CF + 300 MHz, or 2.3 GHz.

It is possible to change this setting after a limit line has been entered. When changing from On to Off or vice-versa, the frequency values in the limit line table change so that the limit line remains in the same position for the current frequency settings of the analyzer.

Pressing this button makes Center Frequency the active function.

Key Path	<b>Meas Setup, Limits, Properties, Fixed/Relative</b>
Remote Command	:CALCulate:LLINe[1] 2 ... 6:FREQuency:CMODe:RELative ON   OFF   1   0 :CALCulate:LLINe[1] 2 ... 6:FREQuency:CMODe:RELative?
Example	:CALC:LLIN:FREQ:CMOD:REL ON makes limit line 1 relative to the center frequency.
Notes	If the Trace Domain is changed to Time (:CALCulate:LLINe:CONTRol:DOMain TIME), the command : :CALCulate:LLINe[1] 2 3 4 5 6:FREQuency:CMODe:RELative ON OFF 1 0 will have no effect.
Couplings	Pressing this button makes Center Frequency the active function.
Preset	Off, not affected by Mode Preset, preset by Restore Mode Defaults.

State Saved	Saved in instrument state.
Initial S/W Revision	A.02.00

### Relative to RL

Chooses whether the limit line amplitude points are coupled to the instrument reference level, and whether the amplitude points are expressed as an offset from the instrument reference level.

For example, assume you have a limit line, and the reference level at  $-10$  dBm. If Relative to RL is “Off”, entering a limit line segment with an amplitude coordinate of  $-20$  dB displays the limit line segment at  $-20$  dBm, and the limit line segment will not change amplitude if the reference level amplitude changes. If Relative to RL is “On”, entering a limit line segment with an amplitude coordinate of  $-20$  dB displays the limit line segment at  $RL - 20$  dB, or  $-30$  dBm. Furthermore, if the reference level amplitude changes to  $-30$  dBm, the limit line segment will be displayed at  $RL - 20$  dB, or  $-50$  dBm.

It is possible to change this setting after a limit line has been entered. When changing from On to Off or vice-versa, the amplitude values in the limit line table change so that the limit line remains in the same position for the current reference level settings of the analyzer.

Key Path	<b>Meas Setup, Limits, Properties, Fixed/Relative</b>
<b>Remote Command</b>	:CALCulate:LLINE[1] 2 ... 6:AMPLitude:CMODE:RELative ON   OFF   1   0 :CALCulate:LLINE[1] 2 ... 6:AMPLitude:CMODE:RELative?
<b>Example</b>	:CALC:LLIN:AMPL:CMOD:REL ON makes limit line 1 relative to the reference level amplitude.
Couplings	Pressing this button makes Reference level the active function.
Preset	Off, not affected by Mode Preset, preset by Restore Mode Defaults.
State Saved	Saved in instrument state.
Initial S/W Revision	A.02.00

### Description

Provides a description of up to 60 characters by which the operator can easily identify the limit. Will be stored in the exported file. Can be displayed in the active function area by selecting as the active function, if desired to be in a screen dump.

Key Path	<b>Meas Setup, Limits, Properties</b>
<b>Remote Command</b>	:CALCulate:LLINE[1] 2 ... 6:DESCription “Description” :CALCulate:LLINE[1] 2 ... 6:DESCription?
<b>Example</b>	:CALC:LLIN:DESC “European Emissions”
Dependencies	60 characters max
Preset	” (null String), not affected by Mode Preset, preset by Restore Mode Defaults.

State Saved	Saved in instrument state.
Readback	As much of the description will fit on one line of the key, followed by “...” if some of the description will not fit on one line of the key.
Initial S/W Revision	A.02.00

### Comment

Sets an ASCII comment field, which will be stored in an exported file. Can be displayed in the active function area by selecting as the active function, if desired to be in a screen capture. The Limits .csv file supports this field.

Key Path	<b>Meas Setup, Limits, Properties</b>
<b>Remote Command</b>	:CALCulate:LLINe[1] 2 ... 6:COMMeNt "text" :CALCulate:LLINe[1] 2 ... 6:COMMeNt?
<b>Example</b>	:CALC:LLIN1:COMM "this is a comment"
Dependencies	60 characters max
Preset	"" (null String), not affected by Mode Preset, preset by Restore Mode Defaults.
State Saved	Saved in instrument state.
Readback	As much of the description will fit on one line of the key, followed by “...” if some of the description will not fit on one line of the key.
Initial S/W Revision	A.02.00

### 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 key until Off is underlined. 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.

Key Path	<b>Meas Setup, Limits</b>
<b>Remote Command</b>	:CALCulate:LLINe[1] 2 ... 6:MARGIn <rel_amp1> :CALCulate:LLINe[1] 2 ... 6:MARGIn?

	<code>:CALCulate:LLINe[1] 2 ... 6:MARGin:STATe OFF ON 0 1</code>
	<code>:CALCulate:LLINe[1] 2 ... 6:MARGin:STATe?</code>
<b>Example</b>	<p><code>:CALC:LLIN1:MARG -2dB</code> sets limit line 1's margin to -2 dB (Limit Line 1 is by default an upper limit).</p> <p><code>:CALC:LLIN2:MARG 1dB</code> sets limit line 2's margin to 1 dB (Limit Line 2 is by default a lower limit).</p> <p><code>:CALC:LLIN2:MARG:STAT OFF</code> turns off the margin for limit line 2 and removes any tests associated with that margin line.</p>
Notes	The queries "Limit Line Fail?" ( <code>:CALCulate:LLINe[1] 2 3 4 5 6:FAIL?</code> ) and "Trace Fail?" ( <code>:CALCulate:TRACe[1] 2 3 4 5 6:FAIL?</code> ) will return 1 if the margin fails.
Couplings	This will affect <code>:CALC:LLIN3:FAIL</code> or <code>:CALC:TRAC2:FAIL?</code>
Preset	Not affected by Mode Preset, set to 0 dB for all Limits by Restore Mode Defaults.
State Saved	Saved in instrument state.
Min	-40 dB (Upper); 0 dB (Lower)
Max	0 dB (Upper); 40 dB (Lower);
Default Unit	dB
Initial S/W Revision	A.02.00

### Edit

Opens the Table Editor for the selected 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 its 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 analyzer 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.**

When exiting the edit menu (by using the Return key or by pressing an instrument front panel key), the editor window turns off, however the Limit is still on and displayed, and the amplitude scale remains **Log**.

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 analyzer application, which means they will survive a power cycle.

Key Path	<b>Meas Setup, Limits</b>
Couplings	A remote user can enter or access limit line data via <code>:CALCulate:LLINe[1] 2 3 4 5 6:DATA</code>
Initial S/W Revision	A.02.00

## Navigate

Lets you move through the table to edit the desired point

Key Path	<b>Meas Setup, Limits, Edit</b>
Notes	There is no value readback on the key
Min	1
Max	2000
Initial S/W Revision	A.02.00

## Frequency

Lets you edit the frequency of the current row.

Key Path	<b>Meas Setup, Limits, Edit</b>
Notes	There is no value readback on the key
Min	0
Max	1 THz
Initial S/W Revision	A.02.00

## Amplitude

Lets you edit the Amplitude of the current row.

Key Path	<b>Meas Setup, Limits, Edit</b>
Notes	There is no value readback on the key
Min	-1000 dBm
Max	1000 dBm
Initial S/W Revision	A.02.00

## Insert Point Below

Pressing this key 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.

Key Path	<b>Meas Setup, Limits, Edit</b>
Initial S/W Revision	A.02.00

## Delete Point

This is an immediate action key. It will immediately delete the currently-selected point, whether or not that point is being edited, and select Navigate. The point following the currently-selected point (or the point preceding if there is none) will be selected.

Key Path	<b>Meas Setup, Limits, Edit</b>
Initial S/W Revision	A.02.00

## Copy from Limit

Copies an existing limit into the current limit, including all secondary parameters (Description, Associated Trace, Type, Margin, Interpolation, Relative to CF/RL).

Key Path	Meas Setup, Limits, Edit
Remote Command	:CALCulate:LLINE[1] 2 ... 6:COPY LLINE1   LLINE2   LLINE3   LLINE4   LLINE5   LLINE6
Example	:CALC:LLINE2:COPY LLINE1 copies the data from line 1 into line 2.
Notes	Auto return to the Edit menu.
Initial S/W Revision	A.02.00

## Build from Trace

Builds a limit using an existing trace. This command will overwrite all data in the limit. Since a straight copy would typically have hundreds or thousands of segments, the data will be approximated to better represent a limit line; small excursions whose width is less than 10 trace buckets will sometimes not be captured. Secondary parameters which are not associated with traces (Description, Associated Trace, Type, Margin, Interpolation, Relative to CF/RL) will be unchanged.

When taking a trace in order to build a limit, it will often work well to take the trace with a resolution bandwidth wider than the expected measurement, a video bandwidth lower than the expected measurement, and with the detector set to Max Hold or Min Hold.

Note that an upper limit will be built above the trace, while a lower limit will be built below the trace. If the trace is constant, the limit should pass after being built.

Key Path	Meas Setup, Limits, Edit
Remote Command	:CALCulate:LLINE[1] 2 ... 6:BUILD TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6
Example	:CALC:LLIN2:BUIL TRACE1 builds limit line 2 based on the data in trace 1. This will overwrite the data in the table editor.
Notes	Auto return to Edit menu.
Initial S/W Revision	A.02.00

## Offset

Enters a menu which allows you to offset the limit trace by a specified frequency, time, or amplitude. The offsets will be immediately applied to the limit trace for display and failure calculation; the offset can also be applied to the points in the limit line.

Key Path	Meas Setup, Limits, Edit
Initial S/W Revision	A.02.00



## X Offset

Offsets the limit trace by some specified frequency (for Frequency-based limit lines) or a time (for time-based limit lines).

Key Path	Meas Setup, Limits, Edit, Offset
<b>Remote Command</b>	:CALCulate:LLINE[1] 2 ... 6:OFFSet:X <value> :CALCulate:LLINE[1] 2 ... 6:OFFSet:X? <value> = <freq> if Limit X-Axis Unit is Frequency, <value> = <time> if Limit X-Axis Unit is Time
<b>Example</b>	:CALC:LLIN:OFFS:X -50MHZ sets the X axis offset to -50 MHz. :CALC:LLIN:OFFS:UPD will apply the X axis offset to all points in the limit line, then reset the X axis offset to zero.
Preset	0 Hz if Limit X-Axis Unit is Frequency 0 S if Limit X-Axis Unit is Time
State Saved	Saved in instrument state, survives Preset
Min	-500 GHz
Max	500 GHz
Default Unit	Determined by X axis scale.
Initial S/W Revision	A.02.00

## Y Offset

Offsets all segments in the limit line by some specified amplitude.

Key Path	Meas Setup, Limits, Edit, Offset
<b>Remote Command</b>	:CALCulate:LLINE[1] 2 ... 6:OFFSet:Y <rel ampl> :CALCulate:LLINE[1] 2 ... 6:OFFSet:Y?
<b>Example</b>	:CALC:LLIN:OFFS:Y -3 dB sets the Y axis offset to -3 dB. :CALC:LLIN:OFFSet:UPD will apply the Y axis offset to all points in the limit line, then reset the Y axis offset to zero.
Preset	0 dB
State Saved	Saved in instrument state.
Min	-Infinity
Max	+Infinity
Default Unit	dB
Initial S/W Revision	A.02.00

## Apply Offsets to Limit Table

Adds the X and Y offsets to each point in the limit table, then resets the X and Y offset values to zero. This has no effect on the position of the limit trace.

For example, if the X offset is -10 MHz and the Y offset is 1 dB, the values in the limit table will be updated as follows: 10 MHz will be subtracted from each X value, 1 dB will be added to each Y value. The offset values will then be reset to zero. The limit

trace will not be moved and the limit table will be updated to accurately reflect the currently-displayed limit trace.

Key Path	<b>Meas Setup, Limits, Edit, Offset</b>
<b>Remote Command</b>	<b>:CALCulate:LLINe[1] 2 ... 6:OFFSet:UPDate</b>
<b>Example</b>	:CALC:LLIN:OFFS:UPD sets updates the limit table to reflect the X and Y offsets, then resets the offsets to zero.
State Saved	No state
Initial S/W Revision	A.02.00

### Scale X Axis

Matches the X Axis to the selected Limit, as well as possible.

For frequency limits and a frequency-domain X-axis, sets the Start and Stop Frequency to contain the minimum and maximum Frequency of the selected Limit. 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.

For time limits and a time-domain X-axis, sets the sweep time to match the maximum Time of the selected Limit.

If the domain of the selected limit does not match the domain of the X Axis, no action is taken. Standard clipping rules apply, if the value in the table is outside the allowable range for the X axis.

Key Path	<b>Meas Setup, Limits, Edit</b>
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"
Initial S/W Revision	A.02.00

### Delete Limit

Deletes the currently selected limit line. Pressing Delete Limit purges the data from the limit line tables.

Limit data – including secondary parameters such as description, margin value, etc. – will be cleared and returned to factory preset settings.

When this key is pressed a prompt is placed on the screen that says "Please press Enter or OK key to delete limit. Press ESC or Cancel to close this dialog." The deletion is only performed if you press OK or Enter; if so, after the deletion, the informational message "Limit deleted" appears in the MSG line.

Key Path	<b>Meas Setup, Limits</b>
<b>Remote Command</b>	<b>:CALCulate:LLINe[1] 2 ... 6:DELete</b>

<b>Example</b>	:CALC:LLIN2:DEL deletes all data for limit line 2.
Initial S/W Revision	A.02.00

### 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.

This command only affects the display, and has no impact on remote behavior. Limit queries over SCPI test the trace against the limit regardless of whether the trace or the limit is turned on (exception: the query :CALCulate:TRACe[1]|2|3|4|5|6:FAIL? tests only the limits that are turned on for that trace).

Key Path	<b>Meas Setup, Limits</b>
<b>Remote Command</b>	:CALCulate:LLINe:TEST OFF ON 0 1 :CALCulate:LLINe:TEST?
<b>Example</b>	:CALC:LLIN:TEST ON turns on testing, and displays the results in the upper left corner.
Preset	On, not affected by Mode Preset, preset by Restore Mode Defaults.
State Saved	Saved in instrument state.
Initial S/W Revision	A.02.00

### 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 softkey in the Limit Table Editor will read Time instead of Frequency

Switching the limit-line definition between Freq and Time will erase all of the current limit lines. When you do this from the front panel, a warning dialog will pop up letting you know that you are about to erase all the limit lines, and prompting you to hit "OK" if you are sure:

Changing the X Axis Unit will erase all your limit lines. Are you sure you want to do this? Press **Enter** or **OK** to proceed, or **Cancel(Esc)** to cancel.

Key Path	<b>Meas Setup, Limits</b>
<b>Remote Command</b>	:CALCulate:LLINe:CONTRol:DOMain FREQuency TIME :CALCulate:LLINe:CONTRol:DOMain?
<b>Example</b>	:CALC:LLIN:CONT:DOM FREQ deletes all currently existing limit lines, then sets all limit lines to be specified in terms of frequency.
Couplings	This 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.
Initial S/W Revision	A.02.00

### 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 key is pressed a prompt is placed on the screen that says "Please press Enter or OK key to delete all limits. Press ESC or Cancel to close this dialog." The deletion is only performed if you press OK or Enter; if so, after the deletion, the informational message "All Limits deleted" appears in the MSG line.

Key Path	<b>Meas Setup, Limits</b>
<b>Remote Command</b>	:CALCulate:LLINe:ALL:DELeTe
<b>Example</b>	:CALC:LLIN:ALL:DEL deletes all data for all limit lines.
Initial S/W Revision	A.02.00

### 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.

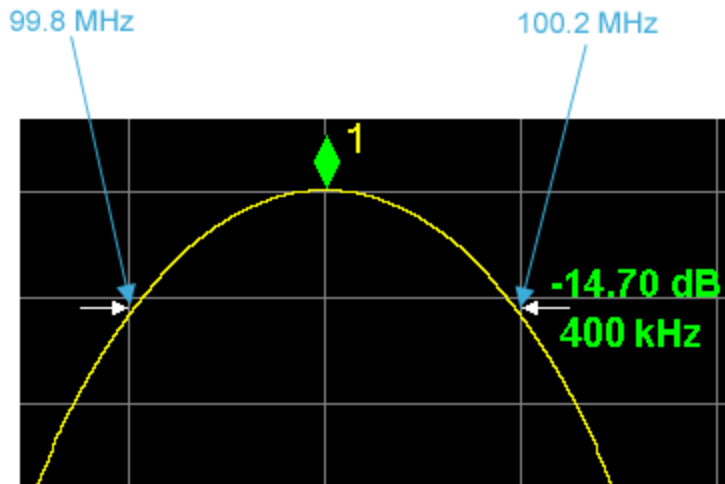
See ["N dB Points Results Queries" on page 857](#).

See "More Information" on page 858.

Key Path	Meas Setup
Remote Command	:CALCulate:BWIDth BANDwidth:NDB <rel_ampl> :CALCulate:BWIDth BANDwidth:NDB? :CALCulate:BWIDth BANDwidth[:STATe] OFF ON 0 1 :CALCulate:BWIDth BANDwidth[:STATe]?
Notes	If the selected marker is turned <b>Off</b> it turns off N dB Points. N DB Points is unaffected by Auto Couple
Preset	Off, -3.01 dB OFF
Preset	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
Backwards Compatibility Notes	In ESA, N dB points paid attention to the peak excursion and peak threshold set in the Search Criteria menu under Peak Search. This is not the case in the X-Series. In ESA, an invalid N dB reading was indicated, both onscreen and remotely, with a value of -100. In the X-Series it is indicated on screen by --- but remotely still by -100 Hz
Initial S/W Revision	Prior to A.02.00

### N dB Points Results Queries

You can query the width of the N dB band as well as the right and left edges of the band. For example, for the signal shown below, the marker is at 100 MHz and each graticule division represents 200 kHz. The N dB value is -14.7 dB and this makes the width of the NdB band 400 kHz. The frequencies at the left and right edge of the N dB band are as shown, 99.8 MHz and 100.2 MHz:



The following queries return the following values:

CALC:BAND:RES? 400 kHz

CALC:BAND:RLEF? 99.8 MHz

CALC:BAND:RRIG? 100.2 MHz

<b>Remote Command</b>	:CALCulate:BWIDth BANDwidth:RESult?
<b>Example</b>	:CALC:MARK:AOff Set selected marker to 1 :CALC:MARK:MAX Put marker 1 on peak :CALC:BWID ON Turn on N dB for the selected marker (1) :CALC:BWID:NDB-3.01 Set the offset to -3.01 dB :CALC:BWID:RES? Query the result
Notes	-100 returned if invalid reading
Initial S/W Revision	Prior to A.02.00

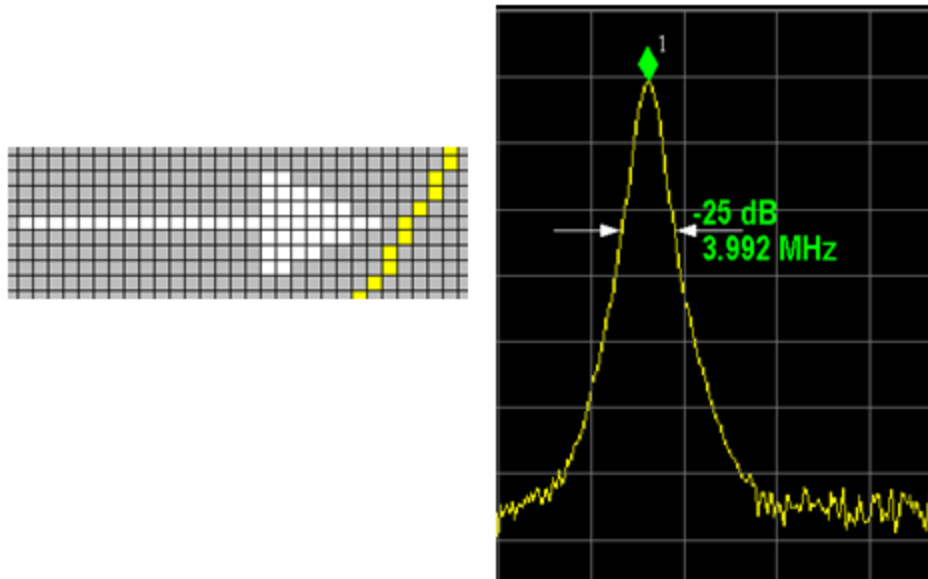
<b>Remote Command</b>	:CALCulate:BWIDth BANDwidth:RLEFt?
<b>Example</b>	:CALC:BWID:RLEF? Return the leftmost X Axis value for the N dB band
Notes	-100 returned if invalid reading
Initial S/W Revision	Prior to A.17.00

<b>Remote Command</b>	:CALCulate:BWIDth BANDwidth:RRIGht?
<b>Example</b>	:CALC:BWID:RRIG? Return the rightmost X Axis value for the N dB band
Notes	-100 returned if invalid reading
Initial S/W Revision	Prior to A.17.00

### 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. There is one pixel between the arrow and the trace



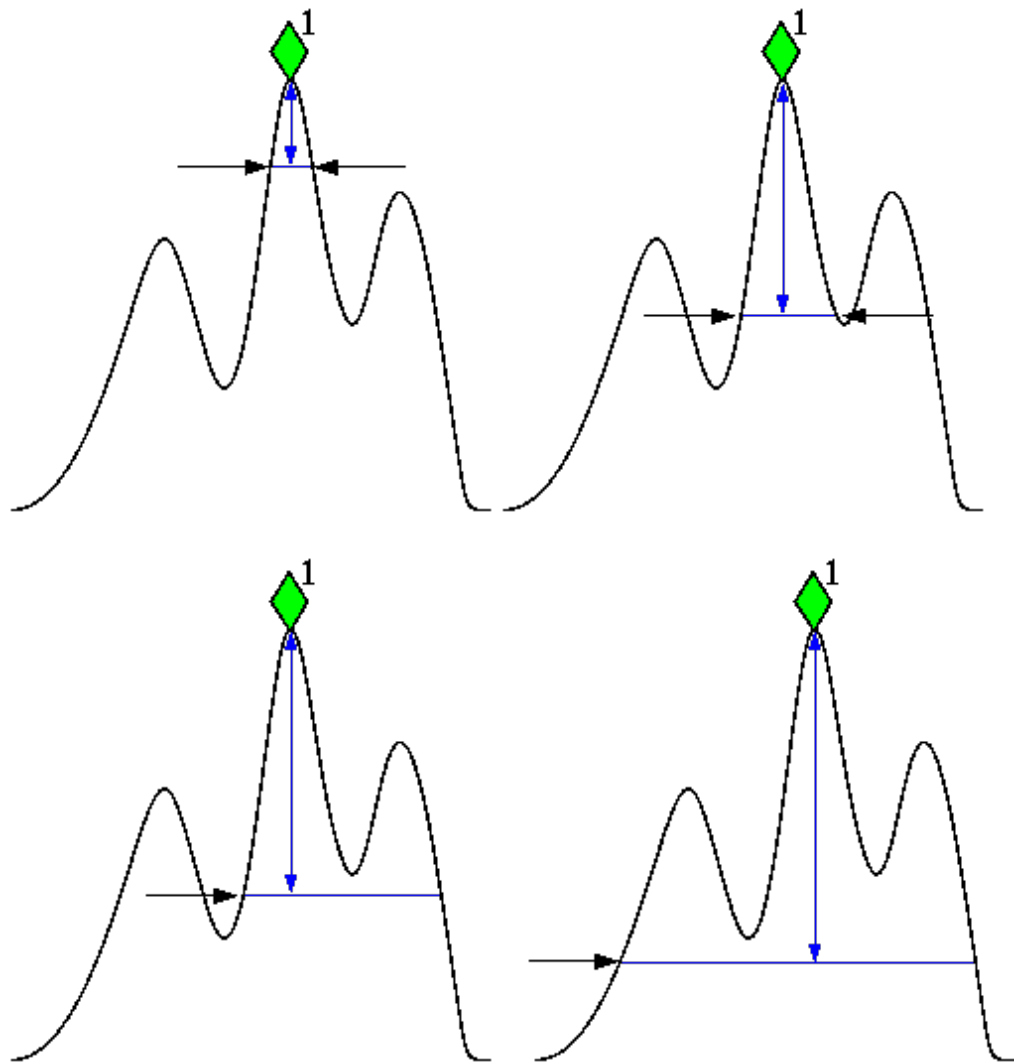
N dB Points can be used to measure the bandwidth of a signal; it is commonly used in conjunction with a tracking generator to measure filter bandwidths.

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.

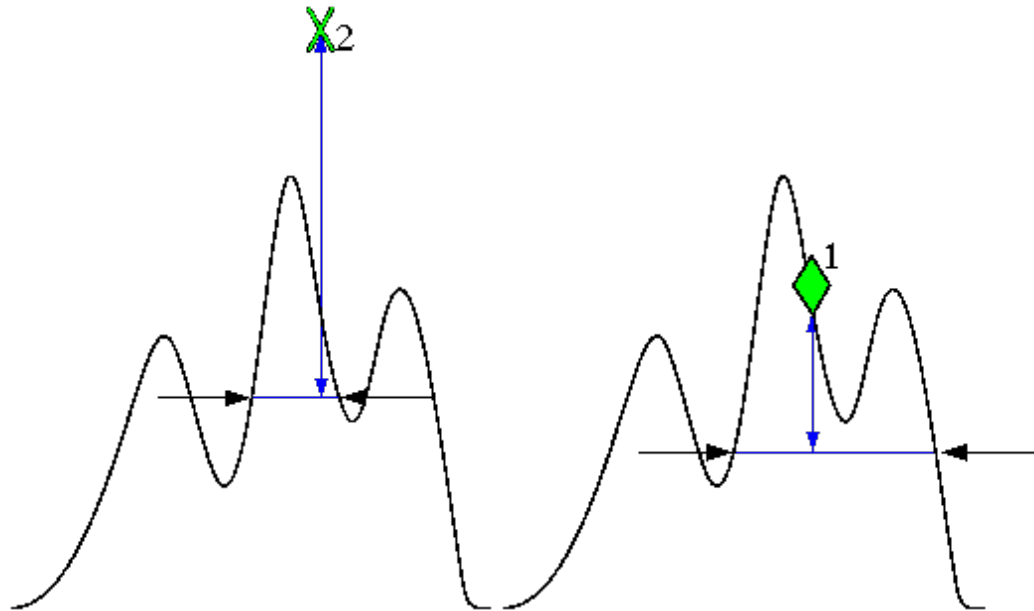
If the analyzer is unable to find data that is N dB below the marker on either side of the marker, the arrows are displayed at the indicator point of the marker, no value (--) will be displayed as the result and -100 Hz returned remotely (see figure below):



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.







### PhNoise Opt

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

See ["More Information" on page 863](#)

Path	Meas Setup
<b>Remote Command</b>	[ :SENSe ] :FREQuency:SYNThesis[ :STATe ] 1 2 3 4 5 [ :SENSe ] :FREQuency:SYNThesis[ :STATe ]?
<b>Example</b>	FREQ:SYNT 2    selects optimization for best wide offset phase noise
Range	All but EPO: Best Close-In Best Wide-Offset Fast Tuning EPO: Best Close-In Best Wide-Offset Fast Tuning Balanced Best Spurs
Range (Long Form)	No EPx option: Best Close-In $\Phi$ Noise [offset < 20 kHz] Best Wide-Offset $\Phi$ Noise [offset > 30 kHz] Fast Tuning [same as Close-in] EPO: Best Close-In $\Phi$ Noise [offset < 600 kHz] Balance Noise & Spurs [offset < 600 kHz]

---

Best Spurs  
[offset < 600 kHz]  
Best Wide-Offset  $\Phi$  Noise  
[offset > 800 kHz]  
Fast Tuning  
EP1:  
Best Close-In  $\Phi$  Noise  
[offset < 140 kHz]  
Best Wide-Offset  $\Phi$  Noise  
[offset > 160 kHz]  
Fast Tuning  
[single loop]  
EP2 & EP3:  
Best Close-In  $\Phi$  Noise  
[offset < 70 kHz]  
Best Wide-Offset  $\Phi$  Noise  
[offset > 100 kHz]  
Fast Tuning  
[medium loop bw]  
EP4:  
Best Close-In  $\Phi$  Noise  
[offset < 90 kHz]  
Best Wide-Offset  $\Phi$  Noise  
[offset > 130 kHz]  
Fast Tuning  
[same as Close-in]

---

Notes

Parameter:

- 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.
- 2: optimizes phase noise for wide frequency offsets from the carrier.
- 3: optimizes LO for tuning speed
- 4: In instruments with EP0, balances close-in phase noise with spur avoidance. In instruments without EP0 this setting is accepted but no action taken.
- 5: In instruments with EP0, emphasizes spur avoidance with close-in phase noise performance. In instruments without EP0 this setting is accepted but no action taken.

The actual behavior varies somewhat depending on model number and option; you always get fast tuning by choosing #3, but in some models, the “Fast Tuning” choice is identical to the “Best Close-In” choice. Specifically:

- Models with option EP0 (for example UXA), have a two stage local oscillator, which switches to a single loop for fast tuning
- Models with option EP1 (for example PXA), have a two-loop local oscillator, which

---

	switches to a single loop for fast tuning
	<ul style="list-style-type: none"> <li>- Models with option EP2 (available, for example, for MXA), 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 Close-In; this is useful when you have to look across a wide range of spans</li> <li>- In all other cases, Fast Tuning is the same as Best Close-In.</li> </ul>
Dependencies	Does not appear in all models. The key is blank in those models, but the SCPI command is accepted for compatibility (although no action is taken).
Preset	Because this function is in Auto after preset, and because Span after preset > 314.16 kHz (see Auto rules, next section) the state of this function after Preset will be 2
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.15.00
Path	Meas Setup, PhNoise Opt
<b>Remote Command</b>	<code>[ :SENSe]:FREQuency:SYNTHeSis:AUTO[:STATe] OFF ON 0 1</code> <code>[ :SENSe]:FREQuency:SYNTHeSis:AUTO[:STATe]?</code>
<b>Example</b>	FREQ:SYNT:AUTO ON
Preset	ON
State Saved	Saved in instrument state.
Initial S/W Revision	Prior to A.02.00

### More Information

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.

Here is detail about the various settings you can choose:

- ["Auto " on page 864](#)
- ["Best Close-in  \$\Phi\$  Noise" on page 864](#)
- ["Best Wide-offset  \$\Phi\$  Noise" on page 864](#)
- ["Fast Tuning" on page 865](#)
- ["Balance Noise and Spurs " on page 864](#)
- ["Best Spurs " on page 864](#)
- ["Phase Noise Optimization Auto Rules" on page 865](#)

## Auto

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SCPI Example                      FREQ:SYNT:AUTO ON

---

Selects the LO (local oscillator) phase noise behavior to optimize dynamic range and speed for various instrument operating conditions. See "[Phase Noise Optimization Auto Rules](#)" on page 865 for details on the Auto rules.

### Best Close-in $\Phi$ Noise

---

SCPI Example                      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 analyzers this annotation appears as [offset <20 kHz]

In instruments with Option EPO, the LO is configured for the best possible phase noise at offsets up to 600 kHz from the carrier, regardless of spurious products that occur with some center frequencies.

### Balance Noise and Spurs

---

SCPI Example                      FREQ:SYNT 4

---

In instruments with EPO, 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  $\pm 1$  octave around 400 kHz offset. The spurs will always be below  $-70$  dBc.

### Best Spurs

---

SCPI Example                      FREQ:SYNT 5

---

In instruments with EPO, the LO is configured for better phase noise than the "Wide-Offset" case close to the carrier, but the configuration has 11 dB worse phase noise than the "Best Close-In" case mostly within  $\pm 1$  octave around 300 kHz offset. Spurs are even lower than in the "Balance Noise and Spurs" 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 $\Phi$ Noise

---

SCPI Example                      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 analyzers 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  $\pm 1$  octave around 400 kHz offset. The spurs will always be below  $-70$  dBc.

## Fast Tuning

---

SCPI Example

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” 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 the Best Spurs configuration. It is available with this “Fast Tuning” label to inform the user, and to make the user interface more consistent with other X-Series analyzer family members.

(In models whose hardware does not provide for a fast tuning option, the settings for Best Close-in  $\Phi$  Noise are used if Fast Tuning is selected. This gives the fastest possible tuning for that hardware set.)

## Phase Noise Optimization Auto Rules

The X-Series has several grades of LO that offer different configurations when in the Auto Mode.

- ["Models with Option EP0" on page 866](#) (available in UXA)
- ["Models with Option EP1" on page 866](#) (available in PXA)
- ["Models with Option EP2" on page 866](#) (available, for example, in MXA for excellent phase noise)
- ["Models with Option EP4" on page 867](#)(available in CXA for improved phase noise)

- "All other Models" on page 867

### Models with Option EP0

Auto will choose:

Balanced Noise and Spurs whenever:

Center frequency is  $< 699.9$  kHz

Otherwise, Auto will choose Fast Tuning whenever:

Span  $> 114.1$  MHz, or when

RBW  $> 800$  kHz

Otherwise, Auto will choose Best Wide-offset  $\Phi$  Noise whenever:

RBW  $> 290$  kHz, or when

Span  $> 4.2$  MHz

Otherwise, Auto will choose Balanced Noise and Spurs.

The RBW to be used in the calculations above is the equivalent  $-3$  dB bandwidth of the current RBW filter.

These rules apply whether in swept spans, zero span, or FFT spans.

