

**89601X VXA Signal Analyzer
User's and Programmer's Reference**

**Option 205 Basic VSA-lite
Option 333 Connectivity to X-Series Analyzers
Option AYA Vector Modulation Analysis
Option B7R WLAN Modulation Analysis**

Agilent EXA and MXA Signal Analyzers

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

MXA Signal Analyzer N9020A

EXA Signal Analyzer N9010A



Agilent Technologies

Manufacturing Part Number: 89601-90001

Printed in USA

August 2008

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[[:SENSe]:DDEMod:APSK:R2Ratio <real>	470
[[:SENSe]:DDEMod:APSK:R2Ratio?	470
[[:SENSe]:DDEMod:APSK:R3Ratio <real>	471
[[:SENSe]:DDEMod:APSK:R3Ratio?	471
[[:SENSe]:DDEMod:CADJust <real>	468
[[:SENSe]:DDEMod:CADJust?	468
[[:SENSe]:DDEMod:EQUalization:CONVergence <real>	476
[[:SENSe]:DDEMod:EQUalization:CONVergence?	476
[[:SENSe]:DDEMod:EQUalization:FLENgth <integer>	475
[[:SENSe]:DDEMod:EQUalization:FLENgth?	475
[[:SENSe]:DDEMod:EQUalization:HOLD OFF ON 0 1	476

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[:SENSe]:DDEMod:EQUalization:STATe OFF ON 0 1	.474
[:SENSe]:DDEMod:EQUalization:STATe?	.474
[:SENSe]:DDEMod:FILTer:MEASurement NONE RRCosine GAUSSian EDGE IS95EQ RECT-angle LPASs USER	.458
[:SENSe]:DDEMod:FILTer:MEASurement:REGister D1 D2 D3 D4 D5 D6	.459
[:SENSe]:DDEMod:FILTer:MEASurement:REGister?	.459
[:SENSe]:DDEMod:FILTer:MEASurement?	.458
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[:SENSe]:DDEMod:FILTer:REFerence:REGister D1 D2 D3 D4 D5 D6	.462
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[:SENSe]:DDEMod:FILTer:REFerence?	.461
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[:SENSe]:DDEMod:MODulation BPSK QPSK OQPSK PI4DQPSK DQPSK PSK8 PI8DPSK8 DPSK8 QAM16 QAM32 QAM64 QAM128 QAM256 QAM512 QAM1024 FSK2 FSK4 FSK8 FSK16 MSK1 MSK2 EDGE APSK16 APSK32 DVBAPSK16 DVBAPSK32 DVBQAM16 DVBQAM32 DVBQAM64 DVBQAM128 DVBQAM256 VSB8 VSB16	.452
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[[:SENSe]:DDEMod:SYNC:SWORd:PATtern?.....	466
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[[:SENSe]:DDEMod:SYNC:SWORd:STATe?.....	464
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[:SENSe]:W11A:GINTErval?	509
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[[:SENSe]:W11A:TIME:RESult:MAX <integer>	515
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[:SENSe]:W11B:STANdard:PRESet I11BGDSSS	559
[:SENSe]:W11B:SYNC:SLENgth <time>	560
[:SENSe]:W11B:SYNC:SLENgth?	560
[:SENSe]:W11B:TIME:INTerval <integer>	564
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[:SENSe]:W11B:TIME:RESult:AUTO OFF ON 0 1	561
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[:SENSe]:W11B:TIME:RESult:AUTO?	561
[:SENSe]:W11B:TIME:RESult:AUTO?	562
[:SENSe]:W11B:TIME:RESult:LENgth <integer>	561
[:SENSe]:W11B:TIME:RESult:LENgth <integer>	562
[:SENSe]:W11B:TIME:RESult:LENgth?	561
[:SENSe]:W11B:TIME:RESult:LENgth?	562
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List of Commands

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1

Introduction

This chapter provides overall information on the Agilent 89601X VXA Signal Analyzer Measurement Application and describes the measurements made by the analyzer. Installation instructions for adding this option to your analyzer are provided in this section, in case you purchased this option separately.

What Does the Agilent 89601X VXA Signal Analyzer Measurement Application Do?

The 89601X VXA is a full-featured vector signal analyzer that can help determine if an RF modulated source or transmitter is working correctly. There are standard and optional measurements for complete analysis and demodulation of most communications signals.

- The Vector Analysis measurement (included in Option 205) provides:
 - Spectrum analysis and Time Domain analysis with Signal Tracking
 - Band Power, Occupied Bandwidth, and ACP measurements
 - Markers, Marker Coupling, Triggering
 - Time Gating
 - Frequency Counter
- The Analog Demodulation measurement (included in Option 205) will perform all the above and will also analyze and demodulate signals that use the following modulation formats:
 - AM, FM, PM
- The Digital Demodulation measurement (Option AYA) will analyze and demodulate signals that use the following modulation formats:
 - MSK
 - QPSK
 - 8PSK
 - BPSK
 - $\pi/4$ DQPSK
 - DQPSK
 - $\pi/8$ D8PSK
 - D8PSK
 - Offset QPSK
 - QAM16, 32, 64, 128, 256, 512, 1024
 - DVB QAM 16, 32, 64, 128, 256
 - FSK 2, 4, 8, 16 states
 - VSB8, VSB16
 - APSK16, 32, 16 w/dub, 32 w/dub

- Standard communications formats provided by Option AYA include:
 - Cellular: IS-95 Base and Mobile, GSM, EDGE, CDPD, NADC, PDC, PHP, 3GPP (W-CDMA)
 - Wireless Networking: 802.11b, HIPERLAN/1 (HBR and LBR), Bluetooth, ZigBee 868, 915, and 2450
 - Digital Video: DTV8, DTV16, DVB16, DVB32, DVB64, DVB128, DVB256, DVB 16APSK with code rates 2/3 to 9/10, DVB 32 APSK with code rates 3/4 to 9/10.
 - Other: APCO 25, DECT, TETRA, VDL Mode 3
- With other digital demod options, the 89601X VXA will also demodulate more complicated signals that conform to the following standard communications formats:
 - Option B7R - WLAN 802.11 a/b/g, OFDM and DSSS

NOTE

For CDMA signals, 89601X VXA can analyze digital modulation for a single code channel only. If multiple code channels are transmitted, synchronization will fail, and incorrect EVM results will be obtained. For modulation quality measurements of multiple code channels, Modulation Accuracy and Code Domain measurements must be performed by a full-featured standard-based measurement application, like N9073 for W-CDMA.

Installing Application Software

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

So when you purchase an application, you will receive an entitlement certificate that is used to obtain a license key for that particular measurement application. Enter the license key that you obtain into the N9020A Signal Analyzer to activate the new measurement application. See below for more information.

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

http://www.agilent.com/find/sa_upgrades

Viewing a License Key

Measurement personalities 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 which measurement applications are currently licensed in your analyzer.

Press **System, More, Licensing. . .** to view the license keys for the installed measurement applications.

NOTE You may want to keep a copy of your license key in a secure location. You can print out a copy of the display showing the license numbers to do this. If you should lose your license key, call your nearest Agilent 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. Follow the instructions that accompany the certificate to obtain your license key.

Installing a license key for the selected application can be done automatically using a USB memory device. To do this, you would put the license file on 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 license management application in the instrument. It is found through the instrument front panel keys at **System, Licensing. . .**, or internally at C:\Programming Files\Agilent\Licensing.

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

Missing and Old 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 assures that you get any improvements and expanded functionality that is available.

Because the software was loaded at the initial purchase, there may be additional measurement applications that are now available. If the application you are interested in licensing is not available, you will need to do a software update. (Press **System, Show, System.**)

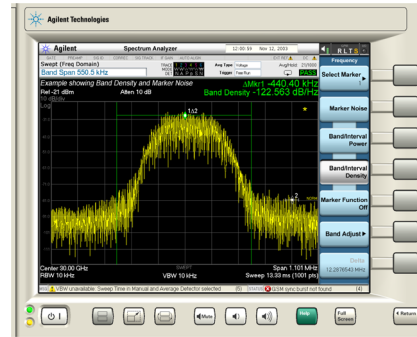
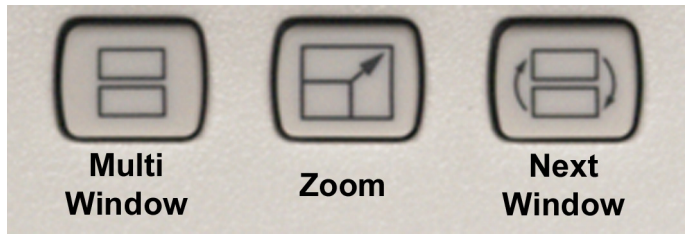
Check the Agilent internet website for the latest software versions available for downloading:

http://www.agilent.com/find/mxa_software
http://www.agilent.com/find/exa_software

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

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 is not used at this time. It is there to support future functionality.

Key Path	Front-panel key
----------	-----------------

Zoom

Zoom is a toggle function. Pressing once Zooms the selected window; pressing again un-zooms.

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.

The state of zoom, and which window is zoomed, is saved in State.

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

Remote Command :DISP:WINDow:FORMat:TILE|ZOOM

Example :DISP:WIND:FORM:ZOOM sets zoomed
 :DISP:WIND:FORM:TILE sets un-zoomed

Preset TILE

Next Window

This key selects the next window of the current view. When this key is selected in Help Mode, it toggles focus between the table of contents window and the topic pane window.

Remote Command	:DISPlay:WINDow[:SElect] <number> :DISPlay:WINDow[:SElect] ?
Example	:DISP:WIND 1
Preset	1
Min	1
Max	If <number> is greater than the number of windows, limit to <number of windows>

Selected Window

One and only one window is always selected. The selected window has the focus; as far as the user is concerned, all key presses are going to that window.

If a window is not selected, its boundary is gray. The selected window has a green boundary.

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.

Navigating Windows

When the Next Window key is pressed, the next window in the order of precedence (see below) becomes selected. If the selected window was zoomed, the next window will also be zoomed.

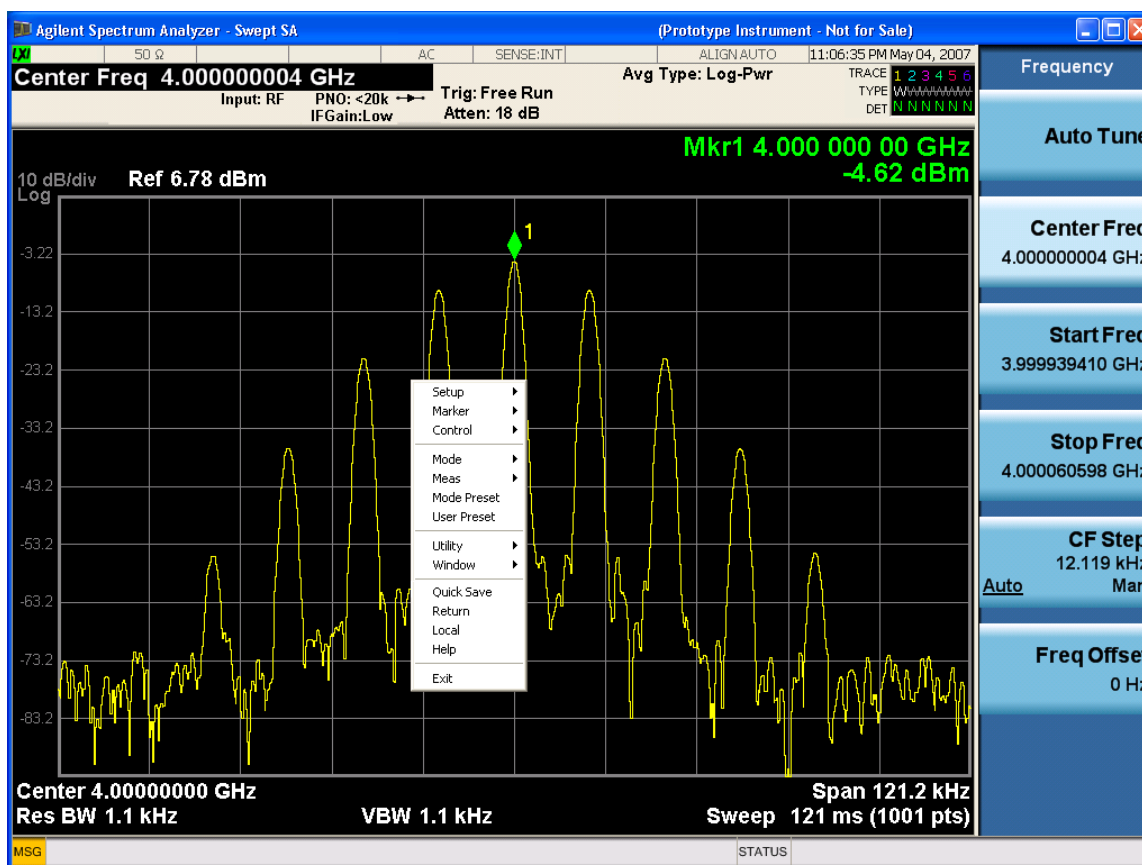
The window navigation does NOT use the arrow and select keys. Those are reserved for navigation within a window.

Mouse and Keyboard Control

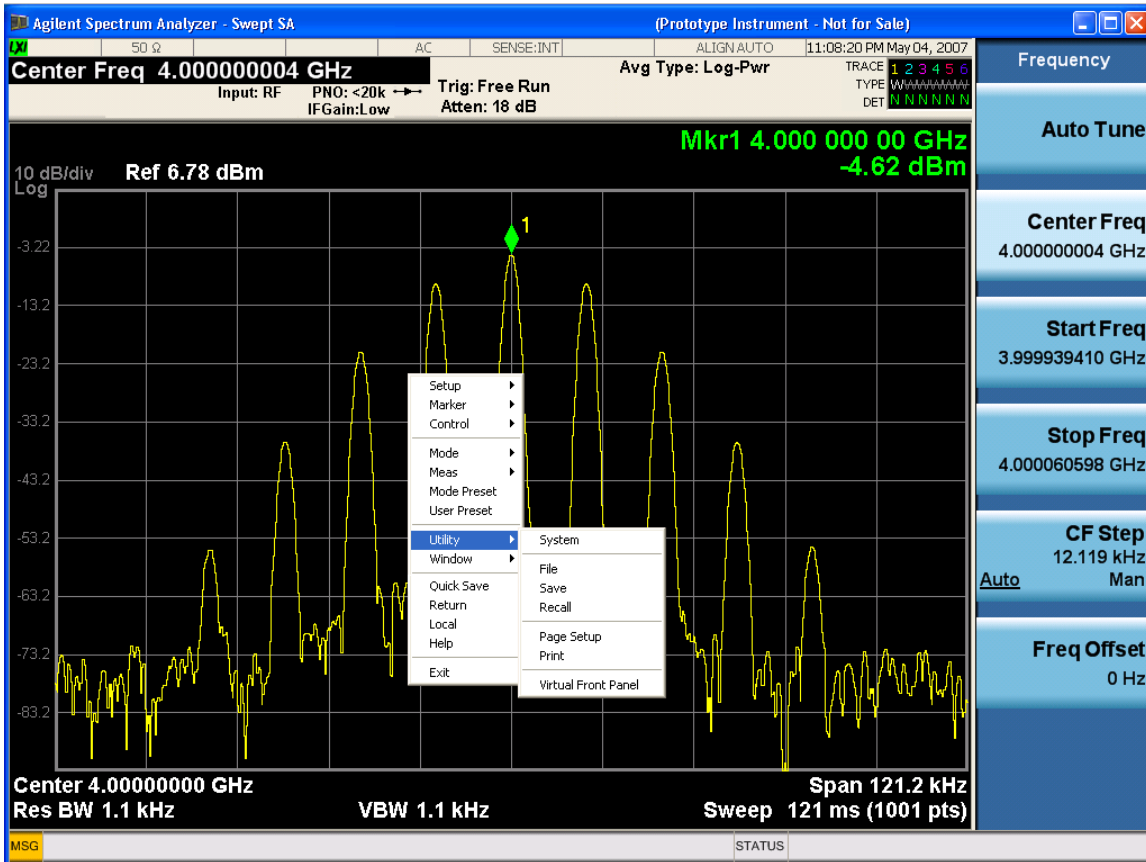
If you do not have access to the instrument front-panel, there are several ways that a mouse and PC Keyboard can give you access to functions normally accessed using the front panel keys.