### Models with Option EP1

Auto will choose:

Fast Tuning whenever:

Span  $> 44.44$  MHz, or when

RBW  $> 1.9$  MHz, or if

Source Mode is set to "Tracking"

otherwise Auto will choose Best Close in Phase Noise whenever:

Center frequency is  $< 195$  kHz, or when

CF  $\geq 1$  MHz and Span  $\leq 1.3$  MHz and RBW  $\leq 75$  kHz

otherwise, Auto will choose Best Wide-offset Phase Noise

The RBW to be used in the calculations above is the equivalent  $-3$  dB bandwidth of the current RBW filter.

These rules apply whether in swept spans, zero span, or FFT spans.

### Models with Option EP2

Auto will choose:

Best Close-in  $\Phi$  Noise whenever:

CF < 130 kHz , or when

CF > 12 MHz and Span < 495 kHz and RBW < 40 kHz

Otherwise, Auto will choose Fast Tuning whenever:

Span > 22 MHz, or when

RBW > 400 kHz, or when

CF ≤ 12 MHz and Span < 495 kHz and RBW < 23 kHz

Otherwise, Auto will choose Best Wide-offset  $\Phi$  Noise.

The RBW to be used in the calculations above is the equivalent -3 dB bandwidth of the current RBW filter.

These rules apply whether in swept spans, zero span, or FFT spans.

### **Models with Option EP4**

Auto will choose:

Fast Tuning whenever:

Span > 101 MHz or when

RBW > 1.15 MHz or if

Source Mode is set to “Tracking”

otherwise, Auto will choose Best Close in Phase Noise whenever:

CF is < 109 kHz or when

CF ≥ 4.95 MHz and Span ≤ 666 kHz and RBW < 28 kHz

Otherwise, Auto will choose Best Wide-offset  $\Phi$  Noise.

The RBW to be used in the calculations above is the equivalent -3 dB bandwidth of the current RBW filter.

These rules apply whether in swept spans, zero span, or FFT spans.

### **All other Models**

Auto will choose:

Fast Tuning whenever:

Span > 12.34 MHz, or when

RBW > 250 kHz, or if

Source Mode is set to “Tracking”

Otherwise, Auto will choose Best Close in Phase Noise whenever:

Center frequency is < 25 kHz, or when

CF ≥ 1 MHz and Span ≤ 141.4 kHz and RBW ≤ 5 kHz

Otherwise, Auto will choose Best Wide-offset Phase Noise

Note that in these models, the hardware does not actually provide for an extra-fast tuning option, so the settings for Fast Tuning are actually the same as Best Close-in, 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.

The RBW to be used in the calculations above is the equivalent -3 dB bandwidth of the current RBW filter.

These rules apply whether in swept spans, zero span, or FFT spans.

## ADC Dither

Accesses the menu to control the ADC Dither function. The dither function 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.

Key Path	Meas Setup
<b>Remote Command</b>	[ :SENSe ] :ADC :DITHer [ :STATe ] OFF   ON   HIGH [ :SENSe ] :ADC :DITHer [ :STATe ] ?
<b>Example</b>	ADC:DITH:HIGH Sets the ADC dither setting to High ADC:DITH ON Sets the ADC dither setting to Medium In older instruments the "Medium" key was labeled "On" and the SCPI for this setting is NOT changing.
Dependencies	In some models, the "High" parameter is not available. In some instruments, the HIGH parameter is honored and the HIGH state set, and returned to a query, but the Medium dither level is actually used.
Preset	AUTO
<b>Backwards Compatibility SCPI</b>	The old command



	[:SENSe]:ADC:DITHer AUTO is aliased to [:SENSe]:ADC:DITHer:AUTO[:STATe] ON; because of this, the [:SENSe]:ADC:DITHer function cannot be a true Boolean, so the query, [:SENSe]:ADC:DITHer? returns OFF or ON (not 1 or 0 like a true Boolean)
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

### Auto

Sets the ADC dither to automatic. The analyzer 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 analyzer 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.

Key Path	<b>Meas Setup, ADC Dither</b>
<b>Remote Command</b>	[ :SENSe ] :ADC :DITHer :AUTO [ :STATe ] OFF   ON   0   1 [ :SENSe ] :ADC :DITHer :AUTO [ :STATe ] ?
<b>Example</b>	ADC:DITH:AUTO ON
Preset	ON
State Saved	Saved in instrument state
Readback	The "Auto" is underlined, and the readback value is whatever setting is auto-selected
Initial S/W Revision	Prior to A.02.00

### 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.

Key Path	<b>Meas setup, ADC Dither</b>
<b>Example</b>	ADC:DITH:ON
Readback	If manually selected, the readback is Medium, with the "Man" underlined
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.02.00

## 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.

Key Path	<b>Meas setup, ADC Dither</b>
<b>Example</b>	ADC:DITH:OFF
Readback	If manually selected, the readback is Off, with the “Man” underlined.
Initial S/W Revision	Prior to A.02.00

## IF Gain

To take full advantage of the RF dynamic range of the analyzer, there is an added switched IF amplifier with approximately 10 dB of gain. When you can turn it on without overloading the analyzer, the dynamic range is always better with it on than off. The **IF Gain** key can be used to set the IF Gain function to High Gain (the extra 10 dB), or to Low Gain. These settings affect sensitivity and IF overloads.

Key Path	<b>Meas Setup</b>
<b>Remote Command</b>	[ :SENSe ] : IF : GAIN [ : STATE ] ON   OFF   1   0 [ :SENSe ] : IF : GAIN [ : STATE ] ?
<b>Example</b>	IF:GAIN ON
Couplings	If the start frequency of the instrument is less than 10 MHz, and you put IF Gain in Manual High, a warning condition is generated and remains in effect as long as this condition exists. The warning message is about a possible IF overload.
Preset	OFF
State Saved	Saved in instrument state.
Readback Line	High Gain (ON or 1 in SCPI) or Low Gain (OFF or 0 in SCPI)
Initial S/W Revision	A.13.00

## Auto

Activates the auto rules for IF Gain This sets the IF Gain to its default value which is Low Gain (Off)

Key Path	<b>Meas setup</b>
<b>Remote Command</b>	[ :SENSe ] : IF : GAIN : AUTO [ : STATE ] OFF   ON   0   1 [ :SENSe ] : IF : GAIN : AUTO [ : STATE ] ?
<b>Example</b>	IF:GAIN:AUTO ON
Preset	ON
Initial S/W Revision	A.13.00

## Low Gain

Forces IF Gain to be off.

---

Key Path	<b>Meas Setup, IF Gain</b>
<b>Example</b>	IF:GAIN OFF
State Saved	Saved in instrument state.
Readback	Low Gain
Initial S/W Revision	A.13.00

---

### High Gain

Forces IF Gain to be on.

---

Key Path	<b>Meas Setup, IF Gain</b>
<b>Example</b>	IF:GAIN:SWEP ON
State Saved	Saved in instrument state.
Readback	High Gain
Initial S/W Revision	A.13.00

---

### Meas Preset

This key returns the Meas Local variables in the Real Time SA measurement to their preset values. The only exception is Limits On/Off, which is a persistent Meas Local variable. It will be set to Off by a Mode Preset but not by Meas Preset.

Meas Preset is only supported via the front panel. There is no SCPI command for Meas Preset.

---

Key Path	<b>Meas Setup</b>
Initial S/W Revision	A.13.00

---

## Mode

See ["Mode" on page 224](#)

## Mode Preset

Returns the active mode to a known state.

Mode Preset does the following for the currently active mode:

- Aborts the currently running measurement.
- Brings up the default menu for the mode, with no active function.
- Sets measurement Global settings to their preset values for the active mode only.
- Activates the default measurement.
- Brings up the default menu for the mode.
- Clears the input and output buffers.
- Sets Status Byte to 0.

Mode Preset does not:

- Cause a mode switch
- Affect mode persistent settings
- Affect system settings
- See "[How-To Preset](#)" on page 874 for more information.

Key Path	Front-panel key
Remote Command	:SYSTem:PRESet
Example	:SYST:PRES
Notes	<p>*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.</p> <p>Clears all pending OPC bits. The Status Byte is set to 0.</p>
Couplings	A Mode Preset aborts the currently running measurement, activates the default measurement, and gets the mode to a consistent state with all of the default couplings set.
Backwards Compatibility Notes	<p>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.</p> <p>There is also no "Preset Type" as there is on the PSA. There is a green Mode Preset front-panel key that does a <b>Mode Preset</b> 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.</p> <p>The settings and correction data under the Input/Output front-panel key (examples: Input Z Corr,</p>

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.

Initial S/W Revision      Prior to A.02.00

## How-To Preset

The table below shows all possible presets, their corresponding SCPI commands and front-panel access (key paths). Instrument settings depend on the current measurement context. Some settings are local to the current measurement, some are global (common) across all the measurements in the current mode, and some are global to all the available modes. In a similar way, restoring the settings to their preset state can be done within the different contexts.

Auto Couple - is a measurement local key. It sets all Auto/Man parameter couplings in the measurement to Auto. Any Auto/Man selection that is local to other measurements in the mode will not be affected.

Meas Preset - is a measurement local key. Meas Preset resets all the variables local to the current measurement except the persistent ones.

Mode Preset - resets all the current mode's measurement local and measurement global variables except the persistent ones.

Restore Mode Defaults - resets ALL the Mode variables (and all the Meas global and Meas local variables), including the persistent ones.

Type Of Preset	SCPI Command	Front Panel Access
Auto Couple	:COUPle ALL	Auto Couple front-panel key
Meas Preset	:CONFigure: <Measurement>	Meas Setup Menu
Mode Preset	:SYSTem:PRESet	Mode Preset (green key)
Restore Mode Defaults	:INSTrument:DEFault	Mode Setup Menu
Restore All Mode Defaults	:SYSTem:DEFault MODes	System Menu; Restore System Default Menu
*RST	*RST	not possible (Mode Preset with Single)
Restore Input/Output Defaults	:SYSTem:DEFault INPut	System Menu; Restore System Default Menu
Restore Power On Defaults	:SYSTem:DEFault PON	System Menu; Restore System Default Menu
Restore Alignment Defaults	:SYSTem:DEFault ALIGN	System Menu; Restore System Default Menu
Restore Miscellaneous Defaults	:SYSTem:DEFault MISC	System Menu; Restore System Default Menu

Restore All System Defaults	:SYSTem:DEFault [ALL] :SYSTem:PRESet:PERsistent	System Menu; Restore System Default Menu
User Preset	:SYSTem:PRESet:USER	User Preset Menu
User Preset All Modes	:SYSTem:PRESet:USER:ALL	User Preset Menu
Power On Mode Preset	:SYSTem:PON:TYPE MODE	System Menu
Power On User Preset	:SYSTem:PON:TYPE USER	System Menu
Power On Last State	:SYSTem:PON:TYPE LAST	System Menu

### Preset Type (Remote Command Only)

As stated in the Backward Compatibility section, to be compatible with ESA/PSA the PRESet:TYPE command will be implemented as a no-op.

Mode	All
<b>Remote Command</b>	:SYSTem:PRESet:TYPE FACTory  MODE  USER :SYSTem:PRESet:TYPE?
<b>Example</b>	:SYST:PRESet:TYPE FACT
Notes	This command is supported for backward compatibility only. It is a no-op which does not change the behavior of any preset operation.
Preset	This is unaffected by Preset but is set to Mode on a "Restore System Defaults->All"
State Saved	No
Initial S/W Revision	<b>Prior to A.02.00</b>

## Mode Setup

The Mode Setup menu is used to control functions that are independent of which measurement is currently running. In the RTSA mode, the only such functions are Restore Mode Defaults and Global Settings.

Key Path	Front-panel key
Initial S/W Revision	A.13.00

### Restore Mode Defaults

Resets the state for the currently active mode by resetting the mode persistent settings to their factory default values, clearing mode data and by performing a Mode Preset. This function will never cause a mode switch. This function performs a full preset for the currently active mode; whereas, Mode Preset performs a partial preset. Restore Mode Defaults does not affect any system settings. System settings are reset by the Restore System Defaults function. This function does reset mode data; as well as settings.

Key Path	Mode Setup
<b>Remote Command</b>	:INSTrument:DEFault
<b>Example</b>	:INST:DEF
Notes	Clears all pending OPC bits. The Status Byte is set to 0. A message comes up saying: "If you are sure, press key again".
Couplings	A Restore Mode Defaults will cause 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.
Initial S/W Revision	Prior to A.02.00

### Global Settings

Opens a menu that allows you to switch certain Meas Global parameters to a Mode Global state. These switches apply to all Modes that support global settings. No matter what Mode you are in when you set the "Global Center Frequency" switch to on, it applies to all Modes that support Global Settings.

Key Path	Mode Setup
Initial S/W Revision	Prior to A.02.00

### Global Center Freq

The software maintains a Mode Global value called "Global Center Freq".

When the **Global Center Freq** key is switched to **On** in any mode, the current mode's center frequency is copied into the Global Center Frequency, and from then on all



modes that support global settings use the Global Center Frequency. So you can switch between any of these modes and the Center Freq will remain unchanged.

Adjusting the Center Freq of any mode which supports Global Settings, while **Global Center Freq is On**, will modify the Global Center Frequency.

When **Global Center Freq** is turned **Off**, the Center Freq of the current mode is unchanged, but now the Center Freq of each mode is once again independent.

When **Mode Preset** is pressed while **Global Center Freq** is **On**, the Global Center Freq is preset to the preset Center Freq of the current mode.

This function is reset to Off when the Restore Defaults key is pressed in the Global Settings menu, or when **System, Restore Defaults, All Modes** is pressed.

Key Path	<b>Mode Setup, Global Settings</b>
Scope	Mode Global
<b>Remote Command</b>	<b>:INSTrument:COUPle:FREQuency:CENTer ALL NONE</b> <b>:INSTrument:COUPle:FREQuency:CENTer?</b>
<b>Example</b>	INST:COUP:FREQ:CENt ALL INST:COUP:FREQ:CENt?
Preset	Set to Off on Global Settings, Restore Defaults and System, Restore Defaults, All Modes
Range	On Off
Initial S/W Revision	Prior to A.02.00

<b>Remote Command</b>	<b>:GLOBal:FREQuency:CENTer[:STATe] 1 0 ON OFF</b> <b>:GLOBal:FREQuency:CENTer[:STATe]?</b>
Preset	Off
Initial S/W Revision	Prior to A.02.00

## Restore Defaults

This key resets all of the functions in the Global Settings menu to Off. This also occurs when **System, Restore Defaults, All Modes** is pressed.

Key Path	<b>Mode Setup, Global Settings</b>
<b>Remote Command</b>	<b>:INSTrument:COUPle:DEFault</b>
<b>Example</b>	INST:COUP:DEF
<b>Backwards Compatibility SCPI</b>	<b>:GLOBal:DEFault</b>
Initial S/W Revision	Prior to A.02.00

## Peak Search

Pressing the Peak Search key displays the Peak Search menu and places the selected marker on the trace point with the maximum y-axis value for that marker's trace. The Peak Search features allow you to define specific search criteria to determine which signals can be considered peaks, excluding unwanted signals from the search.

### NOTE

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.

See "[More Information](#)" on page 878.

Key Path	Front-panel key
<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 12:MAXimum
<b>Example</b>	CALC:MARK2:MAX performs a peak search using marker 2. CALC:MARK2:Y? queries the marker amplitude (Y-axis) value for marker 2. CALC:MARK2:X? queries the marker frequency or time (X-axis) value for marker 2. SYST:ERR? can be used to query the errors to determine if a peak is found. The message "No peak found" will be returned after an unsuccessful search.
Notes	Sending this command selects the subopcoded marker.
Initial S/W Revision	Prior to A.02.00

## More Information

The behavior of a Peak Search is dependent on settings under the Peak Criteria softkey on the second page of the menu. If **Same as "Next Peak" Criteria** is selected, and either **Pk Excursion** or **Pk Threshold** are on, a signal must meet those criteria to 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 Peak Search menu. Then go to the other menus that you need to access. Finally, you can get back to the Peak Search key menu by using the front panel Return key and pressing it as many times as

required to navigate back through the previously accessed menus until you get back to the Peak Search menu.

## Next Peak

Pressing Next Peak moves the selected marker to the peak that has the next highest amplitude less than the marker's current value. Only peaks which meet all enabled peak criteria are considered. If there is no valid peak lower than the current marker position, a "No peak found" message is generated and the marker is not moved.

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

Key Path	<b>Peak Search</b>
<b>Remote Command</b>	<b>:CALCulate:MARKer[1] 2 ... 12:MAXimum:NEXT</b>
<b>Example</b>	CALC:MARK2:MAX:NEXT Selects marker 2 and moves it to the peak that is closest in amplitude to the current peak, but the next lower value.
Notes	Sending this command selects the subopcoded marker.
State Saved	Not part of saved state.
Initial S/W Revision	Prior to A.02.00

## Next Pk Right

Pressing Next Pk Right moves the selected marker to the nearest peak right of the current marker that meets all enabled peak criteria. If there is no valid peak to the right of the current marker position, a "No peak found" message is generated and the marker is not moved.

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

Key Path	<b>Peak Search</b>
<b>Remote Command</b>	<b>:CALCulate:MARKer[1] 2 ... 12:MAXimum:RIGHT</b>
<b>Example</b>	CALC:MARK2:MAX:RIGH Selects marker 2 and moves it to the next peak to the right of the current marker position.
Notes	Sending this command selects the subopcoded marker.
State Saved	Not part of saved state.
Initial S/W Revision	Prior to A.02.00

## Next Pk Left

Pressing Next Pk Left moves the selected marker to the nearest peak left of the current marker that meets all enabled peak criteria. If there is no valid peak to the left of the current marker position, a "No peak found" message is generated and the marker is not moved.

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

Key Path	<b>Peak Search</b>
<b>Remote Command</b>	<b>:CALCulate:MARKer[1] 2 ... 12:MAXimum:LEFT</b>
<b>Example</b>	CALC:MARK2:MAX:LEFT selects marker 2 and moves it to the next peak to the left of the current marker position.
State Saved	Not part of saved state.
Initial S/W Revision	Prior to A.02.00

## Marker Delta

Performs the same function as the Delta 1-of-N selection key in the Marker menu. Basically this sets the control mode for the selected marker to Delta mode. See the Section ["Marker" on page 778](#) for the complete description of this function. The key is duplicated here in the Peak Search Menu to allow you to conveniently perform a peak search and change the marker's control mode to Delta without having to access two separate menus.

Key Path	<b>Peak Search or Marker</b>
Notes	Whenever the selected marker is in Delta mode and you are in the Peak Search menu, the Marker Delta key should be highlighted and the active function for setting its delta value turned on.
Initial S/W Revision	Prior to A.02.00

## Mkr->CF

Assigns the selected marker's frequency to the Center Frequency setting. See the Section ["Marker To" on page 796](#) for the description of this function. The key is duplicated here in the Peak Search Menu to allow you to conveniently perform a peak search and marker to CF without having to access two separate menus.

Key Path	<b>Peak Search or Marker -&gt;</b>
Dependencies	Same as specified under Marker To
Initial S/W Revision	Prior to A.02.00

## Mkr->Ref Lvl

Assigns the selected marker's level to the Reference Level setting. See the Section ["Marker To" on page 796](#) for the description of this function. The key is duplicated here in the Peak Search Menu to allow you to conveniently perform a peak search and marker to RL without having to access two separate menus.

Key Path	<b>Peak Search or Marker -&gt;</b>
Dependencies	Same as specified under Marker To
Initial S/W Revision	Prior to A.02.00

## Peak Criteria

Pressing this key opens the Peak Criteria menu and allows you to adjust the Pk Threshold and Pk Excursion parameters used for peak search functions.

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.

Key Path	<b>Peak Search</b>
Backwards Compatibility Notes	In the ESA, this menu was called Search Criteria; in the PSA, it was called Search Param. The menu structure in X-Series is different (for clarity) but the functionality is essentially the same. Basically, the Peak Excursion and Peak Threshold keys appeared at the top level of this menu in the PSA/ESA, whereas in the X-Series they are one level down under “Next Peak” Criteria
Initial S/W Revision	Prior to A.02.00

### “Peak Search” Criteria

This menu lets you decide what kind of search you want to do when the Peak Search key is pressed (or the equivalent SCPI command sent).

Note that there are two “types” of peak search functions. One type is the “Peak Search” type, the other type is the “Next Peak” type. “Next Peak” searches (for example, Next Peak, Next Pk Left, Next Pk Right) are always checked using the Excursion and Threshold criteria as long as these criteria are On. The “Peak Search” type of search, simply finds the highest point on the trace. However you can change the “Peak Search” type of search 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.

When **Highest Peak** is selected, pressing **Peak Search** simply finds the highest peak on the marker’s trace. If **Same as “Next Peak” Criteria** is selected, then the search is also forced to consider the Excursion and Threshold found under the “**Next Peak**” **Criteria** menu.

Key Path	<b>Peak Search, Peak Criteria</b>
<b>Remote Command</b>	<b>:CALCulate:MARKer:PEAK:SEARch:MODE MAXimum PARAmeter</b>

	<b>:CALCulate:MARKer:PEAK:SEARch:MODE?</b>
Notes	MAXimum corresponds to the <b>Highest Peak</b> setting PARameter corresponds to the <b>Same as “Next Peak” Criteria</b> setting
Preset	MAXimum
State Saved	Saved in instrument state.
Readback line	Current state
Backwards Compatibility Notes	The submenu called “Peak Search” Criteria in the X-Series was called Peak Search Type in the ESA, and in the PSA was not a submenu but a single called Peak Search with a toggle between Param and Max.  Nonetheless, the functionality and SCPI commands are identical in all three, only the structure of the user interface is different
Initial S/W Revision	Prior to A.02.00

### Highest Peak

When this key is selected, pressing the Peak Search key or issuing the equivalent SCPI command finds the maximum point on the trace, subject to the peak-search qualifications. This also affects the Peak Search half of Pk-Pk search and the Continuous Peak Search.

Key Path	<b>Peak Search, Peak Criteria, “Peak Search” Criteria</b>
<b>Example</b>	CALC:MARK:PEAK:SEAR:MODE MAX
Readback	Highest Peak
Initial S/W Revision	Prior to A.02.00

### Same as “Next Peak” Criteria

When this key is selected, pressing the Peak Search key or issuing the equivalent SCPI command finds the maximum point on the trace, but subject to the Excursion and Threshold set under the Next Peak Criteria menu. The search is, of course, also subject to the peak-search qualifications. This also affects the Peak Search half of Pk-Pk search and the Continuous Peak Search.

Key Path	<b>Peak Search, Peak Criteria, “Peak Search” Criteria</b>
<b>Example</b>	CALC:MARK:PEAK:SEAR:MODE PAR
Readback	Use Excurs & Thr
Initial S/W Revision	Prior to A.02.00

### “Next Peak” Criteria

This key opens up a menu which allows you to independently set the Peak Excursion and Peak Threshold and turn them on and off.

Key Path	<b>Peak Search, Peak Criteria</b>
Backwards	In the X-Series, you can enable <b>Pk Excursion</b> and <b>Pk Threshold</b> independently, but they default to

Compatibility Notes	“both on”. Since “both on” is always the case in ESA and PSA, this difference should not cause code compatibility problems.
Initial S/W Revision	Prior to A.02.00

### Pk 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 884](#).

Key Path	Peak Search, Peak Criteria, “Next Peak” Criteria
Remote Command	:CALCulate:MARKer:PEAK:EXCursion <rel_amp1> :CALCulate:MARKer:PEAK:EXCursion? :CALCulate:MARKer:PEAK:EXCursion:STATE OFF ON 0 1 :CALCulate:MARKer:PEAK:EXCursion:STATE?
Example	:CALC:MARK:PEAK:EXC:STAT ON :CALC:MARK:PEAK:EXC 30 DB sets the minimum peak excursion requirement to 30 dB
Dependencies	Available only when Y axis unit is amplitude units, otherwise grayed out.
Couplings	Whenever you adjust the value of Pk Excursion (with the knob, step keys, or by completing a numeric entry), and Peak Threshold is turned ON, the Peak Threshold Line and the Peak Excursion Region are displayed.
Preset	6.0 dB ON
Preset	6.0 dB ON
State Saved	Saved in instrument state
Min	0.0 dB
Max	100.0 dB
Initial S/W Revision	Prior to A.02.00

## 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.

## Pk 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.

Key Path	Peak Search, Peak Criteria, "Next Peak Criteria"
Remote Command	:CALCulate:MARKer:PEAK:THReshold <amp;lt;1> :CALCulate:MARKer:PEAK:THReshold? :CALCulate:MARKer:PEAK:THReshold:STATe OFF ON 0 1 :CALCulate:MARKer:PEAK:THReshold:STATe?
Example	CALC:MARK:PEAK:THR:STAT ON turns on the threshold criterion. CALC:MARK:PEAK:THR -60 dBm sets the threshold to $-60$ dBm.
Dependencies	When Ref Level Offset changes, Peak Threshold must change by the same amount.
Preset	$-90.0$ dBm ON
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.
Default Unit	depends on the current selected Y axis unit
Initial S/W Revision	Prior to A.02.00

### Pk Threshold Line

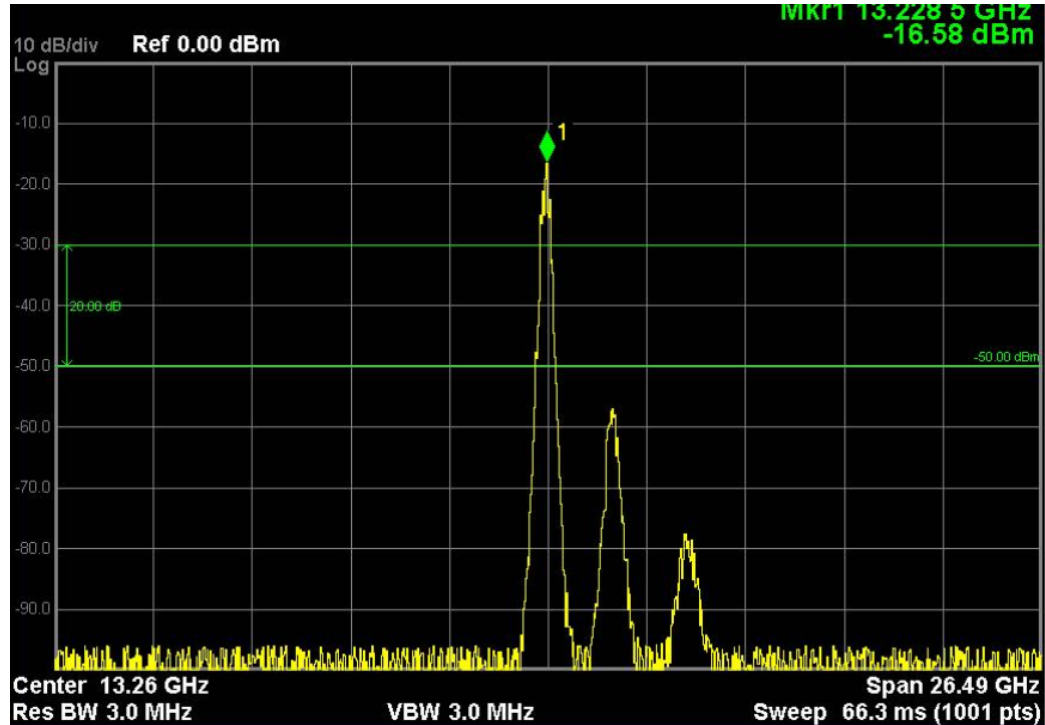
Turns the peak threshold line on or off. Preset state is off. No equivalent SCPI command.

See ["More Information" on page 885](#).

Key Path	Peak Search, Peak Criteria, "Next Peak" Criteria
Initial S/W Revision	Prior to A.02.00

### More Information

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.



This function is automatically set to 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 to 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.

## 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 886.

Key Path	<b>Peak Search</b>
<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 12:CPSearch[:STATE] ON OFF 1 0 :CALCulate:MARKer[1] 2 ... 12:CPSearch[:STATE]?
<b>Example</b>	CALC:MARK:CPS ON Turns on Continuous Peak Search.
Notes	Sending this command selects the subopcoded marker
Couplings	The Continuous Peak Search key is grayed out when the selected marker is a <b>Fixed</b> 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 key grayed out. <b>Signal Track</b> and <b>Continuous Peak Search</b> are mutually exclusive so if <b>Signal Track</b> is on, <b>Continuous Peak Search</b> 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.
Backwards Compatibility Notes	In ESA and PSA, the Continuous Pk function would only consider a peak within a small window relative to the marker's previous position, and thus was designed to track a signal drifting in frequency but with similar amplitude. The new Continuous Peak Search function simply performs a Peak Search operation after each sweep with no regard for the marker's previous position. Because of this difference, the SCPI commands for the old command (CPEak) is not accepted by the X-Series.  Also in ESA and PSA, Continuous Pk was grayed out when span equaled zero. The new Continuous Peak Search function will be available within zero span.  Also in ESA and PSA, turning Continuous Pk on would not automatically execute a peak search. A peak search would not be performed until the end of the next sweep. The new Continuous Peak Search function will perform a peak search when it is turned on, without waiting for the next sweep to complete.
Initial S/W Revision	Prior to A.02.00

### 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 analyzer 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 repeak 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 little “hat” is placed above the marker.



### Pk-Pk Search

Finds and displays the amplitude and frequency (or time, if in zero span) differences between the highest and lowest y-axis value. It places the selected marker on the minimum value on its selected trace. And it places that marker's reference marker on the peak of its selected trace. This function turns on the reference marker and sets its mode to **Fixed** 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.

<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 12:PTPeak
<b>Example</b>	CALC:MARK:PTP CALC:MARK:Y? queries the delta amplitude value for marker 1.
Notes	Turns on the Marker $\Delta$ active function.
Notes	Sending this command selects the subopcoded marker.
Dependencies	Pk-Pk Search is grayed out when <b>Coupled Markers</b> is on.
Couplings	The selected marker becomes a delta marker if not already in delta mode.
State Saved	Not part of saved state.
Initial S/W Revision	Prior to A.02.00

## Min Search

Moves the selected marker to the minimum y-axis value on the current trace. Minimum (negative) peak searches do not have to meet the peak search criteria. It just looks for the lowest y-axis value. If the selected marker is Off, it is turned on before the minimum search is performed.

Key Path	<b>Peak Search</b>
<b>Remote Command</b>	:CALCulate:MARKer[1] 2 ... 12:MINimum
<b>Example</b>	CALC:MARK:MIN Selects marker 1 and moves it to the minimum amplitude value.
Notes	Sending this command selects the subopcoded marker.
State Saved	Not part of saved state.
Initial S/W Revision	Prior to A.02.00

Print

See ["Print" on page 251](#)

## 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 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	LLine_	(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.

If the filename you entered ends with \_dddd, where d=any number, 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.

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Key Path	Front-panel key
Notes	No remote command for this key specifically.
Initial S/W Revision	Prior to A.02.00

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## Recall

The **Recall** menu lets you choose what you want to recall, and where you want to recall it from. Among the types of files you can recall are **States and Traces**. In addition, an **Import (Data)** option lets you recall a number of data types stored in CSV files (as used by Excel and other spreadsheet programs).

The default paths for Recall are data type dependent and are the same as for the Save key.

Key Path	Front-panel key
Notes	<p>No remote command for this key specifically, but the :MMEM:LOAD command is available for specific file types. An example is :MMEM:LOAD:STATE &lt;filename&gt;.</p> <p>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.</p>
Backwards Compatibility Notes	<p>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.</p> <p>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.</p>
Backwards Compatibility Notes	<p>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.</p> <p>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.</p> <p>It may be appropriate to issue a warning if the state is limited on the recall; warnings do not go out to SCPI so this would only affect the manual user.</p> <p>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.</p>
Initial S/W Revision	Prior to A.02.00

## State

The **Recall State** menu lets you choose a register or file from which to recall the state.



The content of a state file includes all of the settings and data required to return the analyzer as closely as possible to the Mode it was in, with the exact settings that were in place, when the save occurred. The Mode settings in each state file include the settings that are affected by Mode Preset, as well as the additional settings affected by Restore Mode Defaults; all of the Mode's settings. In addition, all of the settings of the **Input/Output** system are included, even though they are outside of the Mode's state, because they are needed to restore the complete setup. Persistent System settings (for example, GPIB address) are not affected by either a Mode Preset or Restore Mode Defaults, nor are they included in a saved State 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.

After the recall completes, the message "File <filename> recalled" or "Recalled State Register <register number>" is displayed.

For rapid recalls, the State menu lists 16 registers that you can choose from to recall. Pressing a Register key initiates the recall. You can also select a file from which to recall.

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 the INST:SEL command (for example, SA for the Spectrum Analyzer).

See "[More Information](#)" on page 894.

Key Path	<b>Recall</b>
Mode	All
<b>Remote Command</b>	<b>:MMEMory:LOAD:STATe &lt;filename&gt;</b>
<b>Example</b>	:MMEM:LOAD:STAT "myState.state" This recalls the file myState.state on the default path
<b>Example</b>	MMEM:LOAD:STAT "MyStateFile.state" This loads the state file data (on the default file directory path) into the instrument state.
Notes	When you pick a file to recall, the 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. <ul style="list-style-type: none"> <li>- 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.</li> </ul>

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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 analyzer exits the Recall menu and returns to the previous menu.

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**Backwards  
Compatibility SCPI**

:MMEMory:LOAD:STATE 1,<filename>

For backwards compatibility, the above syntax is supported. The "1" is simply ignored.