Right-Click

If the user plugs in a mouse and right-clicks on the analyzer screen, a menu will appear as below:

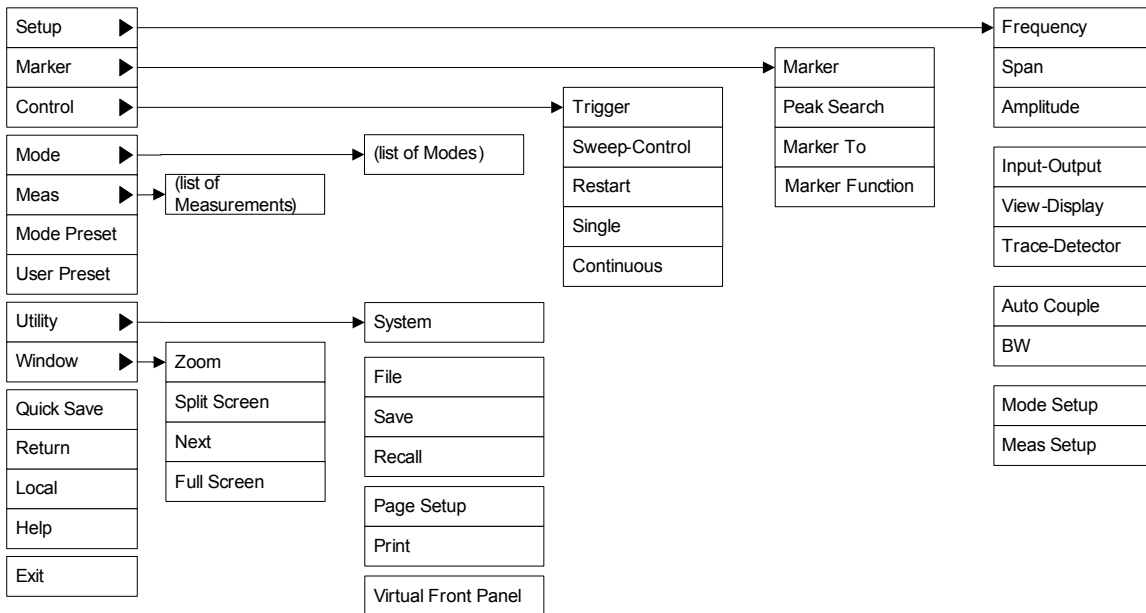


Placing the mouse on one of the rows marked with a right arrow symbol will cause that row to expand, as for example below where the mouse is hovered over the “Utility” row:



This method can be used to access any of the front-panel keys by using a mouse; as for example if the user is 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:

Function	Keyboard
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+SHIFT+E
Marker	CTRL+SHIFT+K
Peak Search	CTRL+SHIFT+P
Marker To	CTRL+ALT+N
Marker Function	CTRL+ALT+F
System	CTRL+SHIFT+Y
QuickSave	CTRL+SHIFT+Q
Save	CTRL+S
Recall	CTRL+R
Mode Preset	CTRL+M
User Preset	CTRL+U
Print	CTRL+P
File	CTRL+F
Mode	CTRL+SHIFT+M
Measure	CTRL+ALT+M
Mode Setup	CTRL+ALT+E
Meas Setup	CTRL+ALT+U
Trigger	CTRL+SHIFT+T
Sweep/Control	CTRL+SHIFT+W

Function	Keyboard
Restart	CTRL+ALT+R
Single	CTRL+ALT+S
Cont	CTRL+ALT+C
Zoom	CTRL+SHIFT+Z
NextWindow	CTRL+SHIFT+N
SplitScreen	CTRL+SHIFT+L
FullScreen	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 key1	CTRL+SHIFT+F1
Menu key2	CTRL+SHIFT+F2
Menu key3	CTRL+SHIFT+F3
Menu key4	CTRL+SHIFT+F4
Menu key5	CTRL+SHIFT+F5
Menu key6	CTRL+SHIFT+F6
Menu key7	CTRL+SHIFT+F7

Utility Functions
Mouse and Keyboard Control

Function	Keyboard
Backspace	BACKSPACE
Enter	ENTER
Tab	Tab
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
0	0

Here is a pictorial view of the table above:

	ANALYZER SETUP			MARKER	UTILITY	
	FREQ Channel Ctl-Sh-F	Input/Output Ctl-Sh-O	Auto Couple Ctl-Sh-C	Marker Ctl-Alt-K	System Ctl-Sh-Y	Mode Preset Ctl-M
	SPAN X Scale Ctl-Sh-S	View/Display Ctl-Sh-V	BW Ctl-Alt-B	Peak Search Ctl-Alt-P	Quick Save Ctl-Q	User Preset Ctl-U
	AMPTD Y Scale Ctl-Sh-A	Trace/Detector Ctl-Alt-T	Source Ctl-Alt-U	Marker → Ctl-Alt-N	Save Ctl-S	File Ctl-F
	Mode Ctl-Sh-M	Mode Setup Ctl-Sh-E	Trigger Ctl-Sh-T	Marker Function Ctl-Alt-F	Recall Ctl-R	 Ctl-P
	Meas Ctl-Alt-M	Meas Setup Ctl-Alt-E	Sweep/Control Ctl-Sh-W	Restart Ctl-Alt-R	Single Ctl-Alt-S	Cont Ctl-Alt-C

Ctl-Sh-L	Ctl-Sh-Z	Ctl-Sh-N
Help F1	Full Screen Ctl-Sh-B	Select Space

System

Opens a menu of keys that access various configuration menus and dialogs.

Remote Command Notes	No remote command for this key specifically.
Key Path	Front-panel key

Show

Opens a menu of choices that enable you to select the information window you want to view.

Mode	All
Remote Command	:SYSTem:SHOW OFF ERRor SYSTem HARDware LXI HWSTatistics ALIGNment SOFTware :SYSTem:SHOW?
Example	:SYST:SHOW SYST
Remote Command 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
Key Path	System

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 button 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 time is displayed to the second.

The fields on the Errors display are:

Type (unlabelled) - Displays the icon identifying the event or condition as an error or warning.

ID - Displays the error number.

Message - Displays the message text.

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

If the value of Repeat is 1 the field does not display. If the value of Repeat is >1, the time and date shown are those of the most recent occurrence. If the value of repeat reaches 999,999 it stops there.

Time - Shows the most recent time (including the date) at which the event occurred.

Mode	All
Remote Command	:SYSTem:ERRor [:NEXT] ?
Example	:SYST:ERR?
Restriction and Notes	The return string has the format: “<Error Number>,<Error>” Where <Error Number> and <Error> are defined in the Master Error Messages document.
State Saved	No
Key Path	System, Show

Next Page

Next Page and Previous Page menu keys move the user 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	System, Show, Show Errors
----------	----------------------------------

Previous Page See Next Page.

History

The History and Status keys select the Errors view. The Status key has a second line which shows a number in [square brackets]. This is the number of currently open status items.

Key Path **System, Show, Show Errors**

Status See History.

Verbose SCPI On/Off

This is a capability that will allow the SCPI data stream to be displayed when a SCPI error is detected, showing the characters which stimulated the error and several of the characters preceding the error.

Mode	All
Remote Command	:SYSTem:ERRor:VERBoSe OFF ON 0 1 :SYSTem:ERRor:VERBoSe?
Example	:SYST:ERR:VERB ON
Preset	This is unaffected by Preset but is set to OFF on a "Restore System Defaults->Misc"
State Saved	No
Range	On Off
Key Path	System, Show, Show Errors

Refresh

When pressed, refreshes the Show Errors display.

Key Path **System, Show, Show Errors**

Clear Error Queue

This clears all errors in all error queues.

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 **System, Show, Show Errors**

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     Precision 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.

Mode **All**
 Example **SYST:SHOW SYST**
 Key Path **System, Show**

Hardware

The show hardware screen is used to view details of the installed hardware. This information can be used to determine versions of hardware assemblies and field programmable devices, in the advent of future upgrades or potential repair needs.

The screen is formatted into two groupings: product descriptive information and hardware information. The hardware information is listed in a table format:

Utility Functions
System

Hardware Information
 MXA Signal Analyzer
 Product Number: N9020A
 Serial Number: US46220107
 Firmware Revision: A.01.14

Assembly Name	Part #	Serial #	Mat Rev	Rev	OF Rev	Hw Id	Misc
Analog IF	E441060104	78060200131	003	0	C	15	
YIG Tuned Filter	50877305	11061500550	005	0	A	11	
Digital IF	E441060105	78060100559	003	0	F	14	
Front End Controller	E441060101	78060100147	004	2	A	8	
Low Band Switch	E441060170	78060800346	005	1	A	10	
LO Synthesizer	E441060102	78060100226	003	3	G	2	
Reference	E441060108	78060300420	004	1	C	16	
Front End	E441060154	13062800820	010	2	B	9	

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.

Mode All
 Example SYST:SHOW HARD
 Key Path **System, Show**

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 **System, Show**

LAN Reset

This key resets the LAN connection.

Key Path **System, Show, LXI**

Power On

The Power On menu key enables you to select how the instrument should power on. The options are: Mode and Input/Output Defaults, User Preset and Last State.

Mode	All
Remote Command	:SYSTem:PON:TYPE MODE USER LAST PRESet :SYSTem:PON:TYPE?
Example	:SYST:PON:TYPE MODE
Preset	This is unaffected by Preset but is set to Mode on a “Restore System Defaults->All”
State Saved	No
Key Path	System

Mode and Input/Output Defaults

When the analyzer is powered on in Mode and Input/Output Defaults, it will perform a Restore Mode Defaults to all modes in the instrument and a Restore Input/Output Defaults as well.

Mode	All
Example	SYST:PON:TYPE MODE
Key Path	System, Power On

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.

Mode	All
Example	SYST:PON:TYPE USER

Key Path **System, Power On**

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 could never power up for the first time in Last.

NOTE: 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 will not work properly. For more information see Power Standby (Instrument Shutdown).

Mode	All
Example	SYST:PON:TYPE LAST
Restriction and Notes	Power on Last State only works if the user has 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 <code>:SYSTem:PDOWn</code> command.
Key Path	System, Power On

Power On Mode

This menu key brings up a Mode Menu that lists the available modes and lets you select which Mode to be the power-on mode. This Mode Menu is a 1-of-N list of available modes; not the Mode Menu under the Mode front-panel key. They will look the same, but have very different behavior.

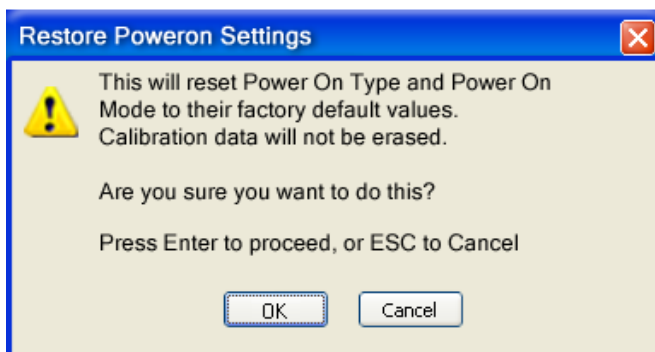
This Mode will be used for Power On Mode and Input/Output Defaults and Restore System Defaults All.

Mode All

Remote Command	:SYSTem: PON: MODE SA PNOISE EDGE GSM BASIC WIMAX OFDMA PNOISE WCDMA VSA VSA89601 :SYSTem: PON: MODE?
Example	SYST: PON: MODE SA
Restriction and Notes	The list of possible modes (and remote parameters) to choose from is dependent on which modes are installed in the instrument.
Preset	This is unaffected by Preset but is set on a “Restore System Defaults->All” to SA unless Spectrum Analysis mode is not installed in the instrument in which case the factory will load the default power-on mode.
State Saved	No
Key Path	System, Power On

Restore Power On Defaults

This selection causes the Power On Type and Power On Mode 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 menu 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.

Example	:SYST: DEF PON
Key Path	System, Power On

Alignments

The Alignments Menu controls and displays the automatic alignment of the instrument, and provides the ability to restore the default alignment values.

Key Path **System**

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**.

Mode	All
Remote Command	:CALibration:AUTO ON PARTial OFF ALERT :CALibration:AUTO?
Example	:CAL:AUTO ON
Restriction and Notes	While Auto Align is executing, bit 0 of Status Operation register is set.
Dependencies/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
Key Path	System, Alignments
SCPI Status Bits/OPC Dependencies	When Auto Align is executing Bit 0 in the Status Operational register is set.

Normal

Auto Align, Normal turns on the automatic alignment of all measurement systems. **Auto Align, Normal** 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:

Mode	All
Example	:CAL:AUTO ON
Restriction and Notes	<p>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.</p> <p>The presence of an external signal may interfere with the RF portion of the alignment. If so, the Error Condition “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. A subsequent alignment of the RF will clear the condition, and clear bit 11 in the Status Questionable Calibration register.</p>
Key Path	System, Alignments, Auto Align
SCPI Status Bits/OPC Dependencies	An interfering user signal may prevent automatic alignment of the RF subsystem. If this occurs, the Error Condition “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.

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 personalities. 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 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:



Mode	All
Example	:CAL:AUTO PART
Restriction and Notes	Auto Align Partial begins the elapsed time counter for Auto Align Off time.
Key Path	System, Alignments, Auto Align

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 **Off** 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:

Mode	All
Example	:CAL:AUTO OFF
Restriction and Notes	Auto Align Off begins the elapsed time counter for Auto Align Off time.
Dependencies/Couplings	Auto Align is set to Off if Restore Align Data is invoked.
Key Path	System, Alignments, Auto Align

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):

Mode	All
Remote Command	:CALibration:AUTO:MODE ALL NRF :CALibration:AUTO:MODE?
Example	:CAL:AUTO:MODE NRF
Preset	This is unaffected by Preset but is set to ALL on a “Restore System Defaults->Align”.
State Saved	No
Key Path	System, Alignments, Auto Align

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.

Mode	All
Remote Command	:CALibration:AUTO:ALERT TTEMPerature DAY WEEK NONE :CALibration:AUTO:ALERT?
Example	:CAL:AUTO:ALER TTEM

Remote Command 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
Key Path	System, Alignments, Auto Align
SCPI Status Bits/OPC Dependencies	The alert is the Error Condition “Align Now, All required” and bit 14 is set in the Status Questionable Calibration register.

Time & Temperature

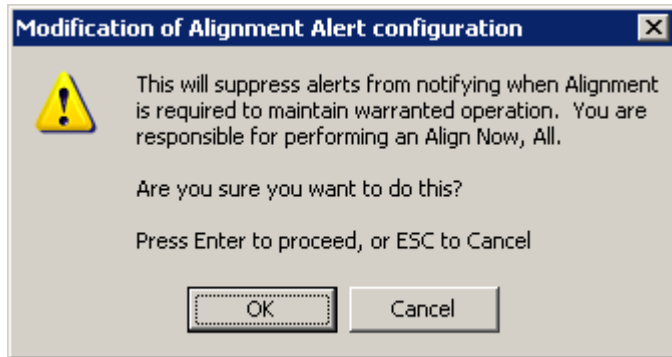
With Auto Align Alert set to **Time & Temperature** the instrument will signal an alert when alignments expire due to the combination of the passage of time and changes in temperature. The alert is the Error Condition “Align Now, All required”. If this choice for Alert is selected, the absence of an alert means that the analyzer alignment is sufficiently up-to-date to maintain warranted accuracy.

Mode	All
Example	:CAL:AUTO:ALERTTEMP
Key Path	System, Alignments, Auto Align, Alert
SCPI Status Bits/OPC Dependencies	Bit 14 is set in the Status Questionable Calibration register.

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 “Align Now, All required”.

For front panel operation, confirmation is required to transition into this setting of Alert. The confirmation dialog is:



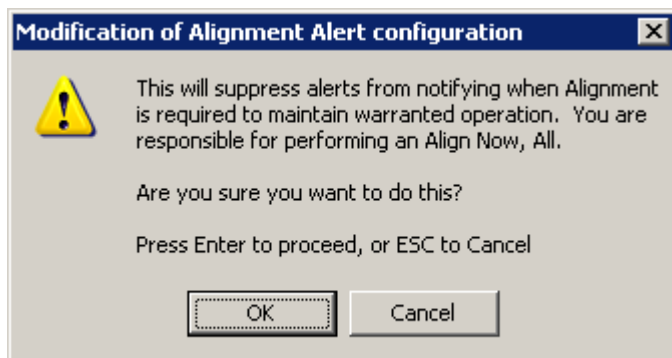
No confirmation is required when Alert is configured through a remote command.

Mode	All
Example	:CAL:AUTO:ALER DAY
Key Path	System, Alignments, Auto Align, Alert
SCPI Status Bits/OPC Dependencies	Bit 14 is set in the Status Questionable Calibration register.

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 “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.

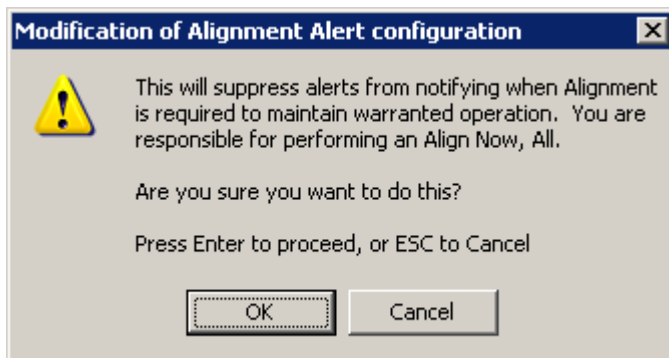
Mode	All
------	-----

Example :CAL:AUTO:ALER WEEK
Key Path **System, Alignments, Auto Align, Alert**
SCPI Status Bits/OPC Bit 14 is set in the Status Questionable Calibration register.
Dependencies

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. Agilent does not recommends 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.