Initial S/W Revision

Prior to A.02.00

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### More Information

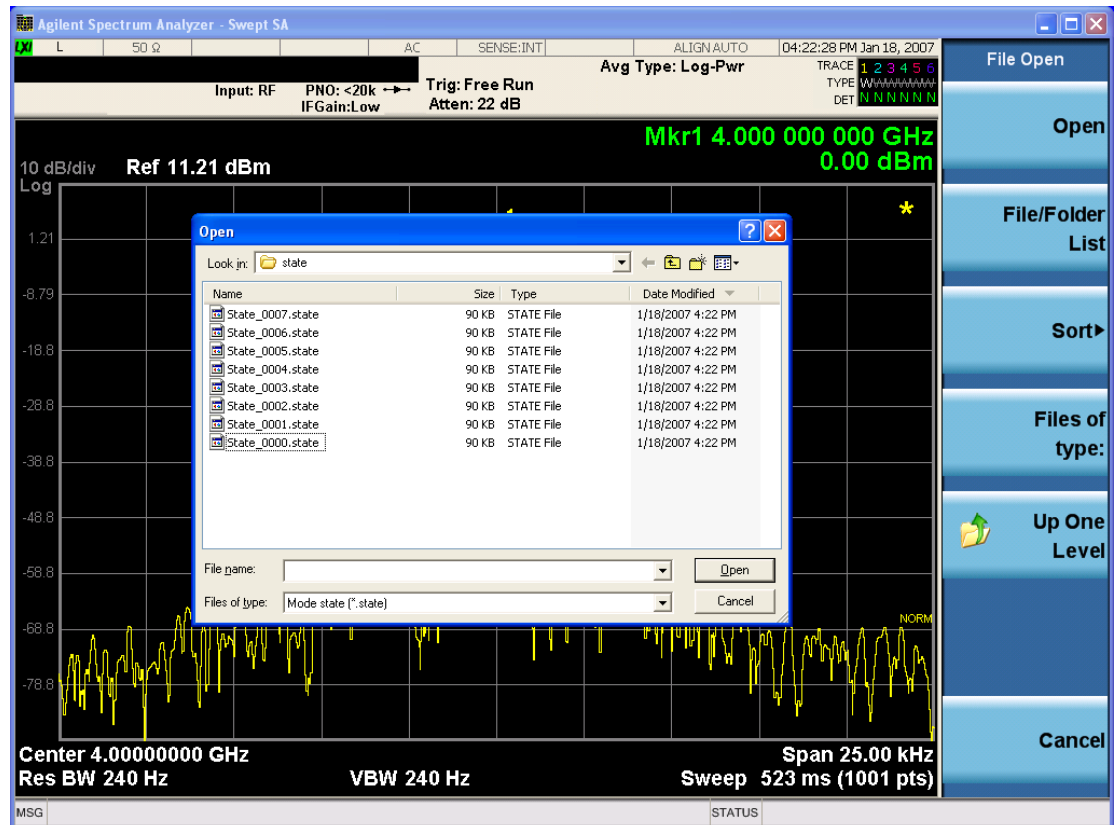
In measurements that support saving Traces, for example, Swept SA, the Trace data is saved along with the State in the State file. When recalling the State, the Trace data is recalled as well. Traces are recalled exactly as they were stored, including the writing mode and update and display modes. If 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.

## From File...

When you press “From File”, the analyzer brings up a Windows dialog and a menu entitled “File Open.” This menu allows you to navigate to the various fields in the Windows dialog without using a keyboard or mouse. The **Tab** and **Arrow** keys can also be used for dialog navigation.



Listed below are the functions of the various fields in the dialog, and the corresponding softkeys:

### Open

Performs the recall of the specified file. While the recall is being performed, the floppy icon appears briefly in the Meas bar.

### File/Folder List

Enables you to navigate to the center of the dialog that contains the list of files and folders. Once here you can get information about the file and use the tab keys to navigate to the other fields in the dialog, such as Look In.

### Look In

The **Look In** field shows the path from which the file will be recalled and allows you to change the path using the up and down arrow keys to navigate to other paths; the Enter key to open a directory; and the Backspace key to go back one directory. The **Look In** field first uses the last path from the Save As dialog **Save In:** path for that

same file type. There is no softkey for directly navigating to the Look In field, but you can use the left tab to get here from the File/Folder List.

User specified paths are remembered when you leave and return to a Mode and are reset back to the default using **Restore Mode Defaults**.

### Sort

Accesses a menu that enables you to sort the files within the File Open dialog. Only one sorting type can be selected at a time and the sorting happens immediately. The sorting types are **By Date**, **By Name**, **By extension**, and **By Size**.

### Files of Type

This field shows the file suffix for the type of file you have selected to recall. For example, if you navigated here while recalling State, "Mode state (\*.state)" is in the field. If you navigated here while recalling Trace, "Mode state (\*.trace)" is in the field. If you navigated here while importing a trace data file, "Trace Data (\*.csv)" is in the field. For some file types, there is more than one choice in the dropdown menu, which you can select by using the up and down arrow keys and Enter.

### Up One Level

This key corresponds to the icon of a folder with the up arrow that is in the tool bar of the dialog. When pressed, it causes the file and folder list to navigate up one level in the directory structure. The Backspace key does the same thing.

### Cancel

This key corresponds to the **Cancel** selection in the dialog. It causes the current **Open** request to be cancelled. The ESC key does the same thing.

Key Path	<b>Recall, State</b>
Notes	Brings up the Open dialog for recalling a State Save Type
Initial S/W Revision	Prior to A.02.00

## 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 save. To do this, press the **Edit Register Names** key, choose the register whose name you wish to edit, and then enter the desired label using the Alpha Editor or an external PC keyboard.

The maximum number of characters that can be added is 30. In most cases, 30 characters will fit on two lines of the key.

For more information and the SCPI command, see Edit Register Names under the **Save, State** function.

Key Path	<b>Recall, State</b>
Mode	All
Dependencies	N9060A-7FP or N9060B-2FP license required to edit the register names. When the feature is not

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	licensed, sending the SCPI command generates an error, -221, "Settings conflict;Option not available"
Initial S/W Revision	A.11.00

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### Register 1 thru Register 16

Selecting any one of these register keys causes the State of the mode from the specified Register to be recalled. Each of the register keys annotates whether it is empty or at what date and time it was last modified. In addition, you can use the **Edit Register Names** key under **Save, State** to enter custom names for each register.

Registers are shared by all modes, so recalling from any one of the registers will cause a mode switch to the mode that was active when the save to the Register occurred.

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.

After the recall completes, the message "Register <register number> recalled" appears in the message bar. 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.

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Key Path	<b>Recall, State</b>
<b>Example</b>	*RCL 1
Range	1-16 from front panel, 1-128 from SCPI
Readback	Date and time with seconds resolution are displayed on the key OR A custom name of up to 30 characters entered using the <b>Save, State,Edit Register Names</b> key OR “(empty)” if no prior save operation has been performed to this register.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	Prior to A.11.00

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### Register 1 thru Register 16

Selecting any one of these register keys causes the State of the mode from the specified Register to be recalled. Each of the register keys annotates whether it is empty or at what date and time it was last modified. In addition, you can use the **Edit Register Names** key under **Save, State** to enter custom names for each register.

Registers are shared by all modes, so recalling from any one of the registers will cause a mode switch to the mode that was active when the save to the Register occurred.

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.

After the recall completes, the message "Register <register number> recalled" appears in the message bar. 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.

Key Path	<b>Recall, State</b>
<b>Example</b>	*RCL 1
Range	1-16 from front panel, 1-128 from SCPI
Readback	Date and time with seconds resolution are displayed on the key OR A custom name of up to 30 characters entered using the <b>Save, State,Edit Register Names</b> key OR “(empty)” if no prior save operation has been performed to this register.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	Prior to A.11.00

## Trace (+State)

The Recall Trace (+State) menu lets you choose a register or file from which to recall the Trace+State state file.

A saved state contains all of the settings and data required to return the analyzer as closely as possible to the exact setup it had when the save occurred. This includes the Input/Output settings, even though they are outside of the Mode’s state, because they are needed to restore the complete setup. A Trace+State file also includes trace data from one trace or all traces, which will load in View mode when the Trace+State file is recalled. Recall Trace (+State) will also cause a mode switch if the state being recalled is not for the current active mode.

After the recall completes, the message "File <filename> recalled" or “Recalled Trace Register <register number>” is displayed.

For rapid recalls, the Trace (+State) menu lists 5 registers to choose from to recall. Pressing a Register key initiates the recall. You can also select a file from which to recall.

The default path for all State Files including .trace files is:

My Documents\<<mode name>\state

where <mode name> is the parameter used to select the mode with the INST:SEL command (for example, SA for the Spectrum Analyzer).

Key Path	Recall
Mode	SA
Remote Command	:MMEMory:LOAD:TRACe TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6,<filename>  :MMEMory:LOAD:TRACe:REGister TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6,<integer>
Example	MMEM:LOAD:TRAC TRACE2, "MyTraceFile.trace"  This loads the trace file data (on the default file directory path) into the specified trace; if it is a "single trace" save file, that trace is loaded to trace 2, and is set to be not updating.  :MMEM:LOAD:TRAC:REG TRACE1,2  restores the trace data in register 2 to Trace 1
Notes	When you perform the recall, the recalling Trace function must first verify the file is recallable in this instrument by checking instrument software version and model number, since it includes State. If everything matches, a full recall proceeds by aborting the currently running measurement, and loading the state from the saved state file to as close as possible to the context in which the save occurred. You can open .trace files from any mode that supports them, so recalling a Trace file switches to the mode that was active when the save occurred. After switching to the mode of the saved state file, mode settings and data (if any for the mode) are loaded with values from the saved file and the saved measurement of the mode becomes the newly active measurement, and the data relevant to the measurement (if there is any) is recalled.  Once the state is loaded, the trace data must be loaded. The internal flags are consulted to see which trace to load and the "To Trace" setting to see where to load it. Trace data is always loaded with the specified trace set to View, so that the data is visible and not updating (so as not to erase the recalled data). If the file is an "all trace" file, all traces are loaded with the saved data (to the original trace the data was saved from) and set to View. Traces whose data is not loaded are restored to the update state that existed when they were saved.  After the Recall the analyzer exits the Recall menu and returns to the previous menu.  Some modes and measurements do not have available all 6 traces. Phase Noise mode command, for example, is: MMEMory:LOAD:TRACe TRACE1 TRACE2 TRACE3,<filename>  Some modes and measurements have more than 6 traces available. The Realtime SA mode command, for example, is: MMEMory:STORe:TRACe TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6   TRACE7   TRACE8   TRACE9   TRACE10   TRACE11   TRACE12   ALL,<filename>
Initial S/W Revision	Prior to A.02.00

## To Trace

These menu selections let you choose the Trace where the recalled saved trace will go. Not all modes have the full 6 traces available. The default is the currently selected trace, selected in this menu or in the Trace/Detector, Export Data, Import Data, or Save Trace menus, except if you have chosen All, then it remains chosen until you specifically change it to a single trace.

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.

Once selected, the key returns back to the Recall Trace menu and the selected Trace number is annotated on the key. Now you have selected exactly where the

trace needs to be recalled. To trigger a recall of the selected Trace, you must select the **Open** key in the Recall 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.

Key Path	<b>Save, Data, Trace</b>
Mode	SA
Initial S/W Revision	Prior to A.02.00

### Register 1 thru Register 16

Selecting any one of these register keys causes the State of the mode from the specified Register to be recalled. Each of the register keys annotates whether it is empty or at what date and time it was last modified. In addition, you can use the **Edit Register Names** key under **Save, State** to enter custom names for each register.

Registers are shared by all modes, so recalling from any one of the registers will cause a mode switch to the mode that was active when the save to the Register occurred.

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.

After the recall completes, the message "Register <register number> recalled" appears in the message bar. 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.

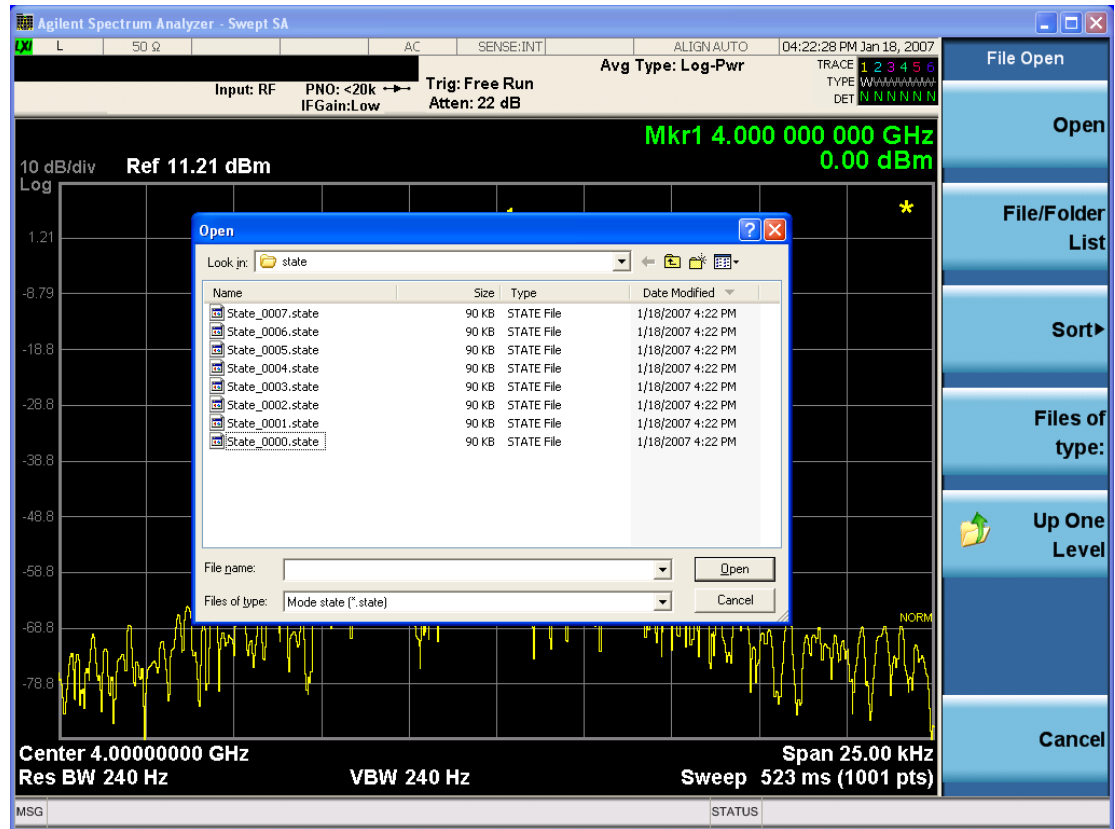
Key Path	<b>Recall, State</b>
<b>Example</b>	*RCL 1
Range	1-16 from front panel, 1-128 from SCPI
Readback	Date and time with seconds resolution are displayed on the key OR A custom name of up to 30 characters entered using the <b>Save, State, Edit Register Names</b> key OR “(empty)” if no prior save operation has been performed to this register.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	Prior to A.11.00

### From File...

When you press “From File”, the analyzer brings up a Windows dialog and a menu entitled “**File Open.**” This menu allows you to navigate to the various fields in the



Windows dialog without using a keyboard or mouse. The **Tab** and **Arrow** keys can also be used for dialog navigation.



Listed below are the functions of the various fields in the dialog, and the corresponding softkeys:

#### Open

Performs the recall of the specified file. While the recall is being performed, the floppy icon appears briefly in the Meas bar.

#### File/Folder List

Enables you to navigate to the center of the dialog that contains the list of files and folders. Once here you can get information about the file and use the tab keys to navigate to the other fields in the dialog, such as Look In.

#### Look In

The **Look In** field shows the path from which the file will be recalled and allows you to change the path using the up and down arrow keys to navigate to other paths; the Enter key to open a directory; and the Backspace key to go back one directory. The **Look In** field first uses the last path from the Save As dialog **Save In:** path for that same file type. There is no softkey for directly navigating to the Look In field, but you can use the left tab to get here from the File/Folder List.

User specified paths are remembered when you leave and return to a Mode and are reset back to the default using **Restore Mode Defaults**.

### Sort

Accesses a menu that enables you to sort the files within the File Open dialog. Only one sorting type can be selected at a time and the sorting happens immediately. The sorting types are **By Date, By Name, By extension, and By Size.**

### Files of Type

This field shows the file suffix for the type of file you have selected to recall. For example, if you navigated here while recalling State, "Mode state (\*.state)" is in the field. If you navigated here while recalling Trace, "Mode state (\*.trace)" is in the field. If you navigated here while importing a trace data file, "Trace Data (\*.csv)" is in the field. For some file types, there is more than one choice in the dropdown menu, which you can select by using the up and down arrow keys and Enter.

### Up One Level

This key corresponds to the icon of a folder with the up arrow that is in the tool bar of the dialog. When pressed, it causes the file and folder list to navigate up one level in the directory structure. The Backspace key does the same thing.

### Cancel

This key corresponds to the **Cancel** selection in the dialog. It causes the current **Open** request to be cancelled. The ESC key does the same thing.

Key Path	<b>Recall, State</b>
Notes	Brings up the Open dialog for recalling a State Save Type
Initial S/W Revision	Prior to A.02.00

## Data (Import)

Importing a data file loads data that was previously saved from the current measurement or from other measurements and/or modes that produce compatible data files. The Import Menu only contains Data Types that are supported by the current measurement.

Since the commonly exported data files are in .csv format, the data can be edited by the user prior to importing. This allows you to export a data file, manipulate the data in Excel (the most common PC Application for manipulating .csv files) and then import it.

Importing Data loads measurement data from the specified file into the specified or default destination, depending on the data type selected. Selecting an Import Data menu key will not actually cause the importing to occur, since the analyzer still needs to know from where to get the data. Pressing the Open key in this menu brings up the Open dialog and Open menu that provides you with the options from where to recall the data. Once a filename has been selected or entered in the Open menu, the recall occurs as soon as the Open button is pressed.

Key Path	<b>Recall</b>
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Mode	All
Notes	The menu is built from whatever data types are available for the mode. Some keys will be missing completely, so the key locations in the sub-menu will vary. No SCPI command directly controls the Data Type that this key controls. The Data Type is included in the MMEM:LOAD commands.
Dependencies	If a file type is not used by a certain measurement, it is grayed out for that measurement. The key for a file type will not show at all if there are no measurements in the Mode that support it.
Preset	Is not affected by Preset or shutdown, but is reset during Restore Mode Defaults
Readback	The data type that is currently selected
Initial S/W Revision	Prior to A.02.00

### Amplitude Correction

This key selects the Amplitude Corrections as the data type to be imported. When pressed a second time, it brings up the Select Menu, which lets you select the Correction into which the data will be imported.

Amplitude Corrections are fully discussed in the documentation of the Input/Output key, under the Corrections key.

A set of preloaded Corrections files can be found in the directory

/My Documents/ EMC Limits and Ampcor.

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 Unit in the file.

Key Path	<b>Recall</b>
Mode	SA EDGE GSM PN
<b>Remote Command</b>	<b>:MMEMory:LOAD:CORRection 1 2 3 4 5 6 7 8, &lt;filename&gt;</b>
<b>Example</b>	:MMEM:LOAD:CORR 2, "myAmpcor.csv" recalls the Amplitude Correction data from the file myAmpcor.csv in the current directory to the 2nd Amplitude Correction table, and turns on Correction 2. The default path is D:\User_My_Documents\Instrument\My Documents\amplitudeCorrections\
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 ( <b>Correction ON</b> ) and <b>ApplyCorrections</b> is set to On. This allows you to see its effect, thus confirming the load.
Readback	selected Correction
<b>Backwards Compatibility SCPI</b>	<b>:MMEMory:LOAD:CORRection ANTenna   CABLe   OTHer   USER, &lt;filename&gt;</b> For backwards compatibility, ANTenna maps to 1, CABLe maps to 2, OTHer maps to 3 and USER maps to 4
Initial S/W Revision	A.02.00

## Amplitude Correction

These keys let you select which Correction to import the data into. Once selected, the key returns back to the Import Data menu and the selected Correction number is annotated on the key. The next step is to select the Open key in the Import Data menu.

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 Units.

Key Path	<b>Recall, Data, Amplitude Correction</b>
Notes	auto return
Dependencies	Only Correction 1 may be used to load a Correction that contains an Antenna Unit other than None
Preset	Not part of Preset, but is reset to Correction 1 by Restore Input/Output Defaults; survives shutdown.
State Saved	The current Correction number is saved in instrument state
Initial S/W Revision	A.02.00

## Trace

This key selects Trace as the data type to be imported. When pressed a second time, it brings up the Trace Menu, which lets you select the Trace into which the data will be imported.

The trace file contains “meta” data that describes the state of the analyzer when the trace was exported (see ["Trace File Contents" on page 926](#)). If the meta data in the file does not match the current SA state, the “invalid data indicator” (\*) is displayed.

Key Path	<b>Recall, Data</b>
<b>Remote Command</b>	<b>:MMEMory:LOAD:TRACe:DATA TRACE1   TRACE2   TRACE3   TRACE4   TRACE5</b>

	TRACE6   TRACE7   TRACE8   TRACE9   TRACE10   TRACE11   TRACE12, <filename>
<b>Example</b>	:MMEM:LOAD:TRAC:DATA TRACE2, "myTrace2.csv" Imports the 2nd trace from the file myTrace2.csv in the current path. The default path is My Documents\RTSA\data\traces
Notes	TRACE1-TRACE6 corresponds to Spectrum Trace1-6 and TRACE7-TRACE12 corresponds to the Pvt Trace1-6.
Dependencies	For both Spectrum and Power vs Time 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 does not match the number of acquisition 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, <b>Trace Update</b> is always turned OFF for that trace and <b>Trace Display</b> is always turned ON.
Readback	Selected Trace
Status Bits/OPC dependencies	Sequential - aborts the current measurement.
Initial S/W Revision	A.13.00

### Trace Selection

These keys let you select which Trace to import the data into; TRACE1 – TRACE12. TRACE1-TRACE6 corresponds to Spectrum Trace1-6 and TRACE7-TRACE12 corresponds to the Pvt Trace1-6. The default is the currently selected trace, selected in this menu or in the Trace/Det, Export Data, Recall Trace, or Save Trace menus; except if you have chosen **All** then **All** remains chosen until you specifically change it to a single trace.

Once selected, the key returns back to the Import Data menu and the selected Trace number is annotated on the key. The next step is to select the Open key in the Import Data menu.

Key Path	<b>Recall, Data, Trace</b>
Notes	Auto return
Preset	not part of Preset, but is reset to TRACE1 by Restore Mode Defaults; survives shutdown
State Saved	The current trace number is saved in instrument state
Initial S/W Revision	A.13.00

### Limit

This key selects Limit Lines as the data type to be imported. When pressed a second time, it brings up the Limits Menu, which lets you select into which Limit the data will be imported.

A set of preloaded Limits files can be found in the directory  
/My Documents/ EMC Limits and Ampcor.

Under this directory, the directory called Limits (Legacy Naming) contains a set of legacy limits, generally the same files that were supplied with older Agilent EMC analyzers, that use the legacy suffix .lim, and the old 8-character file names. In the directory called Limits, the same files can be found, with the same suffix, but with longer, more descriptive filenames.

Key Path	<b>Recall, Data</b>
<b>Remote Command</b>	<b>:MMEMory:LOAD:LIMit LLINE1 LLINE2,&lt;filename&gt;</b>
<b>Example</b>	:MMEM:LOAD:LIM LLINE2, "myLimitLine2.csv" Imports the 2nd Limit Line from the file myLimitLine2.csv in the current path. The default path is My Documents\SA\data\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.
Readback	Selected Limit Line
Status Bits/OPC dependencies	Sequential - aborts the current measurement
Initial S/W Revision	A.02.00

### Limit Selection

These keys let you pick which Limit Line to import the data into; either 1, 2, 3, 4, 5 or 6. The default is the currently selected limit. Once selected, the key returns back to the Import Data menu and the selected Limit Line number is annotated on the key. Now you have selected exactly what needs to be imported. In order to trigger an import of the selected Limit Line, you must select the Open key in the Import Data menu.

An example of using this menu is: If you select 2 and continue to the File Open menu, Limit Line 2 will be imported from the file selected or entered in File Name option in the File Open dialog.

Key Path	<b>Recall, Data, Limit Line</b>
Notes	Auto return
Preset	Not part of Preset, but is reset to LLINE1 by Restore Mode Defaults; survives a shutdown.

State Saved	The selected limit number is saved in instrument state
Initial S/W Revision	A.02.00

### Recall FMT From File

Allows you to import a mask from a file. Selecting this key will select recall type as FMT and bring up the Open dialog box.

Key Path	<b>Recall, Data (Import), FMT</b>
<b>Remote Command</b>	<b>:MMEMory:LOAD:FMT &lt;filename&gt;</b> The file name must have extension “.csv”.
<b>Example</b>	:MMEM:LOAD:FMT "myFmt.csv" recalls the FMT mask data from the file myFmt.csv in the current directory and sets the Trigger Type to FMT.
Notes	The default path is My Documents\“Mode”\data\FMT
Couplings	All the FMT setup parameters will be updated with the values from the imported file. Trigger Type will change to FMT is not already selected. This will only be the case when the command is executed remotely.
Initial S/W Revision	A.13.00

### Open...

When you press “Open”, the analyzer brings up a Windows dialog and a menu entitled “**File Open.**” This menu allows you to navigate to the various fields in the Windows dialog without using a keyboard or mouse. The **Tab** and **Arrow** keys can also be used for dialog navigation.

See "[From File...](#)" on page 919 in **Recall, State**, for a full description of this dialog and menu.

Key Path	<b>Recall, Data</b>
Notes	The key location is mode-dependent and will vary. Brings up Open dialog for recalling a <mode specific> Save Type
Initial S/W Revision	Prior to A.02.00

## Restart

The Restart function restarts the current sweep, or measurement, or set of averaged/hold sweeps or measurements. If you are Paused, pressing Restart does a Resume.

The Restart function is accessed in several ways:

- Pressing the Restart key
- Sending the remote command INIT:IMMEDIATE
- Sending the remote command INIT:RESTART

See "[More Information](#)" on page 908

Key Path	Front-panel key
<b>Remote Command</b>	:INITiate[:IMMEDIATE] :INITiate:RESTART
<b>Example</b>	:INIT:IMM :INIT:REST
Notes	:INITiate:RESTART and :INITiate:IMMEDIATE perform exactly the same function.
Couplings	Resets average/hold count k. For the first sweep overwrites all active (update=on) traces with new current data. For application modes, it resets other parameters as required by the measurement.
Status Bits/OPC dependencies	This is an Overlapped command. The STATus:OPERation register bits 0 through 8 are cleared. The STATus:QUESTionable register bit 9 (INTEgrity sum) is cleared. The SWEEPING bit is set. The MEASURING bit is set.
Backwards Compatibility Notes	For Spectrum Analysis mode in ESA and PSA, the <b>Restart</b> hardkey and the INITiate:RESTART command restart trace averages (displayed average count reset to 1) for a trace in <b>Clear Write</b> , but did not restart <b>Max Hold</b> and <b>Min Hold</b> . In the X-Series, the <b>Restart</b> hardkey and the INITiate:RESTART command restart not only <b>Trace Average</b> , but <b>MaxHold</b> and <b>MinHold</b> traces as well. For wireless comms modes in ESA and PSA, the <b>Restart</b> hardkey and the INITiate:RESTART command restart every measurement, which includes all traces and numeric results. There is no change to this operation.
Initial S/W Revision	Prior to A.02.00

## More Information

The **Restart** function first aborts the current sweep/measurement as quickly as possible. It then resets the sweep and trigger systems, sets up the measurement



and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the analyzer is in the process of aligning when **Restart** is executed, the alignment finishes before the restart function is performed.

Even when set for Single operation, multiple sweeps may be taken when Restart is pressed (for example, when averaging/holding is on). Thus when we say that **Restart** "restarts a measurement," we may mean:

- It restarts the current sweep
- It restarts the current measurement
- It restarts the current set of sweeps if any trace is in Trace Average, Max Hold or Min Hold
- It restarts the current set of measurements if Averaging, or Max Hold, or Min Hold is on for the measurement
- depending on the current settings.

With **Average/Hold Number** (in **Meas Setup** menu) set to 1, or Averaging off, or no trace in Trace Average or Hold, a single sweep is equivalent to a single measurement. A single sweep is taken after the trigger condition is met; and the analyzer stops sweeping once that sweep has completed. However, with **Average/Hold Number** > 1 and at least one trace set to **Trace Average**, **Max Hold**, or **Min Hold (SA Measurement)** or **Averaging on (most other measurements)**, multiple sweeps/data acquisitions are taken for a single measurement. The trigger condition must be met prior to each sweep. The sweep is stopped when the average count  $k$  equals the number  $N$  set for **Average/Hold Number**. A measurement average usually applies to all traces, marker results, and numeric results; but sometimes it only applies to the numeric results.

Once the full set of sweeps has been taken, the analyzer will go to idle state. To take one more sweep without resetting the average count, increment the average count by 1, by pressing the step up key while **Average/Hold Number** is the active function, or sending the remote command `CALC:AVER:TCON UP`.

## Save

The **Save** menu lets you choose what you want to save and where you want to save it. Among the types of files you can save are **States**, **Traces**, and **Screen Images**. In addition, an **Export (Data)** option lets you save a number of data types as CSV files for easy import into Excel and other spreadsheet programs.

Key Path	<b>Front-panel key</b>
Mode	All
Notes	No remote command for this key specifically, but the :MMEM:STORe command is available for specific file types. An example is :MMEM:STOR:STATe <filename>.
Initial S/W Revision	Prior to A.02.00

## State

The Save State menu lets you choose a register or file for saving the state.

The content of a state file includes all of the settings and data required to return the analyzer as closely as possible to the Mode it was in, with the exact settings which were in place, when the save occurred. The Mode settings in each state file include the settings that are affected by Mode Preset, as well as the additional settings affected by Restore Mode Defaults; all of the Mode's settings. In addition, all of the settings of the **Input/Output** system are included, even though they are outside of the Mode's state, because they are needed to restore the complete setup. Persistent **System** settings (for example, Verbose SCPI) are not affected by either Mode Preset or Restore Mode Defaults, nor are they included in a saved State file.

After the save completes, the message "File <filename> saved" or "State Register <register number> saved" is displayed.

For rapid saving, the State menu lists 16 registers to save to. Pressing a Register key initiates the save. You can also select a file to save to.

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 the INST:SEL command (for example, SA for the Spectrum Analyzer).

Key Path	<b>Save</b>
Mode	All
<b>Remote Command</b>	<b>:MMEMory:STORe:STATe &lt;filename&gt;</b>
<b>Example</b>	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

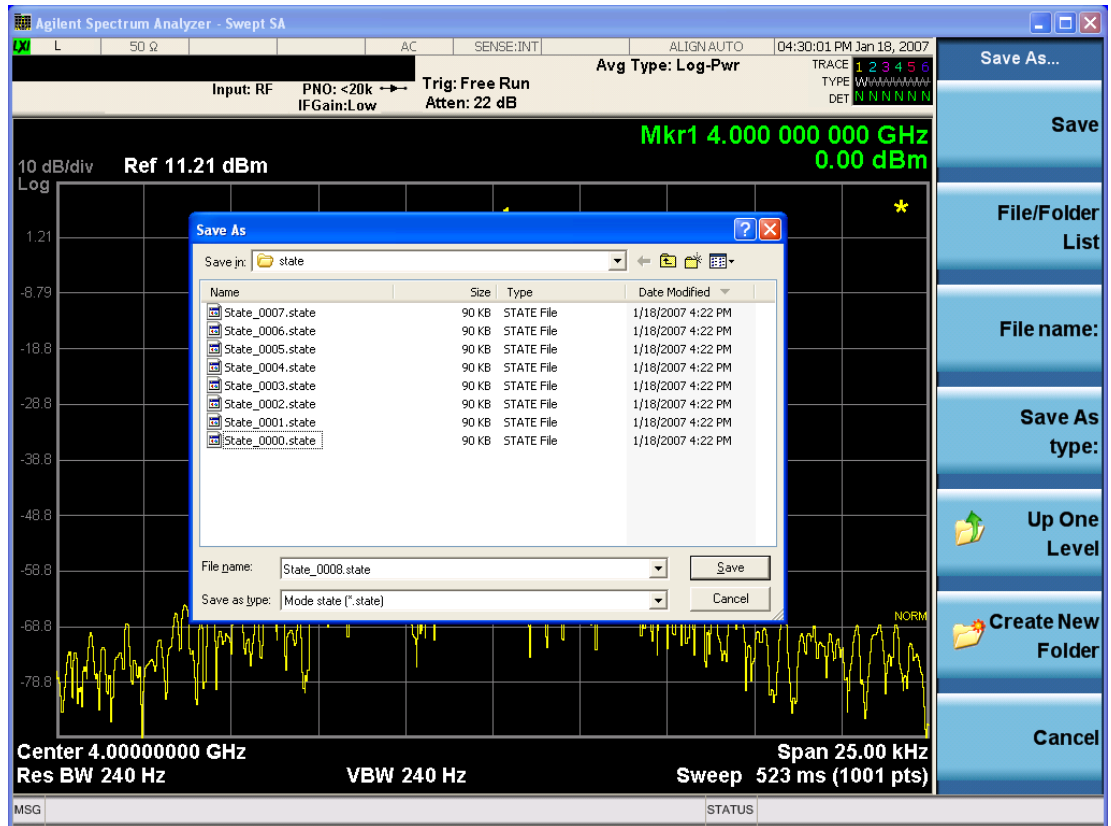
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	custom label has been entered for that key. After saving to a register, you remain in the <b>Save State</b> menu, so that you can see the Register key update. After saving to a file, the analyzer automatically returns to the previous menu and any Save As dialog goes away.
<b>Backwards Compatibility SCPI</b>	<b>:MMEMory:STORe:STATe 1,&lt;filename&gt;</b> For backwards compatibility, the above syntax is supported. The "1" is simply ignored. The command is sequential.
Initial S/W Revision	Prior to A.02.00

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### To File . . .

When you press "To File", the analyzer brings up a Windows dialog and a menu entitled "**Save As.**" This menu allows you to navigate to the various fields in the Windows dialog without using a keyboard or mouse. The **Tab** and **Arrow** keys can also be used for dialog navigation.



The Listed below are the functions of the various fields in the dialog, and the

corresponding softkeys:

#### Save

Performs the save to the specified file of the selected type. If the file already exists, a dialog will appear that allows you to replace the existing file by selecting **OK**, or you can Cancel the request. If you select OK, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade.

While the save is being performed, the floppy icon appears briefly in the Meas bar.

#### File/Folder List

Enables you to navigate to the center of the dialog that contains the list of files and folders. Once here you can get information about the file and use the tab keys to navigate to the other fields in the dialog, such as Save In.

#### Save In

The Save In field shows the path to which the file will be saved and allows you to change the path using the up and down arrow keys to navigate to other paths; the Enter key to open a directory; and the Backspace key to go back one directory. The **Save In field** defaults to the default path for this type of file and remembers the last path you used to save this type of file. There is no softkey for directly navigating to the Save In field but you can use left tab to get here from the File/Folder List.

User specified paths are remembered when you leave and return to a Mode and are reset back to the default using **Restore Mode Defaults**.

#### File Name

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 replace or modify this filename using the File Name key. See the ["Quick Save " on page 890](#) documentation for more on the automatic file naming algorithm.

When you press the **File Name** key the analyzer displays the Alpha Editor. Use the knob to choose the letter to add and the front-panel Enter key to add the letter to the file name. The BK character moves you back and the FW character moves you forward in the filename. The Select key on the front panel generates a space character. When you are done entering the filename press the **Done** softkey. This returns back to the **File Open** dialog and menu, but does not cause the save to occur.

#### Save As Type

This field shows the file suffix for the type of file you have selected to save. For example, if you navigated here while saving State, "Mode state (\*.state)" is in the field. If you navigated here from saving Trace, ""Mode state (\*.trace)" is in the field. If you navigated here while exporting a trace data file, "Trace Data (\*.csv)" is in the field. For some file types, there is more than one choice in the dropdown, which you can select by using the up and down arrow keys and Enter.

#### Up One Level

This key corresponds to the icon of a folder with the up arrow that is in the tool bar of the dialog. When pressed, it causes the file and folder list to navigate up one level in the directory structure. The Backspace key does the same thing.

Create New Folder

This key corresponds to the icon of a folder with the "\*" that is in the tool bar of the dialog. When pressed, a new folder is created in the current directory with the name **New Folder** and you can enter a new folder name using the Alpha Editor.

Cancel

This key corresponds to the **Cancel** selection in the dialog. It causes the current **Save As** request to be cancelled. The ESC key does the same thing.

Key Path	<b>Save, State</b>
Mode	All
Notes	Brings up Save As dialog for saving a State Save Type
Initial S/W Revision	Prior to A.02.00

### 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 save. To do this, press the **Edit Register Names** key, choose the register whose name you wish to edit, and then enter the desired label using the Alpha Editor or an external PC keyboard.

The maximum number of characters that can be added is 30. In most cases, 30 characters will fit on two lines of the key.

See ["More Information" on page 915](#)

Key Path	<b>Save, State</b>
Mode	All
<b>Remote Command</b>	<b>:MMEMory:REGiSTER:STATe:LABe1 &lt;reg number&gt;,"label"</b> <b>:MMEMory:REGiSTER:STATe:LABe1? &lt;reg number&gt;</b>
<b>Example</b>	:MMEM:REG:STAT:LAB 1,"my label"
Notes	<reg number> is an integer from 1 to 16. If the SCPI specifies an invalid register number an error message is generated, -222,"Data out of range;Invalid register label number" "label" is a string from 0 to 30 characters in length. If a label exceeds 30 characters, an error message is generated, -150,"String data error;Label clipped to 30 characters" "label" of length 0 erases the custom label and restores the default (time and date) label. E.g.: :MMEM:REG:STAT:LAB 1,""
Dependencies	N9060A-7FP or N9060B-2FP license required to edit the register names. When the feature is not licensed, sending this command generates an error, -221,"Settings conflict;Option not available"
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"
Initial S/W Revision	A.11.00

## More Information

When you edit one of the register names, the time and date field will be replaced by the custom name.

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.

The \*SAV and \*RCL commands will not be affected by the custom register names, nor will the MMEM commands.

## Register 1 thru Register 16

Selecting any one of these register menu keys 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 use the **Edit Register Names** key to enter custom names for each 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.

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.

Key Path	<b>Save, State</b>
Mode	All
<b>Example</b>	*SAV 1
Range	1-16 from front panel, 1-128 from SCPI
Readback	Date and time with seconds resolution are displayed on the key OR A custom name of up to 30 characters entered using the <b>Edit Register Names</b> key OR “(empty)” if no prior save operation has been performed to this register.

Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.11.00

### Register 1 thru Register 16

Selecting any one of these register menu keys 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 use the **Edit Register Names** key to enter custom names for each 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.

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.

Key Path	<b>Save, State</b>
Mode	All
<b>Example</b>	*SAV 1
Range	1-16 from front panel, 1-128 from SCPI
Readback	Date and time with seconds resolution are displayed on the key OR A custom name of up to 30 characters entered using the <b>Edit Register Names</b> key OR “(empty)” if no prior save operation has been performed to this register.

Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.11.00

### Trace (+State)

The **Save Trace (+State)** menu lets you choose a register or file specifying where to save the Trace+State state file.

A saved state contains all of the settings and data required to return the analyzer as closely as possible to the exact setup it had when the save occurred. This includes the Input/Output settings, even though they are outside of the Mode’s state, because they are needed to restore the complete setup. A Trace+State file also



includes trace data from one trace or all traces, which will load in View mode when the Trace+State file is recalled.

After the save completes, the message "File <filename> saved" or "Trace Register <register number> saved" is displayed.

For rapid saves, the Trace (+State) menu lists 5 registers to save to. Pressing a Register key initiates the save. You can also select a file to save to.

The default path for all State Files including .trace files is:

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 IQAnalyzer).

This key is grayed out for measurements that do not 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. You may select to save one trace or ALL traces.

Key Path	<b>Save</b>
Mode	SA
<b>Remote Command</b>	:MMEMory:STORe:TRACe TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6   ALL,<filename> :MMEMory:STORe:TRACe:REGister TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6   ALL,<integer>
<b>Example</b>	:MMEM:STOR:TRAC TRACE1, "myState.trace" saves the file myState.trace on the default path and flags it as a "single trace" file with Trace 1 as the single trace (even though all of the traces are in fact stored). :MMEM:STOR:TRAC ALL, "myState.trace" saves the file myState.trace on the default path and flags it as an "all traces" file :MMEM:STOR:TRAC:REG TRACE1, 2 stores trace 1 data in trace register 2
Notes	This command actually performs a save state, which in the Swept SA measurement includes the trace data. However it flags it (in the file) as a "save trace" file of the specified trace (or all traces). Some modes and measurements do not have available all 6 traces. The Phase Noise mode command, for example, is: MMEMory:STORe:TRACe TRACE1 TRACE2 TRACE3 ALL,<filename> Some modes and measurements have more than 6 traces available. The Realtime SA mode command, for example, is: MMEMory:STORe:TRACe TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6   TRACE7   TRACE8   TRACE9   TRACE10   TRACE11   TRACE12   ALL,<filename> The range for the register parameter is 1-5 When you initiate a save, if the file already exists, a dialog will appear that allows you to replace the existing file by selecting <b>OK</b> or you can Cancel the request. If you select OK, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade. Both single and double quotes are supported for any filename parameter over remote. After saving to a register, that register's menu key is updated with the date and time of the save. After saving to a register, you remain in the <b>Save Trace</b> menu, so that you can see the Register

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key update. After saving to a file, the analyzer automatically returns to the previous menu and any Save As dialog goes away.

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Initial S/W Revision      Prior to A.02.00

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## Register 1 thru Register 16

Selecting any one of these register menu keys 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 use the **Edit Register Names** key to enter custom names for each 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.

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.

Key Path	<b>Save, State</b>
Mode	All
<b>Example</b>	*SAV 1
Range	1-16 from front panel, 1-128 from SCPI
Readback	Date and time with seconds resolution are displayed on the key OR A custom name of up to 30 characters entered using the <b>Edit Register Names</b> key OR “(empty)” if no prior save operation has been performed to this register.
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.11.00

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## From Trace

Accesses a menu that enables you to select the trace to be saved. Once a trace is selected, the key returns to the Save Trace menu and the selected trace number is annotated on the key. The default is the currently selected trace, selected in this menu or in the Trace/Det, Export Data, Import Data or Recall Trace menus, except if you have chosen All then it remains chosen until you specifically change it to a single trace. To save the Trace you must select the **Save As** key in the Save 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.

Key Path	<b>Save, Trace + State</b>
Mode	SA
Initial S/W Revision	Prior to A.02.00

### To Trace

These menu selections let you choose the Trace where the recalled saved trace will go. Not all modes have the full 6 traces available. The default is the currently selected trace, selected in this menu or in the Trace/Detector, Export Data, Import Data, or Save Trace menus, except if you have chosen All, then it remains chosen until you specifically change it to a single trace.

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.

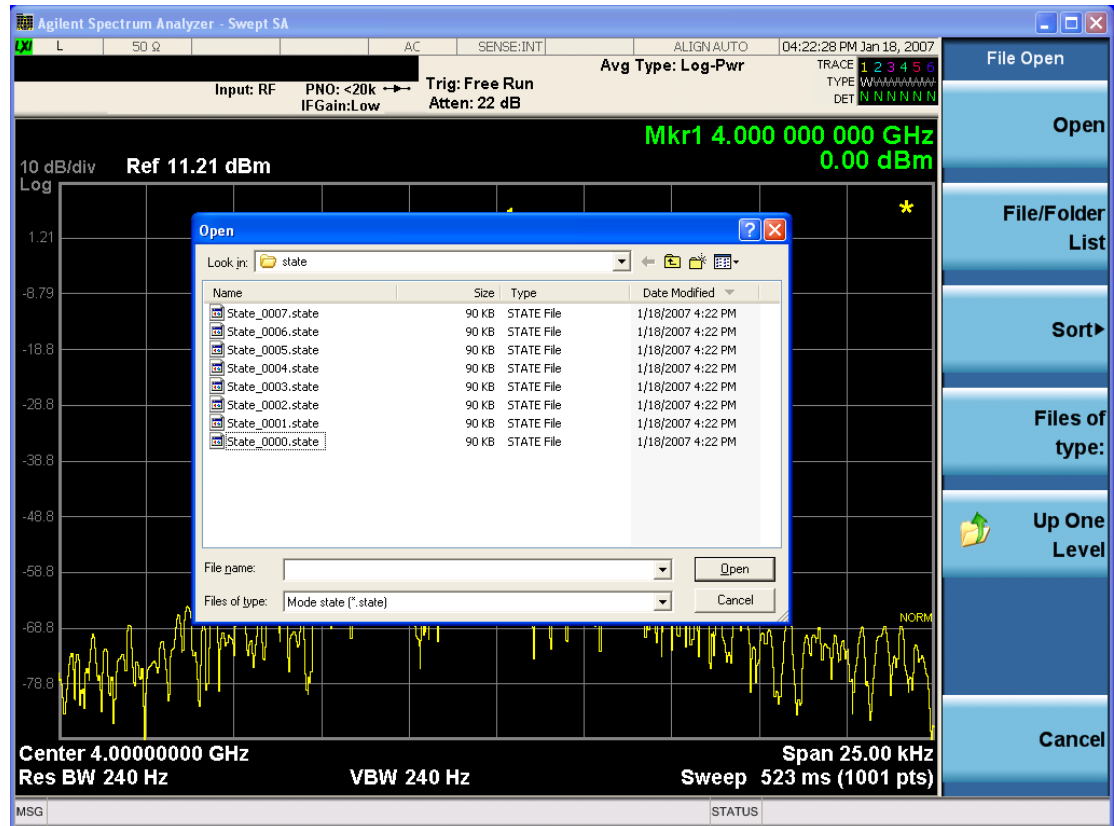
Once selected, the key returns back to the Recall Trace menu and the selected Trace number is annotated on the key. Now you have selected exactly where the trace needs to be recalled. To trigger a recall of the selected Trace, you must select the **Open** key in the Recall Trace menu.

When you select a trace, it makes that trace the current trace, so it displays on top of all of the other traces.

Key Path	<b>Save, Data, Trace</b>
Mode	SA
Initial S/W Revision	Prior to A.02.00

### From File...

When you press "From File", the analyzer brings up a Windows dialog and a menu entitled "**File Open.**" This menu allows you to navigate to the various fields in the Windows dialog without using a keyboard or mouse. The **Tab** and **Arrow** keys can also be used for dialog navigation.



Listed below are the functions of the various fields in the dialog, and the corresponding softkeys:

#### Open

Performs the recall of the specified file. While the recall is being performed, the floppy icon appears briefly in the Meas bar.

#### File/Folder List

Enables you to navigate to the center of the dialog that contains the list of files and folders. Once here you can get information about the file and use the tab keys to navigate to the other fields in the dialog, such as Look In.

#### Look In

The **Look In** field shows the path from which the file will be recalled and allows you to change the path using the up and down arrow keys to navigate to other paths; the Enter key to open a directory; and the Backspace key to go back one directory. The **Look In** field first uses the last path from the Save As dialog **Save In:** path for that same file type. There is no softkey for directly navigating to the Look In field, but you can use the left tab to get here from the File/Folder List.

User specified paths are remembered when you leave and return to a Mode and are reset back to the default using **Restore Mode Defaults**.

#### Sort

Accesses a menu that enables you to sort the files within the File Open dialog. Only one sorting type can be selected at a time and the sorting happens immediately. The sorting types are **By Date**, **By Name**, **By extension**, and **By Size**.

#### Files of Type

This field shows the file suffix for the type of file you have selected to recall. For example, if you navigated here while recalling State, "Mode state (\*.state)" is in the field. If you navigated here while recalling Trace, "Mode state (\*.trace)" is in the field. If you navigated here while importing a trace data file, "Trace Data (\*.csv)" is in the field. For some file types, there is more than one choice in the dropdown menu, which you can select by using the up and down arrow keys and Enter.

#### Up One Level

This key corresponds to the icon of a folder with the up arrow that is in the tool bar of the dialog. When pressed, it causes the file and folder list to navigate up one level in the directory structure. The Backspace key does the same thing.

#### Cancel

This key corresponds to the **Cancel** selection in the dialog. It causes the current **Open** request to be cancelled. The ESC key does the same thing.

Key Path	<b>Recall, State</b>
Notes	Brings up the Open dialog for recalling a State Save Type
Initial S/W Revision	Prior to A.02.00

### Data (Export)

Exporting a data file stores data from the current measurement to mass storage files. The Export Menu only contains data types that are supported by the current measurement.

Since the commonly exported data files are in .csv format, the data can be edited by you prior to importing. This allows you to export a data file, manipulate the data in Excel (the most common PC Application for manipulating .csv files) and then import it.

Selecting an Export Data menu key will not actually cause the exporting to occur, since the analyzer still needs to know where you wish to save the data. Pressing the Save As key in this menu brings up the Save As dialog and Save As menu that allows you to specify the destination file and directory. Once a filename has been selected or entered in the Open menu, the export will occur as soon as the Save key is pressed.

Key Path	<b>Save</b>
Mode	All
Notes	The menu is built from whatever data types are available for the mode. So the key locations in the sub menu will vary.  No SCPI command directly controls the Data Type that this key controls. The Data Type is included in the MMEM:STORe commands.

Dependencies	If a file type is not used by a certain measurement, that type is grayed out for that measurement. The key for a file type will not show at all if there are no measurements in the Mode that support it.
Preset	Is not affected by a Preset or shutdown, but is reset during Restore Mode Defaults
Readback	The data type that is currently selected
Initial S/W Revision	Prior to A.02.00

## Amplitude Correction

Pressing this key selects **Amplitude Corrections** as the data type to be exported. Pressing this key again brings up the Select Menu, which allows the user to select which **Amplitude Correction** to save.

Amplitude Corrections are fully discussed in the documentation of the Input/Output key, under the Corrections softkey.

See "[Correction Data File](#)" on page 922

Key Path	<b>Save</b>
<b>Remote Command</b>	<b>:MMEMory:STORe:CORRection 1 2 3 4 5 6, &lt;filename&gt;</b>
<b>Example</b>	:MMEM:STOR:CORR 2 "myAmpcor.csv" saves Correction 2 to the file myAmpcor.csv on the current path. The default path is My Documents\amplitudeCorrections.
Notes	If the save is initiated via SCPI, and the file already exists, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade. Both single and double quotes are supported for any filename parameter over SCPI.
Dependencies	Corrections are not supported by all Measurements. If in a Mode in which some Measurements support it, this key will be grayed out in measurements that do not. The key will not show at all if no measurements in the Mode support it. This key will not appear unless you have the proper option installed in your instrument.
Readback	Selected Correction
<b>Backwards Compatibility SCPI</b>	<b>:MMEMory:STORe:CORRection ANTenna   CABLe   OTHer   USER, &lt;filename&gt;</b> For backwards compatibility, ANTenna maps to 1, CABLe maps to 2, OTHer maps to 3 and USER maps to 4
Initial S/W Revision	A.02.00

## 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.

Line #	Type of field	Example	Notes
1	File type, must be "Amplitude Correction"	Amplitude Correction	May not be omitted
2	File Description (in quotes)	"Correction Factors for 11966E"	60 characters max; may be empty but may not be omitted. If exceeds 60 characters, error -233 Too much data reported
3	Comment (in quotes)	"Class B Radiated"	60 characters max; may be empty but may not be omitted. . If exceeds 60 characters, error -233 Too much data reported
4	Instrument Version, Model #	A.02.06,N9020A	May be empty but may not be omitted
5	Option List, File Format Version	K03 LFE EXM ,01	May be empty but may not be omitted
6	Freq Unit to be used for all frequency values in the file	Frequency Unit,MHz	assumed to be Hz if omitted
7	Antenna Unit	Antenna Unit,None	If omitted leaves the Antenna unit unchanged. The amplitude unit in the Antenna Unit field is a conversion factor that is used to adjust the Y Axis Units of the current mode, if the mode supports Antenna Units. For more details on antenna correction data, refer to the Input/Output,Corrections key description. Allowable values: dBuV/m, dBuA/m, dBG, dBpT, None
8	Freq Interpolation	Frequency Interpolation,Linear	if omitted leaves the Freq Interpolation unchanged. Allowable values: Linear, Logarithmic
9	Bias value in mA	Bias,0.00	If omitted leaves the Bias value unchanged (added as of A.08.50)
10	Bias State	Bias State,On	If omitted leaves the Bias State unchanged. Allowable values: On, Off (added as of A.08.50)

Line #	Type of field	Example	Notes
11	Overlap, two values, Freq1 and Freq2, separated by commas.	Overlap,33500,40000	Uses Freq Unit from line 6. Thus, in this example Freq1=33.5 GHz, Freq2= 40.0 GHz (see note below). If omitted leaves the overlap unchanged (added as of A.08.50)
12	DATA marker	DATA	Corrections data begins in the next line

Lines 2 through 5 can be empty but must appear in the file. Lines 6 through 11 are optional, the lines can be left out of the file altogether.

The Overlap row and the two Bias rows apply only to external mixing. Both are read-only, they are never written by the analyzer. The only way to insert or modify these rows is to edit the file with a text editor or a spreadsheet editor. These rows are intended for use by mixer manufacturers, as they allow the manufacturer to insert data about how the mixer corrections were generated and how they should be applied. The Bias rows allow you to specify whether to turn Bias on or off when the Correction is turned on and to specify a Bias value (turning off the Correction does not change the Bias, but turning it back on again sets it to the value specified in the file). The Overlap row allows you to specify an overlap region in which two different corrections may be applied. It is expected that in the corrections data itself, there will be TWO corrections values exactly at Max Freq, otherwise Overlap is ignored. The way the overlap is processed is as follows: if at any given time the current analyzer Start Freq is greater than Freq 1 and lower than Freq 2, and the current Stop Freq is greater than Freq 2, extend the first correction point at or above Freq 2 down to Freq 1, rather than using the correction data between Freq1 and Freq2.

The Antenna Unit row can only be used in Correction register 1, because there can only be one setting for Antenna Unit at any given time. If a Correction whose Antenna Unit is set to anything but None is loaded into any Correction register but 1, an error is generated (Mass storage error; Can only load an Antenna Unit into Correction 1). When a correction file is saved from any Correction register but 1, Antenna Unit is always written as None.

Similarly, the Bias rows can only be used in Correction register 1, because there can only be one setting for Bias at any given time. If a Correction file with a Bias or Bias State row is loaded into any Correction register but 1, an error is generated: Mass storage error; Can only load Bias Settings into Correction 1

The data follows the DATA row, as comma separated X, Y pairs; one pair per line.

For example, suppose you have an Antenna to correct for on an N9020A version A.02.06 and the correction data is:

- 0 dB at 200 MHz



- 17 dB at 210 MHz
- 14.8 dB at 225 MHz

Then the file will look like:

- Amplitude Correction
- "Correction Factors for 11966E"
- "Class B Radiated"
- A.02.06,N9020A
- P13 EA3 UK6,01
- Frequency Unit,MHz
- Antenna Unit,dBuV/m
- Frequency Interpolation,Linear
- DATA
- 200.000000,0.00
- 210.000000,17.00
- 225.000000,14.80

The choices for the 1 of N fields in the metadata are as follows:

- Frequency Unit: Hz, kHz, MHz, GHz
- Antenna Unit: dBuv/m, dBuA/m, dBG, dBpT, None
- Frequency Interpolation: Logarithmic, Linear

### Amplitude Correction

These keys let you choose which Correction to save. Once selected, the key returns back to the Export Data menu and the selected Correction number is annotated on the key.

The next step in the Save process is to select the Save As key in the Export Data menu.

Key Path	Save, Data, Amplitude Correction
Preset	Not part of a Preset, but is reset to Correction 1 by Restore Input/Output Defaults. Survives a shutdown.
Readback	1
Initial S/W Revision	A.02.00

## Trace

Pressing this key selects Traces as the data type to be exported. Pressing this key when it is already selected brings up the Trace Menu, which allows you to select which Trace to save.

The trace file contains “meta” data which describes the current state of the analyzer. The metadata is detailed in "[Trace File Contents](#)" on page 926 below.

Key Path	Save, Data
Remote Command	:MMEMory:STORe:TRACe:DATA TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6   ALL   TRACE7   TRACE8   TRACE9   TRACE10   TRACE11   TRACE12, <filename>
Example	:MMEM:STOR:TRAC:DATA TRACE2, "myTrace2.csv" Exports the 2nd trace to the file myTrace2.csv in the current path. The default path is My Documents\SA\data\traces
Notes	If the save is initiated via SCPI, and the file already exists, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade. Both single and double quotes are supported for any filename parameter over SCPI.
Dependencies	For both Spectrum and Power vs Time measurements, traces cannot be recalled from a trace file that was saved with ALL traces selected.
Readback	selected Trace
Status Bits/OPC dependencies	Sequential - waits for previous measurement to complete
Initial S/W Revision	A.13.00

## Trace File Contents

A Trace Data File contains the data for one trace.

### Metadata:

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” which, if changed, cause a measurement restart.

- Measurement Type (Spectrum or PVT)
- Number of Points
- PVT Number of Points
- Acquisition Time (Frequency or PVT Acquisition Time depending on the Measurement Type)
- Start Frequency

- Stop Frequency
- Average Count (actual; not the limit for the instrument)
- Average Type
- RBW
- RBW Filter Type
- RBW Filter BW Type
- Trigger (source, level, slope, delay)
- Preamp (on/off, band)
- Phase Noise optimization setting
- IF Gain
- AC/DC setting (RF Coupling)
- External Reference setting
- Input (which input is in use)
- RF calibrator on/off
- External Gain
- Attenuation
- Ref Level Offset
- X-Axis Unit
- Y-Axis Unit
- Trace name/number
- Trace Type
- Detector
- Pvt Detector
- Trace math (function, operand1, operand2, offset, reference)

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.

An example output for both Spectrum and Pvt traces are provided below.

**Spectrum trace metadata example**

Trace	
Real Time SA	
A.13.00	N9030A
526 540 ALV ATP B1A B1X B1Y B25 B40 BBA CR3 CRP DCF DDA DP2 DRD EA3 EDP EMC EP1 ERC ESP EXM FS1 FSA FT2 LFE LNP MAT MPB NFE NUL P26 PFR PNC RT2 RTL RTS S40 SB1 SEC SM1 TVT YAS YAV	1
Segment	0
Measurement Type	Spectrum
Number of Points	821
Pvt Number of Points	1024
Acquisition Time	0.0300005
Start Frequency	1.993E+10
Stop Frequency	2.009E+10
Average Count	0
Average Type	Voltage
RBW	680000
RBW Filter	Gaussian
RBW Filter BW	3dB
Trigger Source	Free
Trigger Level	1.2
Trigger Slope	Positive
Trigger Delay	0
PreAmp State	Off
PreAmp Band	Low
Phase Noise Optimization	Fast
If Gain	Low
RF Coupling	DC
Ext Ref	10000000
Input	RF
RF Calibrator	Off
External Gain	0
Attenuation	10

Ref Level Offset	0
X Axis Units	Hz
Y Axis Units	dBm
Detector	Peak
Pvt Detector	Peak
Trace Name	Spectrum Trace1
Trace Type	Clearwrite
Trace Math	Off
Trace Math Oper1	Trace5
Trace Math Oper2	Trace6
Trace Math Offset	0
DATA	
Spectrum X	Spectrum Trace 1 Y
19925000000	-64.96347
19925195122	-64.783043
19925390244	-64.444908

(Continue until Number of Points)

**Power vs Time metadata example**

Trace	
Real Time SA	
A.13.00	N9030A
526 540 ALV ATP B1A	1
B1X B1Y B25 B40 BBA	
CR3 CRP DCF DDA DP2	
DRD EA3 EDP EMC EP1	
ERC ESP EXM FS1 FSA	
FT2 LFE LNP MAT MPB	
NFE NUL P26 PFR PNC	
RT2 RTL RTS S40 SB1	
SEC SM1 TVT YAS YAV	
Segment	0
Measurement Type	Pvt
Number of Points	821
Pvt Number of Points	1024
Acquisition Time	0.0300005
Start Frequency	1.993E+10
Stop Frequency	2.009E+10
Average Count	0

Average Type	Voltage
RBW	680000
RBW Filter	Gaussian
RBW Filter BW	3dB
Trigger Source	Free
Trigger Level	1.2
Trigger Slope	Positive
Trigger Delay	0
PreAmp State	Off
PreAmp Band	Low
Phase Noise Optimization	Fast
If Gain	Low
RF Coupling	DC
Ext Ref	10000000
Input	RF
RF Calibrator	Off
External Gain	0
Attenuation	10
Ref Level Offset	0
X Axis Units	Hz
Y Axis Units	dBm
Detector	Peak
Pvt Detector	Peak
Trace Name	Pvt Trace1
Trace Type	Clearwrite
Trace Math	Off
Trace Math Oper1	Trace5
Trace Math Oper2	Trace6
Trace Math Offset	0
DATA	
PVT X	Pvt Trace 1 Y
0	-64.96347
6.67E-05	-64.783043
0.000133333	-64.444908
(Continue until Pvt Number of Points)	

**Metadata example when saving all traces**



Notes	If the save is initiated via SCPI, and the file already exists, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade. Both single and double quotes are supported for any filename parameter over SCPI.
Dependencies	This key will only appear if you have the proper option installed in your instrument.
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.
Readback	selected Limit Line
Status Bits/OPC dependencies	Sequential - waits for previous measurement to complete
Initial S/W Revision	A.02.00

### Limits 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.

<b>Limit</b>	<i>Data file type name</i>
<b>"FCC Part 15"</b>	<i>File Description</i>
<b>"Class B Radiated"</b>	<i>Comment</i>
<b>A.01.00.R0001,N9020A</b>	<i>Instrument Version, Model Number</i>
<b>P13 EA3 UK6 ,01</b>	<i>Option List, File Format Version{</i>

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.

<b>Type, Upper</b>	<i>Upper Lower</i>
<b>X Axis Unit, MHz</b>	<i>MHz S; other units should be converted; this also specifies the domain</i>
<b>Amplitude Unit, dBm</b>	<i>dBm V; all other units should be converted appropriately</i>
<b>Frequency Interpolation, Linear</b>	<i>Logarithmic Linear</i>
<b>Amplitude Interpolation, Logarithmic</b>	<i>Logarithmic Linear</i>
<b>X Control, Fixed</b>	<i>Fixed Relative; on input we consider only the first three characters</i>
<b>Y Control, Fixed</b>	<i>Fixed Relative; on input we consider only the first three characters</i>
<b>Margin, 0</b>	<i>Always in dB. A 0 margin is equivalent to margin off</i>
<b>X Offset, 10</b>	<i>Expressed in the X axis units</i>
<b>Y Offset, 5</b>	<i>Expressed in the Amplitude units</i>

The Amplitude Unit line in the limits file may contain an antenna factor unit, for example:



Amplitude Unit=dBuV/m

Antenna 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.

### Limit Selection

These keys let you pick which Limit Line to save. Once selected, the key returns back to the **Export Data** menu and the selected Limit Line number is annotated on the key.

The next step in the Save process is to select the Save As key in the Export Data menu.

Key Path	<b>Save, Data, Limit Line</b>
Notes	auto return
Preset	Not part of Preset, but is reset to LLINE1 by Restore Mode Defaults; survives shutdown
Initial S/W Revision	A.02.00

### Measurement Results

Pressing this key selects Meas Results as the data type to be exported. Pressing the key a second time brings up the Meas Results menu, which allows you to select which Meas Result to save. In the RT SA measurement, there are four types of Measurement Results files: Peak Table, Marker Table, Spectrogram and Density.

See "Meas Results File Contents" on page 934

See "Marker Table" on page 934

See "Peak Table" on page 937

See "Spectrogram" on page 940

See "Density" on page 941

Key Path	Save, Data
Initial S/W Revision	A.13.00

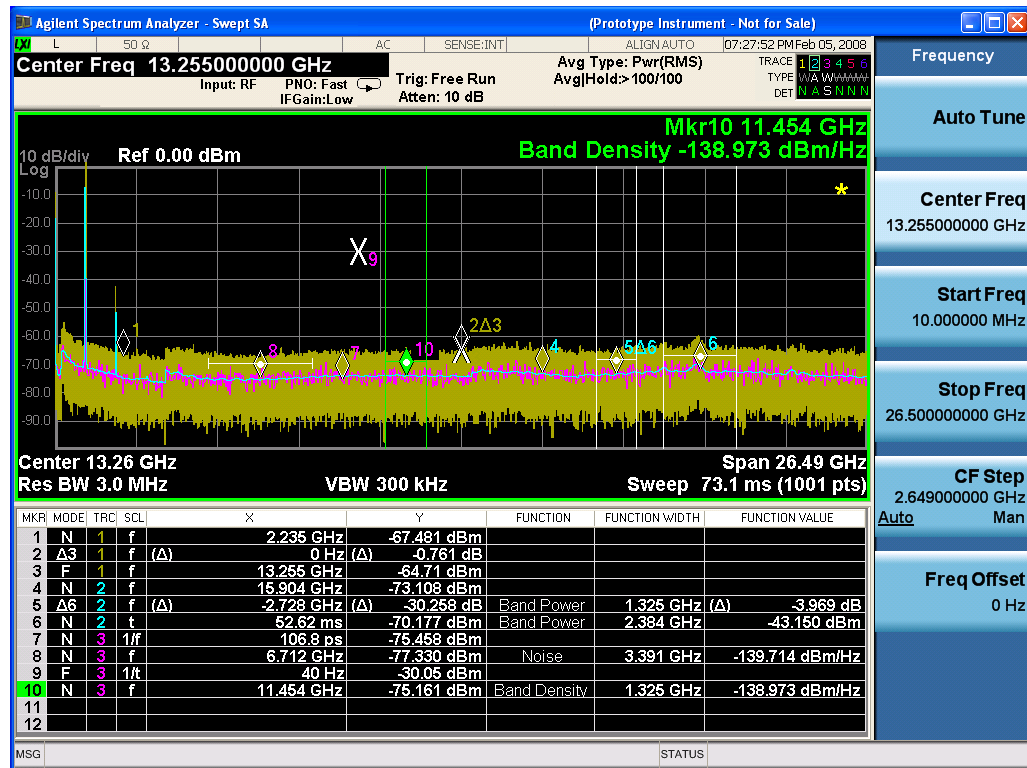
### Meas Results File Contents

All files are .csv files. The following section details the data in each file type.

### Marker Table

This section discusses the Marker Table Meas Results file format.