Mode All
Example :CAL:AUTO:ALER NONE
Key Path **System, Alignments, Auto Align, Alert**

Align Now

Accesses alignment processes that are immediate action operations. They perform complete operations and run until they are complete.

Key Path **System, Alignments**

All

Immediately executes an alignment of all subsystems. The instrument stops any measurement currently underway, performs the alignment, then restarts the measurement from the beginning (similar to pressing the **Restart** key).

If an interfering user signal is present at the RF Input, the alignment is performed on all subsystems except the RF. After completion, the Error Condition “Align skipped: 50 MHz interference” or “Align skipped: 4.8 GHz interference” is set. In addition the Error Condition “Align Now, RF required” is set, and bits 11 and 12 are set in the Status Questionable Calibration register.

The query form of the remote commands (:CALibration[:ALL]? or *CAL?) invokes the alignment of all subsystems and returns a success or failure value. An interfering user signal is not grounds for failure; if the alignment was able to succeed on all portions but unable to align the RF because of an interfering signal, the resultant will be the success value.

Successful completion of **Align Now, All** will clear the “Align Now, All required” Error Condition, and clear bit 14 in the Status Questionable Calibration register. It will also begin the elapsed time counter for Last Align Now, All Time, and capture the Last Align Now, All Temperature.

If the Align RF subsystem succeeded in aligning (no interfering signal present), the elapsed time counter begins for Last Align Now, RF Time, and the temperature is captured for the Last Align Now, RF Temperature. In addition the Error Conditions “Align 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 “Align Now, All required” is set, 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.

Mode	All
Remote Command	:CALibration[:ALL] :CALibration[:ALL]?
Example	:CAL
Restriction and Notes	An interfering user supplied signal will result in the instrument requiring an Align Now, RF with the interfering signal removed.

Dependencies/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>
Remote Command Notes	<p>:CALibration[:ALL]? returns 0 if successful</p> <p>:CALibration[:ALL]? returns 1 if failed</p> <p>:CALibration[:ALL]? is the same as *CAL?</p> <p>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.</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.</p> <p>Successful completion will clear bit 14 in the Status Questionable Calibration register.</p> <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>
Key Path	System, Alignments, Align Now
SCPI Status Bits/OPC Dependencies	Bits 11, 12 or 14 may be set in the Status Questionable Calibration register.
Mode	All
Remote Command	*CAL?
Example	*CAL?
Restriction and Notes	Everything about :CALibration[:ALL]? is synonymous with *CAL? including all conditions, status register bits, and couplings
Remote Command 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>

All but RF

Immediately executes an alignment of all subsystems except the RF subsystem. The instrument will stop any measurement currently underway, perform the alignment, 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 “Align Now, RF required” is asserted 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 “Align Now, All required” is set, 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.

Mode	All
Remote Command	:CALibration:NRF :CALibration:NRF?
Example	:CAL:NRF
Dependencies/Couplings	Initializes the time for the Last Align Now, All Time. Records the temperature for the Last Align Now, All Temperature.

Remote Command	:CALibration:NRF? returns 0 if successful
Notes	: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”.
Key Path	System, Alignments, Align Now
SCPI Status Bits/OPC Dependencies	Bits 12 or 14 may be set in the Status Questionable Calibration register.

RF

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 raise the Error Condition “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.

A failure encountered during alignment will set the Error Condition “Align RF failed” and set bit 3 in the Status Questionable Calibration register.

Successful completion of **Align Now, RF** 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. It will also 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 “Align Now, RF required” is set, and bit 12 is set in the Status Questionable Condition register. None of the new alignment data is used.

Mode	All
Remote Command	:CALibration:RF :CALibration:RF?
Example	:CAL:RF
Restriction and Notes	An interfering user supplied signal will result in the instrument requiring an Align Now, RF with the interfering signal removed.
Dependencies/Couplings	Initializes the time for the Last Align Now, RF Time. Records the temperature for the Last Align Now, RF Temperature.
Remote Command 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 will clear bits 3, 11, and 12 in the Status Questionable Calibration register. A failure encountered during alignment will set the Error Condition “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.
Key Path	System, Alignments, Align Now
SCPI Status Bits/OPC Dependencies	Bits 11, 12 or 14 may be set in the Status Questionable Calibration register.

Advanced

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**

Characterize Preselector (Only with Option 507, 508, 513, or 526)

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.

Agilent 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 set the Error Condition “Characterize YTF failed” and set bit 9 in the Status Questionable Calibration register.

Successful completion of **Advanced, Characterize Preselector** will clear the Error Condition “Characterize YTF failed”, and clear bit 9 in the Status Questionable Calibration register. 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 must survive across the power cycle as this operation is performed infrequently.

Advanced, Characterize Preselector 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.

Mode	All
Remote Command	:CALibration:YTF :CALibration:YTF?
Example	:CAL:YTF
Restriction and Notes	For Option 507, 508, 513, and 526 only.
Dependencies/Couplings	Initializes the time for the Last Characterize Preselector Time. Records the temperature for the Last Characterize Preselector Temperature.

Remote Command	:CALibration:YTF? returns 0 if successful
Notes	<p>:CALibration:YTF? returns 1 if failed (including interfering user signal)</p> <p>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.</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.</p> <p>Successful completion will clear bit 9 in the Status Questionable Calibration register.</p> <p>A failure encountered during alignment will set the Error Condition “Characterize Preselector failed” and set bit 9 in the Status Questionable Calibration register.</p>
Key Path	System, Alignments, Align Now

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 which access this information obtain current values.

An example of the Show Alignment Statistics screen would be similar to:

Utility Functions System

Std Header	Product Number: N9020A Serial Number: US46340924 Firmware Revision: A.01.01		
Instrument Info	Time since start-up: Current Temperature:	300 hrs +28 degC	} Times & Temperature delta. Shown as "---" if none since start-up.
Auto Align Info	Time while Auto Align off:	90 min	
Std Align Now	Time since last Align Now All:	12.5 hrs	} Times & Temperature delta. Shown as "---" if none since start-up.
	Temperature since last Align Now All:	-1.3 degC	
	Time since last Align Now RF:	5 min	
If TG Option (Not Zorro1)	Temperature since last Align Now RF:	+0.1 degC	} Times & Temperature delta. Shown as "---" if none since start-up.
	Time since last Align TG:	2.5 hrs	
Opts 508,513 526	Temperature since last Align TG:	+0.2 degC	} Time & Temperature 'stamp'
	Last Characterize Preselector:	Jun 1, 2006 15:00:00	
	Last Characterize Preselector Temperature:	+32.1 degC	

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.

Mode	All
Example	SYST:SHOW ALIGN
Restriction and Notes	The values displayed on the screen are only updated upon entry to the screen and not updated while the screen is being displayed.
State Saved	No
Key Path	Visual annotation in the Show Alignment Statistics screen
Mode	All
Remote Command	:SYSTem: PON: TIME?
Example	:SYST: PON: TIME?
Restriction and Notes	Value is the time since the present application start-up in seconds.
State Saved	No
Key Path	Visual annotation in the Show Alignment Statistics screen

Mode	All
Remote Command	:CALibration:TEMPerature:CURRent?
Example	:CAL:TEMP:CURR?
Restriction and Notes	Value is in degrees Centigrade. Value is invalid if using default alignment data (Align Now, All required)
State Saved	No
Key Path	Visual annotation in the Show Alignment Statistics screen

Mode	All
Remote Command	:CALibration:TIME:LALL?
Example	:CAL:TIME:LALL?
Restriction and 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
Key Path	Visual annotation in the Show Alignment Statistics screen

Mode	All
Remote Command	:CALibration:TEMPerature:LALL?
Example	:CAL:TEMP:LALL?
Restriction and 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
Key Path	Visual annotation in the Show Alignment Statistics screen

Mode	All
Remote Command	:CALibration:TIME:LRF?
Example	:CAL:TIME:LRF?

Utility Functions
System

Restriction and 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

Key Path **Visual annotation in the Show Alignment Statistics screen**

Mode All

Remote Command :CALibration:TEMPerature:LRF?

Example :CAL:TEMP:LRF?

Restriction and 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

Key Path **Visual annotation in the Show Alignment Statistics screen**

Mode All

Remote Command :CALibration:TIME:LPreselector?

Example :CAL:TIME:LPR?

Restriction and Notes Value is 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.

State Saved No

Key Path **Visual annotation in the Show Alignment Statistics screen**

Mode All

Remote Command :CALibration:TEMPerature:LPreselector?

Example :CAL:TEMP:LPR?

Restriction and Notes Value is in degrees Centigrade at which the last successful Characterize Preselector was executed.

State Saved No

Key Path **Visual annotation in the Show Alignment Statistics screen**

Mode	All
Remote Command	:CALibration:AUTO:TIME:OFF?
Example	:CAL:AUTO:TIME:OFF?
Restriction and 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
Key Path	Visual annotation in the Show Alignment Statistics screen

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.

Mode	All
Remote Command	:CALibration:FREquency:REFerence:MODE CALibrated USER :CALibration:FREquency:REFerence:MODE?
Example	:CAL:FREQ:REF:MODE CAL
Restriction and Notes	If the value of the timebase is changed the alignment system automatically performs an alignment or alerts that an alignment is due.
Remote Command Notes	If the value of the timebase is changed the alignment system automatically performs an alignment or alerts that an alignment is due.
Preset	This is unaffected by Preset but is set to CALibrated on a "Restore System Defaults->Align".
State Saved	No
Key Path	System, Alignments

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.

Mode	All
Example	:CAL:FREQ:REF:MODE CAL
Key Path	System, Alignments, Timebase DAC

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.

Mode	All
Example	:CAL:FREQ:REF:MODE USER
Key Path	System, Alignments, Timebase DAC

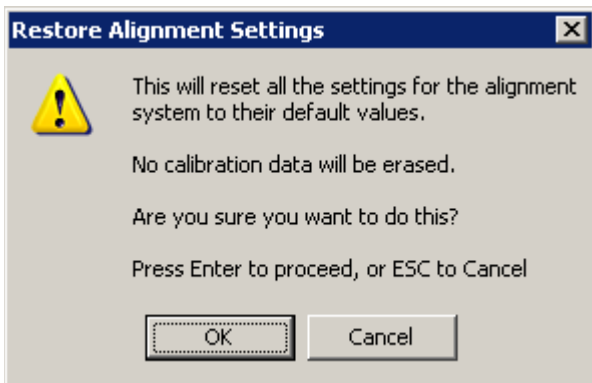
Mode	All
Remote Command	:CALibration:FREQuency:REFeRence:FINE <integer> :CALibration:FREQuency:REFeRence:FINE?
Example	:CAL:FREQ:REF:FINE 8191
Restriction and Notes	If the value of the timebase is changed the alignment system automatically performs an alignment or alerts that an alignment is due.
Dependencies/Couplings	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
Key Path	System, Alignments, Timebase DAC

Remote Command	:CALibration:FREQuency:REFerence:COARse <integer> :CALibration:FREQuency:REFerence:COARse?
Example	:CAL:FREQ:REF:COAR 8191
Dependencies/Couplings	Setting :CAL:FREQ:REF:COAR sets :CAL:FREQ:REF:MODE USER
Remote Command 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.

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:

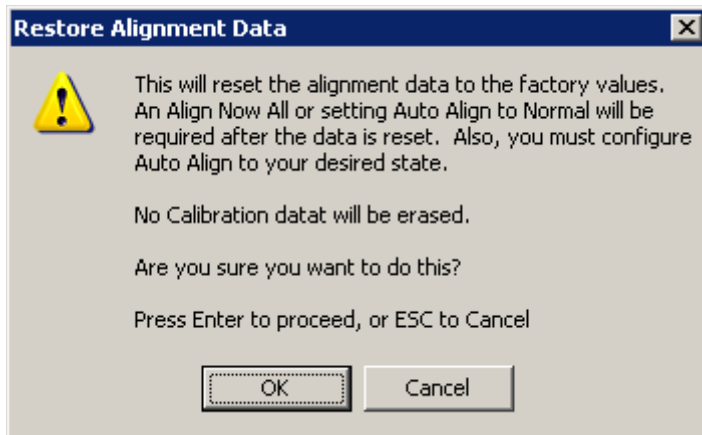
Parameter	Setting
Timebase DAC	Calibrated
Timebase DAC setting	Calibrated value
Auto Align State	Normal (if the instrument is not operating with default alignment data, Off otherwise)
Auto Align All but RF	Off
Auto Align Alert	Time & Temperature

Mode	All
Example	:SYST:DEF ALIG
Restriction and 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.
Key Path	System, Alignments

Restore Align Data

Initializes the alignment data to the factory default values. This action is normally not necessary. It is recommended if alignment errors occur. If alignment errors continue to occur after Restore Align Data, the instrument is in need of repair. Align Now, All must be executed to regain warranted operation, and the user is responsible for configuring Auto Align thereafter.

For front panel operation, confirmation is required before setting the alignment data to factory defaults. The confirmation dialog is:



The Error Condition “Align Now, All required” is set, and bit 14 in the Status Questionable Calibration register is set. Auto Align is set to Off.

Mode	All
Remote Command	:CALibration:DATA:DEFault
Example	:CAL:DATA:DEF
Dependencies/Couplings	Sets Auto Align to Off. Sets bit 14 in the Status Questionable Calibration register. The Error Condition “Align Now, All required” is set.
Key Path	System, Alignments

I/O Config

Activates a menu for identifying and changing the I/O configuration for remote control.

Key Path **System**

GPIB Address

Select the GPIB remote address.

Mode	All
Remote Command	:SYSTem:COMMunicate:GPIB[1] [:SELF]:ADDRess <integer> :SYSTem:COMMunicate:GPIB[1] [:SELF]:ADDRess?
Example	:SYST:COMM:GPIB:ADDR 17
Remote Command Notes	NOTE: 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
Key Path	System, I/O Config

SCPI LAN Menu

Activates a menu for identifying and changing the SCPI over 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 SACL capability.

Key Path **System, I/O Config**

SCPI Telnet

Turns the SCPI LAN telnet capability On or Off allowing you to limit SCPI access over

LAN through telnet.

Mode	All
Remote Command	:SYSTem:COMMunicate:LAN:SCPI:TELNet:ENABle OFF ON 0 1 :SYSTem:COMMunicate:LAN:SCPI:TELNet:ENABle?
Example	:SYST:COMM:LAN:SCPI:TELN:ENAB OFF
Preset	This is unaffected by Preset but is set to ON on a “Restore System Defaults->Misc”
State Saved	No
Range	On Off
Key Path	System, I/O Config, SCPI LAN

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.

Mode	All
Remote Command	:SYSTem:COMMunicate:LAN:SCPI:SOCKet:ENABle OFF ON 0 1 :SYSTem:COMMunicate:LAN:SCPI:SOCKet:ENABle?
Example	:SYST:COMM:LAN:SCPI:SOCK:ENAB OFF
Preset	This is unaffected by Preset but is set to ON on a “Restore System Defaults->Misc”
State Saved	No
Range	On Off
Key Path	System, I/O Config, SCPI LAN

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
Remote Command	:SYSTem:COMMunicate:LAN:SCPI:SOCKet:CONTRol?
Example	:SYST:COMM:LAN:SCPI:SOCK:CONT?
Preset	This is unaffected by Preset or “Restore System Defaults->Misc”.
State Saved	No
Range	0 to 65534

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 analyzer	gpib7
Emulated GPIB Logical Unit	The unique integer assigned to your device when it is being controlled using SICL LAN	8
Emulated GPIB Address	The emulated GPIB address assigned to your transmitter tester when it is a SICL server (the same as your GPIB address)	18

Mode	All
Remote Command	:SYSTem:COMMunicate:LAN:SCPI:SICL:ENABle OFF ON 0 1 :SYSTem:COMMunicate:LAN:SCPI:SICL:ENABle?
Example	:SYST:COMM:LAN:SCPI:SICL:ENAB OFF
Preset	This is unaffected by Preset, but is set to ON on a “Restore System Defaults->Misc”
State Saved	No

Range	On Off
Key Path	System, I/O Config, SCPI LAN

Query USB Connection (Remote Command Only)

Enables you to determine the speed of USB connection.

Mode	All
Remote Command	:SYSTem:COMMunicate:USB:CONNectioN?
Example	:SYST:COMM:USB:CONN?
Remote Command Notes	NONE – Indicates no USB connection has been made. LSpeed – Indicates a USB low speed connection (1.5 Mbps). Note: this is reserved for future use, the T+M488 protocol is not supported on low speed connections. HSPeed – Indicates that a USB high speed connection (480 Mbps) has been negotiated. FSPeed – Indicates that a USB full speed connection (12 Mbps) has been negotiated.
State Saved	No
Range	NONE LSPeed HSPeed FSPeed

USB Connection Status (Remote Command Only)

Enables you to determine the current status of the USB connection.