Imagine that, at the point where a Marker Table Meas Result is requested, the following screen is showing:



Then the Meas Results file, when opened, would show the following data:

Measureme  
ntResult

Swept SA	
A.01.40_ R0017	N9020A
526 B25 PFR P26 EA3	1
Result Type	Marker Table
Ref Level	0
Number of Points	1001
Sweep Time	0.06626 6667
Start Frequency	100000 00
Stop Frequency	265000 00000
Average Count	0
Average Type	LogPow er (Video)
RBW	300000 0
RBW Filter	Gaussia n
RBW Filter BW	3dB
VBW	300000 0
Sweep Type	Swept
X Axis Scale	Lin
PreAmp State	Off
PreAmp Band	Low
Trigger Source	Free
Trigger Level	1.2
Trigger Slope	Positive
Trigger	1.00E-

Delay	06								
Phase Noise Optimization	Fast								
Swept If Gain	Low								
FFT If Gain	Autorange								
RF Coupling	AC								
FFT Width	411900								
Ext Ref	1000000								
Input	RF								
RF Calibrator	Off								
Attenuation	10								
Ref Level Offset	0								
External Gain	0								
X Axis Units	Hz								
Y Axis Units	dBm								
DATA									
MKR	MODE	T R C	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	FUNCTION 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	-2.728	-30.	Band Power	1.3250E+06	-3.969	dB

				0E+09	25				
					8				
6	Normal	2	Time	5.262 0E-02	- 70. 17 7	Band Power	2.384 0E+06	- 43.15	dBm
7	Normal	3	Period	1.068 0E-10	- 75. 45 8	Off	0.000 0E+00	0	None
8	Normal	3	Frequency	6.712 0E+09	- 77. 33	Noise	3.391 0E+06	- 139.7 14	dBm/ Hz
9	Fixed	3	Inverse Time	4.000 0E+01	- 30. 05	Off	0.000 0E+00	0	None
10	Normal	3	Frequency	1.145 4E+10	- 75. 16 1	Band Density	1.325 0E+06	- 138.9 73	dBm/ Hz
11	Off	1	Frequency	0.000 0E+00	0	Off	0.000 0E+00	0	None
12	Off	1	Frequency	0.000 0E+00	0	Off	0.000 0E+00	0	None

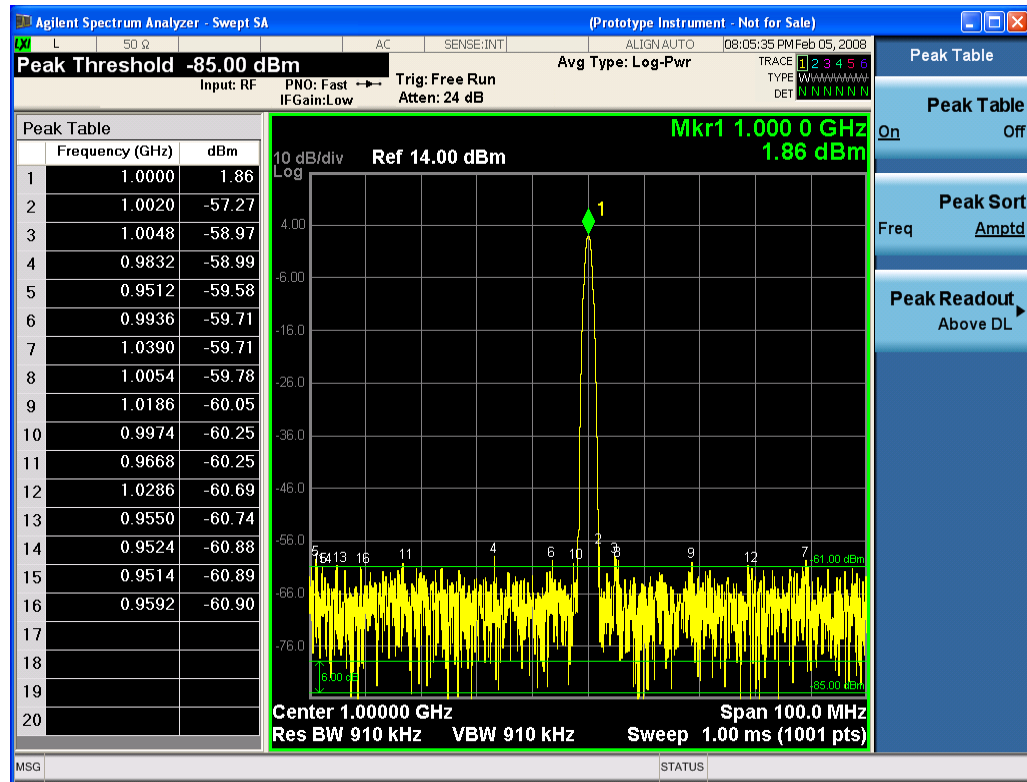
The numbers appear in the file exactly as they appear onscreen.

### Peak Table

This section discusses the Peak Table Meas Results file format.

See also, "[Store Peak Search Results](#)" on page 943 remote command.

Imagine that, at the point where a Marker Table Meas Result is requested, the following screen is showing:



Then 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
t
Swept SA

9 Power vs Time Measurement  
Save

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	2650000000 0
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		

## Spectrogram

The Spectrogram View allows you to view a history of 10,000 traces, with up to 600 traces being displayed at any one time. In the Spectrogram View, each horizontal line in the spectrogram display represents one historical trace, which is the summary of an accumulation over an acquisition time interval. The data streams upwards from newest to oldest; the latest trace displays on the bottom and the oldest trace on the top.



Note that whenever you do a save state while in Spectrogram, and then recall the state, Spectrogram comes back with all the settings just as they were when you saved the state, but not including the Spectrogram data itself. If you want to save the Spectrogram data, you can Export it using Meas Results, and import it into a PC, although you cannot load it back into the analyzer.

See ["Spectrogram" on page 712](#) for more information.

See also, ["Save Spectrogram Results" on page 944](#) remote command.

## Density

This section discusses the Density results file format.

See also, ["Store Density Results" on page 944](#) and ["Fetch Density Results" on page 625](#) remote commands.

The Density result file has the same metadata as the other Meas Results files with the additional meta data #FFT's, Sample Rate and Acquisition Time. The meta data is followed by a row marked DATA, then all the density values for the bitmap of the last acquisition.

The format of the data will be a series of frequency/amplitude points with the value at each point representing the density percentage, in the range 0–1. Therefore a frequency/amplitude point that is hit 50% of the time during an acquisition will be represented by 0.5. The location of the frequency/amplitude point within the bitmap will correspond to the row/column point in the .csv file.

Trace	
Real Time SA	
A.13.00_R1005	N9030A
503 508 513 526 ALV	1
Scale Per Div	10
Segment	0
Result Type	Density
Measurement Type	Spectrum
Number of Points	821
Pvt Number of Poi	1024
Acquisition Time	0.030000775
Start Frequency	2370000000
Stop Frequency	2530000000
Average Count	0
Average Type	Voltage
RBW	765417.2251
RBW Filter	Gaussian
RBW Filter BW	3dB
Trigger Source	Free
Trigger Level	1.2
Trigger Slope	Positive
Trigger Delay	0
PreAmp State	Off
PreAmp Band	Low
Phase Noise Optim	Fast
If Gain	Low
RF Coupling	AC
Ext Ref	10000000
Input	RF
RF Calibrator	Off
External Gain	0
Attenuation	6
Ref Level Offset	0
X Axis Units	Hz
Pvt X Axis Units	Sec
Y Axis Units	dBm
Trace Name	Spectrum Trace
Trace Type	Clearwrite
Detector	Peak
Pvt Detector	
Trace Math	Off
Trace Math Oper1	Trace5
Trace Math Oper2	Trace6
Trace Math Offset	0

DATA					
Freq/Ampl	2370000000 Hz	2370195121.95122 Hz	2370390243.90244 Hz	2370585365.85366 Hz	2370780487.80488 Hz
-110 dBm	0.000538963	0.000808444	0.000943184	0.001212666	0.00062879
-109.5556 dBm	0.000853357	0.000449135	0.000808444	0.000943184	0.000718617
-109.1111 dBm	0.001077925	0.001122838	0.001302493	0.001077925	0.000898271
-108.6667 dBm	0.001077925	0.000898271	0.001077925	0.001033011	0.000988098
-108.2222 dBm	0.00139232	0.001302493	0.000898271	0.001661801	0.001706715
-107.7778 dBm	0.001212666	0.001616888	0.001706715	0.001482147	0.001302493
-107.3333 dBm	0.001302493	0.00152706	0.001482147	0.001437233	0.001482147
-106.8889 dBm	0.001437233	0.001661801	0.002245677	0.001796542	0.001976196
-106.4444 dBm	0.001751094	0.001500938	0.001751094	0.001626016	0.001459245
-106 dBm	0.002084636	0.002251407	0.002042944	0.002459871	0.003168647
-105.5556 dBm	0.002501563	0.0022931	0.002918491	0.002793413	0.00275172
-105.1111 dBm	0.001751094	0.001876173	0.002168022	0.002459871	0.001917865
-104.6667 dBm	0.001959558	0.002584949	0.002126329	0.002543256	0.003293725
-104.2222 dBm	0.002835105	0.003293725	0.003627267	0.003877423	0.004336043
-103.7778 dBm	0.002793413	0.002835105	0.002710027	0.003752345	0.00321034
-103.3333 dBm	0.004044194	0.004669585	0.004252658	0.004210965	0.004294351
-102.8889 dBm	0.003835731	0.003335418	0.004294351	0.005128205	0.004836356
-102.4444 dBm	0.004878049	0.004210965	0.003877423	0.005253283	0.005545132
-102 dBm	0.003752345	0.003794038	0.004085887	0.004752971	0.00550344

## Marker Table Results

<b>Remote Command</b>	:MMEMory:STORe:RESults:MTABle <filename>
<b>Example</b>	:MMEM:STOR:RES:MTAB "myResults.csv" saves the results from the current marker table to the file myResults.csv in the current path. The default path is My Documents\RTSA\data\results
<b>Notes</b>	If the save is initiated via SCPI, and the file already exists, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade. Both single and double quotes are supported for any filename parameter over SCPI.
<b>Dependencies</b>	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
<b>Preset</b>	Not part of Preset, but is reset to Peak Table by Restore Mode Defaults. Survives a shutdown.
<b>Initial S/W Revision</b>	A.13.00

## Store Peak Search Results

<b>Remote Command</b>	:MMEMory:STORe:RESults:PTABle <filename>
<b>Example</b>	:MMEM:STOR:RES:PTAB "myResults.csv" saves the results from the current peak table to the file myResults.csv in the current path. The default path is My Documents\RTSA\data\results
<b>Notes</b>	If the save is initiated via SCPI, and the file already exists, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade. Both single and double quotes are supported for any filename parameter over SCPI.
<b>Dependencies</b>	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
<b>Preset</b>	Not part of Preset, but is reset to Peak Table by Restore Mode Defaults. Survives a shutdown.
<b>Initial S/W Revision</b>	A.13.00

## Save Spectrogram Results

<b>Remote Command</b>	:MMEMory:STORe:RESults:SPECTrogram <filename>
<b>Example</b>	:MMEM:STOR:RES:SPEC "SpecResults.csv" saves the results from the current Spectrogram display to the file SpecResults.csv in the current path. Default path is My Documents\RTSA\data\results
<b>Notes</b>	If the save is initiated via SCPI, and the file already exists, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade. Both single and double quotes are supported for any filename parameter over SCPI.
<b>Dependencies</b>	If a save of Spectrogram results is requested and the Spectrogram is not on, no file is saved and a message is generated.
<b>Preset</b>	Not part of Preset, but is reset to Peak Table by Restore Mode Defaults. Survives a shutdown.
<b>Initial S/W Revision</b>	A.13.00

## Store Density Results

<b>Remote Command</b>	:MMEMory:STORe:RESults:DENSity <filename>
<b>Example</b>	:MMEM:STOR:RES:DENS "myResults.csv" saves the results from the current Density display to the file myResults.csv in the current path. The default path is My Documents\RTSA\data\results
<b>Notes</b>	If the save is initiated via SCPI, and the file already exists, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade. Both single and double quotes are supported for any filename parameter over SCPI.
<b>Dependencies</b>	If a save of Density results is requested and the Density view is not on, no file is saved and a message is generated.
<b>Preset</b>	Not part of Preset, but is reset to Peak Table by Restore Mode Defaults. Survives a shutdown.
<b>Initial S/W Revision</b>	A.13.00

## Measurement Results

Pressing this key selects Meas Results as the data type to be exported. Pressing the key a second time brings up the Meas Results menu, which allows you to select which Meas Result to save. In the RT SA measurement, there are four types of Measurement Results files: Peak Table, Marker Table, Spectrogram and Density.

See ["Meas Results File Contents" on page 945](#)

See ["Marker Table" on page 945](#)

See ["Peak Table" on page 948](#)

See ["Spectrogram" on page 951](#)

See ["Density" on page 951](#)

Key Path	Save, Data
Initial S/W Revision	A.13.00

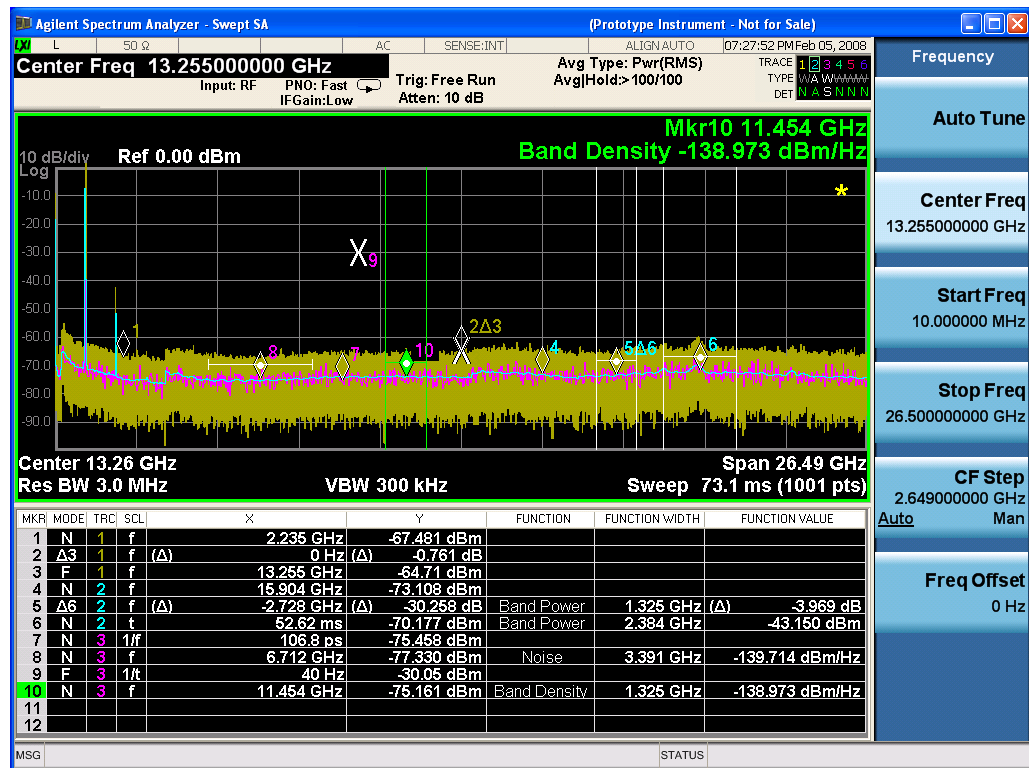
### Meas Results File Contents

All files are .csv files. The following section details the data in each file type.

### Marker Table

This section discusses the Marker Table Meas Results file format.

Imagine that, at the point where a Marker Table Meas Result is requested, the following screen is showing:



Then the Meas Results file, when opened, would show the following data:

MeasurementResult	
Swept SA	
A.01.40_	N9020A
R0017	
526 B25	1
PFR P26	
EA3	
Result Type	Marker Table

Ref Level	0
Number of Points	1001
Sweep Time	0.06626667
Start Frequency	10000000
Stop Frequency	2650000000
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	100000 00								
Input	RF								
RF Calibrator	Off								
Attenuation	10								
Ref Level Offset	0								
External Gain	0								
X Axis Units	Hz								
Y Axis Units	dBm								
DATA									
MKR	MODE	T R C	SCL	X	Y	FUNC TION	FUNC TION WIDT H	FUNC TION VALU E	FUNC TION UNIT
1	Normal	1	Frequ ency	2.2350 E+09	- 67. 48 1	Off	0.0000 E+00	0	None
2	Delta3	1	Frequ ency	0.0000 E+00	- 0.7 61	Off	0.0000 E+00	0	None
3	Fixed	1	Frequ ency	1.3255 E+10	- 64. 71	Off	0.0000 E+00	0	None
4	Normal	2	Frequ ency	1.5904 E+10	- 73. 10 8	Off	0.0000 E+00	0	None
5	Delta7	2	Frequ ency	- 2.7280 E+09	- 30. 25 8	Band Power	1.3250 E+06	- 3.969	dB
6	Normal	2	Time	5.2620 E-02	- 70. 17 7	Band Power	2.3840 E+06	- 43.15	dBm
7	Normal	3	Perio d	1.0680 E-10	- 75. 45 8	Off	0.0000 E+00	0	None

8	Normal	3	Frequency	6.7120 E+09	- 77. 33	Noise	3.3910 E+06	- 139.7 14	dBm/ Hz
9	Fixed	3	Inverse Time	4.0000 E+01	- 30. 05	Off	0.0000 E+00	0	None
10	Normal	3	Frequency	1.1454 E+10	- 75. 16 1	Band Densi ty	1.3250 E+06	- 138.9 73	dBm/ Hz
11	Off	1	Frequency	0.0000 E+00	0	Off	0.0000 E+00	0	None
12	Off	1	Frequency	0.0000 E+00	0	Off	0.0000 E+00	0	None

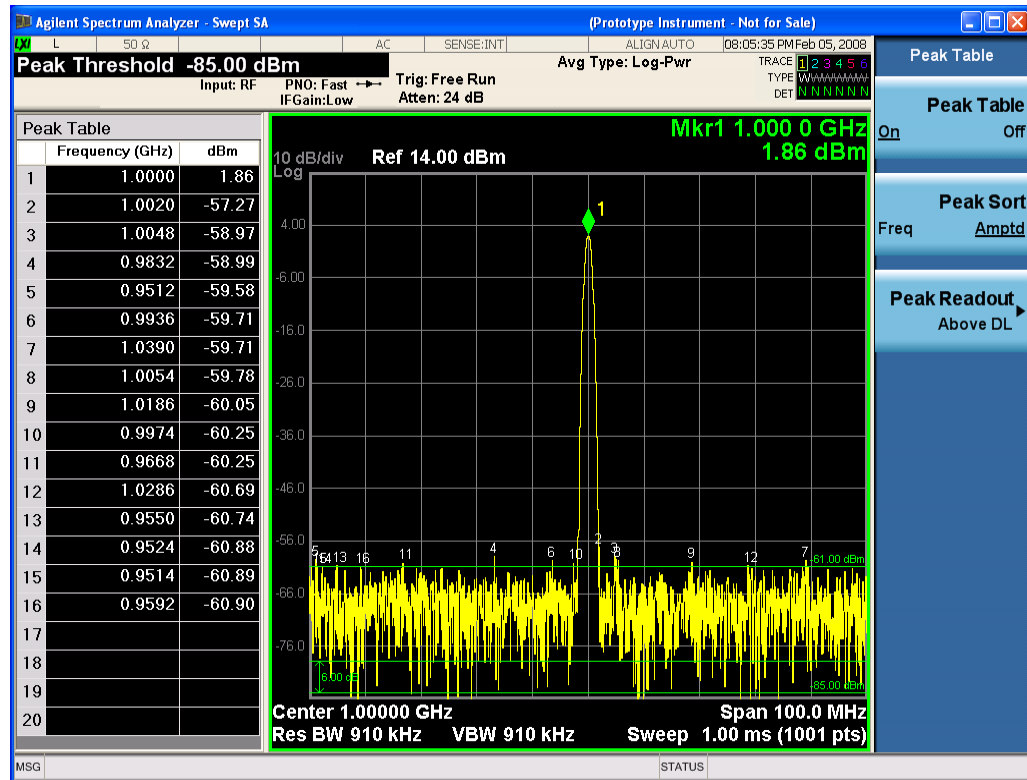
The numbers appear in the file exactly as they appear onscreen.

### Peak Table

This section discusses the Peak Table Meas Results file format.

See also, "[Store Peak Search Results](#)" on page 943 remote command.

Imagine that, at the point where a Marker Table Meas Result is requested, the following screen is showing:





Then 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:

<b>MeasurementResult</b>	
<b>t</b>	
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	2650000000 0
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		

## Spectrogram

The Spectrogram View allows you to view a history of 10,000 traces, with up to 600 traces being displayed at any one time. In the Spectrogram View, each horizontal line in the spectrogram display represents one historical trace, which is the summary of an accumulation over an acquisition time interval. The data streams upwards from newest to oldest; the latest trace displays on the bottom and the oldest trace on the top.

Note that whenever you do a save state while in Spectrogram, and then recall the state, Spectrogram comes back with all the settings just as they were when you saved the state, but not including the Spectrogram data itself. If you want to save the Spectrogram data, you can Export it using Meas Results, and import it into a PC, although you cannot load it back into the analyzer.

See ["Spectrogram" on page 712](#) for more information.

See also, ["Save Spectrogram Results" on page 944](#) remote command.

## Density

This section discusses the Density results file format.

See also, ["Store Density Results" on page 944](#) and ["Fetch Density Results" on page 625](#) remote commands.

The Density result file has the same metadata as the other Meas Results files with the additional meta data #FFT's, Sample Rate and Acquisition Time. The meta data is followed by a row marked DATA, then all the density values for the bitmap of the last acquisition.

The format of the data will be a series of frequency/amplitude points with the value at each point representing the density percentage, in the range 0–1. Therefore a frequency/amplitude point that is hit 50% of the time during an acquisition will be represented by 0.5. The location of the frequency/amplitude point within the bitmap will correspond to the row/column point in the .csv file.

Trace	
Real Time SA	
A.13.00_R1005	N9030A
503 508 513 526 ALV	1
Scale Per Div	10
Segment	0
Result Type	Density
Measurement Type	Spectrum
Number of Points	821
Pvt Number of Poi	1024
Acquisition Time	0.030000775
Start Frequency	2370000000
Stop Frequency	2530000000
Average Count	0
Average Type	Voltage
RBW	765417.2251
RBW Filter	Gaussian
RBW Filter BW	3dB
Trigger Source	Free
Trigger Level	1.2
Trigger Slope	Positive
Trigger Delay	0
PreAmp State	Off
PreAmp Band	Low
Phase Noise Optim	Fast
If Gain	Low
RF Coupling	AC
Ext Ref	10000000
Input	RF
RF Calibrator	Off
External Gain	0
Attenuation	6
Ref Level Offset	0
X Axis Units	Hz
Pvt X Axis Units	Sec
Y Axis Units	dBm
Trace Name	Spectrum Trace
Trace Type	Clearwrite
Detector	Peak
Pvt Detector	
Trace Math	Off
Trace Math Oper1	Trace5
Trace Math Oper2	Trace6
Trace Math Offset	0

DATA					
Freq/Ampl	2370000000 Hz	2370195121.95122 Hz	2370390243.90244 Hz	2370585365.85366 Hz	2370780487.80488 Hz
-110 dBm	0.000538963	0.000808444	0.000943184	0.001212666	0.00062879
-109.5556 dBm	0.000853357	0.000449135	0.000808444	0.000943184	0.000718617
-109.1111 dBm	0.001077925	0.001122838	0.001302493	0.001077925	0.000898271
-108.6667 dBm	0.001077925	0.000898271	0.001077925	0.001033011	0.000988098
-108.2222 dBm	0.00139232	0.001302493	0.000898271	0.001661801	0.001706715
-107.7778 dBm	0.001212666	0.001616888	0.001706715	0.001482147	0.001302493
-107.3333 dBm	0.001302493	0.00152706	0.001482147	0.001437233	0.001482147
-106.8889 dBm	0.001437233	0.001661801	0.002245677	0.001796542	0.001976196
-106.4444 dBm	0.001751094	0.001500938	0.001751094	0.001626016	0.001459245
-106 dBm	0.002084636	0.002251407	0.002042944	0.002459871	0.003168647
-105.5556 dBm	0.002501563	0.0022931	0.002918491	0.002793413	0.00275172
-105.1111 dBm	0.001751094	0.001876173	0.002168022	0.002459871	0.001917865
-104.6667 dBm	0.001959558	0.002584949	0.002126329	0.002543256	0.003293725
-104.2222 dBm	0.002835105	0.003293725	0.003627267	0.003877423	0.004336043
-103.7778 dBm	0.002793413	0.002835105	0.002710027	0.003752345	0.00321034
-103.3333 dBm	0.004044194	0.004669585	0.004252658	0.004210965	0.004294351
-102.8889 dBm	0.003835731	0.003335418	0.004294351	0.005128205	0.004836356
-102.4444 dBm	0.004878049	0.004210965	0.003877423	0.005253283	0.005545132
-102 dBm	0.003752345	0.003794038	0.004085887	0.004752971	0.00550344

## Marker Table Results

<b>Remote Command</b>	:MMEMory:STORE:RESults:MTABle <filename>
<b>Example</b>	:MMEM:STOR:RES:MTAB "myResults.csv" saves the results from the current marker table to the file myResults.csv in the current path. The default path is My Documents\RTSA\data\results
<b>Notes</b>	If the save is initiated via SCPI, and the file already exists, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade. Both single and double quotes are supported for any filename parameter over SCPI.
<b>Dependencies</b>	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
<b>Preset</b>	Not part of Preset, but is reset to Peak Table by Restore Mode Defaults. Survives a shutdown.
<b>Initial S/W Revision</b>	A.13.00

## Save FMT to File

Allows you to export a mask to a file. Selecting this key will select the save type as FMT and bring up the Save As dialog box.

<b>Key Path</b>	Save, Data (Export), FMT
<b>Remote Command</b>	:MMEMory:STORE:FMT <filename>
<b>Example</b>	:MMEM:STOR:FMT "MYFMT.CSV" saves the FMT mask data to the file myFmt.csv in the current directory.
<b>Notes</b>	The default path is My Documents\Mode\data\FMT If the save is initiated via SCPI, and the file already exists, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade. Both single and double quotes are supported for any filename parameter over SCPI.

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Initial S/W Revision      A.13.00

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### Save As . . .

When you press “Save As”, the analyzer brings up a Windows dialog and a menu entitled “**Save As.**” This menu allows you to navigate to the various fields in the Windows dialog without using a keyboard or mouse. The **Tab** and **Arrow** keys can also be used for dialog navigation.

See "[To File . . .](#)" on page 911 in **Save, State** for a full description of this dialog and menu.

The default path for saving files is:

For all of the Trace Data Files:

- My Documents\`<mode name>`\data\traces

For all of the Limit Data Files:

- My Documents\`<mode name>`\data\limits

For all of the Measurement Results Data Files:

- My Documents\`<mode name>`\data\`<measurement name>`\results

For all of the Capture Buffer Data Files:

- My Documents\`<mode name>`\data\captureBuffer

---

Key Path	<b>Save, Data</b>
Mode	All
Notes	The key location is mode-dependent and will vary. Brings up the Save As dialog for saving a <code>&lt;mode specific&gt;</code> Save Type. The save is performed immediately and does not wait until the measurement is complete.
Initial S/W Revision	Prior to A.02.00

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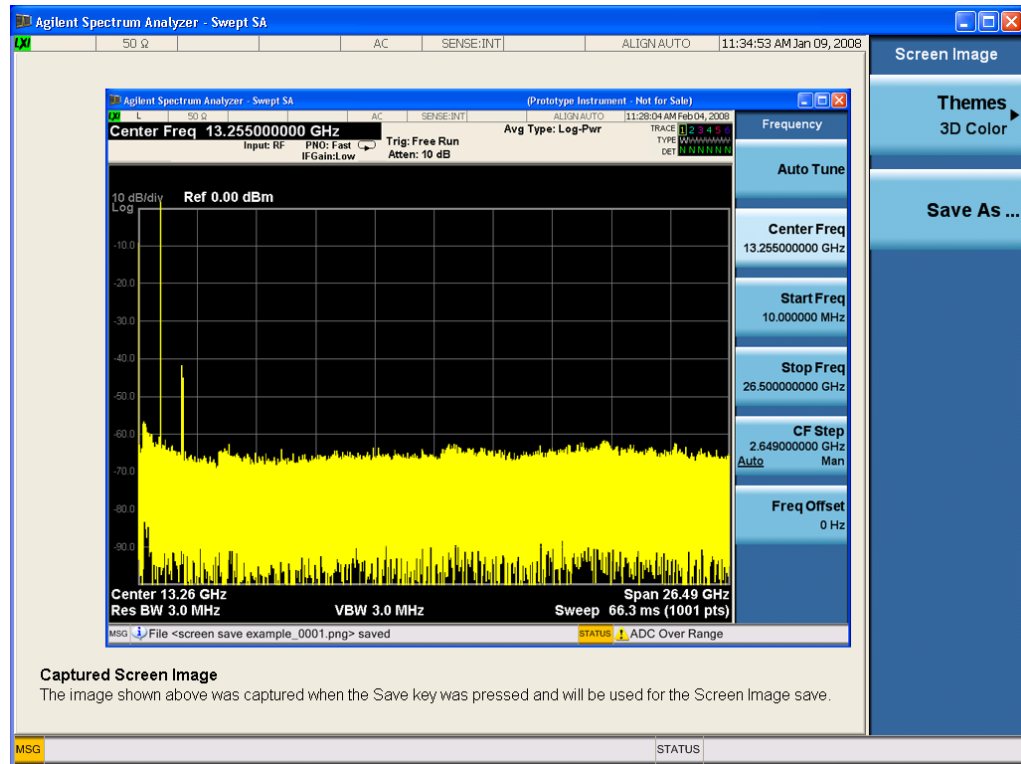
### Screen Image

Pressing Screen Image accesses a menu of functions that enable you to specify a format and location for the saved screen image. It brings up a menu that allows you to specify the color scheme of the Screen Image (Themes) or navigate to the Save As dialog to perform the actual save.

Screen Image files contain an exact representation of the analyzer display. They cannot be loaded back onto the analyzer, but they can be loaded into your PC for use in many popular applications.

The image to be saved is actually captured when the **Save** front panel key is pressed, and kept in temporary storage to be used if you ask for a Screen Image

save. When the Screen Image key is pressed, a "thumbnail" of the captured image is displayed, as shown below:



When you continue on into the **Save As** menu and complete the Screen Image save, the image depicted in the thumbnail is the one that gets saved, showing the menus that were on the screen before going into the **Save** menus. The save is performed immediately and does not wait until the measurement is complete.

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 the current screen data.

**NOTE**

For versions previous to A.01.55, if you initiate a screen image save by navigating through the Save menus, the image that is saved will contain the Save menu softkeys, not the menus and the active function that were on the screen when you first pressed the Save front panel key.

<b>Key Path</b>	<b>Save</b>
<b>Mode</b>	All
<b>Remote Command</b>	:MMEMory:STORe:SCReen <filename>
<b>Example</b>	:MMEM:STOR:SCR "myScreen.png" This stores the current screen image in the file MyScreenFile.png in the default directory.
<b>Backwards Compatibility SCPI</b>	HCOPy : SDUMp : DATA? returns the screen image in a <DEFINITE LENGTH ARBITRARY RESPONSE DATA> element. The response data is IEEE Block format; the controlling computer can strip the header and store the result as a .png file.

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Initial S/W Revision      Prior to A.02.00

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## Themes

Accesses a menu of functions that enable you to choose the theme to be used when saving the screen image.

The **Themes** option is the same as the **Themes** option under the **Display** and **Page Setup** dialogs. It allows you to choose between themes to be used when saving the screen image.

---

Key Path	<b>Save, Screen Image</b>
<b>Remote Command</b>	:MMEMory:STORe:SCReen:THEMe TDCoLor   TDMonochrome   FCOLor   FMONochrome  :MMEMory:STORe:SCReen:THEMe?
<b>Example</b>	:MMEM:STOR:SCR:THEM TDM
Preset	3D Color; Is not part of Preset, but is reset by Restore Misc Defaults or Restore System Defaults All and survives subsequent running of the modes.
Readback	3D Color   3D Mono   Flat Color   Flat Mono
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 "Flat Color" theme available in X-Series. Also, if you selected Reverse Bitmap AND a black & white screen image, that would be much like "Flat Monochrome". In other words, each of the X-Series themes has a similar screen image type in ESA/PSA. But they are not identical.
Initial S/W Revision	Prior to A.02.00

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## 3D Color

Selects a standard color theme with each object filled, shaded and colored as designed.

---

Key Path	<b>Save, Screen Image, Themes</b>
<b>Example</b>	MMEM:STOR:SCR:THEM TDC
Readback	3D Color
Initial S/W Revision	Prior to A.02.00

---

## 3D Monochrome

Selects a format that is like 3D color but shades of gray are used instead of colors.

---

Key Path	<b>Save, Screen Image, Themes</b>
<b>Example</b>	MMEM:STOR:SCR:THEM TDM
Readback	3D Mono
Initial S/W Revision	Prior to A.02.00

---



## Flat Color

Selects a format that is best when the screen is to be printed on an ink printer.

Key Path	<b>Save, Screen Image, Themes</b>
<b>Example</b>	MMEM:STOR:SCR:THEM FCOL
Readback	Flat Color
Initial S/W Revision	Prior to A.02.00

## Flat Monochrome

Selects a format that is like Flat Color. But only black is used (no colors, not even gray), and no fill.

Key Path	<b>Save, Screen Image, Themes</b>
<b>Example</b>	MMEM:STOR:SCR:THEM FMON
Readback	Flat Mono
Initial S/W Revision	Prior to A.02.00

## Save As...

When you press "Save As", the analyzer brings up a Windows dialog and a menu entitled "**Save As.**" This menu allows you to navigate to the various fields in the Windows dialog without using a keyboard or mouse. The **Tab** and **Arrow** keys can also be used for dialog navigation.

See "[To File . . .](#)" on page 911 in **Save, State** for a full description of this dialog and menu.

The default path for Screen Images 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).