Mode	All
Remote Command	:SYSTem:COMMunicate:USB:STATus?
Example	:SYST:COMM:USB:STAT?

Remote Command Notes	<p>SUSPended – Indicates that the USB bus is currently in its suspended state. The bus is in the suspended state when:</p> <ul style="list-style-type: none"> The bus is not connected to any controller The controller is currently powered off The controller has explicitly placed the USB device into the suspended state. <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

USB Packet Count (Remote Command Only)

Enables you to determine the number of packets received and transmitted on the USB bus.

Mode	All
Remote Command	:SYSTem:COMMunicate:USB:PACKets?
Example	:SYST:COMM:USB:PACK?
Remote Command Notes	<p>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.</p> <p>The packet count is initialized to 0,0 when the instrument application is started.</p>
State Saved	No

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. The menu options are: Input/Output Settings, Power On, Alignments, Misc, All Modes, and All.

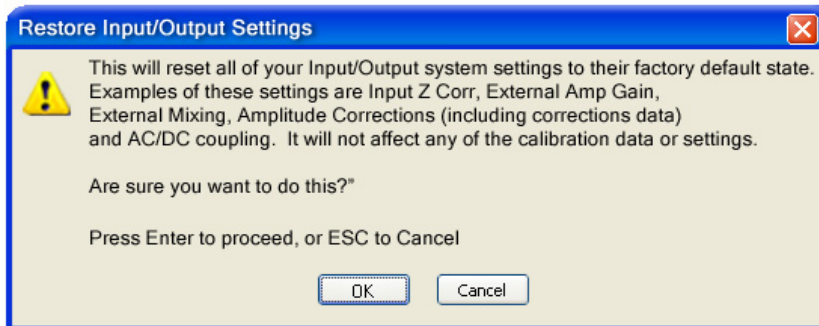
Mode	All
------	-----

Remote Command	:SYSTem:DEFault [ALL] ALIGn INPut MISC MODes PON
Example	SYST:DEF
State Saved	No
Key Path	System

Input/Output Settings

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:

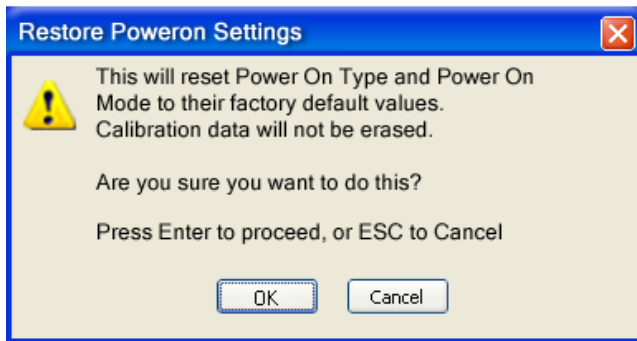


Example	:SYST:DEF INP
Key Path	System, Restore System Defaults

Power On

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 Mode reset to whatever the factory set as its default value.

Confirmation is required to restore the factory default values. The confirmation dialog is:



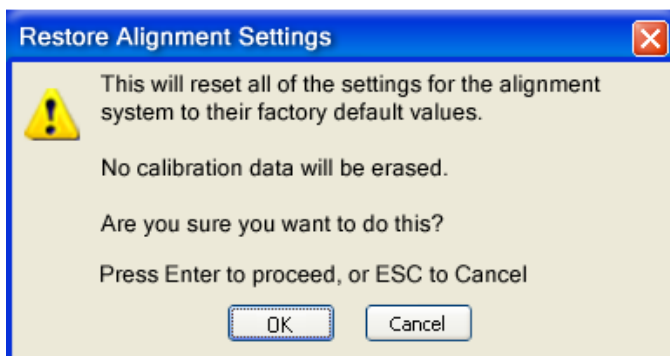
Example :SYST:DEF PON
Key Path **System, Restore System Defaults**

Align

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:



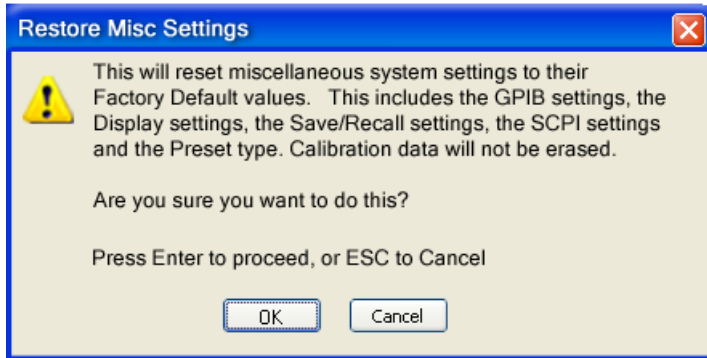
Example :SYST:DEF ALIG
Key Path **System, Restore System Defaults**

Misc

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
GPIB Address	18
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
SILC Server	ON
Display Intensity	100
Display Backlight	ON
Display Theme	TDColor
System Annotation	ON
The SYST:PRES:TYPE	MODE

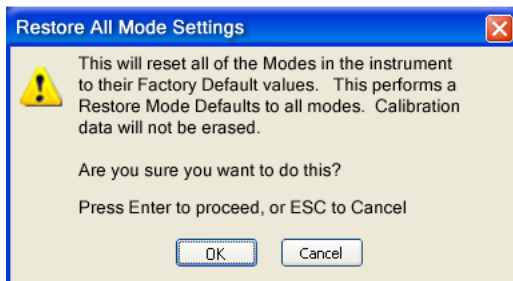
Confirmation is required to restore the factory default values. The confirmation dialog is:



Example :SYST:DEF MISC
Key Path **System, Restore System 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:

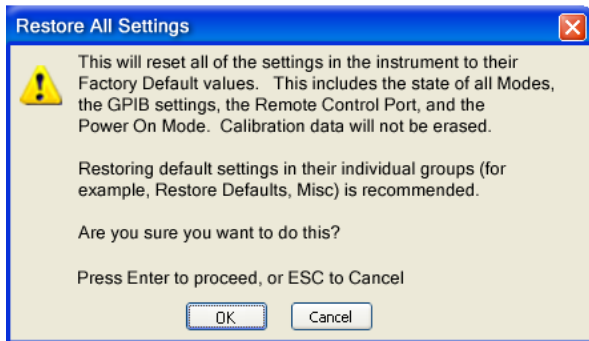


Example :SYST:DEF MOD
Dependencies/Couplings An All Mode will cause the currently running measurement to be aborted, mode switch to the power-on mode and activate the default measurement for the power-on mode. It gets the mode to a consistent state with all of the default couplings set.
Key Path **System, Restore System Defaults**

All

This is the catastrophic function that does 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:



Example	:SYST:DEF ALL
Dependencies/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.
Key Path	System, Restore System Defaults

Control Panel...

Opens the Windows Control Panel.

Pressing any key will cause the Control Panel to exit.

Remote Command	No remote command for this key.
Notes	
Key Path	System

Licensing...

Opens the license explorer.

For Help on this key, select Help in the menu bar at the top of the license explorer window.

Remote Command	No equivalent remote command for this key.
Notes	
Key Path	System

There are five remote commands available for licensing.

Remote Command	<code>:SYSTem:LKEY <"OptionInfo">, <"LicenseInfo"></code>
Example	<pre>SYST:LKEY "N9073A-1FP", "B043920A51CA" SYST:LKEY "N9073A-1F1,1.000", "5D71E9BA814C,13-aug-2005" SYST:LKEY "N9000-001,1.000", "8BEDC0B6D4AE,05-apr-2005,SN=0"</pre>
Remote Command Notes	<p>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.</p> <p>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 backward compatibility.</p>

Remote Command	<code>:SYSTem:LKEY:DELeTe <"OptionInfo">,<"LicenseInfo"></code>
Example	<pre>SYST:LKEY:DEL "N9073A-1FP", "B043920A51CA" SYST:LKEY:DEL "N9073A-1F1,1.000", "5D71E9BA814C, 13-aug-2005"</pre>

Remote Command 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 backward compatibility.

Remote Command :SYSTem:LKEY:LIST?

Remote Command Notes

Return Value:

An <arbitrary block data> of all the installed instrument licenses.

The format of each license is as follows.

<Feature>,<Version>,<Signature>,<Expiration Date>,<Serial Number for Transport>

Return Value Example:

#3136

N9073A-1FP,1.000,B043920A51CA

N9060A-2FP,1.000,4D1D1164BE64

N9020A-508,1.000,389BC042F920

N9073A-1F1,1.000,5D71E9BA814C,13-aug-2005<arbitrary block data> is:

#NMMM<data>

Where:

N is the number of digits that describes the number of MMM characters. For example if the data was 55 bytes, N would be 2.

MMM would be the ASCII representation of the number of bytes. In the previous example, N would be 55.

<data> ASCII contents of the data

Remote Command :SYSTem:LKEY? <"OptionInfo">

Example SYST:LKEY? "N9073A-1FP"

Remote Command 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.

Return Value:

<"LicenseInfo"> if the license is valid, null otherwise.

<"LicenseInfo"> contains the signature, the expiration date, and serial number if transportable.

Return Value Example:

"B043920A51CA"

Remote Command :SYSTem:HID?

Remote Command Notes Return value is the host ID as a string

Diagnostics

The Diagnostics key in the System menu gives you access to basic diagnostic capabilities of the instrument.

Key Path **System, More**

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.

Utility Functions
System

Std Header	Product Number: N9020A	
	Serial Number: US46340924	
	Firmware Revision: A.01.01	
Mechanical relays	Calibrator Switch Cycles:	1800
	AC/DC Switch Cycles:	60
	2 dB #1 Mechanical Atten Cycles	23489
	2 dB #2 Mechanical Atten Cycles	23400
	6 dB Mechanical Atten Cycles	500000
	10 dB Mechanical Atten Cycles	1000000
	20 dB Mechanical Atten Cycles	2500
	30 dB Mechanical Atten Cycles	60000
Odometer	High operating temperature extreme:	+37.2degC
	Low operating temperature extreme	+18.1degC
	Elapsed Time (on time) (hours):	1600

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.

Mode	All
Restriction and Notes	The values displayed on the screen are only updated upon entry to the screen and not updated while the screen is being displayed.
Key Path	System, Diagnostics

Each of the hardware statistic items can be queried via SCPI. Query the Mechanical Relay Cycle Count

Returns the count of mechanical relay cycles.

Remote Command :SYSTem:MRELay:COUNT?

Example :SYST:MREL:COUN?

Restriction and Notes The return value is a comma separated list of the individual counts for each mechanical relay.

The position of the relays in the list is:

“<Cal Signal>,<AC/DC>,<2dB #1 Atten>,<2dB #2 Atten>,<6dB Atten>,<10dB Atten>,<20dB Atten>,<30dB Atten>”

Remote Command Query Only
Notes

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

Remote Command :SYSTem:TEMPerature:LEXTreme?

Example :SYST:TEMP:LEXT?

Restriction and Notes Value is in degrees Celsius at which the lowest operating temperature has been recorded since 1st power-up.

State Saved No

Returns the high operating temperature extreme value. The value survives a power-cycle and is the temperature extreme encountered since the value was reset by the factory or service center.

Mode All

Remote Command :SYSTem:TEMPerature:HEXTreme?

Example :SYST:TEMP:HEXT?

Restriction and Notes Value is in degrees Celsius at which the highest operating temperature has been recorded since 1st power-up.

State Saved No

Query the Elapsed Time since 1st power on

Returns the elapsed on-time since 1st power-on (odometer).

Remote Command :SYSTem:PON:ETIMe?

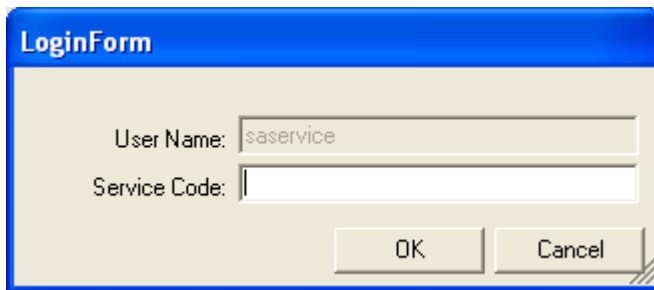
Example :SYST:PON:ETIM?

Remote Command Query Only

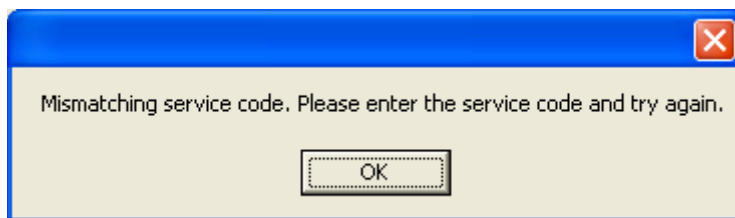
Notes

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”. 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 the user is provided the following dialog:



Restriction and Notes

Password is required to access this menu.

Key Path

System, Diagnostics

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	System
----------	---------------

List installed Options (Remote Command Only)

Lists the installed options that pertain to the instrument (signal analyzer)..

Mode	All
Remote Command	:SYSTem:OPTions?
Example	:SYST:OPT?
Restriction and 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

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
------	-----

Remote Command	:SYSTem:KLOCK OFF ON 0 1 :SYSTem:KLOCK?
Example	:SYST:KLOC ON
Remote Command 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

List SCPI Commands (Remote Command Only)

Outputs a list of the valid SCPI commands for the currently selected Mode.

Remote Command	:SYSTem:HELP:HEADers?
Example	:SYST:HELP:HEAD?
Remote Command Notes	The output is an IEEE Block format with each command separated with the New-Line character (hex 0x0A)

SCPI Version Query (Remote Command Only)

Returns the SCPI version number with which the instrument complies. The SCPI industry standard changes regularly. This command indicates the version used when the instrument SCPI commands were defined.

Remote Command	:SYSTem:VERSion?
Example	:SYST:VERS?

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
Remote Command	:SYSTem:DATE "<year>,<month>,<day>" :SYSTem:DATE?

Example	:SYST:DATE "2006,05,26"
Remote Command	<year> is the four digit representation of year. (for example, 2006)
Notes	<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

Time (Remote Command Only)

Sets or queries the time in the instrument.

Mode	All
Remote Command	:SYSTem:TIME "<hour>, <minute>, <second>" :SYSTem:TIME?
Example	:SYST:TIME "13,05,26"
Remote Command	<hour> is the two digit representation of the hour in 24 hour format
Notes	<minute> is the two digit representation of minute <day> is the two digit representation of second

Preset

Mode Preset

The Mode preset is the most common way to get the active mode back to a known state. It will keep you in the currently active mode and reset the mode settings to their mode preset state. It will never cause a mode switch. It does a partial preset. It does not affect any mode persistent settings or any system settings.

The **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 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.

Remote Command	:SYSTem:PRESet
Example	:SYST:PRES
Restriction and Notes	Clears all pending OPC bits. The Status Byte is set to 0.
Dependencies/Couplings	A Mode Preset will cause the currently running measurement to be aborted and cause the default measurement to be active. Mode Preset gets the mode to a consistent state with all of the default couplings set.
Remote Command Notes	*RST is preferred over :SYST:PRES for remote operation. *RST does a Mode Preset as done by the :SYST:PRES command and it sets the measurement mode to Single measurement rather than Continuous for optimal remote control throughput.
Key Path	Front-panel key

How-To Preset

The table below shows all possible presets, their corresponding SCPI commands and front panel access. Instrument settings depend on the current measurement context. Some settings are local to the current measurement, some are global (common) across all the measurement 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.

The Auto Couple front panel key is a Meas local key. It sets all Auto/Man parameter couplings in the measurement to Auto. Any Auto/Man selection that is local to the other measurements in the mode will not be affected by Auto Couple.

The Meas Preset key is a Meas local key. Meas Preset resets all the variables local to the current measurement except the persistent ones.

The Mode Preset (front-panel key on front panel) resets all the current mode's Meas local and Meas global variables except the persistent ones.

The Restore Mode Defaults key 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

Restore Mode Defaults

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 Restore System Defaults. This function does reset mode data; as well as settings.

Remote Command	:INSTrument:DEFault
Example	:INST:DEF
Restriction and Notes	A pop-up message comes up saying: “If you are sure, press key again”.
Dependencies/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.
Remote Command Notes	Clears all pending OPC bits. The Status Byte is set to 0.
Key Path	Mode Setup

*RST (Remote Command Only)

*RST is equivalent to :SYST:PRES;:INIT:CONT OFF which is a Mode Preset in Single measurement state. This remote command is preferred over Mode Preset remote command -:SYST:PRES, as optimal remote programming occurs with the instrument in single measurement state.

Remote Command	*RST
Example	*RST
Restriction and Notes	Clears all pending OPC bits and the Status Byte is set to 0.
Dependencies/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.
Remote Command Notes	Sequential

User Preset

The User Preset key opens up a menu that gives you three choices – execute the **User Preset** by pressing the **User Preset** softkey, User Preset all of the modes in the analyzer by pressing the **User Preset All Modes** softkey, and save the current state for the current mode by pressing the **Save User Preset** softkey.