Key Path	<b>Save, Screen Image</b>
Notes	Brings up Save As dialog for saving a Screen Image Save Type
Initial S/W Revision	Prior to A.02.00

## Mass Storage Catalog (Remote Command Only)

Key path	<b>SCPI Only</b>
<b>Remote Command</b>	<b>:MMEMory:CATalog? [&lt;directory_name&gt;]</b>
Notes	The string must be a valid logical path. Queries disk usage information (drive capacity, free space available) and obtains a list of files and directories in a specified directory in the following format: <numeric_value>,<numeric_value>,{<file_entry>}

It returns two numeric parameters and as many strings as there are files and directories. The first parameter indicates the total amount of storage currently used in bytes. The second parameter indicates the total amount of storage available, also in bytes. The <file\_entry> is a string. Each <file\_entry> indicates the name, type, and size of one file in the directory list:

<file\_name>,<file\_type>,<file\_size>

As the windows file system has an extension that indicates file type, <file\_type> is always empty. <file\_size> provides the size of the file in bytes. For directories, <file\_entry> is surrounded by square brackets and both <file\_type> and <file\_size> are empty

Initial S/W Revision      Prior to A.02.00

## Mass Storage Change Directory (Remote Command Only)

Key path                      **SCPI Only**

**Remote Command**        :MMEMory:CDIRectory [<directory\_name>]  
                                  :MMEMory:CDIRectory?

Notes                         The string must be a valid logical path.  
  
Changes the default directory for a mass memory file system. The <directory\_name> parameter is a string. If no parameter is specified, the directory is set to the \*RST value.  
  
At \*RST, this value is set to the default user data storage area, that is defined as System.Environment.SpecialFolder.Personal.  
  
Query returns full path of the default directory.

Initial S/W Revision      Prior to A.02.00

## Mass Storage Copy (Remote Command Only)

Key path                      **SCPI Only**

**Remote Command**        :MMEMory:COpy <string>,<string>[,<string>,<string>]

Notes                         The string must be a valid logical path.  
  
Copies an existing file to a new file or an existing directory to a new directory.  
  
Two forms of parameters are allowed. The first form has two parameters. In this form, the first parameter specifies the source, and the second parameter specifies the destination.  
  
The second form has four parameters. In this form, the first and third parameters specify the source. The second and fourth parameters specify the directories. The first pair of parameters specifies the source. The second pair specifies the destination. An error is generated if the source doesn't exist or the destination file already exists.  
  
This command will generate an "access denied" error if the destination is a restricted folder (e.g., C:\Windows) and the current user does not have Power User or Administrator privileges.

## Mass Storage Device Copy (Remote Command Only)

This command transfers data to/from a file and a peripheral device.

Key path                      **SCPI Only**

<b>Remote Command</b>	<b>:MMEMory:COPIY:DEVIce &lt;source_string&gt;,&lt;dest_string&gt;</b>
Notes	<p>The strings must be a valid logical path or a valid device keyword. If the dest_string is a device keyword, the data is copied from the source file to the device. If the source_string is a device keyword, the data is copied to the source file from the device.</p> <p>Valid device keywords are:          SNS (smart noise source)</p> <p>An error is generated if the file or device is not found.</p>

### Mass Storage Delete (Remote Command Only)

Key path	<b>SCPI Only</b>
<b>Remote Command</b>	<b>:MMEMory:DELeTe &lt;file_name&gt;[,&lt;directory_name&gt;]</b>
Notes	<p>The string must be a valid logical path.</p> <p>Removes a file from the specified directory. The &lt;file_name&gt; parameter specifies the file name to be removed. This command will generate an “access denied” error if the file is in a restricted folder (e.g., C:\Windows) and the current user does not have Power User or Administrator privileges.</p>
Initial S/W Revision	Prior to A.02.00

### Mass Storage Data (Remote Command Only)

Creates a file containing the specified data OR queries the data from an existing file.

Key path	<b>SCPI Only</b>
<b>Remote Command</b>	<b>:MMEMory:DATA &lt;file_name&gt;, &lt;data&gt;</b> <b>:MMEMory:DATA? &lt;file_name&gt;</b>
Notes	<p>The string must be a valid logical path.</p> <p>The command form is MMEMory:DATA &lt;file_name&gt;,&lt;data&gt;. It loads &lt;data&gt; into the file &lt;file_name&gt;. &lt;data&gt; is in 488.2 block format. &lt;file_name&gt; is string data.</p> <p>The query form is MMEMory:DATA? &lt;file_name&gt; with the response being the associated &lt;data&gt; in block format.</p>
Initial S/W Revision	Prior to A.02.00

### Mass Storage Make Directory (Remote Command Only)

Key path	<b>SCPI Only</b>
<b>Remote Command</b>	<b>:MMEMory:MDIRectory &lt;directory_name&gt;</b>
Notes	<p>The string must be a valid logical path.</p> <p>Creates a new directory. The &lt;directory_name&gt; parameter specifies the name to be created.</p> <p>This command will generate an “access denied” error if the new directory would be in a restricted folder (e.g., C:\Windows) and the current user does not have Power User or Administrator privileges.</p>
Initial S/W Revision	Prior to A.02.00

## Mass Storage Move (Remote Command Only)

Key path	SCPI Only
<b>Remote Command</b>	<b>:MMEMory:MOVE &lt;string&gt;,&lt;string&gt;[,&lt;string&gt;,&lt;string&gt;]</b>
Notes	<p>The string must be a valid logical path.</p> <p>Moves an existing file to a new file or an existing directory to a new directory.</p> <p>Two forms of parameters are allowed. The first form has two parameters. In this form, the first parameter specifies the source, and the second parameter specifies the destination.</p> <p>The second form has four parameters. In this form, the first and third parameters specify the source. The second and fourth parameters specify the directories. The first pair of parameters specifies the source. The second pair specifies the destination. An error is generated if the source doesn't exist or the destination file already exists.</p> <p>This command will generate an "access denied" error if the destination is a restricted folder (e.g., C:\Windows) and the current user does not have Power User or Administrator privileges.</p>
Initial S/W Revision	Prior to A.02.00

## Mass Storage Remove Directory (Remote Command Only)

Key path	SCPI Only
<b>Remote Command</b>	<b>:MMEMory:RDIRECTory &lt;directory_name&gt;</b>
Notes	<p>The string must be a valid logical path.</p> <p>Removes a directory. The &lt;directory_name&gt; parameter specifies the directory name to be removed. All files and directories under the specified directory shall also be removed.</p> <p>This command will generate an "access denied" error if the folder is a restricted folder (e.g., C:\Windows) or is in a restricted folder and the current user does not have Power User or Administrator privileges.</p>
Initial S/W Revision	Prior to A.02.00

## Mass Storage Determine Removable Media (Remote Command Only)

This command is used to determine if any removable media devices are connected to the instrument. Primarily, these are USB memory devices plugged-in to the front panel or rear panel USB ports. On instruments with PC6 or PC7 CPU's, one SD card slot is available for removable media. The instrument's primary disk drive is not a removable media device.

Key Path	SCPI Only
<b>Remote Command</b>	<b>:MMEMory:RMEDIA:LIST?</b>
Notes	<p>The return value is a string containing a list of partition identifiers that are removable media devices. Each identifier is separated by a comma. If no removable media is present, an empty string is returned.</p> <p>Examples:</p> <ul style="list-style-type: none"> <li>- One removable device present results in a return string of "F:".</li> </ul>

- Two removable devices present results in a return string of "F:,G:".
- No removable devices present results in a return string of "".

Initial S/W Revision      x.15.00

## Mass Storage Determine Removable Media Label (Remote Command Only)

This command is used to set or query a removable media device's label.

Key Path	SCPI Only
<b>Remote Command</b>	<b>:MMEMory:RMEDia:LABel &lt;partition&gt;,&lt;string&gt;</b> <b>:MMEMory:RMEDia:LABel? &lt;partition&gt;</b>
<b>Example</b>	MMEM:RMED:LAB "F:","My Device"
Notes	If the <partition> specified does not exist or is not a removable media device, the error - 252,"Missing Media" is generated.  Setting the removable media label requires Administrative privileges. If the currently logged in user does not have appropriate privileges the error "-221.9900,Settings conflict;Administrator privileges required" is generated.
Initial S/W Revision	x.15.00

## Mass Storage Determine Removable Media Write-protect status (Remote Command Only)

This command is used to query a removable media device's write-protect status.

Key Path	SCPI Only
<b>Remote Command</b>	<b>:MMEMory:RMEDia:WPRotect? &lt;partition&gt;</b>
<b>Example</b>	MMEM:RMED:WPR? "F:"
Notes	The return value is 1 if the device is write-protected, or 0 if the device is write-enabled.  If the <partition> specified does not exist or is not a removable media device the error - 252,"Missing Media" is generated.
Preset	The return value will be depending on SD card installed.
Initial S/W Revision	x.15.00

## Mass Storage Determine Removable Media size (Remote Command Only)

This command is used to query a removable media device's total memory size (not available memory size).

Key Path	SCPI Only
<b>Remote Command</b>	<b>:MMEMory:RMEDia:SIZE? &lt;partition&gt;</b>
<b>Example</b>	MMEM:RMED:SIZE? "F:"

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Notes	The return value is integer value in GBytes. Any device that is less than 1 GB returns 0 GB. If the <partition> specified does not exist or is not a removable media device, the error - 252, "Missing Media" is generated.
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Initial S/W Revision	x.15.00
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### :SYSTem:SET (Remote Command Only)

Remote command that allows the user to obtain the state of the currently active mode in a form that can then be loaded back into the instrument quickly.

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<b>Remote Command</b>	<b>SYSTem:SET &lt;instrument state in IEEE Block&gt;</b> <b>SYSTem:SET?</b>
-----------------------	--

---

Notes	SYST:SET? returns current instrument state of the active mode in IEEE Block data format. The state is in a machine readable format only. Sending the query returns the following format:
-------	--

<syst set preamble><state block data>

Where:

<syst set preamble> is the format:

#NMMM

N=number of digits that comprise MMM

MMM=length in bytes of following data

<state block data> is machine readable state data

Example response: #42016<state data>

The state is recalled by sending the SYST:SET? Response data to the instrument. From example above: SYST:SET #42016<state data>

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Initial S/W Revision	x.17.00
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## Single (Single Measurement/Sweep)

Sets the analyzer for Single measurement operation. The single/continuous state is Meas Global, so the setting will affect all the measurements. If you are Paused, pressing **Single** does a Resume.

See "[More Information](#)" on page 963

Key Path	Front-panel key
Example	:INIT:CONT OFF
Notes	See <b>Cont</b> key description.
Backwards Compatibility Notes	<p>For Spectrum Analysis mode in ESA and PSA, the <b>Single</b> hardkey and the INITiate:IMM switched from continuous measurement to single measurement and restarted sweeps and averages (displayed average count reset to 1), but did not restart <b>Max Hold</b> and <b>Min Hold</b>. In the X-Series, the <b>Single</b> hardkey and the INITiate:IMM command initiate a sweep/ measurement/ average sequence/hold sequence including <b>MaxHold</b> and <b>MinHold</b>.</p> <p>For Spectrum Analysis mode in ESA and PSA, the <b>Single</b> hardkey restarted the sweep regardless of whether or not you were in an active sweep or sweep sequence. In the X-Series, <b>Restart</b> does this but <b>Single</b> only restarts the sweep or sweep sequence if you are in the idle state.</p> <p>INIT[:IMM] in ESA &amp; PSA Spectrum Analysis Mode does an implied ABORT. In some other PSA Modes, INIT[:IMM] is ignored if not in the idle state. . The X-Series follows the ESA/PSA SA Mode model, which may cause some Modes to have compatibility problems.</p>
Initial S/W Revision	Prior to A.02.00

### More Information

See "[Restart](#)" on page 908 for details on the INIT:IMMEDIATE (Restart) function.

If you are already in single sweep, the INIT:CONT OFF command has no effect.

If you are already in Single Sweep, then pressing the **Single** key in the middle of a sweep does not restart the sweep or sequence. Similarly, pressing the **Single** key does not restart the sweep or sequence if the sweep is not in the idle state (for example, if you are taking a very slow sweep, or the analyzer is waiting for a trigger). Instead, it results in a message. "Already in Single, press Restart to initiate a new sweep or sequence". Even though pressing the **Single** key in the middle of a sweep does not restart the sweep, sending INIT:IMMEDIATE does reset it.

To take one more sweep without resetting the average count, increment the average count by 1, by pressing the step up key while **Average/Hold Number** is the active function, or sending the remote command CALC:AVER:TCON UP.

## Source

There is no Source functionality in RTSA. If this key is pressed, a blank menu will be displayed.

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Key Path	<b>Front-panel key</b>
Initial S/W Revision	A.13.00

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## Span

Activates the Span function and displays a menu of span functions. This key also allows control of the X Scale display when the Power vs Time window is selected.

Key Path	<b>SPAN X Scale</b>
Initial S/W Revision	A.13.00

### Span

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

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**.

While discussing the Span function we make the distinction between “swept spans” and “zero span”. We use the term “swept spans” to mean spans other than zero; recognizing that, because of this terminology, the user can be in what we call a “swept span” even while performing an FFT “sweep”.

While in swept spans, setting the span to 0 Hz through SCPI or the front panel numeric key pad puts the analyzer into zero span. However, using the Step keys and the RPG in swept spans, the Span can only go as far down as 10 Hz and cannot be set to zero.

While in zero span, setting the Span to a non-zero value through SCPI or Front Panel puts the analyzer in swept spans.

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

See ["Span Presets" on page 966](#)

Key Path	<b>SPAN X Scale</b>
<b>Remote Command</b>	[ :SENSe ] :FREQuency :SPAN <freq> [ :SENSe ] :FREQuency :SPAN?
<b>Example</b>	FREQ:SPAN 2GHz sets the span to 2GHz FREQ:SPAN 0 Hz Sets the span to 0 Hz and puts the instrument in Zero Span
Dependencies	If the electrical attenuator is enabled, any attempt to set Span such that the Stop Frequency would be >3.6 GHz results in an error.  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 analyzers 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 key 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": <ul style="list-style-type: none"> <li>- Any value of the Center Frequency or Span that is within the frequency range of the analyzer 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 analyzer's frequency range</li> <li>- When using the knob or the step up/down keys or the UP  DOWN keywords in SCPI, the value that is being changed i.e. the Center Frequency or Span, is limited so that the other parameter is not forced to a new value</li> <li>- 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.</li> </ul>
Preset	Depends on instrument maximum frequency, mode, measurement, and selected input. See <a href="#">"Span Presets" on page 966</a>
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. In the Swept SA measurement, in Trace Zoom, Zero Span is not allowed, so the Span may not go below 10 Hz. In the Swept SA measurement, in Zone Span, Zero Span is not allowed in the top window, so the Span may not go below 10 Hz in the top window.
Max	Depends on instrument maximum frequency, mode, measurement, and selected input. See <a href="#">"Span Presets" on page 966</a> 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.
Default Unit	Hz
Status Bits/OPC dependencies	Overlapped if Signal Track is on (OPC shouldn't return or clear until the zooming has completed for the new span)
Initial S/W Revision	Prior to A.02.00

### Span Presets

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

<b>Freq Option</b>	<b>Span after Mode Preset</b>	<b>Max Span (can't set higher than this)</b>
503 (all but N9000A)	3.59 GHz	3.7 GHz
503 (N9000A)	2.99 GHz	3.08 GHz
507 (all but N9000A)	6.99 GHz	7.1 GHz
507 (N9000A)	7.49 GHz	7.58 GHz
508 (all but N9038A)	8.39 GHz	8.5 GHz
508 (N9038A)	3.59 GHz	8.5 GHz
513	13.59 GHz	13.8 GHz
526 (all but N9000A and N9038A)	26.49 GHz	27.0 GHz
526 (N9038A)	3.59 GHz	27.0 GHz
526 (N9000A)	26.49 GHz	26.55 GHz
543	42.99 GHz	TBD
544	43.99 GHz	44.5 GHz
550	49.99 GHz	51 GHz

Input 2:

<b>Model</b>	<b>Span after Mode Preset</b>	<b>Max Span (can't set higher than this)</b>
N9000A opt C75	1.499 GHz	1.58 GHz
N9038A	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.

## Full Span

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

The span is dependent on the currently selected Input (see the Section “Input/Output”). For example, when using external mixing, it changes the frequency to the Preset frequency range specified for the selected external mixing band.

Pressing this key while in zero span puts the analyzer back in swept span.

Key Path	<b>SPAN X Scale</b>
<b>Remote Command</b>	[ :SENSe ] :FREQuency :SPAN :FULL
<b>Example</b>	FREQ:SPAN:FULL Sets the span to full frequency range of the analyzer
Notes	n /a
Couplings	Turns off signal tracking (span zoom). It does NOT turn off the markers, nor the current active function.
Backwards Compatibility Notes	In the past, the <b>Full Span</b> function turned off all markers. In the X-Series this is not the case.
Initial S/W Revision	Prior to A.02.00

## Last Span

Changes the displayed frequency span to the previous span setting. If it is pressed immediately after Signal Track is turned off, then the span setting returns to the span that was in effect before Signal Track was turned on.

If this key is pressed while in a nonzero span, and the previous value of span was 0, it will put the analyzer back in Zero Span. And if it is pressed while in zero span, it will set the analyzer back to its last nonzero span.

Pressing Last Span places the analyzer in Center/Span frequency entry mode.

Key Path	<b>SPAN X Scale</b>
<b>Remote Command</b>	[ :SENSe ] :FREQuency :SPAN :PREVious
<b>Example</b>	FREQ:SPAN:PREV Sets the span to the previous value
Notes	n /a
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.
Initial S/W Revision	Prior to A.02.00

## Power vs Time Reference Value

Sets the horizontal scale reference value for the Power vs Time window. Changing the reference level does not restart the measurement because it is a display function only; instead, it horizontally ‘pans’ all display traces and markers to the new value. This value will change if Auto Scaling is on and the Ref Position is changed.

Key Path	<b>SPAN X Scale</b>
Mode	RTSA

Couplings	If the Auto Scaling is set to On, this value is automatically determined by the measurement result and Ref Position. When set manually, Auto Scaling automatically changes to Off.
Preset	0.000 s
State Saved	Saved in instrument state.
Min	-1.00 s
Max	57 s ! Determined by the PvT Acq Time max value
Initial S/W Revision	A.13.00

## Power vs Time Scale/Div

Sets the horizontal scale in the Power vs Time window by changing the time value per division. There are ten graticule division for the x scale. The default value for Power vs Time Scale/Div is 10% of the Reference value. By decreasing the Scale/Div value, you will be able to zoom in on a selected portion of the trace.

Key Path	<b>SPAN X Scale</b>
Mode	RTSA
Couplings	If the Auto Scaling is set to On, this value is automatically determined by the measurement result. When set manually, Auto Scaling automatically changes to Off. When Auto Scaling is changed from Off to On, then it is set
Preset	3 ms
State Saved	Saved in instrument state.
Min	1.000 ns
Max	5.7 s ! Determined by the Max Ref value / 10
Initial S/W Revision	A.13.00

## Power vs Time Reference Position

Sets the X scale reference position in the Power vs Time window to Left, Ctr (center) or Right.

When Auto Scaling is on, changing the reference position will show the current Reference value at the specified position. For instance, when the reference position is set to Left, the Reference value will show the left most value (typically 0[s]) of the display grid. When the reference position is changed from Left → Ctr, then the Reference value changes and will show the current value of the center point of the grid which will be half the value of the Pvt acq time. If the reference position is further toggled and set to Right, then the Reference value changes and will show the current value of the right most point of the grid which will be the Pvt acq time.

When Auto Scaling is off, then changing the reference position will set the display grid to the current Reference value. For instance, if the Reference value is set to 0[s] and the Reference position is changed from Left → Ctr, then the display grid shifts and the center of the grid will now become 0[s]. If the reference position is further toggled and set to Right, then the display grid shifts and the right most point of the grid now becomes 0[s].

Key Path	<b>SPAN X Scale</b>
Mode	RTSA
Preset	LEFT
State Saved	Saved in instrument state.
Range	Left   Ctr   Right
Initial S/W Revision	A.13.00

## Power vs Time Auto Scaling

Allows toggling of the Auto Scaling function in the Power vs Time window between On and Off. When Auto Scaling is turned on, the left most portion of the display grid will be set to the start of the trace (usually 0[s]) and the right most portion of the display grid will be set to the Pvt Acq Time value. The values of the Reference Level and Scale/Div are dependent on the current Reference position setting, which does not change when Auto Scaling is toggled.

Key Path	<b>SPAN X Scale</b>
Mode	RTSA
Couplings	Upon pressing the Restart front-panel key, this function automatically determines the scale per division and reference values based on the measurement results. When a value is set manually to either Scale/Div or Ref Value parameters, Auto Scaling automatically changes to Off.
Preset	ON
State Saved	Saved in instrument state.
Range	On   Off
Initial S/W Revision	A.13.00

## Sweep/Control

Accesses a menu that enables you to configure the Sweep and Control functions of the analyzer, such as Sweep Time and Gating.

Key Path	<b>Front-panel key</b>
Initial S/W Revision	Prior to A.02.00

### Power vs Time Acquisition Time

The acquisition time parameter used by the Power vs Time Measurement views can be different from the acquisition time used by the Spectrum measurement views. This parameter is the acquisition time parameter used for all traces when in the Power vs Time measurement. This means it will apply to all traces in the Power versus Time measurement including the Spectrum and Spectrogram traces. For instance, even if the Spectrum window of the Power vs Time – Spectrum dual view is selected, the acquisition time used for the Spectrum trace is not Frequency Acquisition Time but is the Power vs Time Acquisition Time.

Key Path	<b>Sweep/Control</b>
<b>Remote Command</b>	<pre>[ :SENSe]:ACQuisition:TIME:PVTime &lt;time&gt; [ :SENSe]:ACQuisition:TIME:PVTime? [ :SENSe]:ACQuisition:TIME:PVTime:AUTO OFF ON 0 1 [ :SENSe]:ACQuisition:TIME:PVTime:AUTO?</pre>
<b>Example</b>	<pre>:ACQ:TIME:PVT 500 ms :ACQ:TIME:PVT:AUTO OFF</pre>
Dependencies	Set to Auto when Auto Couple is pressed or sent remotely
Couplings	This parameter is context sensitive. It will be used when PvT Measurement is active. When Power vs Time Acquisition Time Auto State is On, this parameter is coupled to the Frequency Acquisition Time parameter
Preset	30 ms ON
State Saved	Saved in instrument state
Min	200[us] is the absolute minimum, but the actual value will be the next available value greater than 200[us] based on other parameter settings.
Max	40 s
Status Bits/OPC dependencies	Meas Uncal is Bit 0 in the STATus:QUESTionable:INTEgrity:UNCalibrated register
Initial S/W Revision	A.13.00
Note	For any hardware setup, only certain discrete values are settable. Thus, any value entered for this parameter will be rounded to the nearest valid value.

### Pause

Pauses all measurements after the current data acquisition is complete.

When Paused, the label on the key changes to Resume. Pressing Resume un-pauses the measurement. When you are Paused, pressing **Single** or **Cont** also does a Resume.

Key Path	<b>Sweep/Control</b>
<b>Remote Command</b>	<b>:INITiate:PAUSE</b>
Couplings	<p>When Averaging is On, if the measurement is paused no more updates will occur until either a Resume or Restart occurs.</p> <p>If the measurement is resumed, the averaging will continue using the traces from before the Pause occurred and continue using the traces from the point where the Resume occurred. This will still provide real-time traces but they will no longer be gap free.</p> <p>In Spectrogram view, when the measurement is paused the Spectrogram will stop updating. When resume is selected the spectrogram will retain the existing traces and continue updating using traces from the point at which Resume was selected. The time stamp of the individual Spectrogram traces will show the time from the beginning of the measurement the trace relates therefore showing there was a gap in the Spectrogram capture.</p> <p>In Density view, when the measurement is paused the Density Display will stop updating. When the measurement is resumed, if Persistence is on the persistence fading will continue from the point when the measurement was paused. For additional details on Persistence refer to section "<a href="#">Persistence</a>" on page 705.</p> <p>If a restart occurs, the average counter is reset and all results are discarded. The measurement begins again using traces after the Restart occurred.</p>
Initial S/W Revision	A.13.00

Key Path	<b>Sweep/Control</b>
<b>Remote Command</b>	<b>:INITiate:RESume</b>
Couplings	See Couplings in the Pause parameter table.
Initial S/W Revision	A.13.00

### Abort (Remote Command Only)

This command is used to stop the current measurement. It aborts the current measurement as quickly as possible, resets the sweep and trigger systems, and puts the measurement into an "idle" state. If the analyzer is in the process of aligning when ABORt is sent, the alignment finishes before the abort function is performed. So ABORt does not abort an alignment.

If the analyzer is set for Continuous measurement, it sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the analyzer is set for Single measurement, it remains in the "idle" state until an :INIT:IMM command is received.

<b>Remote Command</b>	<b>:ABORt</b>
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<b>Example</b>	:ABOR
Notes	If :INITiate:CONTInuous is ON, then a new continuous measurement will start immediately; with sweep (data acquisition) occurring once the trigger condition has been met. If :INITiate:CONTInuous is OFF, then :INITiate:IMMediate is used to start a single measurement; with sweep (data acquisition) occurring once the trigger condition has been met.
Dependencies	For continuous measurement, ABORt is equivalent to the Restart key. Not all measurements support the abort command.
Status Bits/OPC dependencies	The STATus:OPERation register bits 0 through 8 are cleared. The STATus:QUESTionable register bit 9 (INTEgrity sum) is cleared. Since all the bits that feed into OPC are cleared by the ABORt, the ABORt will cause the *OPC query to return true.
Initial S/W Revision	Prior to A.02.00

### Power vs Time Acquisition Points (Remote Command Only)

Returns the number of points of the Power vs Time trace. This is a query only command and the number of points of the Power vs Time trace cannot be changed.

<b>Remote Command</b>	[ :SENSe ] :ACQuisition:POINts:PVTtime?
<b>Example</b>	ACQ:POIN:PVT?
Preset	1024
State Saved	Saved in instrument state
Min	1024
Max	1024
Initial S/W Revision	A.13.00

## System

See ["System"](#) on page 252

## Trace/Detector

Key Path	<b>Front-panel key</b>
<b>Remote Command</b>	:TRACe[1] 2 ... 12:TYPE WRITe AVERAge MAXHold MINHold :TRACe[1] 2 ... 12:TYPE?
<b>Example</b>	:TRAC1:TYPE MAXH Sets Spectrum Trace1 trace type to MAXHold.
Notes	<b>WRITe</b> = Clear Write <b>AVERAge</b> = Trace Average <b>MAXHold</b> = Maximum Hold <b>MINHold</b> = Minimum Hold Trace index 1–6 corresponds to Spectrum Trace 1–6 and index 7–12 corresponds to Pvt Trace1–6.
Couplings	Sending a trace command does not cause the specified trace to become selected. Selecting a trace type (pressing any of the four keys or sending a TRAC:TYPE command) puts <b>Update</b> in <b>On</b> and <b>Display</b> in <b>On</b> , even if that trace type was already selected. Spectrogram Trace1 only supports WRITe. Thus, if anything other than WRITe is specified for a Spectrogram Trace1, then the error “–221, Settings conflict. Feature not available for this trace” is generated. Similarly, all Pvt traces only support WRITe. Thus, if anything other than WRITe is specified for any trace index 7–12, then the error “–221, Settings conflict. Feature not available for this trace” is generated.
Preset	During normal operation of the instrument (that is, other than at powerup), after a mode preset is performed, all active traces are cleared. This is so their domains and initial x values will match the current X Axis of the analyzer. Inactive traces are not cleared after a preset, so a trace which is in <b>Update=On</b> before a preset, and in <b>Update=Off</b> after the preset, will still have the data that it had before the preset.
State Saved	The type of each trace is saved in Instrument State
Initial S/W Revision	A.13.00

## Select Trace

Determines which trace the type control keys will affect. When you select a trace, it makes that trace the current trace, so it displays on top of all of the other traces.

Key Path	<b>Trace/Detector</b>
Dependencies	When Signal ID is on, Traces 3–6 are grayed out in Image Shift Mode.
Couplings	– In Image Suppress mode when you select a trace it becomes the active trace, and the formerly active trace goes into View  – When you turn on Image Suppress, Update turns off for all traces except the selected trace
Preset	Trace 1
State Saved	The number of the selected trace is saved in Instrument State
Initial S/W Revision	Prior to A.02.00

## Clear Write

In **Clear Write** type each trace update replaces the old data in the trace with new data. Pressing the **Clear Write** key for the selected trace, or sending the TRAC:TYPE WRIT command for the specified 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.

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, and 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, a new sweep is initiated but the trace is not cleared.

Key Path	<b>Trace/Detector</b>
<b>Example</b>	TRAC:TYPE WRIT
Notes	See "Trace/Detector".
Dependencies	When Signal ID is on, this key is grayed out for Traces 2-6 in Image Suppress mode and for Traces 3-6 in Image Shift Mode.
Couplings	Whenever you press <b>Clear Write</b> or send the equivalent SCPI command, <b>Update</b> is set to <b>On</b> and <b>Display</b> is set to <b>On</b> . Automatic detector selection and the VBW:RBW ratio auto rules both depend on the trace type selections
Preset	After a Preset, any trace that is in <b>Clear Write</b> is cleared (all trace points set to mintracevalue).
State Saved	The type for each trace is saved in Instrument State
Backwards Compatibility Notes	Previous to the X-Series, pressing <b>Clear Write</b> while already in <b>Clear Write</b> (or doing so remotely) had no effect. Now it will clear the trace and restart the sweep
Initial S/W Revision	Prior to A.02.00

## View/Blank

This key lets you set the state of the two trace variables, Update and Display. The four choices available in this 1-of-N menu are:

- Trace On: Update and Display both On
- View: Update Off and Display On
- Blank: Update Off and Display Off
- Background: Update On, Display Off (this allows a trace to be blanked and continue to update "in the background", which was not possible in the past)

See ["Trace Update State On/Off" on page 977](#)

See ["Trace Display State On/Off" on page 977](#)

See ["More Information" on page 978](#)

Key Path	Trace/Detector
Notes	<p>The four states of this 1-of-N actually set two variables, Update and Display, to their four possible combinations:</p> <ul style="list-style-type: none"> <li>- Trace On: Update and Display both On</li> <li>- View: Update Off and Display On</li> <li>- Blank: Update Off and Display Off</li> <li>- Background: Update On, Display Off</li> </ul> <p>See tables below for detail on the SCPI to control these two variables.</p>
Dependencies	When Signal ID is on, this key is grayed out.
Couplings	<p>Selecting a trace type (Clear Write, Trace Average, Max Hold, Min Hold) for a trace (pressing the key or sending the equivalent SCPI command) puts the trace in Trace On (Update On and Display On), even if that trace type was already selected.</p> <p>Selecting a detector for a trace (pressing the key or sending a [:SENS]:DET:TRAC command) puts the trace in Trace On (Update On and Display On), even if that detector was already selected.</p> <p>Selecting a math mode other than Off for a trace (pressing the key or sending the equivalent SCPI command) puts the trace in Trace On (Update On and Display On), even if that math mode was already selected.</p> <p>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.</p>
Initial S/W Revision	Prior to A.02.00

### Trace Update State On/Off

Key Path	Trace/Detector
<b>Remote Command</b>	<pre>:TRACe[1] 2 ... 12:UPDate[:STATe] ON OFF 0 1 :TRACe[1] 2 ... 12:UPDate[:STATe]?</pre>
<b>Example</b>	<p>TRAC2:UPD 0</p> <p>Makes Spectrum Trace 2 trace inactive (stops updating)</p>
Notes	Trace index 1-6 corresponds to Spectrum Trace 1-6 and index 7-12 corresponds to Pvt Trace1-6
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 0 0 0 0 0 0 (On for Trace 1; Off for 2-12)
State Saved	Saved in Instrument State
Initial S/W Revision	A.13.00

### Trace Display State On/Off

Key Path	Trace/Detector
<b>Remote Command</b>	<pre>:TRACe[1] 2 ... 12:DISPlay[:STATe] ON OFF 0 1 :TRACe[1] 2 ... 12:DISPlay[:STATe]?</pre>

<b>Example</b>	TRAC2:DISP 1 Makes trace 2 visible TRAC3:DISP 0 Blanks trace 3
Notes	Trace index 1–6 corresponds to Spectrum Trace 1–6 and index 7–12 corresponds to Pvt Trace1–6
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 0 0 0 0 0 0 (On for Trace 1; Off for 2–12)
State Saved	Saved in instrument state
Initial S/W Revision	A.13.00

### More Information

When a trace becomes inactive, the following things happen:

- Any update from the SENSE system (detectors) immediately stops (does not wait for end of sweep)
- the trace is displayed at half intensity (as long as it stays inactive)

Inactive traces 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.

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)

When a trace becomes active (Update=On), the trace is cleared, the average count is reset, and a new sweep is initiated.

Traces which are blanked (Display=off) do not display nor appear on printouts but are otherwise unaffected. They may be queried and markers may be placed on them.

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.

Note also that whenever you set **Update** to **On** for any trace, **Display** is set to **On** for that trace.

### View/Blank

This key lets you set the state of the two trace variables, Update and Display. The four choices available in this 1-of-N menu are:

- Trace On: 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. So 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 980.

See "Trace Display State On/Off" on page 980.

See "More Information" on page 980.