User Preset

User Preset behaves similarly to **Recall State** in that it recalls a hidden Save State file. However, since each Mode has its own **User Preset** file, **User Preset** will never cause a mode switch, whereas recalling a Save State file may cause a mode switch, if the Save State file was saved while in a different mode.

The User Preset file is a Save State file. **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`. So for any given Mode, the only way to perform a User Preset is from that Mode, not from any other Mode. The user has no control over the user preset filename and has no direct access to the user preset file.

User Preset recalls a mode's state which includes all of the variables affected by doing a Mode Preset. It not only recalls Mode Preset settings, but it also recalls all of the mode persistent settings. User Preset also recalls all of the Input/Output system settings 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, so 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.

User Preset 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.

Remote Command `:SYSTem:PRESet:USER`

Example	:SYST:PRES:USER:SAVE :SYST:PRES:USER
Restriction and Notes	Clears all pending OPC bits. The Status Byte is set to 0.
Dependencies/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.
Remote Command Notes	:SYST:PRES:USER:SAVE is used to save the current state as the user preset state.
Key Path	User Preset

User Preset All Modes

User Preset All Modes behaves similarly to Power On User Preset, since it 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.

User Preset 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.

Remote Command	:SYSTem:PRESet:USER:ALL
Example	:SYST:PRES:USER:SAVE :SYST:PRES:USER:ALL
Restriction and Notes	Clears all pending OPC bits. The Status Byte is set to 0.

Dependencies/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.
Remote Command Notes	:SYST:PRES:USER:SAVE is used to save the current state as the user preset state.
Key Path	User Preset

Save User Preset

Save User Preset saves the currently active mode and its state. The way the user recalls this User Preset file is 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.

Remote Command	:SYSTem:PRESet:USER:SAVE
Example	:SYST:PRES:USER:SAVE
Restriction and 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.
Key Path	User Preset

File

Opens a menu of keys which access various standard and custom Windows dialogs. Pressing any other front-panel key exits any of these dialogs.

File Explorer

Opens the standard Windows File Explorer. Pressing any front panel key closes the Explorer application.

File Explorer opens up in My Documents.

Page Setup

Refer to your Microsoft Windows Operating System manual.

Print Theme – Remote Command

The graphical user interface contains a selection for choosing the Theme to use when printing. An equivalent remote command is provided. Refer to the View/Display section for more detail on Themes.

Mode	All
Remote Command	:SYSTem:PRINT:THEMe TDCOLOR TDMonochrome FCOLor FMONochrome :SYSTem:PRINT:THEMe?
Example	:SYST:PRIN:THEM FCOL
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

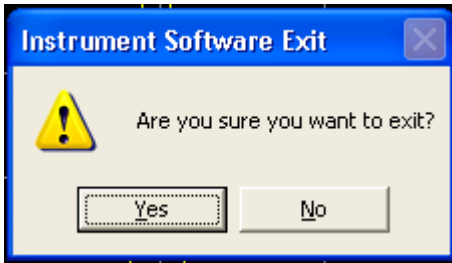
Print

Refer to your Microsoft Windows Operating System manual.

Exit

This key, when pressed, will exit the Instrument Application. A dialog box will be used to

confirm that the user intended to exit the application:



Mode

All

Key Path

File, Exit

Print

The Print front-panel key is equivalent to performing a File, Print, OK. It immediately performs the currently configured Print to the current printer.

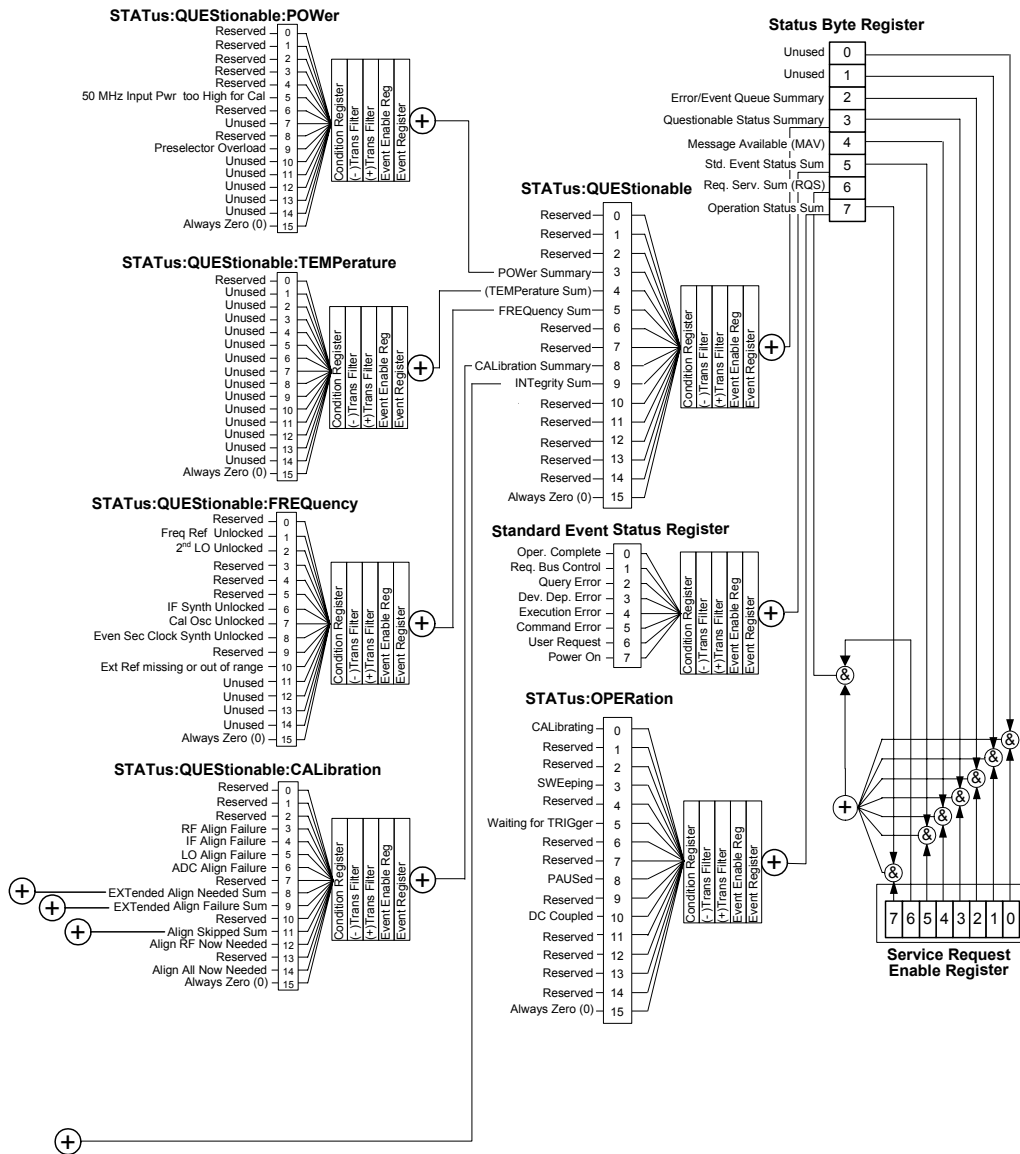
Key Path

Front-panel key

STATUS Subsystem (No equivalent front panel keys)

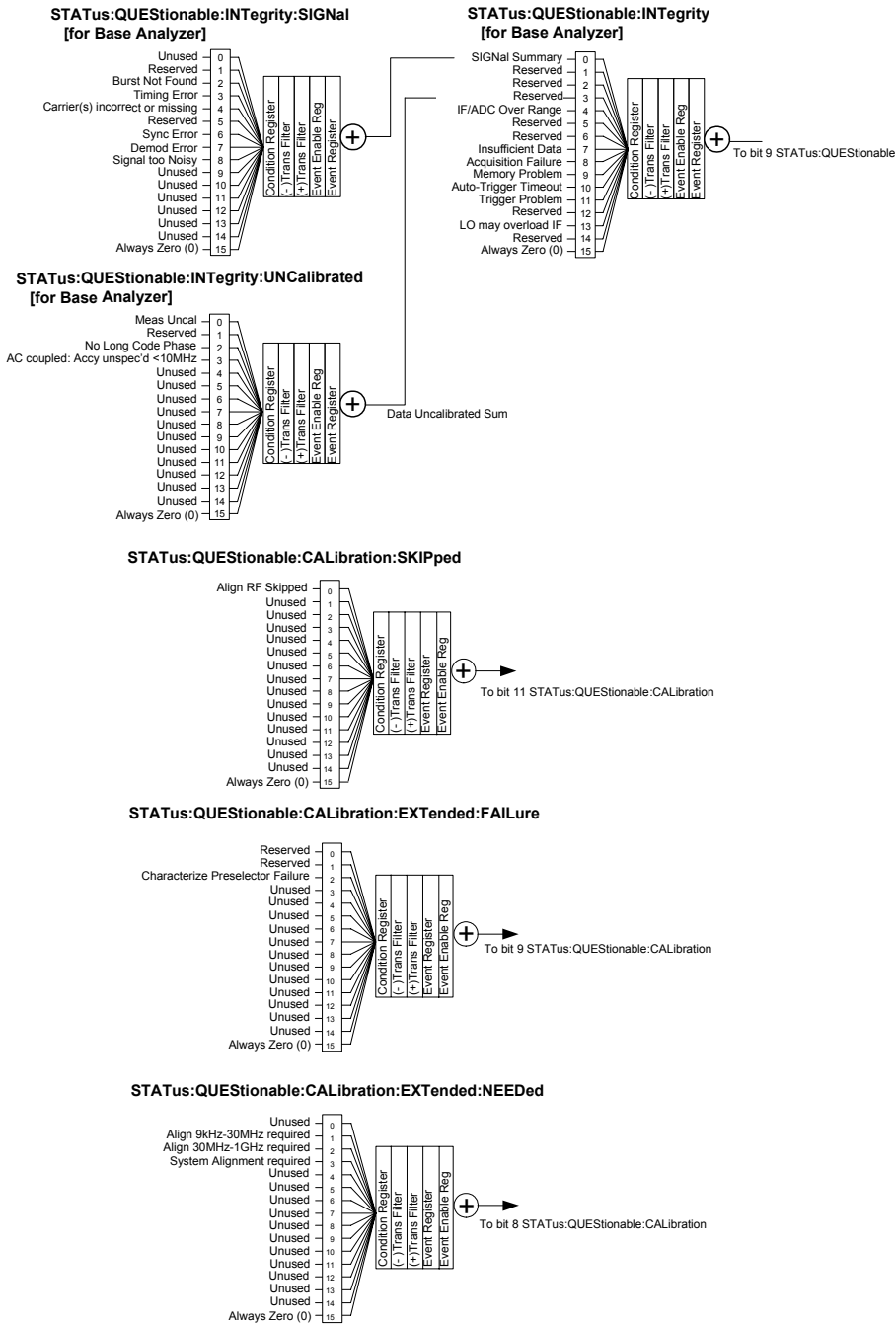
The following graphics show the current MXA Status Register Subsystem implementation.

MXA Status Byte Register System



Utility Functions
STATUS Subsystem (No equivalent front panel keys)

Additional Registers:



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.

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:
 1. Determine which register contains the bit that reports the condition.
 2. Send the unique SCPI query that reads that register.
 3. 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

Decimal Value																			
	32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1			
Bit Number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0			

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.

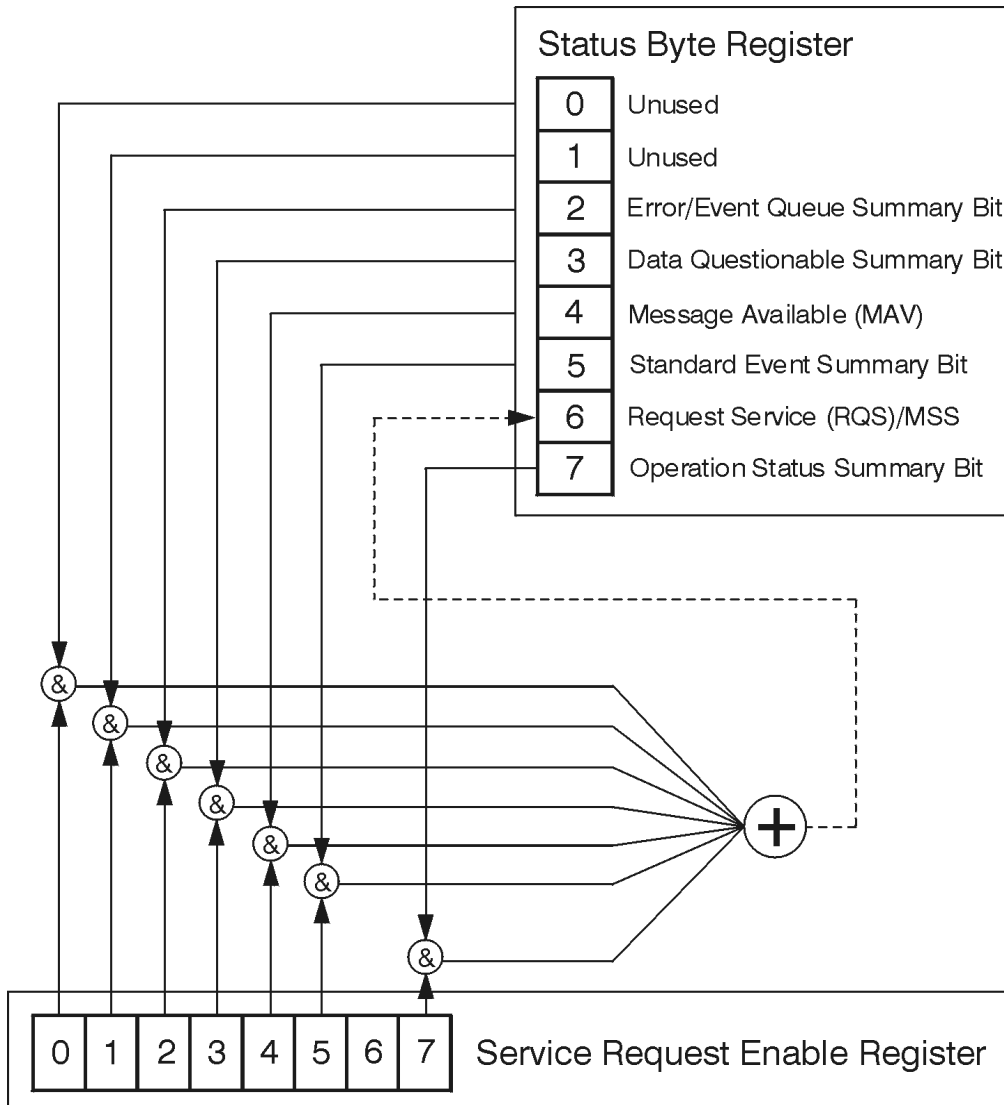
If the status register is configured to SRQ on end-of-measurement and the measurement is in continuous mode, then restarting a measurement (INIT command) can cause the measuring bit to pulse low. This causes an SRQ when you have not actually reached the "end-of-measurement" condition. To avoid this:

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. |

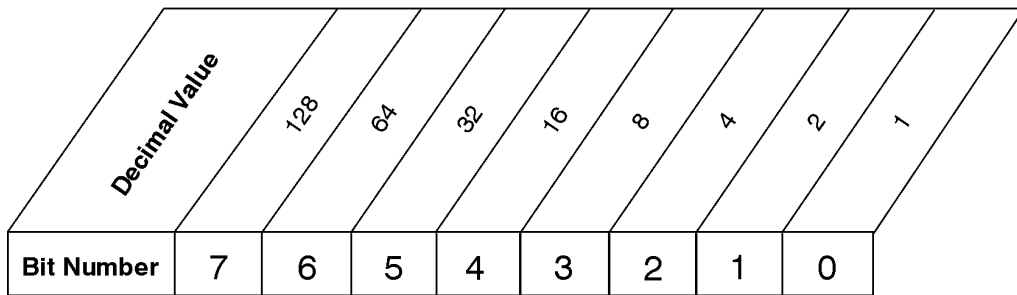
To query the status byte register, send the command *STB?. The response will be the decimal sum of the bits which are set to 1. For example, if bit number 7 and bit number 3 are set to 1, the decimal sum of the 2 bits is 128 plus 8. So the decimal value 136 is returned. The *STB command does not clear 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).