Key Path	Trace/Detector
Notes	<p>The four states of this 1-of-N actually set two variables, Update and Display, to their four possible combinations:</p> <ul style="list-style-type: none"> <li>- Trace On: Update and Display both On</li> <li>- View: Update Off and Display On</li> <li>- Blank: Update Off and Display Off</li> <li>- Background: Update On, Display Off</li> </ul> <p>See tables below for detail on the SCPI to control these two variables.</p>
Dependencies	When Signal ID is on, this key is grayed out.
Couplings	<p>Selecting a trace type (Clear Write, Trace Average, Max Hold, Min Hold) for a trace (pressing the key or sending the equivalent SCPI command) puts the trace in Trace On (<b>Update On and Display On</b>), even if that trace type was already selected.</p> <p>Selecting a detector for a trace (pressing the key or sending a [:SENS]:DET:TRAC command) puts the trace in Trace On (<b>Update On and Display On</b>), even if that detector was already selected.</p> <p>Selecting a math mode other than Off for a trace (pressing the key or sending the equivalent SCPI command) puts the trace in Trace On (<b>Update On and Display On</b>), even if that math mode was already selected.</p> <p>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 <b>Copy</b> or a participant in an <b>Exchange</b>.</p>
Initial S/W Revision	Prior to A.02.00

## Trace Update State On/Off

Key Path	Trace/Detector
<b>Remote Command</b>	:TRACe[1] 2 ... 6:UPDate[:STATe] ON OFF 0 1 :TRACe[1] 2 ... 6:UPDate[:STATe]?
<b>Example</b>	TRAC2:UPD 0 Makes trace 2 inactive (stops updating)
Couplings	Whenever you set <b>Update</b> to <b>On</b> for any trace, the <b>Display</b> is set to <b>On</b> for that trace.
Preset	1 0 0 0 0 0 (On for Trace 1; Off for 2-6)
State Saved	Saved in instrument state
<b>Backwards Compatibility SCPI</b>	:TRACe:MODE VIEW sets :TRACe:UPDate OFF, :TRACe:DISPlay ON, for the selected trace. In earlier analyzers, View and Blank were trace modes, set by TRACe:MODE command. In the X-Series, View and Blank are two of the states set by the :TRACe:UPDate and :TRACe:DISPlay commands. The TRACe:MODE VIEW command will yield its new equivalent, which is Update=Off, Display=On
Initial S/W Revision	Prior to A.02.00

## Trace Display State On/Off

Key Path	Trace/Detector
<b>Remote Command</b>	:TRACe[1] 2 ... 6:DISPlay[:STATe] ON OFF 0 1 :TRACe[1] 2 ... 6:DISPlay[:STATe]?
<b>Example</b>	TRAC2:DISP,1 Makes trace 2 visible TRAC3:DISP,0 Blanks trace 3
Couplings	Whenever you set <b>Update</b> to <b>On</b> for any trace, the <b>Display</b> is set to <b>On</b> for that trace.
Preset	1 0 0 0 0 0 (On for Trace 1; Off for 2-6)
State Saved	Saved in instrument state
<b>Backwards Compatibility SCPI</b>	:TRACe:MODE BLANK sets :TRACe:UPDate OFF, :TRACe:DISPlay OFF, for the selected trace. In earlier analyzers, View and Blank were trace modes, set by TRACe:MODE command. In the X-Series, View and Blank are two of the states set by the :TRACe:UPDate and :TRACe:DISPlay commands. The TRACe:MODE BLANK command will yield its new equivalent, which is Update=Off, Display=Off
Initial S/W Revision	Prior to A.02.00

### More Information

When a trace becomes inactive, the following things happen:

- Any update from the SENSE system (detectors) immediately stops (does not wait for end of sweep)
- the trace is displayed at half intensity (as long as it stays inactive)

Inactive traces 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.



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)

When a trace becomes active (Update=On), the trace is cleared, the average count is reset, and a new sweep is initiated.

Traces which are blanked (Display=off) do not display nor appear on printouts but are otherwise unaffected. They may be queried and markers may be placed on them.

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.

Note also that whenever you set **Update** to **On** for any trace, **Display** is set to **On** for that trace.

## Power Versus Time Detector

Selects the detector for PVT.

Key Path	Trace/Detector
<b>Remote Command</b>	<code>[ :SENSe ]:DETEctor:TRACe:PVTiME AVERAge   NEGAtive   POSitive   SAMPle</code> <code>[ :SENSe ]:DETEctor:TRACe:PVTiME?</code>
<b>Example</b>	:DET:TRAC:PVT AVER -- Sets PVT detector to average
Notes	When a detector selection is made, the menu returns to the previous menu. The same detector is applied to all PVT traces
Notes	The query returns a name that corresponds to the detector type as shown below. String ReturnedDefinition AVER        =Average / RMS POS         =Positive peak SAMP        =Sample NEG         =Negative peak
Couplings	The auto detector rules depend upon marker type, trace state writing mode, and trace active state. The Pvt detectors and non-Pvt detectors are independent.
Preset	Preset returns all traces to "auto", which will result in POS detection for Pvt detectors.
State Saved	Saved in instrument state
Initial S/W Revision	A.13.00

## Power Versus Time Detector Auto

This sets the detector to Auto. This will immediately apply the auto rules to determine a new detector value.

Key Path	Trace/Detector, Detector
Remote Command	[ :SENSe ] :DETECTOR:TRACe:PVTIme:AUTO ON OFF 1 0 [ :SENSe ] :DETECTOR:TRACe:PVTIme:AUTO?
Example	:DET:TRACE:PVT:AUTO ON sets pvt detection to automatic.
Dependencies	The auto detector rules depend upon marker type, trace state writing mode, and trace active state.
Couplings	Selecting AUTO, whether by pressing the softkey or sending the equivalent SCPI command, will turn trace math to Off for the selected/specified trace.
Preset	Auto (On) for all detectors.
State Saved	Saved in instrument state
Initial S/W Revision	A.13.00

## Average (Log/RMS/V)

For each bucket (interval) in the trace, Average detection displays the average of the amplitude within the bucket using one of the following averaging methods:

- Log power (also known as video)
- Power (also known as RMS)
- Voltage envelope

To explicitly set the averaging method, use the **Meas Setup, Average Type** key. When you are using average detection with the Power method is equivalent to what is sometimes referred to as “RMS detection”. The detailed information about the different types of averaging is found in **Average Type** in the **Meas Setup** key menu.

Key Path	Trace/Detector, Detector
Example	DET:TRAC3 AVER Sets the detector to average for trace 3.
Notes	For the specific case of a customer wanting RMS detection, they need to set the averaging type to RMS, and also select average detection for the trace: AVER:TYPE RMS DET:TRAC AVER
Dependencies	Selecting any detector (even the currently selected detector) for a given trace turns Update and Display on for that trace.
Couplings	Selecting a specific detector type turns “Auto” to false for this trace (manual). Selecting a detector for a trace (pressing the key or sending a [:SENS]:DET:TRAC command) puts <b>Update On and Display On</b> for that trace, even if that detector was already selected. Note that the legacy command [:SENS]:DET[:FUNC] does NOT exhibit this behavior.

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Selecting a detector, whether by pressing the softkey or sending the equivalent SCPI command, will turn trace math to Off for the selected/specified trace.

The VBW filter is not used for this detector, 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 are active for which VBW does not apply (traces with Average, EMI Average, RMS Average or Quasi Peak detectors), then an \* displays after the VBW annotation on the front panel.

Use of the Average detector affects the VBW setting because of its effect on the VBW/RBW coupling.

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Initial S/W Revision	Prior to A.02.00
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### Peak

For each bucket (interval) in the trace, Peak detection displays the highest amplitude within the bucket.

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.

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Key Path	<b>Trace/Detector, Detector</b>
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<b>Example</b>	DET:TRAC2 POS Sets the detector to peak for trace 2.
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Couplings	<p>Selecting a specific detector type turns "Auto" to false for this trace (manual).</p> <p>Selecting a detector for a trace (pressing the key or sending a [:SENS]:DET:TRAC command) puts <b>Update On</b> and <b>DisplayOn</b> for that trace, even if that detector was already selected. Note that the legacy command [:SENS]:DET[:FUNC] does NOT exhibit this behavior.</p> <p>Selecting a detector, whether by pressing the softkey or sending the equivalent SCPI command, will turn trace math to Off for the selected/specified trace.</p>
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### Sample

The sample detector displays the instantaneous level of the signal at the center of the bucket (interval) represented by each trace point.

Sample detection is good for displaying noise or noise-like signals.

Sample detection is not the best for making amplitude measurements of CW-like signals for two reasons. First, 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. Second, 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.

Key Path	<b>Trace/Detector, Detector</b>
<b>Example</b>	DET:TRAC SAMP Selects the Sample detector for trace 1.
Couplings	<p>Selecting a specific detector type turns “Auto” to false for this trace (manual).</p> <p>Selecting a detector for a trace (pressing the key or sending a [:SENS]:DET:TRAC command) puts <b>Update On</b> and <b>DisplayOn</b> for that trace, even if that detector was already selected. Note that the legacy command [:SENS]:DET[:FUNC] does NOT exhibit this behavior.</p> <p>Selecting a detector, whether by pressing the softkey or sending the equivalent SCPI command, will turn trace math to Off for the selected/specified trace.</p>
Initial S/W Revision	Prior to A.02.00

### Negative Peak

For each bucket (interval) in the trace, Negative Peak detection displays the lowest sample within the bucket. Negative peak detection is similar to peak detection, but selects the minimum video signal.

Key Path	<b>Trace/Detector, Detector</b>
<b>Example</b>	DET:TRAC2 NEG Selects the negative peak detector for trace 2.
Couplings	<p>Selecting a specific detector type turns “Auto” to false for this trace (manual).</p> <p>Selecting a detector for a trace (pressing the key or sending a [:SENS]:DET:TRAC command) puts <b>Update On</b> and <b>DisplayOn</b> for that trace, even if that detector was already selected. Note that the legacy command [:SENS]:DET[:FUNC] does NOT exhibit this behavior.</p> <p>Selecting a detector, whether by pressing the softkey or sending the equivalent SCPI command, will turn trace math to Off for the selected/specified trace.</p>
Initial S/W Revision	Prior to A.02.00

### Clear Trace

Clears the selected trace (from the front panel) or the specified trace (from SCPI). Does not affect the state of any function or variable in the instrument. Loads mintracevalue into all of the points in the selected trace, unless the trace is in Min Hold in which case it loads maxtracevalue. It does this even if Update=Off.

Key Path	<b>Trace/Detector</b>
<b>Remote Command</b>	<b>:TRACe:CLEAr TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6</b>
<b>Example</b>	TRAC:CLE TRACE1 Clears trace 1
Initial S/W Revision	Prior to A.02.00

### Clear All Traces

Clears all traces. Does not affect the state of any function or variable in the instrument. Loads mintracevalue into all of the points all traces, except traces in Min Hold in which case it loads maxtracevalue. Does so even if Update=Off.

Key Path	<b>Trace/Detector</b>
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<b>Remote Command</b>	:TRACe:CLEAr:ALL :TRACe:PRESet:ALL When Signal ID is on, this key is grayed out.
<b>Example</b>	TRAC:CLE:ALL Clears all traces
Initial S/W Revision	Prior to A.02.00

## 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.

Key Path	<b>Trace/Detector</b>
<b>Remote Command</b>	:TRACe:PRESet:ALL When Signal ID is on, this key is grayed out.
<b>Example</b>	TRAC:PRES:ALL
Initial S/W Revision	A.08.01

## Send Trace Data

Parameter Name	Send Trace Data
<b>Remote Command</b>	:TRACe[:DATA] TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6   TRACE7   TRACE8   TRACE9   TRACE10   TRACE11   TRACE12, <data>
Notes	The TRACe[:DATA] command is of the form: :TRACe:DATA <trace>,<data> where <trace> can be one of the following parameters: TRACE1,TRACE2,TRACE3,TRACE4,TRACE5,TRACE6,TRACE7,TRACE8,TRACE9,TRACE10,TRACE11,TRACE12 <b>TRACE1,TRACE2,TRACE3,TRACE4,TRACE5,TRACE6 corresponds to the Spectrum Trace 1-6.</b> <b>TRACE7 TRACE8 TRACE9 TRACE10 TRACE11 TRACE12 corresponds to the Pvt Trace 1-6.</b> <data> can be - ASCII data, which consists of a string of values separated by comma or - <b>REAL</b> or <b>INTeger</b> sent as a definite length block, with a header describing the data to follow.
Couplings	Acquisition points will affect the amount of data The FORMat:DATA command describes the different types of data formats that can be used with trace data. Use the FORMat:BORDER command to set the byte order.
Initial S/W Revision	A.13.00

## Query Trace Data

Parameter Name	Query Trace Data
<b>Remote Command</b>	:TRACe[:DATA]? TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6   TRACE7   TRACE8   TRACE9   TRACE10   TRACE11   TRACE12
<b>Example</b>	TRAC? TRACE2 queries the analyzer for the contents of trace 2.
Initial S/W Revision	A.13.00

### Identify Trace (Remote Command Only)

The TRACe node index is from 1 to 12. Index 1–6 is for the Spectrum traces 1–6. Index 7–12 is for the Power vs Time traces 1–6. This command allows you to query which trace indexes are for Spectrum traces and which are for Power vs Time traces.

<b>Remote Command</b>	:TRACe[1] 2 ... 12:IDENtify?
<b>Example</b>	:TRAC3:IDEN? TRACe3 is a Spectrum trace and thus returns SPEC :TRAC7:IDEN? TRACe7 is a PVT trace and thus returns PVT
Notes	Return types are either SPEC or PVT. SPEC = Spectrum trace PVT = Power vs Time trace Trace index 1–6 will return SPEC and index7–12 and index will return PVT.
Preset	SPEC SPEC SPEC SPEC SPEC SPEC PVT PVT PVT PVT PVT PVT
Initial S/W Revision	A.13.00

## Trigger

See ["Trigger" on page 348](#)

### Free Run

See ["Free Run " on page 356](#)

### Trigger Level

See ["Trigger Level " on page 357](#)

### Line

See ["Line" on page 357](#)

### Trig Slope

See ["Trig Slope" on page 358](#)

### Trig Delay

See ["Trig Delay" on page 358](#)

### X Axis Relative to Trigger

See ["X Axis Relative to Trigger" on page 381](#)

### External 1

See ["External 1" on page 375](#)

### Trigger Level

See ["Trigger Level" on page 376](#)

### Trig Slope

See ["Trig Slope" on page 376](#)

### Trig Delay

See ["Trig Delay" on page 361](#)

### X Axis Relative to Trigger

See ["X Axis Relative to Trigger" on page 381](#)

### External 2

See ["External 2 " on page 377](#)

### Trigger Level

See ["Trigger Level" on page 378](#)

### **Trig Slope**

See ["Trig Slope" on page 378](#)

### **Trig Delay**

See ["Trig Delay " on page 364](#)

### **X Axis Relative to Trigger**

See ["X Axis Relative to Trigger" on page 381](#)

### **RF Burst**

See ["RF Burst" on page 378](#)

### **Absolute Trigger**

See ["Absolute Trigger Level" on page 379](#)

### **Relative Trigger**

See ["Relative Trigger Level" on page 367](#)

### **Trig Slope**

See ["Trigger Slope" on page 380](#)

### **Trig Delay**

See ["Trig Delay" on page 369](#)

### **X Axis Relative to Trigger**

See ["X Axis Relative to Trigger" on page 381](#)

### **Periodic Timer**

See ["Periodic Timer \(Frame Trigger\)" on page 370](#)

### **Period**

See ["Period" on page 372](#)

### **Offset**

See ["Offset" on page 372](#)

### **Offset Adjust (Remote Command Only)**

See ["Offset Adjust \(Remote Command Only\)" on page 373](#)

### **Reset Offset Display**

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### **Sync Source**

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### **Off**

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### **External 1**

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### **Trigger Level**

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### **Trig Slope**

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### **External 2**

See ["External 2 " on page 377](#)

### **Trigger Level**

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### **Trig Slope**

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### **RF Burst**

See ["RF Burst" on page 378](#)

### **Absolute Trigger**

See ["Absolute Trigger Level" on page 379](#)

### **Trig Slope**

See ["Trigger Slope" on page 380](#)

### **Trig Delay**

See ["Trig Delay" on page 381](#)

### **X Axis Relative to Trigger**

See ["X Axis Relative to Trigger" on page 381](#)

### **Time 1**

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## Time 2

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## Time Criteria

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## Disabled

See ["Disabled" on page 383](#)

## Time1

See ["< Time1" on page 383](#)

## Time1

See ["> Time1 " on page 384](#)

## T1 and T2

See ["> T1 and < T2" on page 384](#)

## T1 or T2

See ["< T1 or > T2" on page 384](#)

## Frequency Mask Trigger FMT

See ["Frequency Mask Trigger \(FMT\)" on page 385](#)

## FMT Editor

See ["FMT Editor" on page 385](#)

## Navigate

See ["Navigate" on page 385](#)

## Frequency

See ["Frequency" on page 385](#)

## Amplitude

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## Insert Point Below

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## Delete Point

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### **New Mask**

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### **Mask Type**

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### **Trigger Setup**

See ["Trigger Setup" on page 388](#)

### **Trigger Criteria**

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### **Trigger Mask**

See ["Trigger Mask" on page 388](#)

### **Trig Delay**

See ["Trig Delay" on page 389](#)

### **Number of Acquisitions Per Trigger**

See ["Number of Acquisitions Per Trigger" on page 390](#)

### **Time 1**

See ["Time 1" on page 397](#)

### **Time 2**

See ["Time 2" on page 398](#)

### **Time Criteria**

See ["Time Criteria" on page 398](#)

### **Disabled**

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### **Time1**

See ["< Time1" on page 399](#)

### **Time1**

See ["> Time1" on page 399](#)

### **T1 and T2**

See ["> T1 and < T2" on page 399](#)

## T1 or T2

See "[< T1 or > T2](#)" on page 400

## Mask Setup

See "[Mask Setup](#)" on page 390

## Build Mask from Trace

See "[Build Mask from Trace](#)" on page 391

## Import Mask From File

See "[Import Mask From File](#)" on page 391

## Export Mask to File

See "[Export Mask to File](#)" on page 391

## Offsets

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## X Offset

See "[X Offset](#)" on page 392

## Y Offset

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## Fixed Relative

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## Mask Name

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## Mask Color

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## Mask Hue

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### **Mask Opacity**

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### **Mask Opacity Preview**

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### **Delete Mask**

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### **Delete All Masks**

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### **Trig Holdoff**

See "[Trig Holdoff](#)" on page 400

### **Holdoff Type**

See "[Holdoff Type](#)" on page 401

## User Preset

Accesses a menu that gives you the following three choices:

- **User Preset** – recalls a state previously saved using the Save User Preset function.
- **User Preset All Modes** – presets all of the modes in the analyzer
- **Save User Preset**– saves the current state for the current mode

Key Path	Front-panel key
Backwards Compatibility Notes	<p>User Preset is actually loading 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.</p> <p>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.</p> <p>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.</p> <p>User Preset recalls mode state which can now include data like traces; whereas on ESA and PSA, User Preset did not affect data.</p>
Initial S/W Revision	Prior to A.02.00

## User Preset

User Preset sets the state of the currently active mode back to the state that was previously saved for this mode using the Save User Preset menu key or the SCPI command, **SYST:PRES:USER:SAV**. **It not only recalls the** Mode Preset settings, but it also recalls all of the mode persistent settings, and the Input/Output system setting that existed at the time Save User Preset was executed.

If a Save User Preset has not been done at any time, User Preset recalls the default user preset file for the currently active mode. The default user preset files are created if, at power-on, a mode detects there is no user preset file. There will never be a scenario when there is no user preset file to restore. For each mode, the default user preset state is the same state that would be saved if a Save User Preset is performed in each mode right after doing a Restore Mode Default and after a Restore Input/Output Defaults.

The User Preset function does the following:

- Aborts the currently running measurement.
- Sets the mode State to the values defined by Save User Preset.

- Makes the saved measurement for the currently running mode the active measurement.
- Brings up the saved menu for the power-on mode.
- Clears the input and output buffers.
- Sets the Status Byte to 0.

Key Path	User Preset
<b>Remote Command</b>	:SYSTem:PRESet:USER
<b>Example</b>	:SYST:PRES:USER:SAVE:SYST:PRES:USER
Notes	:SYST:PRES:USER:SAVE is used to save the current state as the user preset state. Clears all pending OPC bits. The Status Byte is set to 0. Pressing the User Preset front-panel key while already in the User Preset menu will cause the User Preset to get executed
Couplings	A user preset will cause the currently running measurement to be aborted and cause the saved measurement to be active. Recalling a User Preset file has the same issues that recalling a Save State file has. Some settings may need to be limited and therefore re-coupled, since the capabilities of the mode may have changes when the User Preset file was last saved.
Initial S/W Revision	Prior to A.02.00

## 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.

**NOTE**

**When the instrument is secured, all of the user preset files are converted back to their default user preset files.**

The User Preset function does the following:

- Aborts the currently running measurement.
- Switches the Mode to the power-on mode.
- Restores the User Preset files for each mode.
- Makes the saved measurement for the power-on mode the active measurement.
- Brings up the saved menu for the power-on mode.
- Clears the input and output buffers.
- Sets the Status Byte to 0.

Key Path	User Preset
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<b>Remote Command</b>	:SYSTem:PRESet:USER:ALL
<b>Example</b>	:SYST:PRES:USER:SAVE:SYST:PRES:USER:ALL
Notes	Clears all pending OPC bits. The Status Byte is set to 0. :SYST:PRES:USER:SAVE is used to save the current state as the user preset state.
Couplings	A user preset will cause the currently running measurement to be aborted, cause a mode switch to the power-on mode, and cause the saved measurement to be active in the power-on mode. Recalling a User Preset file has the same issues that recalling a Save State file has. Some settings may need to be limited and therefore re-coupled, since the capabilities of the mode may have changes when the User Preset file was last saved.
Initial S/W Revision	Prior to A.02.00

## Save User Preset

Saves the currently active mode and its State. You can recall this User Preset file by pressing the User Preset menu key or sending the SYST:PRES:USER remote command. This same state is also saved by the Save State function.

Key Path	<b>User Preset</b>
<b>Remote Command</b>	:SYSTem:PRESet:USER:SAVE
<b>Example</b>	:SYST:PRES:USER:SAVE
Notes	:SYST:PRES:SAVE creates the same file as if the user requested a *SAV or a MMEM:STOR:STAT, except User Preset Save does not allow the user to specify the filename or the location of the file.
Initial S/W Revision	Prior to A.02.00



## View/Display

The View/Display key opens the Display Menu (common to most measurements) and the View menu (an embedded 1-of-N menu) for the current measurement.

Some measurements have simple View menus, or even no View menu, others provide many different Views.

Views are different ways of looking at data, usually different ways of looking at the same data, often when the data represents a time record that is being digitally processed with an FFT and/or other digital signal processing algorithms.

The View menu is meas local. So the "views" that are available are specific to the current measurement selected under the Meas key.

Key Path	<b>Front-panel key</b>
Initial S/W Revision	A.13.00

## Display

The Display menu is common to most measurements, and is used for configuring items on the display. Some Display menu settings apply to all the measurements in a mode, and some only to the current measurement. Those under the **System Display Settings** key apply to all measurements in all modes.

Key Path	<b>Display</b>
Key Path	<b>View/Display</b>
Initial S/W Revision	Prior to A.02.00

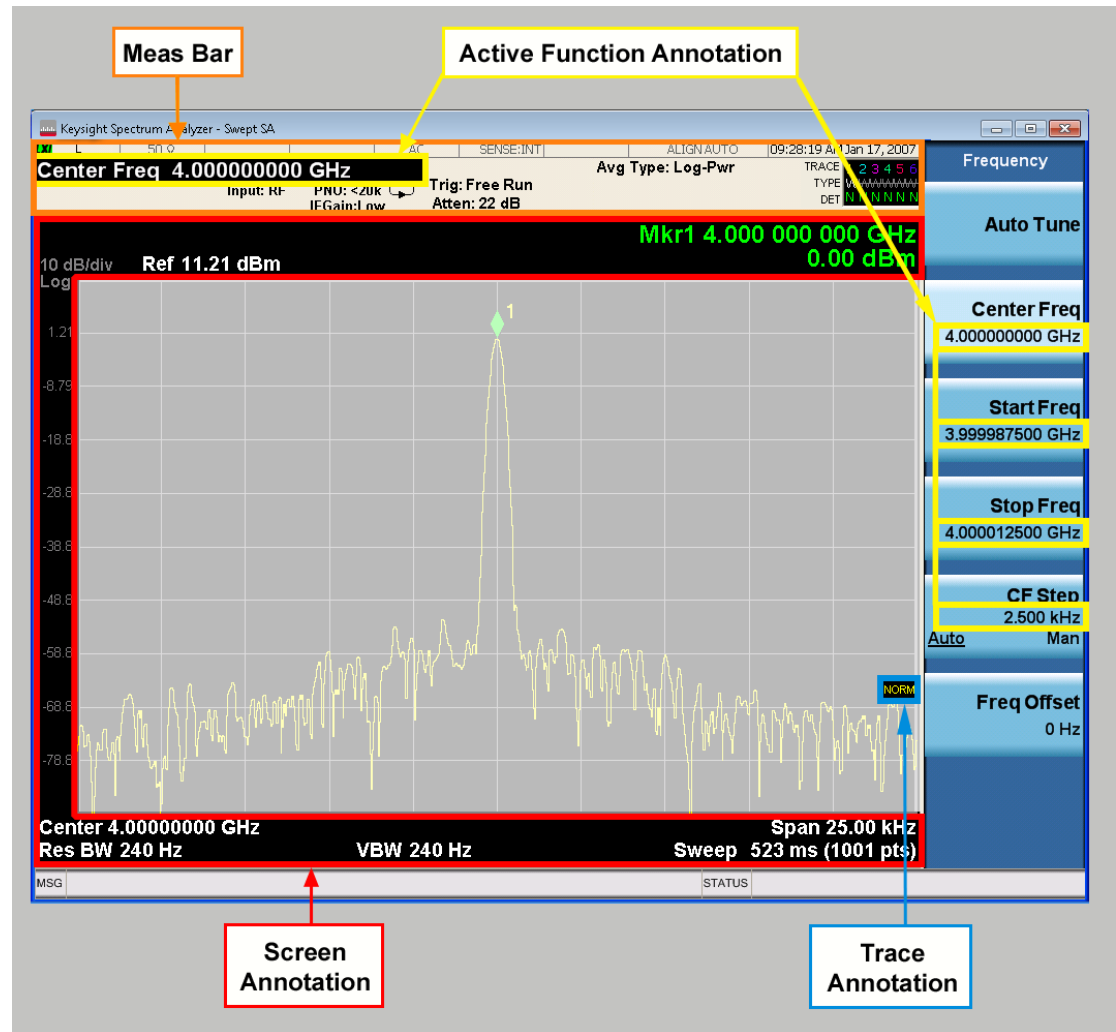
## Annotation

Turns on and off various parts of the display annotation. The annotation is divided up into four categories:

13. Meas Bar: This is the measurement bar at the top of the screen. It does not include the settings panel or the Active Function. Turning off the Meas Bar turns off the settings panel and the Active Function. When the Meas Bar is off, the graticule area expands to fill the area formerly occupied by the Meas Bar.
14. Screen Annotation: this is the annotation and annunciation around the graticule, including any annotation on lines (such as the display line, the threshold line, etc.) This does NOT include the marker number or the N dB result. When off, the graticule expands to fill the entire graticule area.
15. Trace annotation: these are the labels on the traces, showing their detector (or their math mode).

16. Active Function annotation: this is the active function display in the meas bar, and all of the active function values displayed on softkeys.

See the figure below. Each type of annotation can be turned on and off individually.



Key Path	View/Display, Display
Initial S/W Revision	Prior to A.02.00

### Meas Bar On/Off

This function turns the Measurement Bar on and off, including the settings panel. When off, the graticule area expands to fill the area formerly occupied by the Measurement Bar.

Key Path	View/Display, Display, Annotation
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<b>Remote Command</b>	:DISPlay:ANNotation:MBAR[:STATe] OFF ON 0 1 :DISPlay:ANNotation:MBAR[:STATe]?
<b>Example</b>	DISP:ANN:MBAR OFF
Dependencies	Grayed out and forced to OFF when <b>System Display Settings, Annotation</b> is set to Off.
Preset	On This should remain Off through a Preset when <b>System DisplaySettings, Annotation</b> is set to Off.
State Saved	Saved in instrument state.
Initial S/W Revision	Prior to A.02.00

## Screen

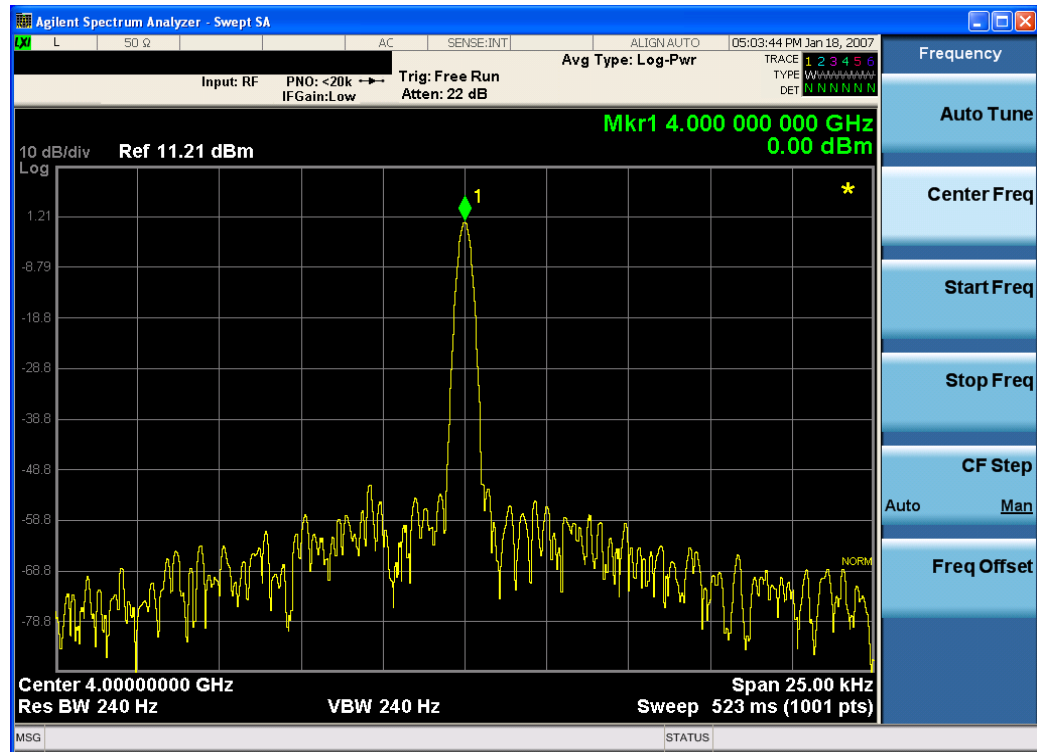
This controls the display of the annunciation and annotation around the graticule, including any annotation on lines (such as the display line, the threshold line, etc.) and the y-axis annotation. This does NOT include marker annotation (or the N dB result). When off, the graticule expands to fill the entire graticule area, leaving only the 1.5% gap above the graticule as described in the Trace/Detector chapter.

Key Path	View/Display, Display, Annotation
<b>Remote Command</b>	:DISPlay:ANNotation:SCReen[:STATe] OFF ON 0 1 :DISPlay:ANNotation:SCReen[:STATe]?
<b>Example</b>	DISP:ANN:SCR OFF
Dependencies	Grayed-out and forced to OFF when <b>System Display Settings, Annotation</b> is set to Off.
Preset	On This should remain Off through a Preset when <b>System DisplaySettings, Annotation</b> is set to Off
State Saved	Saved in instrument state.
Initial S/W Revision	Prior to A.02.00

## Active Function Values On/Off

Turns on and off the active function display in the Meas Bar, and all of the active function values displayed on the softkeys.

Note that all of the softkeys that have active functions have these numeric values blanked when this function is on. This is a security feature..



Key Path	View/Display, Display, Annotation
Remote Command	:DISP:ACTivfunc[:STATe] ON OFF 1 0 :DISP:ACTivfunc[:STATe]?
Example	DISP:ACT OFF
Dependencies	Grayed out and forced to OFF when <b>System Display Settings, Annotation</b> is set to Off.
Preset	On This should remain Off through a Preset when <b>System DisplaySettings, Annotation</b> is set to Off
State Saved	Saved in instrument state.
Initial S/W Revision	Prior to A.02.00

## Title

Displays menu keys that enable you to change or clear a title on your display.

Key Path	View/Display, Display
Initial S/W Revision	Prior to A.02.00

## Change Title

Writes a title into the "measurement name" field in the banner, for example, "Swept SA".

Press Change Title to enter a new title through the alpha editor. Press Enter or Return to complete the entry. Press ESC to cancel the entry and preserve your existing title.

The display title will replace the measurement name. It remains for this measurement until you press **Change Title** again, or you recall a state, or a Preset is performed. A title can also be cleared by pressing **Title**, **Clear Title**.

**NOTE**

Notice the inclusion of the <measurement> parameter in the command below. Because each measurement remembers the Display Title, the command must be qualified with the measurement name. For the Swept SA measurement this is not the case; no <measurement> parameter is used when changing the Display Title for the Swept SA measurement.

Key Path	View/Display, Display, Title
Mode	All
Remote Command	:DISPlay:<measurement>:ANNotation:TITLe:DATA <string> :DISPlay:<measurement>:ANNotation:TITLe:DATA?
Example	DISP:ANN:TITL:DATA "This Is My Title" This example is for the Swept SA measurement in the Spectrum Analyzer mode. The SANalyzer <measurement> name is not used. DISP:ACP:ANN:TITL:DATA "This Is My Title" This example is for Measurements other than Swept SA. Both set the title to: This Is My Title
Notes	Pressing this key cancels any active function. When a title is edited the previous title remains intact (it is not cleared) and the cursor goes at the end so that characters can be added or BKSP can be used to go back over previous characters.
Preset	No title (measurement name instead)
State Saved	Saved in instrument state.
Initial S/W Revision	Prior to A.02.00

### Clear Title

Clears a title from the front-panel display. Once cleared, the title cannot be retrieved. After the title is cleared, the current Measurement Name replaces it in the title bar.

Key Path	View/Display, Display, Title
Example	The following commands clear the title and restore the measurement's original title: DISP:ANN:TITL:DATA "" This example is for the Swept SA measurement in the Spectrum Analyzer mode. The SANalyzer <measurement> name is not used. DISP:ACP:ANN:TITL:DATA "" This example is for ACP; in measurements other than Swept SA the measurement name is

	required.
Notes	Uses the :DISPlay:<measurement>:ANNotation:TITLe:DATA <string> command with an empty string (in the Swept SA, the <measurement> is omitted).
Preset	Performed on Preset.
Initial S/W Revision	Prior to A.02.00

## Graticule

Pressing Graticule turns the display graticule On or Off. It also turns the graticule y-axis annotation on and off.

Key Path	View/Display, Display
<b>Remote Command</b>	:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATE] OFF ON 0 1 :DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATE]?
<b>Example</b>	DISP:WIND:TRAC:GRAT:GRID OFF
Notes	The graticule is the set of horizontal and vertical lines that make up the grid/divisions for the x-axis and y-axis.
Preset	On
State Saved	Saved in instrument state
Initial S/W Revision	Prior to A.02.00

## Display Line

This key allows you to control the Display Line, or for measurements which support multiple Display Lines, it allows you to control Display Line 1. See the key description for **Display Line 1|2|3|4** for detailed information and the SCPI command.

Key Path	View/Display, Display
Initial S/W Revision	Prior to A.02.00

## Display Lines

This key appears in measurements which support multiple display lines, and opens up a menu which lets you control all the display lines.

Key Path	View/Display, Display
Initial S/W Revision	A.17.50

## Select Display Line

This key allows you to select the display line currently being controlled by the **Display Line 1|2|3|4** key.

Key Path	View/Display, Display, Display Lines
Preset	1
Initial S/W Revision	A.17.50

## Display Line 1|2|3|4

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 key controls 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. 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.

Key Path	View/Display, Display
<b>Remote Command</b>	:DISP:WINDow[1]:TRACe:Y:DLINe[1] 2 ... 4 <amp1> :DISP:WINDow[1]:TRACe:Y:DLINe[1] 2 ... 4? :DISP:WINDow[1]:TRACe:Y: DLINe[1] 2 ... 4:STATe OFF   ON   0   1 :DISP:WINDow[1]:TRACe:Y: DLINe[1] 2 ... 4:STATe?
<b>Example</b>	DISP:WIND:TRAC:Y:DLIN:STAT ON Turns on Display Line; if multiple display lines, turns on Display Line 1 DISP:WIND:TRAC:Y:DLIN2 -32 dBm Adjust Display Line 2
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	$-\infty$ (minus infinity) in current units
Max	$+\infty$ (plus infinity) in current units
Default Unit	Depends on the current selected Y axis unit
Initial S/W Revision	Prior to A.02.00
Modified at S/W Revision	A.17.50

## Select Freq Line

This key allows you to select the display line currently being controlled by the **Freq Line 1|2|3|4** key.

Key Path	<b>View/Display, Display, Display Lines</b>
Preset	1
Initial S/W Revision	A.17.50

## Freq Line 1|2|3|4

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 key controls 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. 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.

Control Path	Display, Meas Display
Control Type	Binary Active Function
<b>Remote Command</b>	<pre>:DISP:WIND:W[1]:TRAC:X:FLINE[1] 2 ... 4 &lt;amp;1&gt; :DISP:WIND:W[1]:TRAC:X:FLINE[1] 2 ... 4? :DISP:WIND:W[1]:TRAC:X:FLINE[1] 2 ... 4:STATe OFF ON 0 1 :DISP:WIND:W[1]:TRAC:X:FLINE[1] 2 ... 4:STATe?</pre>
<b>Example</b>	<pre>DISP:WIND:TRAC:X:FLIN:STAT ON Turn Freq Line 1 on DISP:WIND:TRAC:X:FLIN3 1 GHz Set Freq line 3 to 1 GHz</pre>
Preset	Freq Line 1 selected, Off, and set to 1 GHz



	Off
Dependencies	Freq Lines only display in Swept Spans
Couplings	When a value is set for the Freq Line, turn it On, if in Zero Span. 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.
State Saved	Saved in instrument state.
Initial S/W Revision	A.17.50

### Select Time Line

This key allows you to select the display line currently being controlled by the **Time Line 1|2|3|4** key.

Key Path	<b>View/Display, Display, Display Lines</b>
Preset	1
Initial S/W Revision	A.17.50

### Time Line 1|2|3|4

Activates an adjustable vertical line that is used as a visual reference line. The line's horizontal position corresponds to its time value. The value of the time line (for example, 1 ms) 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 "TL1" for Time Line 1, "TL2" for time line 2, etc.

This key controls whichever Time Line has been selected by the **Select Time Line** key.

The Time Line can be adjusted using the step keys, knob, or numeric keypad. If more than one window has a Time Line, the Time Line of the selected window is controlled.

If the Time 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 Time Line is unaffected by Auto Couple.

Control Path	Display, Meas Display
Control Type	Numeric Toggle
<b>Remote Command</b>	:DISPlay:WINDow[1]:TRACe:X:TLINE[1] 2 ... 4 <amp1> :DISPlay:WINDow[1]:TRACe:X:TLINE[1] 2 ... 4? :DISPlay:WINDow[1]:TRACe:X:TLINE[1] 2 ... 4:STATe OFF ON 0 1 :DISPlay:WINDow[1]:TRACe:X:TLINE[1] 2 ... 4:STATe?
<b>Example</b>	DISP:WIND:TRAC:X:TLIN:STAT ON Turn Time Line 1 on

	DISP:WIND:TRAC:X:TLIN3 1.2 ms Set Time Line 3 to 1.2 ms
Preset	Time Line 1 selected, Off, and set to 1 ms Off
Dependencies	Time Lines and this control only display in Zero Span
Couplings	When a value is set for the Time Line, turn it On, if in Zero Span. When the Time 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 Time Line's value does not change when it is turned off.
State Saved	Saved in instrument state.
Initial S/W Revision	A.17.50

### System Display Settings

These settings are "Mode Global" – they affect all modes and measurements and are reset only by **Restore Misc Defaults** or **Restore System Defaults** under System.

Key Path	<b>View/Display, Display</b>
Initial S/W Revision	Prior to A.02.00

### Annotation Local Settings

This is a Mode Global override of the meas local annotation settings. When it is **All Off**, it forces **ScreenAnnotation, Meas Bar, Trace, and Active Function Values** settings to be **OFF** for all measurements in all modes. This provides the security based "annotation off" function of previous analyzers; hence it uses the legacy SCPI command.

When it is **All Off**, the **Screen, Meas Bar, Trace, and Active Function Values** keys under the **Display, Annotation** menu are grayed out and forced to **Off**. When **Local Settings** is selected, you are able to set the local annotation settings on a measurement by measurement basis.

Key Path	<b>View/Display, Display, System Display Settings</b>
<b>Remote Command</b>	<b>:DISPlay:WINDow[1]:ANNotation[:ALL] OFF ON 0 1</b> <b>:DISPlay:WINDow[1]:ANNotation[:ALL]?</b>
<b>Example</b>	:DISP:WIND:ANN OFF
Preset	On (Set by Restore Misc Defaults)
State Saved	Not saved in instrument state.
Backwards Compatibility Notes	The WINDow parameter and optional subopcode is included for backwards compatibility but ignored – all windows are equally affected.
Initial S/W Revision	Prior to A.02.00

## Themes

Accesses a menu of functions that enable you to choose the theme to be used when saving the screen image.

The **Themes** option is the same as the **Themes** option under the **Display and Page Setup** dialogs. It allows you to choose between themes to be used when saving the screen image.

Key Path	Save, Screen Image
Remote Command	:MMEMory:STORe:SCReem:THEMe TDCoLor   TDMonochrome   FCOLor   FMONochrome :MMEMory:STORe:SCReem:THEMe?
Example	:MMEM:STOR:SCR:THEM TDM
Preset	3D Color; Is not part of Preset, but is reset by Restore Misc Defaults or Restore System Defaults All and survives subsequent running of the modes.
Readback	3D Color   3D Mono   Flat Color   Flat Mono
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 "Flat Color" theme available in X-Series. Also, if you selected Reverse Bitmap AND a black & white screen image, that would be much like "Flat Monochrome". In other words, each of the X-Series themes has a similar screen image type in ESA/PSA. But they are not identical.
Initial S/W Revision	Prior to A.02.00

### 3D Color

Selects a standard color theme with each object filled, shaded and colored as designed.

Key Path	Save, Screen Image, Themes
Example	MMEM:STOR:SCR:THEM TDC
Readback	3D Color
Initial S/W Revision	Prior to A.02.00

### 3D Monochrome

Selects a format that is like 3D color but shades of gray are used instead of colors.

Key Path	Save, Screen Image, Themes
Example	MMEM:STOR:SCR:THEM TDM
Readback	3D Mono
Initial S/W Revision	Prior to A.02.00

### Flat Color

Selects a format that is best when the screen is to be printed on an ink printer.

Key Path	<b>Save, Screen Image, Themes</b>
<b>Example</b>	MMEM:STOR:SCR:THEM FCOL
Readback	Flat Color
Initial S/W Revision	Prior to A.02.00

### Flat Monochrome

Selects a format that is like Flat Color. But only black is used (no colors, not even gray), and no fill.

Key Path	<b>Save, Screen Image, Themes</b>
<b>Example</b>	MMEM:STOR:SCR:THEM FMON
Readback	Flat Mono
Initial S/W Revision	Prior to A.02.00

### Backlight

Accesses the display backlight on/off keys. 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 will turn backlight on and could potentially perform the action as well.

Key Path	<b>View/Display, Display, System Display Settings</b>
<b>Remote Command</b>	:DISPlay:BACKlight ON OFF :DISPlay:BACKlight?
Preset	ON (Set by Restore Misc Defaults)
Initial S/W Revision	Prior to A.02.00

### Backlight Intensity

An active function used to set the backlight intensity. It goes from 0 to 100 where 100 is full on and 0 is off. This value is independent of the values set under the Backlight on/off key.

Key Path	<b>View/Display, Display, System Display Settings</b>
<b>Remote Command</b>	:DISPlay:BACKlight:INTensity <integer> :DISPlay:BACKlight:INTensity?
<b>Example</b>	DISP:BACK:INT 50
Preset	100 (Set by Restore Misc Defaults)
Min	0

Max	100
Initial S/W Revision	Prior to A.02.00

## View

The RTSA measurements have the following views, which let you look at the trace data in different ways.

- "Normal (Real Time SA)" on page 706
- "Density" on page 707
- "Spectrogram" on page 712
- Trace Zoom
- Zone Span
- "Density / Spectrogram" on page 725
- "Power vs Time" on page 1012
- "Power vs Time / Spectrum" on page 1013
- "Power vs Time / Spectrogram" on page 1014

The views are separated by the measurement they apply to;

	Spectrum Measurement	Power vs Time Measurement
Single Window View	Normal <b>Density</b>	<b>Power vs Time</b>
Multi Window View	<b>Spectrogram</b> Trace Zoom Zone Span Density/Spectrogram	<b>Power vs Time / Spectrum</b> Power vs Time / Spectrogram

### NOTE

The view names in bold in the table above are the default views for the Multi Window toggle key described below.

The Multi Window toggle key allows the user to toggle between a single window view and a multi window view of the measurement.

When the current view is a Single Window View, then pressing the Multi Window toggle key sets the view to the previous Multi Window View. If there was no Multi Window View previously set, then the default Multi Window View will be set. Similarly, when the current view is a Multi Window View, then pressing the Multi Window toggle key sets the view to the previous Single Window View. If there was

no Single Window View previously set, then the default Single Window View will be set.

For example, when the Real Time Spectrum mode is selected for the first time, the Density view of the Spectrum measurement will be set. Pressing the Multi Window toggle key will set the view to a Multi Window View. Since there was no previous Multi Window View selected, the default Multi Window View (Spectrogram view) will be set. Pressing the Multi Window toggle key again will set the view to a Single Window View. Since the previous Single Window View was the Density view, this view will be set. Pressing the Multi Window toggle key in this state will toggle the view between Density view and Spectrogram view until a different view is selected.

When in a multi window layout, the Next Window key or the :DISPlay:WINDow [:SElect] <number> command can be used to switch windows.

Key Path	View/Display
<b>Remote Command</b>	:DISPlay:VIEW NORMal   DENSity   SPECTrogram   TZOm   ZSPan   PVTIme   PSPectrum   PSGRam :DISPlay:VIEW?
<b>Example</b>	:DISP:VIEW NORM sets the Normal view in Real Time Spectrum Meas
Notes	If a window that is not currently active is selected, the window layout will be updated to a layout that accommodates the selected window, setting any new unspecified windows to their default view.  Density view is only available in a single window layout and will be disabled in any other window layout. If any window other than window 1 is selected for density view the error message "Settings Conflict: Density View is only available in single window layout" will be generated.
Preset	DENSity
State Saved	Saved in instrument state
Initial S/W Revision	A.13.00

## Display Trace

You can specify which spectrogram trace to display in the trace window by using the Display Trace parameter. This function determines which of the 10,000 traces stored in the Spectrogram is currently being viewed in the trace window.

The selection of the display trace can be by trace number or by trace time. Display Trace 0 shows the latest trace.

This key only appears in the Spectrogram View. If the SCPI command is sent to any other View, it is accepted without error but you won't see the result until you go back to the Spectrogram View.

Key Path	View/Display
<b>Remote Command</b>	:TRACe:DISPlay:VIEW:SPECTrogram:POSition <integer> :TRACe:DISPlay:VIEW:SPECTrogram:POSition?
<b>Example</b>	:TRAC:DISP:VIEW:SPEC:POS 146
Dependencies	This key only appears in the Spectrogram View. If the SCPI command is sent to any other View, it

	is accepted without error but you won't see the result until you go back to the Spectrogram View.
Couplings	The input to this parameter can be trace number or trace time. See section "Trace Selection" on page 1018 for more details on Trace Selection. When Spectrogram occupies a Window that has half vertical size, only 300 traces can be displayed in the trace window at any one time.
Preset	Unaffected by Mode Preset, but set to 0 by Restore Mode Defaults. The value is remembered when you go in and out of Spectrogram View.
State Saved	Saved in instrument state
Min	0
Max	10,000*
Default Unit	Enter
Initial S/W Revision	A.13.00

### Display Trace Time Query

Can be used to determine the time that the current trace in the spectrogram started or set the display trace to the approximate start time of the entered time.

Key Path	View/Display
Remote Command	TRACe:DISP:VIEW:SPECTrogram:TIME <time> TRACe:DISP:VIEW:SPECTrogram:TIME?
Example	:TRAC:DISP:VIEW:SPEC:TIME 1.0 Sets the display trace to be at the given start time. If the time is not exact, the approximate start will be calculated. :TRAC:DISP:VIEW:SPEC:TIME? Returns the start time of the Display Trace relative to the start time of the "live" trace (Spectrogram Trace 1)
Dependencies	This key only available in the Spectrogram View. If the command is sent in any other View, an error is generated
Couplings	The key input to this parameter can be trace number or trace time. See section "Trace Selection" on page 1018 for more details.
Preset	0 s
Initial S/W Revision	A.12.00

### Markers

In the Spectrogram View, you can put Markers on any trace in the spectrogram window. To put a Marker on a particular trace in the spectrogram window, set the Display Trace to the trace upon which you want the marker, and then position the marker as desired on the trace in the trace window. When you turn a Marker on, or do any kind of Peak Search, the marker will appear on the current Display Trace. Then when you move the Display Trace to other traces in the Spectrogram Window, the Marker will stay on the spectrogram trace it is on.

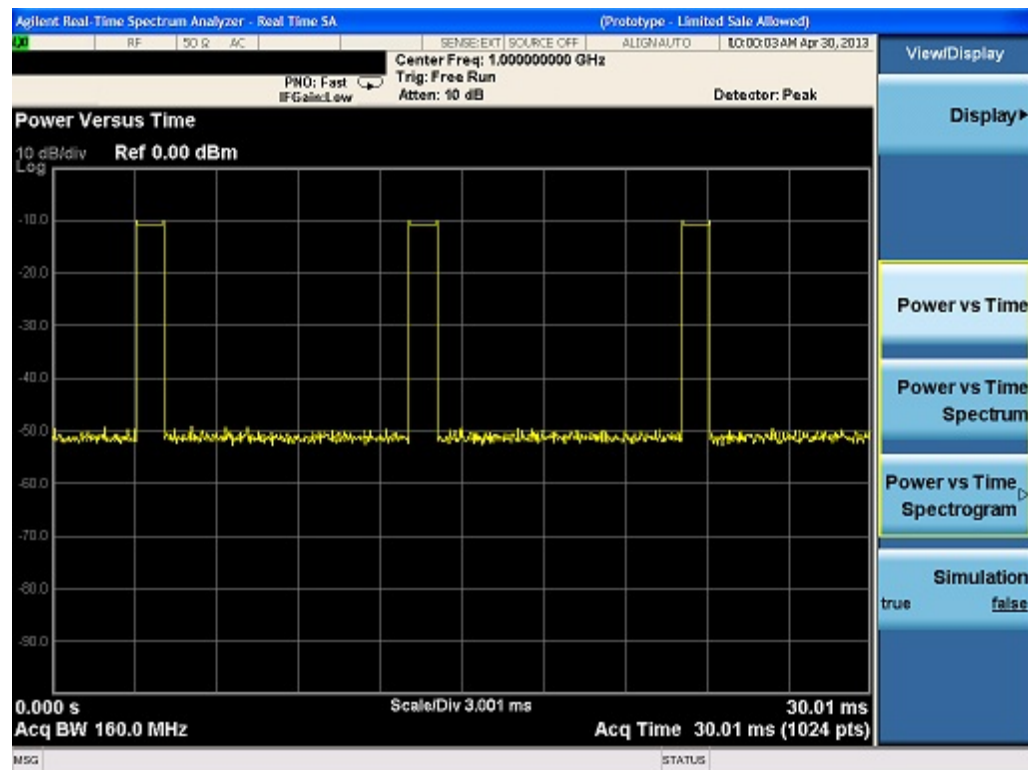
Markers are displayed in the Spectrogram Window as little crosses, with one bar sitting on the trace in question and the other bar perpendicular to it. The selected marker's cross is green; the others are white.

Example: Set Display Trace to spectrogram trace number 125. Turn on Marker 1. Marker 1 appears on the Spectrum trace, which is spectrogram trace number 125. A green diamond appears on trace 1 in the trace window, and a little cross appears on spectrogram trace number 125 in the spectrogram window. Now set Display Trace to 200. The trace window now shows spectrogram trace number 200; Marker 1 disappears out of that window because it is still on spectrogram trace number 125. You can still see the little cross sitting on spectrogram trace number 125 in the spectrogram window.

The selected marker displays in the upper right corner of the top window display, as always. If a delta marker is referenced to a marker on another Spectrogram Trace, then when the Marker X-Axis Scale is time, you will see the delta which represents the Y-axis delta between the two markers, as always; but in this case the X-axis delta now includes the time between the two traces.

When you leave the Spectrogram View, all markers that were not on Display Trace 0 are turned OFF.

## Power vs Time

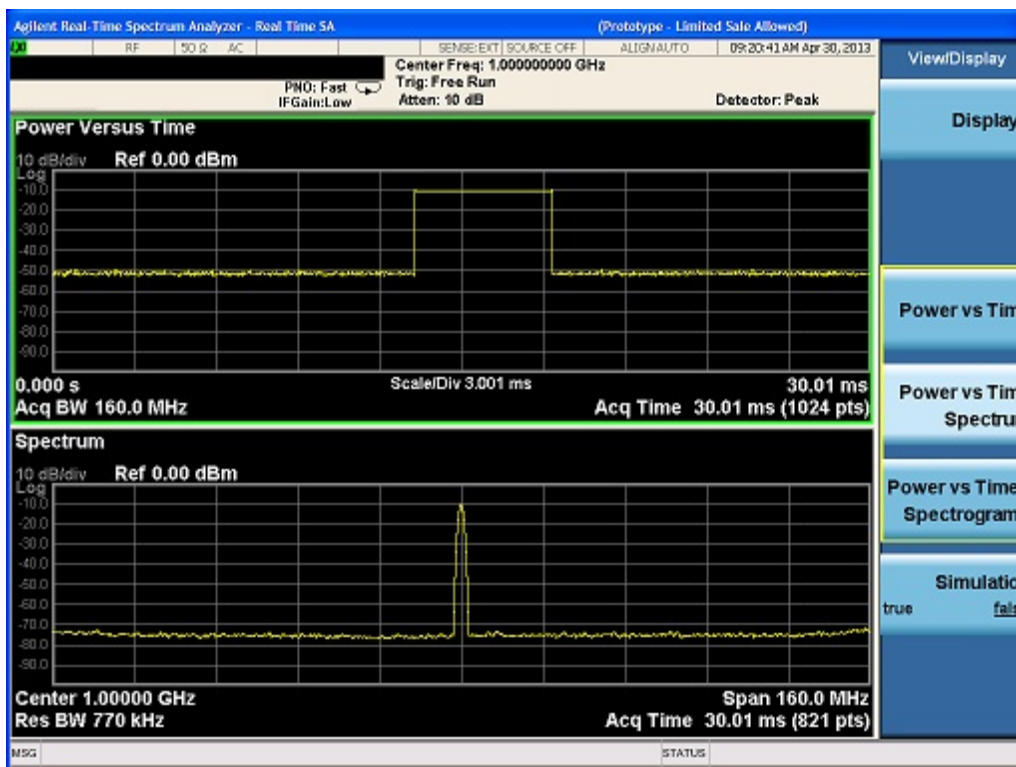


The Power vs Time view shows the RF envelope power over a user defined time period. The horizontal axis represents time and the vertical axis represents amplitude.

Key Path	View/Display
Example	DISP:VIEW PVT
Initial S/W Revision	A.13.00



### Power vs Time / Spectrum

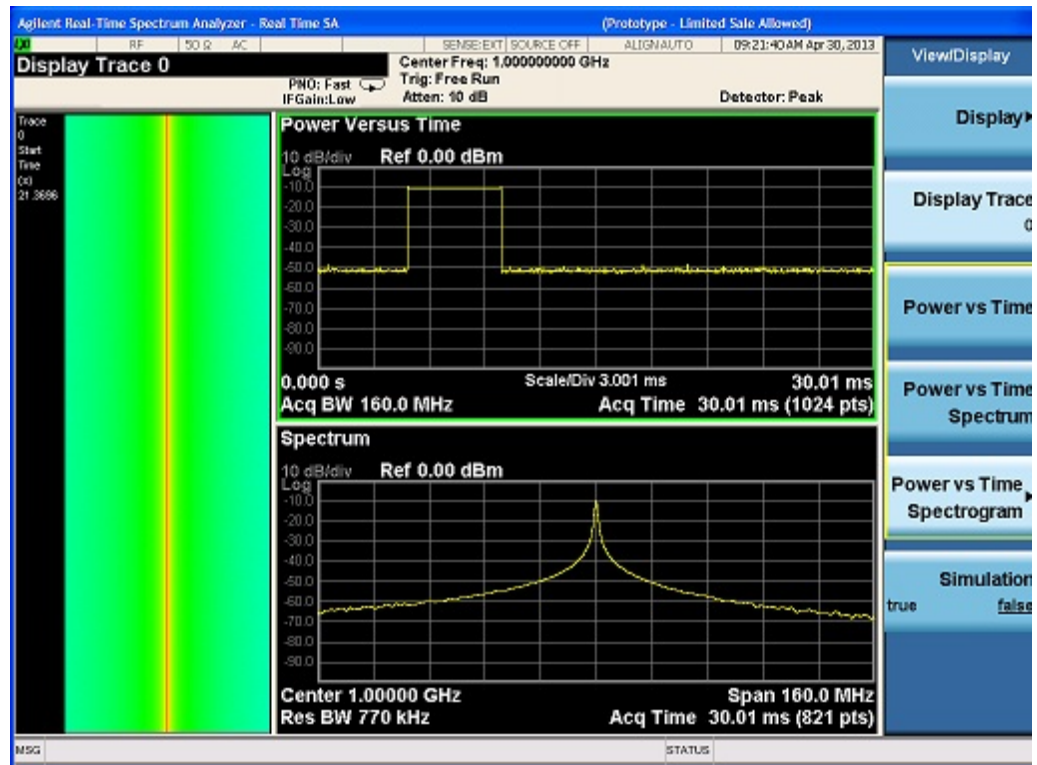


Dual view with the top window showing the Power vs Time trace and the bottom window showing the Spectrum trace.

The horizontal axis for the top window represents time and the vertical axis represents amplitude. The horizontal axis for the bottom window represents frequency and the vertical axis represents amplitude.

Key Path	View/Display
<b>Example</b>	DISP:VIEW PPSpectrum
Initial S/W Revision	A.13.00

## Power vs Time / Spectrogram



Tri view with the top window showing the Power vs Time trace, bottom window showing the Spectrum trace and left window showing Spectrogram.

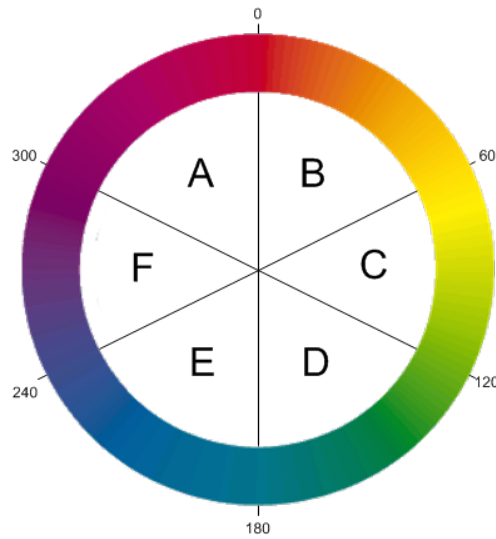
The horizontal axis for the top window represents time and the vertical axis represents amplitude. The horizontal axis for the bottom window represents frequency and the vertical axis represents amplitude.

Key Path	View/Display
Example	DISP:VIEW PSGRam
Initial S/W Revision	A.13.00

### Ref Hue

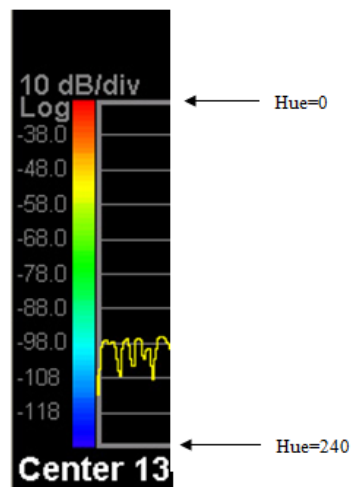
This key allows you to adjust the Hue at the top of the spectrogram color bar. The Spectrogram color bar is the bar placed next to the trace display to map colors into the Spectrogram window.

To understand how this works we need to understand the concept of “Hue”. The Hues of the colors run from 0 to 359 (360 is the same as 0) and are shown on the color wheel below:

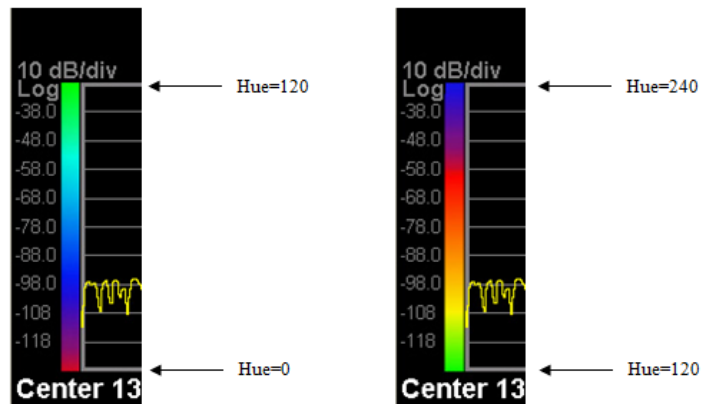


Hue 0 is Red (255,0,0), Hue 120 is Green (0,255,0) and Hue 240 is Blue (0,0,255). Hue 60 is Yellow (255,255,0), Hue 180 is Cyan (0,255,255) and Hue 300 is Magenta (255,0,255). In region A-B, the red value is constant (255), in C-D, the green value is constant (255), and in E-F, the blue value is constant (255). There is no green in region F-A, there is no Red in E-D, and there is no Blue in B-C.

When you adjust the Reference Hue, you are adjusting the Hue at the top of the color bar. The bottom of the color bar shows the Hue that is 240 degrees clockwise from the Ref Hue. Thus, in the normal case, the color bar appears like this:



Here are other examples of Ref Hue settings:



Key Path	View/Display, Spectrogram
<b>Remote Command</b>	:DISPlay:VIEW:SPECTrogram:HUE <real> :DISPlay:VIEW:SPECTrogram:HUE?
<b>Example</b>	:DISP:VIEW:SPEC:HUE 120
Preset	0
State Saved	Saved in instrument state
Min	0, but the next decrement takes you to 359
Max	359.9, but the next increment takes you back to 0
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### Ref Hue Position

This control lets you adjust where, as a percentage of the graticule, the Ref Hue appears. Above the Ref Hue Position, any amplitudes simply map as black. As an example, here is what the color bar looks like when the Ref Hue Position is set to 80%:



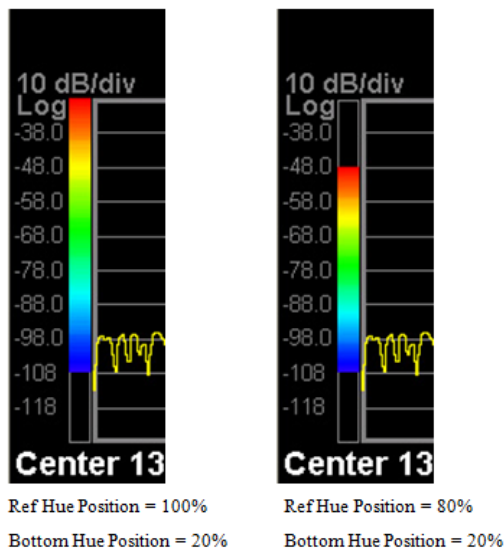
Key Path	View/Display, Spectrogram
<b>Remote Command</b>	:DISPlay:VIEW:SPECTrogram:REFerence <integer> :DISPlay:VIEW:SPECTrogram:REFerence?

<b>Example</b>	:DISP:VIEW:SPEC:REF 60
Notes	We send 60 to set 60%, although 60% is, strictly speaking, 0.6. This is inconsistent with the way percentages read back but, I think, more intuitive when you are setting a value.
Preset	100
State Saved	Saved in instrument state
Min	Ref Hue Position is not allowed to go any lower than 10% or Bottom Hue Position + 10, whichever is higher.
Max	100
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### Bottom Hue Position

This control lets you adjust where, as a percentage of the graticule, the bottom of the color bar appears. Below the color bar is black, and any amplitudes in this region simply map as black.

Examples:



Key Path	View/Display, Spectrogram
<b>Remote Command</b>	:DISPlay:VIEW:SPECTrogram:BOTTom <integer> :DISPlay:VIEW:SPECTrogram:BOTTom?
<b>Example</b>	:DISP:VIEW:SPEC:BOTT 40
Notes	We send 40 to set 40%, although 40% is, strictly speaking, 0.4. This is inconsistent with the way percentages read back but, I think, more intuitive when you are setting a value.
Preset	0
State Saved	Saved in instrument state
Min	0
Max	Bottom Hue Position is not allowed to go any higher than 90% or Ref Position - 10, whichever is

	lower.
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### Auto Adjust Hue Positions

Sets the Ref Hue Position (see section "Ref Hue Position" on page 1016"Ref Hue" on page 1014) to the highest amplitude value found in the Spectrogram and sets the Bottom Hue Position (see section "Bottom Hue Position" on page 1017) to the lowest amplitude value found in the Spectrogram.

Key Path	View/Display, Spectrogram
<b>Remote Command</b>	:DISPlay:VIEW:SPECTrogram:AADJust
<b>Example</b>	DISP:VIEW:SPECTrogram:AADJ
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### Trace Selection

Allows the user to determine how they will select the trace they want to display in the trace window. This can be either trace number or time. Each trace will have a time value associated with it which represents the time it occurred in the acquisition. This can be computed using Trace Time = Trace Number \* Acquisition Time

Key Path	View/Display, Spectrogram
<b>Remote Command</b>	:DISPlay:VIEW:SPECTrogram:TRACe:SELECTION TIME TNUMBER :DISPlay:VIEW:SPECTrogram:TRACe:SELECTION?
<b>Example</b>	:DISP:VIEW:SPEC:TRAC:SEL TIME
Couplings	Changing Trace Selection will change the value represented by Display Trace
Preset	TNUMBER
State Saved	Saved in instrument state
Range	Time Trace #
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### Couple Marker To Trace

Allows you to couple the maker to the selected Display Trace. When turned Off, this allows you to fix the marker to the Display Trace that was active when the marker was turned on. When turned On the Marker will stay with the selected Display Trace as it is changed.

Key Path	View/Display, Spectrogram
<b>Remote Command</b>	:DISPlay:VIEW:SPECTrogram:TRACe:COUPlE ON OFF 1 0 :DISPlay:VIEW:SPECTrogram:TRACe:COUPlE?
<b>Example</b>	DISP:VIEW:SPEC:TRAC:COUP ON
Preset	OFF

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State Saved	Saved in instrument state
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