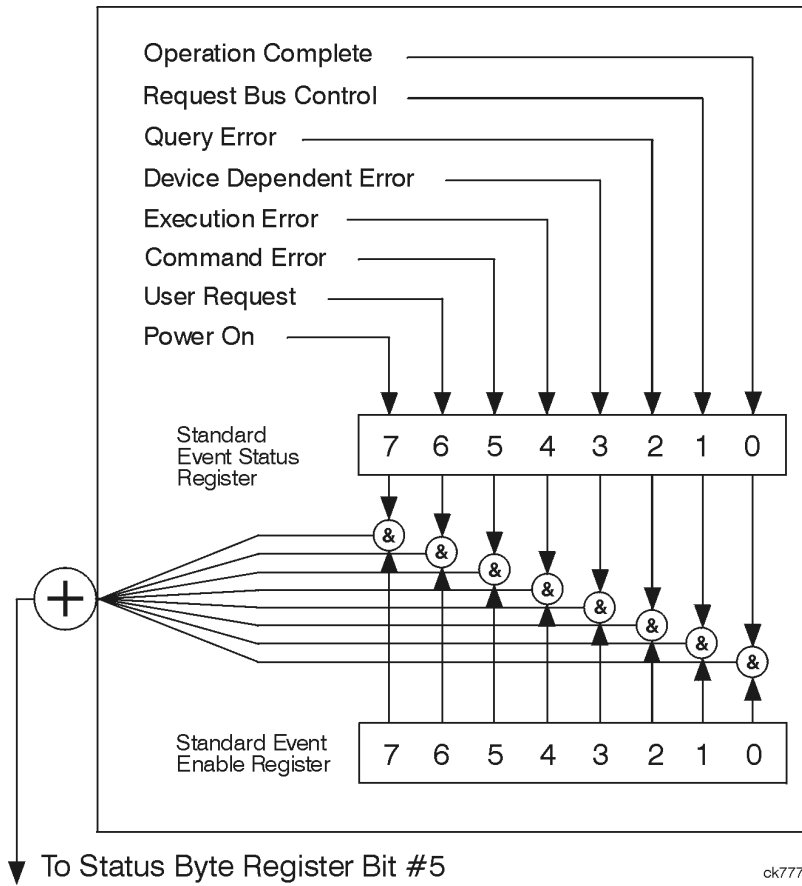


`*SRE <num>`
`*SRE?`

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	Reserved	Command Error	Execution Error	Device Dependent Error	Query Error	Request Control	Operation Complete

*ESR?

Standard Event Status Register

ck727a

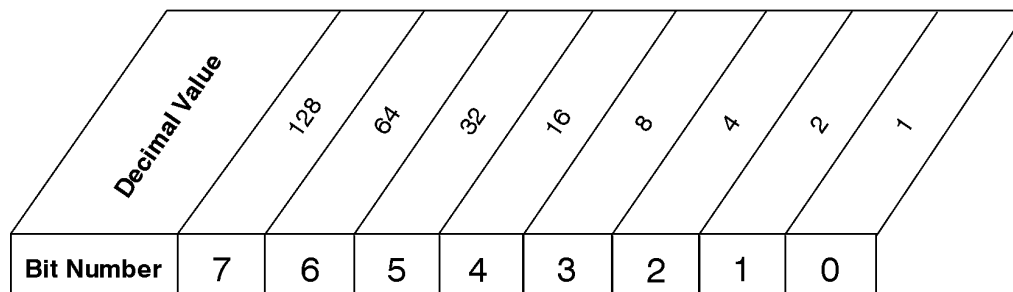
Bit Description

- 0 A 1 in this bit position indicates that all pending operations were completed following execution of the *OPC command.
- 1 This bit is for GPIB handshaking to request control. Currently it is set to 0 because there are no implementations where the spectrum analyzer controls another instrument.
- 2 A 1 in this bit position indicates that a query error has occurred. Query errors have SCPI error numbers from -499 to -400.
- 3 A 1 in this bit position indicates that a device dependent error has occurred. Device dependent errors have SCPI error numbers from -399 to -300 and 1 to 32767.
- 4 A 1 in this bit position indicates that an execution error has occurred. Execution errors have SCPI error numbers from -299 to -200.
- 5 A 1 in this bit position indicates that a command error has occurred. Command errors have SCPI error numbers from -199 to -100.
- 6 A 1 in this bit position indicates that the LOCAL key has been pressed. This is true even if the instrument is in local lockout mode.
- 7 A 1 in this bit position indicates that the instrument has been turned off and then on.

The standard event status register is used to determine the specific event that set bit 5 in the status byte register. To query the standard event status register, send the 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 currently only valid for Modes: ESA/PSA: Spectrum Analysis, Phase Noise, and ESA: Bluetooth, cdmaOne, GSM
5	Waiting for trigger	The instrument is waiting for the trigger conditions to be met, then it will trigger a sweep or measurement.
8	Paused	The instrument is paused (waiting) because you have pressed the Pause Meas Control key or send the INITiate:PAUSE command. Bit is currently only valid for Modes: ESA/PSA: Spectrum Analysis, Phase Noise, and ESA: Bluetooth, cdmaOne, GSM

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

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

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

Mode	All
Remote Command	:STATus:OPERation:CONDition?
Example	STAT:OPER:COND?

Preset	0
SCPI Status Bits/OPC Dependencies	Sequential command

Operation Enable

This command determines which bits in the Operation Event register, will set the Operation Status Summary bit (bit 7) in the Status Byte Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

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.

R&D: There is little reason to have any bits enabled for typical manufacturing tests. Enabling bits in this register would be of more value during test development.

Mode	All
Remote Command	:STATus:OPERation:ENABLE <integer> :STATus:OPERation:ENABLE?
Example	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
SCPI Status Bits/OPC Dependencies	Sequential command

Operation Event Query

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

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
Remote Command	:STATus:OPERation[:EVENT]?
Example	STAT:OPER?
Preset	0

SCPI Status Bits/OPC Sequential command
 Dependencies

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
Remote Command	:STATus:OPERation:NTRansition <integer> :STATus:OPERation:NTRansition?
Example	STAT:OPER:NTR 1 Align Now operation complete will be reported to the Status Byte Register.
Preset	0
Min	0
Max	32767
SCPI Status Bits/OPC Dependencies	Sequential command

Operation Positive Transition

This command determines which bits in the Operation Condition register will set the corresponding bit in the Operation Event register when the condition register bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Mode	All
Remote Command	:STATus:OPERation:PTRansition <integer> :STATus:OPERation:PTRansition?
Example	STAT:OPER:PTR 1 Align Now operation beginning will be reported to the Status Byte Register.
Preset	32767
Min	0
Max	32767

SCPI Status Bits/OPC Sequential command
 Dependencies

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.

Remote Command :STATus:PRESet

Example STAT:PRES

Questionable Register

Questionable Condition

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

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

Mode All

Remote Command :STATus:QUEStionable:CONDition?

Example STAT:QUES:COND?

Preset 0

SCPI Status Bits/OPC Sequential command
 Dependencies

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.

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
Remote Command	:STATus:QUESTionable:ENABle 16 Sets the register so that temperature summary will be reported to the Status Byte Register :STATus:QUESTionable:ENABle?
Example	STAT:OPER:PTR 1 Align Now operation beginning will be reported to the Status Byte Register.
Preset	0
Min	0
Max	32767
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Event Query

This query returns the decimal value of the sum of the bits in the Questionable Event register.

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
Remote Command	:STATus:QUESTionable[:EVENT]?
Example	STAT:QUES?
Preset	0
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Negative Transition

This command determines which bits in the Questionable Condition register will set the corresponding bit in the Questionable Event register when the condition register bit has a negative transition (1 to 0). The variable <integer> is the sum of the decimal values of the

bits that you want to enable.

Mode	All
Remote Command	:STATus:QUEStionable:NTRansition 16 Temperature summary 'questionable cleared' will be reported to the Status Byte Register. :STATus:QUEStionable:NTRansition?
Example	STAT:QUES:NTR 16 Temperature summary 'questionable cleared' will be reported to the Status Byte Register.
Preset	0
Min	0
Max	32767
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Positive Transition

This command determines which bits in the Questionable Condition register will set the corresponding bit in the Questionable Event register when the condition register bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Mode	All
Remote Command	:STATus:QUEStionable:PTRansition <integer> :STATus:QUEStionable:PTRansition?
Example	STAT:QUES:PTR 16 Temperature summary 'questionable asserted' will be reported to the Status Byte Register.
Preset	32767
Min	0
Max	32767
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Calibration Register

Questionable Calibration Condition

This query returns the decimal value of the sum of the bits in the Questionable Calibration Condition register.

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

Mode	All
Remote Command	:STATus:QUESTionable:CALibration:CONDition?
Example	STAT:QUES:CAL:COND?
Preset	0
SCPI Status Bits/OPC	Sequential command
Dependencies	

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
Remote Command	:STATus:QUESTionable:CALibration:ENABle <integer> :STATus:QUESTionable:CALibration:ENABle?
Example	STAT:QUES:CAL:ENAB 16384 Can be used to query if an alignment is needed, if you have turned off the automatic alignment process.
Min	0
Max	32767
SCPI Status Bits/OPC	Sequential command
Dependencies	

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
Remote Command	:STATus:QUESTionable:CALibration[:EVENT]?
Example	STAT:QUES:CAL?

Preset	0
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Calibration Negative Transition

This command determines which bits in the Questionable Calibration Condition register will set the corresponding bit in the Questionable Calibration Event register when the condition register bit has a negative transition (1 to 0). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Mode	All
Remote Command	:STATus:QUEStionable:CALibration:NTRansition <integer> :STATus:QUEStionable:CALibration:NTRansition?
Example	STAT:QUES:CAL:NTR 16384 Alignment is not required.
Preset	0
Min	0
Max	32767
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Calibration Positive Transition

This command determines which bits in the Questionable Calibration Condition register will set the corresponding bit in the Questionable Calibration Event register when the condition register bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Mode	All
Remote Command	:STATus:QUEStionable:CALibration:PTRansition <integer> :STATus:QUEStionable:CALibration:PTRansition?
Example	STAT:QUES:CAL:PTR 16384 Alignment is required.
Preset	32767
Min	0
Max	32767

SCPI Status Bits/OPC Sequential command
 Dependencies

Questionable Calibration Skipped Register

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

Remote Command :STATus:QUESTionable:CALibration:SKIPped:CONDition?

Example STAT:QUES:CAL:SKIP:COND?

Preset 0

SCPI Status Bits/OPC Sequential command
 Dependencies

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

Remote Command :STATus:QUESTionable:CALibration:SKIPped:ENABle
 <integer>
 :STATus:QUESTionable:CALibration:SKIPped:ENABle?

Example STAT:QUES:CAL:SKIP:ENAB 1 Can be used to query if an EMI alignment skipped condition is detected

Preset 32767

Min 0

Max 32767

SCPI Status Bits/OPC Sequential command
Dependencies

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

Remote Command :STATus:QUESTionable:CALibration:SKIpped[:EVENT]?

Example STAT:QUES:CAL:SKIP?

Preset 0

SCPI Status Bits/OPC Sequential command
Dependencies

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

Remote Command :STATus:QUESTionable:CALibration:SKIpped:NTRansition <integer>
:STATus:QUESTionable:CALibration:SKIpped:NTRansition?

Example STAT:QUES:CAL:SKIP:NTR 1 Align RF skipped is not required.

Preset 0

Min 0

Max 32767

SCPI Status Bits/OPC Sequential command
 Dependencies

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

Remote Command :STATus:QUEStionable:CALibration:SKIPIped:PTRansiti
 on <integer>
 :STATus:QUEStionable:CALibration:SKIPIped:PTRansiti
 on?

Example STAT:QUES:CAL:SKIP:PTR 1 Align RF skipped is required.

Preset 32767

Min 0

Max 32767

SCPI Status Bits/OPC Sequential command
 Dependencies

Questionable Calibration Extended Failure Register

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

Remote Command :STATus:QUEStionable:CALibration:EXTended:FAILure:CONDition?

Example STAT:QUES:CAL:EXT:FAIL:COND?

Preset 0

SCPI Sequential command
 Status
 Bits/OPC
 Dependencies

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

Remote Command :STATus:QUESTionable:CALibration:EXTended:FAILure:ENABle
 <integer>
 :STATus:QUESTionable:CALibration:EXTended:FAILure:ENABle?

Example STAT:QUES:CAL:EXT:FAIL:ENAB 1 Can be used to query if an EMI
 conducted alignment is needed.

Preset 32767

Min 0

Max 32767

SCPI Status Bits/OPC Sequential command
 Dependencies

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

Remote Command :STATus:QUESTionable:CALibration:EXTended:FAILure[:EVENT]?

Example STAT:QUES:CAL:EXT:FAIL?

Preset	0
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Calibration Extended Failure Negative Transition

This command determines which bits in the Questionable Calibration Extended Failure Condition register will set the corresponding bit in the Questionable Calibration Extended Failure Event register when the condition register bit has a negative transition (1 to 0). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Mode	All
Remote Command	:STATus:QUEStionable:CALibration:EXTended:FAILure:NTRansition <integer> :STATus:QUEStionable:CALibration:EXTended:FAILure:NTRansition?
Example	STAT:QUES:CAL:EXT:FAIL:NTR 1 EMI conducted align failure is not required.
Preset	0
Min	0
Max	32767
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Calibration Extended Failure Positive Transition

This command determines which bits in the Questionable Calibration Extended Failure Condition register will set the corresponding bit in the Questionable Calibration Extended Failure Event register when the condition register bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

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

Max 32767
 SCPI Status Sequential command
 Bits/OPC
 Dependencies

Questionable Calibration Extended Needed Register

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
Remote Command :STATus:QUEStionable:CALibration:EXTended:NEEDED:CONDition?
 Example STAT:QUES:CAL:EXT:NEED:COND?
 Preset 0
 SCPI Status Sequential command
 Bits/OPC
 Dependencies

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
Remote Command :STATus:QUEStionable:CALibration:EXTended:NEEDED:ENABle <integer>
 :STATus:QUEStionable:CALibration:EXTended:NEEDED:ENABle?
 Example STAT:QUES:CAL:EXT:NEED:ENAB 2 Can be used to query if an EMI conducted alignment is needed.
 Preset 32767

Min	0
Max	32767
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Calibration Extended Needed Event Query

This query returns the decimal value of the sum of the bits in the Questionable Calibration Extended Needed Event register.

NOTE	The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.
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Mode	All
Remote Command	:STATus:QUESTionable:CALibration:EXTended:NEEDED[:EVENT]?
Example	STAT:QUES:CAL:EXT:NEED?
Preset	0
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Calibration Extended Needed Negative Transition

This command determines which bits in the Questionable Calibration Extended Needed Condition register will set the corresponding bit in the Questionable Calibration Extended Needed Event register when the condition register bit has a negative transition (1 to 0). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Mode	All
Remote Command	:STATus:QUESTionable:CALibration:EXTended:NEEDED:NTRansition <integer> :STATus:QUESTionable:CALibration:EXTended:NEEDED:NTRansition?
Example	STAT:QUES:CAL:EXT:NEED:NTR 2 Align EMI conducted is not required.
Preset	0

Min	0
Max	32767
SCPI Status	Sequential command
Bits/OPC	
Dependencies	

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
Remote Command	:STATus:QUESTionable:CALibration:EXTended:NEEDED:PTRansition <integer> :STATus:QUESTionable:CALibration:EXTended:NEEDED:PTRansition?
Example	STAT:QUES:CAL:EXT:NEED:PTR 2 Align EMI conducted is required.
Preset	32767
Min	0
Max	32767
SCPI Status	Sequential command
Bits/OPC	
Dependencies	

Questionable Frequency Register

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
Remote Command	:STATus:QUESTionable:FREQuency:CONDition?
Example	STAT:QUES:FREQ:COND?

Preset	0
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Frequency Enable

This command determines which bits in the Questionable Frequency Condition Register will set bits in the Questionable Frequency Event register, which also sets the Frequency Summary bit (bit 5) in the Questionable Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

Mode	All
Remote Command	:STATus:QUESTionable:FREQuency:ENABle <integer> :STATus:QUESTionable:FREQuency:ENABle?
Example	STAT:QUES:FREQ:ENAB 2 Frequency Reference Unlocked will be reported to the Frequency Summary of the Status Questionable register.
Preset	32767
Min	0
Max	32767
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Frequency Event Query

This query returns the decimal value of the sum of the bits in the Questionable Frequency Event register.

NOTE The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

Mode	All
Remote Command	:STATus:QUESTionable:FREQuency[:EVENT]?
Example	STAT:QUES:FREQ?
Preset	0

SCPI Status Bits/OPC Sequential command
Dependencies

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
Remote Command	:STATus:QUEStionable:FREQuency:NTRansition <integer> :STATus:QUEStionable:FREQuency:NTRansition?
Example	STAT:QUES:FREQ:NTR 2 Frequency Reference 'regained lock' will be reported to the Frequency Summary of the Status Questionable register.
Preset	0
Min	0
Max	32767
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Frequency Positive Transition

This command determines which bits in the Questionable Frequency Condition register will set the corresponding bit in the Questionable Frequency Event register when the condition register bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Mode	All
Remote Command	:STATus:QUEStionable:FREQuency:PTRansition <integer> :STATus:QUEStionable:FREQuency:PTRansition?
Example	STAT:QUES:FREQ:PTR 2 Frequency Reference 'became unlocked' will be reported to the Frequency Summary of the Status Questionable register.
Preset	32767
Min	0

Max	32767
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Integrity Register

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
Remote Command	:STATus:QUEStionable:INTEgrity:CONDition?
Example	STAT:QUES:INT:COND?
Preset	0
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Integrity Enable

This command determines which bits in the Questionable Integrity Condition Register will set bits in the Questionable Integrity Event register, which also sets the Integrity Summary bit (bit 9) in the Questionable Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

Mode	All
Remote Command	:STATus:QUEStionable:INTEgrity:ENABle <integer> :STATus:QUEStionable:INTEgrity:ENABle?
Example	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

SCPI Status Bits/OPC Sequential command
 Dependencies

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

Remote Command :STATus:QUESTionable:INTEgrity[:EVENT]?

Example STAT:QUES:INT?

Preset 0

SCPI Status Bits/OPC Sequential command
 Dependencies

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

Remote Command :STATus:QUESTionable:INTEgrity:NTRansition
 <integer>
 :STATus:QUESTionable:INTEgrity:NTRansition?

Example 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

SCPI Status Bits/OPC Sequential command
 Dependencies

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
Remote Command	:STATus:QUEStionable:INTEgrity:PTRansition <integer> :STATus:QUEStionable:INTEgrity:PTRansition?
Example	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
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Integrity Signal Register

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
Remote Command	:STATus:QUEStionable:INTEgrity:SIGNAL:CONDition?
Example	STAT:QUES:INT:SIGN:COND?
Preset	0

SCPI Status Bits/OPC Sequential command
 Dependencies

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

Remote Command :STATus:QUESTionable:INTEgrity:SIGNal:ENABle
 <integer>
 :STATus:QUESTionable:INTEgrity:SIGNal:ENABle?

Example STAT:QUES:INT:SIGN:ENAB 4 Burst Not Found will be reported to the Integrity Summary of the Status Questionable register.

Preset 32767

Min 0

Max 32767

SCPI Status Bits/OPC Sequential command
 Dependencies

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

Remote Command :STATus:QUESTionable:INTEgrity:SIGNal[:EVENT]?

Example STAT:QUES:INT:SIGN?

Preset 0

SCPI Status Bits/OPC Sequential command
Dependencies

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
Remote Command	:STATus:QUEStionable:INTEgrity:SIGNal:NTRansition <integer> :STATus:QUEStionable:INTEgrity:SIGNal:NTRansition?
Example	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
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Integrity Signal Positive Transition

This command determines which bits in the Questionable Integrity Signal Condition register will set the corresponding bit in the Questionable Integrity Signal Event register when the condition register bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Mode	All
Remote Command	:STATus:QUEStionable:INTEgrity:SIGNal:PTRansition <integer> :STATus:QUEStionable:INTEgrity:SIGNal:PTRansition?
Example	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
 SCPI Status Bits/OPC Sequential command
 Dependencies

Questionable Integrity Uncalibrated Register

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
Remote Command :STATus:QUESTionable:INTEgrity:UNCalibrated:CONDition?
 Example STAT:QUES:INT:UNC:COND?
 Preset 0
 SCPI Status Sequential command
 Bits/OPC
 Dependencies

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
Remote Command :STATus:QUESTionable:INTEgrity:UNCalibrated:ENABle
 :STATus:QUESTionable:INTEgrity:UNCalibrated:ENABle
 ?
 Example STAT:QUES:INT:UNC:ENAB 1 Oversweep (Meas Uncal) will be reported to the Integrity Summary of the Status Questionable register.

Preset	32767
Min	0
Max	32767
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Integrity Uncalibrated Event Query

This query returns the decimal value of the sum of the bits in the Questionable Integrity Uncalibrated Event register.

NOTE	The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.
-------------	---

Mode	All
Remote Command	:STATus:QUEStionable:INTEgrity:UNCalibrated[:EVENT]?
Example	STAT:QUES:INT:UNC?
Preset	0
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Integrity Uncalibrated Negative Transition

This command determines which bits in the Questionable Integrity Uncalibrated Condition register will set the corresponding bit in the Questionable Integrity Uncalibrated Event register when the condition register bit has a negative transition (1 to 0). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Mode	All
Remote Command	:STATus:QUEStionable:INTEgrity:UNCalibrated:NTRansition <integer> :STATus:QUEStionable:INTEgrity:UNCalibrated:NTRansition?
Example	STAT:QUES:INT:UNC:NTR 1 Oversweep cleared will be reported to the Integrity Summary of the Status Questionable register.

Preset	0
Min	0
Max	32767
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Integrity Uncalibrated Positive Transition

This command determines which bits in the Questionable Integrity Uncalibrated Condition register will set the corresponding bit in the Questionable Integrity Uncalibrated Event register when the condition register bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Mode	All
Remote Command	:STATus:QUESTionable:INTEgrity:UNCalibrated:PTRansition <integer> :STATus:QUESTionable:INTEgrity:UNCalibrated:PTRansition?
Example	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
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Power Register

Questionable Power Condition T

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
Remote Command	:STATus:QUESTionable:POWer:CONDition?
Example	STAT:QUES:POW:COND?
Preset	0
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Power Enable

This command determines which bits in the Questionable Power Condition Register will set bits in the Questionable Power Event register, which also sets the Power Summary bit (bit 3) in the Questionable Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

Mode	All
Remote Command	:STATus:QUESTionable:POWer:ENABle <integer> :STATus:QUESTionable:POWer:ENABle?
Example	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
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Power Event Query

This query returns the decimal value of the sum of the bits in the Questionable Power Event register.

NOTE The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is

cleared.

Mode	All
Remote Command	:STaTus:QUEStionable:POWer[:EVENT]?
Example	STAT:QUES:POW?
Preset	0
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Power Negative Transition

This command determines which bits in the Questionable Power Condition register will set the corresponding bit in the Questionable Power Event register when the condition register bit has a negative transition (1 to 0). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Mode	All
Remote Command	:STaTus:QUEStionable:POWer:NTRansition <integer> :STaTus:QUEStionable:POWer:NTRansition?
Example	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
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Power Positive Transition

This command determines which bits in the Questionable Power Condition register will set the corresponding bit in the Questionable Power Event register when the condition register bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Mode	All
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Remote Command	:STATus:QUEStionable:POWer:PTRansition <integer> :STATus:QUEStionable:POWer:PTRansition?>
Example	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
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Temperature Register

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
Remote Command	:STATus:QUEStionable:TEMPerature:CONDition?
Example	STAT:QUES:TEMP:COND?
Preset	0
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Temperature Enable

This command determines which bits in the Questionable Temperature Condition Register will set bits in the Questionable Temperature Event register, which also sets the Temperature Summary bit (bit 4) in the Questionable Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

Mode	All
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Remote Command	:STATus:QUEStionable:TEMPerature:ENABle <integer> :STATus:QUEStionable:TEMPerature:ENABle?
Example	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
SCPI Status Bits/OPC	Sequential command
Dependencies	

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.
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Mode	All
Remote Command	:STATus:QUEStionable:TEMPerature[:EVENT]?
Example	STAT:QUES:TEMP?
Preset	0
SCPI Status Bits/OPC	Sequential command
Dependencies	

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
------	-----

Remote Command	<code>:STATus:QUEStionable:TEMPerature:NTRansition</code> <integer> <code>:STATus:QUEStionable:TEMPerature:NTRansition?</code>
Example	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
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Temperature Positive Transition

This command determines which bits in the Questionable Temperature Condition register will set the corresponding bit in the Questionable Temperature Event register when the condition register bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Mode	All
Remote Command	<code>:STATus:QUEStionable:TEMPerature:PTRansition</code> <integer> <code>:STATus:QUEStionable:TEMPerature:PTRansition?</code>
Example	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
SCPI Status Bits/OPC Dependencies	Sequential command

IEEE Common GPIB Commands

Numeric values for bit patterns can be entered using decimal or hexi-decimal representations. (i.e. 0 to 32767 is equivalent to #H0 to #H7FFF).

Calibration Query

*CAL? Performs a full alignment and returns a number indicating the success of the alignment. A zero is returned if the alignment is successful. A one is returned if any part of the alignment fails. The equivalent SCPI command is CALibrate[:ALL]?

See section Alignments for details of *CAL?.

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.

Remote Command	*CLS
Example	*CLS Clears the error queue and the Status Byte Register.
Remote Command Notes	For related commands, see the SYSTem:ERRor[:NEXT]? command. See also the STATus:PRESet command and all commands in the STATus subsystem.
Key Path	No equivalent key. Related key System, Show Errors, Clear Error Queue
SCPI Status Bits/OPC Dependencies	Resets all bits in all event registers to 0, which resets all the status byte register bits to 0 also.

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.

Remote Command	*ESE <integer> *ESE?
Example	*ESE 36 Enables the Standard Event Status Register to monitor query and command errors (bits 2 and 5). *ESE? Returns a 36 indicating that the query and command status bits are enabled.
Remote Command 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
Key Path	No equivalent key. Related key System, Show Errors, Clear Error Queue
SCPI Status Bits/OPC Dependencies	Event Enable Register of the Standard Event Status Register.

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.

Remote Command	*ESR?
Example	*ESR? Returns a 1 if there is either a query or command error, otherwise it returns a zero.
SCPI Status Bits/OPC Dependencies	Standard Event Status Register (bits 0 – 7).
Remote Command Notes	For related commands, see the STATus subsystem commands.
Preset	0
Min	0
Max	255

Identification Query

Returns a string of instrument identification information. The string will contain the model number, serial number and firmware revision.

The response is organized into four fields separated by commas. The field definitions are as follows:

- Manufacturer
- Model
- Serial number
- Firmware version

Remote Command	*IDN?
Example	*IDN? Returns instrument identification information, such as: Agilent Technologies,N9020A,US01020004,A.01.02
Key Path	No equivalent key. See related key System, Show System.

Operation Complete

The *OPC command sets bit 0 in the standard event status register (SER) to “1” when pending operations have finished, that is when all overlapped commands are complete. It does not hold off subsequent operations. You can determine when the overlapped commands have completed either by polling the OPC bit in SER, or by setting up the status system such that a service request (SRQ) is asserted when the OPC bit is set.

The *OPC? query returns a “1” after all the current overlapped commands are complete. So it holds off subsequent commands until the “1” is returned, then the program continues. This query can be used to synchronize events of other instruments on the external bus.

Remote Command	*OPC *OPC?
Example	INIT:CONT 0 Selects single sweeping. INIT:IMM Initiates a sweep. *OPC? Holds off any further commands until the sweep is complete.
SCPI 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.

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.

Remote Command *OPT?

Recall Instrument State

This command recalls the instrument state from the specified instrument memory register.

- If the state being loaded has a newer firmware revision than the revision of the instrument, no state is recalled and an error is reported.
- If the state being loaded has an equal firmware revision than the revision of the instrument, the state will be loaded.
- If the state being loaded has an older firmware revision than the revision of the instrument, the instrument will only load the parts of the state that apply to the older revision.

Remote Command *RCL <register #>

Example *RCL 7 Recalls the instrument state that is currently stored in register 7.

Restriction and Notes Registers 0 through 6 are accessible from the front panel in menu keys for Recall Registers.

SCPI Status Bits/OPC Dependencies The command is sequential.

Min 0

Max 127

Save Instrument State

This command saves the current instrument state and mode to the specified instrument

memory register.

Remote Command	*SAV <register #>
Example	*SAV 9 Saves the instrument state in register 9.
Restriction and Notes	Registers 0 through 6 are accessible from the front panel in menu keys for Save Registers.
SCPI Status Bits/OPC Dependencies	The command is sequential.
Min	0
Max	127

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.

Remote Command	*SRE <integer> *SRE?
Example	*SRE 22 Enables bits 1, 2, and 4 in the service request enable register.
SCPI Status Bits/OPC Dependencies	Service Request Enable Register (all bits, 0 – 7).
Remote Command Notes	For related commands, see the STATus subsystem and SYSTem:ERRor[:NEXT]? commands.
Preset	255
Min	0
Max	255

Status Byte Query

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

Remote Command	*STB?
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Example	*STB? Returns a decimal value for the bits in the status byte register. For example, if a 16 is returned, it indicates that bit 5 is set and one of the conditions monitored in the standard event status register is set.
SCPI Status Bits/OPC Dependencies	Status Byte Register (all bits, 0 – 7).
Remote Command Notes	See related command *CLS.

Trigger

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

Remote Command	*TRG
Example	*TRG Triggers the instrument to take a sweep or start a measurement, depending on the current instrument settings.
Remote Command Notes	See related command :INITiate:IMMediate.
Key Path	No equivalent key. See related keys Single and Restart.

Self Test Query

This query performs the internal self-test routines and returns a number indicating the success of the testing. A zero is returned if the test is successful, 1 if it fails.

Remote Command	*TST?
Example	*TST? Runs the self-test routines and returns 0=passed, 1=some part failed.

Wait-to-Continue

This command causes the instrument to wait until all overlapped commands are completed before executing any additional commands. There is no query form for the command.

Remote Command	*WAI
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Example	INIT:CONT OFF; INIT;*WAI Sets the instrument to single sweep. Starts a sweep and waits for its completion.
SCPI 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.

Quick Save

The Quick Save front-panel key repeats the most recent save which was performed from the Save menu, with some qualification:

Quick Save pays no attention to register saves. Register saves are not remembered as Saves for the purpose of Quick Save

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 in the last save directory by creating a unique filename using the Auto File Naming algorithm described in the Save section.

If Quick Save is pressed after startup before any qualified Save has been performed, the Quick Save 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.

Remote Command Notes No remote command for this key specifically.

Key Path **Front-panel key**

Save

Save functionality is common across multiple Modes and Measurements. These common features are described in this section.

The Save feature prompts you to essentially answer the questions: What do you want to save? And where do you want to save it? Once these questions are answered the save can occur. The options in this menu answer the question, “What do you want to save?”

Accesses a menu that provides the save type options. The **Save Type** options are **State**, **Trace**, **Data**, or a **Screen Image** depending on the active mode.

Mode	All
Key Path	Save
Remote Command Notes	No remote command for this key specifically.

State

Selects **State** as the save type and accesses a menu that provides the options of where to save. You can save either to a register or a file. This menu key will not actually cause the save until the location is chosen.

Saving the state is the only way to save this exact measurement context for the current active mode. The entire state of the active mode is saved in a way that when a recall is requested, the mode will return to as close as possible the context in which the save occurred. This includes all settings and data for only the current active mode.

It should be noted that the Input/Output settings will be saved when saving State, since these settings plus the state of the mode best characterize the current context of the mode, but the mode independent System settings will not be saved.

This softkey will not actually cause the save, since the save feature still needs to know where to save the state. Pressing this key will bring up the Save State menu that provides the user with these options.

For rapid saving, the State menu lists registers to save to, or the user can select a file to save to. Once they pick the destination of the save in the State menu, the save will occur.

Mode	All
Example	MMEM:STOR:STATe "MyStateFile.state" This stores the current instrument state data in the file MyStateFile.state in the default directory.
Remote Command Notes	See .
Key Path	Save

Save

Register 1 thru Register 6

Selecting any one of these register menu keys causes the State of the currently active mode to be saved to the specified Register. Only the State save type supports writing to registers. The other save types can only write to files. 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.

These 6 registers are all that is available from the front panel for all modes in the instrument. There are not 6 registers available for each mode. From remote, 127 Registers are available. Registers are files that are visible to the user in the same folder as other State Files.

Mode	All
Example	*SAV 1
Key Path	Save, State

Mode	All
Example	*SAV 2
Key Path	Save, State

Mode	All
Example	*SAV 3
Key Path	Save, State

Mode	All
Example	*SAV 4
Key Path	Save, State

Mode	All
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Example	*SAV 5
Key Path	Save, State

Mode	All
Example	*SAV 6
Key Path	Save, State

To File . . .

Accesses a menu that enables you to select the location for saving the State. This menu is similar to a standard Windows® **Save As** dialog.

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). This path is the **Save In:** path in the **Save As** dialog for all State Files when they first enter this dialog.

Mode	All
Key Path	Save, State

Save As . . .

This menu lets you select the location where you can save the State. This menu is a standard Windows® dialog with Save As menu keys. The "File Name" field in the Save As dialog 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 softkey. See the Quick Save key documentation for more on the automatic file naming algorithm.

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).

When you first enter this dialog, the path in the **Save In:** field depends on the data type.

Save

The only files that are visible are the *.state files and the Save As type is *.state, since .state is the file suffix for the State Save Type.

Mode	All
Key Path	Save, State

Save

Saves all of the State of the currently active mode plus the system level Input/Output settings to the specified file.

While the save is being performed, the floppy icon shows up in the settings bar near the Continuous/Single sweep icon. After the save completes, the Advisory Event “File <register number> saved” is displayed.

Mode	All
SCPI Command	:MMEMory:STORe:STATe <filename>
Example	:MMEM:STOR:STAT “myState.state” saves the file myState.state on the default path
Key Path	Save, State, To File...
Restriction and Notes	If 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 a instrument software upgrade. Both single and double quotes are supported for any filename parameter over remote. Auto return to the State menu and the Save As dialog goes away.

Trace (+State)

Selects a state file which includes trace data for recalling as the save type and accesses a menu that enables you to select which trace to save. Not all modes support saving trace data with the state; and for modes that do, not all measurements do. 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 also select to save ALL traces.

This softkey will not actually cause the save, since the save feature still needs to know which trace to save and where to save it. Pressing this key will bring up the Save Trace

menu that provides the user with these options.

Mode	SA
Example	MMEM:STOR:STATe TRACE2,"MyTraceFile.trace" This stores trace 2 data in the file MyTraceFile.trace in the default directory.
Remote Command Notes	See .
Key Path	Save

From Trace

Accesses a menu that enables you to select the trace to be saved. You can choose either **1, 2, 3, 4, 5, 6** or **All**. Not all modes have the full six traces. Once a trace is selected, the key returns back to the Save Trace menu and the selected trace number is annotated on the key. The default is **Trace 1**. To save the Trace you must select **Save As**.

These softkeys let you pick which trace to save. Now you have selected exactly what needs to be saved. In order to trigger a save of the selected **Trace**, you must select the **Save As** key in the Save Trace menu.

Mode	SA
Key Path	Save, Trace + State

Save As . . .

This menu lets you select the location where you can save the Trace. It is a standard Windows® dialog with Save As menu keys. The "File Name" field in the Save As dialog 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 softkey. See the Quick Save key documentation for more on the automatic file naming algorithm.

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).

When you first enter this dialog, the path in the **Save In:** field depends on the data type. The only files that are visible are the *.trace files and the Save As type is *.trace, since

Save

.trace is the file suffix for the Trace Save Type.

Mode	SA
Key Path	Save, Trace (+State)
Restriction and Notes	Brings up Save As dialog for saving a Trace Save Type

Save

This key initiates the save of the .trace file. All of the State of the currently active mode plus the system level Input/Output settings are saved to the specified file as well as all of the trace data, including internal flags set in the file indicating which trace is to be saved.

While the save is being performed, the floppy icon shows up in the settings bar near the Continuous/Single sweep icon. After the save completes, the Advisory Event “File <register number> saved” is displayed.

Mode	SA
SCPI Command	<code>:MMEMory:STORe:TRACe TRACE1 TRACE2 TRACE3 TRACE4 TRACE5 TRACE6 ALL, <filename></code>
Example	<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). <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
Remote Command Notes	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, <filename></code> 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).
Key Path	Save, Trace, Save As...
Restriction and Notes	If 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 remote. Auto return to the State menu and the Save As dialog goes away.

Data (Mode Specific)

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.

For any given measurement, the Export Data and Import Data menus match, but keys in Import Data are blanked if the data type is supported for Save but not for Recall.

Since the commonly exported data files are in .csv format, the data can be edited by the user prior to importing. This allows the user 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 softkey is pressed. See section Save As . . . for more details.

Mode	All
Key Path	Save
Remote Command Notes	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 if there are no measurements in Mode that supports it.
Preset	<mode specific>; Is not affected by Preset, but is reset during Restore Mode Defaults and survives subsequent running of the mode. (Refer to the mode Save/Recall PD for this Preset value).

Trace

Pressing this key selects Traces as the data type to be exported with this save request. Pressing this key when it is already selected brings up the **Trace** Menu, which allows you to select which Trace to save. This 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”.) This key is grayed out when measurements are running that do not support trace exporting.

Mode	SA Analog Demod VSA
Example	MMEM:STOR:TRAC:DATA TRACE3,"MyTraceFile.csv" This stores the specified trace data in the file MyTraceFile.csv in the default directory. VSA Example: MMEM:STOR:TRAC:DATA TRACE1,"Trc1.txt",TXT,ON

Save

Remote Command Notes	See .
Dependencies	Trace data is not available from all Measurements. In that case, the key will be grayed out. The key will not show if no measurements in the Mode support it.
Preset	1. Not part of Preset, but is reset by Restore Mode Defaults and survives power cycles.
State Saved	Saved in State
Key Path	Save, Data

Trace selection

These softkeys let you pick which Trace to save. The traces may have names, or they may be labeled **1, 2, 3, 4, 5, or 6**, depending on the current mode. Once selected, the key returns back to the Export Data menu and the selected trace name/number is annotated on the key. Now you have selected exactly what needs to be saved. In order to trigger a save of the selected trace, you must select the **Save As** key in the Export Data menu.

Some measurements have an "ALL" selection. This 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: any traces which are in View or Blank may have different x-axis data than the current measurement settings; but this data will not be output to the file.

An example of using this menu is: If you select 4, Trace 4 is saved to the file selected or entered in **File Name** option in the **Save As** dialog.

Mode	SA Analog Demod VSA
Key Path	Save, Data, Trace
Preset	The first trace key shown.

Include Header

The trace header information includes enough state information to display the trace data with the same formatting and scaling when it is recalled. However, no other instrument state information is saved. If headers are not saved, the scaling and format are set to defaults when the trace is recalled.

Mode	VSA
SCPI Example	MMEM:STOR:TRAC:DATA TRACE1,"Trc1.txt",TXT,ON !The On/Off setting is the last variable passed in the MMEMory:STORe:TRACe:DATA command.
Key Path	Save, Data, Trace

Save

A map file contains zone definitions that will help simplify making measurements of frequently used signals. The OFDMA frame structure can contain multiple-zone definitions for the uplink and downlink subframes and multiple data burst allocations. You can store map files in which you have saved complicated OFDMA frame analysis zone definitions. This can save you time and ensure the accuracy of repeated measurements. Map files are also useful for recreating measurement settings so they can be used by other users.

Mode	OFDMA WiMAX
Example	MMEM:STOR:ZMAP "MyZonemapFile.omf" This stores the zone map data in the file MyZonemapFile.omf in the default directory.
Remote Command Notes	See .
Key Path	Save, Data

Recorded Data

Saving recorded data is not available for all measurements. Recorded data, and the optional header info, may be recalled later (or transferred to another instrument) for analysis.

This function is available in 89601X VSA Option 200, but not in Option 205.

Mode	VSA
SCPI Example	MMEM:STOR:REC "MyRecording.sdf",SDF,ON,ON,OFF
Restriction and Notes	Greyed out unless there is recorded data in the buffer.
Key Path	Save, Data (Export)

Save As . . .

This menu lets you select the location where you can save Data Type files. It is a standard Windows® dialog with Save As menu keys. The "File Name" field in the Save As dialog 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 softkey. See the Quick Save key documentation for more on the automatic file naming algorithm.

When you first enter this dialog, the path in the **Save In:** field depends on the data type.

The only files that are visible are the files with the corresponding data type suffix, and the **Save As** type lists the same suffix.

For example, if the Data Type is **Amplitude Corrections**, the file suffix is .csv and the *.csv files are the only visible files in the **Save As** dialog and .csv is the Save As Type.

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

Mode	All
Key Path	Save, Data
Restriction and Notes	Brings up Save As dialog for saving a <mode specific> Save Type

Save

Saves the specified Data Type. This section describes any specific save behavior relevant to Data that is common to all modes.

When a **Save** of a specific Data File is requested, the specified data is saved to the specified or selected file. The save is performed immediately and does not wait until the measurement is complete.

If the file already exists, a dialog will popup that allows you to replace the existing file by selecting an **OK** or you can **Cancel** the request.

While the save is being performed, the floppy icon will show up in the settings bar near the Continuous/Single icon. After a register save completes, the corresponding register softkey annotation is updated with the date the time and an advisory message that the file was saved appears in the message bar.

Key Path	Save, Data, Save As...
Restriction and Notes	If 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 a instrument software upgrade. Both single and double quotes are supported for any filename parameter over remote.

Save

Mode SA | ADEMOD | BASIC (IQ Analyzer) | CDMA2K | GSMEDGE | PNOISE | WCDMA | WIMAXOFDMA | TDSCDMA

SCPI Command :MMEMory:STORe:RESults <filename>

Example :MMEM:STOR:RES “myResults.csv” saves the results from the current measurement to the file myResults.csv in the default path.

:MMEM:STOR:RES

“MyDocuments\Basic\data\ComplexSpectrum\results\myResults.xml” saves the results from the current measurement (Complex Spectrum) to the file myResults.xml in the default path for IQ Analyzer (Basic) Mode.

Mode SA | Analog Demod

SCPI Command :MMEMory:STORe:TRACe:DATA
TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6 | ALL, <filename>

Example :MMEM:STOR:TRAC:DATA TRACE2,”myTrace2.csv” exports the 2nd trace to the file myTrace2.csv in the default path.

Remote Command Notes Not all measurements have the ALL selection.

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 remote.

Trace Number	Analog Demod Mode: Trace Names
TRACE1	RF Spectrum
TRACE2	Demod
TRACE3	Demod Ave
TRACE4	Demod Max
TRACE5	Demod Min
TRACE6	AF Spectrum

Mode VSA

SCPI Command	:MMEMory:STORe:TRACe:DATA TRACE1 TRACE2 TRACE3 TRACE4 TRACE5 TRACE6, "<filename>" [, CSV TXT SDF [, OFF ON 0 1]]
SCPI Example	MMEM:STOR:TRAC:DATA TRACE1,"Trc1.txt",TXT,ON
Restriction and Notes	<p>If you are not licensed to save a particular file type, then an error will be returned. If an invalid file format is specified or the file cannot be saved successfully, then an error is returned.</p> <p>8901X Option 205 allows export in TXT, CSV, and SDF formats.</p> <p>8901X Option 200 allows the Option 205 formats and additionally: Matlab 4, 5 and HDF5, and an N5110A compatible binary format.</p>
Remote Command Notes	<p>File format is selected by the second parameter, but no default extension is appended to the filename. If the second parameter is not supplied, then the filename extension is used to determine the format. *.mat selects Matlab 5 format. *.sdf, or an unrecognized extension chooses the SDF fast format.</p> <p>The optional Boolean determines if the file is saved with headers. By default the headers are saved.</p>
Mode	WCDMA
SCPI Command	:MMEMory:STORe:CAPTured <filename>
Example	:MMEM:STOR:CAPT "MyDocuments\WCDMA\data\captureBuffer\myCaptureBuffer.bin" saves the capture buffer data from the current measurement to the file myCaptureBuffer.bin in the default path.
Restriction and Notes	<p>If the file already exists, the file will be overwritten.</p> <p>Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during a instrument software upgrade. Both single and double quotes are supported for any filename parameter over remote.</p>
Key Path	Save, Data, Save As
Mode	WIMAXOFDMA
SCPI Command	:MMEMory:STORe:ZMAP <filename>
Example	:MMEM:STOR:ZMAP "myZoneMap.omf" saves current Zone Map as 89601 compatible file type.
Key Path	Save, Data, Zone Map

Save

Restriction and Notes	<p>If a file with the same name already exists, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of overwriting the file during an instrument software upgrade. Both single and double quotes are supported for any filename parameter over remote.</p> <p>Once a save is complete, the Export Data menu will appear, and the Save As dialog will disappear.</p> <p>The message “File <file name> saved” will appear after the save is complete.</p>
Mode	VSA
SCPI Command	<pre>:MMEMory:STORe:RECOrding <filename> [,SDF SDFX CSV TXT MAT4 MAT HDF5 BIN [,OFF ON 0 1 [,OFF ON 0 1 [,OFF ON 0 1]]]</pre>
SCPI Example	MMEM:STOR:REC "MyRecording.sdf",SDF,ON,ON,OFF
Remote Command Notes	<p>Recorded data must be available in the buffer.</p> <p>File format is selected by the second parameter, but no default extension is appended to the filename. If the second parameter is not supplied, then the filename extension is used to determine the format. *.mat selects Matlab 5 format. *.sdf, or an unrecognized extension chooses the SDF fast format.</p> <p>The three optional Booleans determine if:</p> <ol style="list-style-type: none">1. file is saved with headers2. data is resampled to the current span before saving3. player position settings limit the data saved

Screen Image

Accesses a menu of functions that enable you to specify a format and location for the saved screen image.

Pressing **Screen Image** brings up a menu which 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.

NOTE	For some software versions, if you initiate a screen image save by navigating through the Save menus, then the image that is saved will contain the Save menu softkeys, not the menus and the active function
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that were on the screen when you first pressed the Save front panel key. For this reason the Quick Save front-panel key is provided, which repeats the last save performed, using an auto-named file. To get an exact image of the screen just the way you want it, set up the Quick Save by first performing a Screen Image save through the menus under the Save front-panel key. Then any subsequent press of Quick Save will grab an immediate snapshot of what is on the screen and automatically assign it a file name. (You may then discard the initial save, if desired.)

Mode	All
Example	MMEM:STOR:SCR "MyScreenFile.png" This stores the current screen image in the file MyScreenFile.png in the default directory.
Remote Command Notes	See .
Key Path	Save

Themes

Accesses a menu of function 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 the user to pick between themes to be used when saving the screen image.

Key Path	Save, Screen Image, 1
SCPI Name	Themes
SCPI Command	:MMEMory:STORe:SCReen:THEME TDCOLOR TDMonochrome FCOLOR FMONochrome :MMEMory:STORe:SCReen:THEME?
Setup	:SYSTem:DEFault MISC
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
Example	MMEM:STOR:SCR:THEM TDM

3D Color

Save

Selects a standard color theme with each object filled, shaded and colored as designed.

Key Path Save, Screen Image, Themes, 1

Example MMEM:STOR:SCR:THEM TDC

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, 2

Example MMEM:STOR:SCR:THEM TDM

Flat Color

Selects a format that is best when the screen is to be printed on an ink printer.

Key Path Save, Screen Image, Themes, 3

Example MMEM:STOR:SCR:THEM FCOL

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 Save, Screen Image, Themes, 4

Example MMEM:STOR:SCR:THEM FMON

Save As...

Accesses a menu that enables you to select the location where you can save the Screen Image. This menu is a standard Windows® dialog with Save As menu keys. The **Save As** dialog is loaded with the file information related to the Screen Image Type. The filename is filled in using the auto file naming algorithm for the Screen Image Type and is highlighted. The only files that are visible are the *.png files and the Save As Type is *.png, since .png is the file suffix for the Screen Image Type.

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).

This path is the **Save In:** path in the **Save As** dialog for all Screen Files when the user first enters this dialog.

Key Path	Save, Screen Image, 2
Restriction and Notes	Brings up Save As dialog for saving a Screen Image Save Type

Save

Saves the screen image to the specified file using the selected theme. The image that is saved is the measurement display prior to when the **Save As** dialog appeared. The save is performed immediately and does not wait until the measurement is complete.

SCPI Command	:MMEMory:STORe:SCReem <filename>
Example	:MMEM:STOR:SCR "myScreen.png"
Restriction and Notes	<p>If 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 a instrument software upgrade. Both single and double quotes are supported for any filename parameter over remote.</p> <p>Auto return to the Screen Image menu and the Save As dialog goes away.</p> <p>Advisory Event "File <file name> saved" after save is complete.</p>
Key Path	Save, Screen Image, Save As..., 1

Save As . . .

The **Save As** is a standard Windows dialog and with the Save As key menu. The "File Name" field in the Save As dialog 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 softkey. See the Quick Save key documentation for more on the automatic file naming algorithm.

The **Save As** dialog will have the last path loaded in **Save In:** for this particular file type. User specified paths are remembered and persist through subsequent runs of the mode. These remembered paths are mode specific and are reset back to the default using **Restore Mode Defaults**.

Save

Save

Performs the actual save to the specified file of the selected type. The act of saving does not affect the currently running measurement and does not require you to be in single measurement mode to request a save. It performs the save as soon as the currently running measurement is in the idle state; when the measurement completes. This ensures the State or Data that is saved includes complete data for the current settings. The save only waits for the measurement to complete when the state or data that depends on the measurement setup is being saved. The save happens immediately when exporting corrections or when saving a screen image.

If the file already exists, a dialog will popup with corresponding menu keys that allows you to replace the existing file with an **OK** or to **Cancel** the request.

While the save is being performed, the floppy icon shows up in the settings bar near the Continuous/Single icon. After the save completes, the corresponding register menu key annotation is updated with the date the time and the message “File <file name> saved” appears in the message bar.

Restriction and Notes	If the file already exists, the File Exist dialog pops up and allows the user to replace it or not by selecting the Yes or No menu keys that appear with the dialog. (For more details, refer to the File Services PD). Then the key causes an auto return and Save As dialog goes away. Advisory Event “File <file name> saved” after save is complete.
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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.

Key Path	Save, <various>, Save As..., 2
Restriction and Notes	Pressing this key navigates the user to the files and folders list in the center of the dialog.

File Name

Brings up the Alpha Editor as shown in the screen image. Use the knob to choose the letter to add and the **Enter** front panel key to add the letter to the file name. In addition to the list of alpha characters, this editor includes a **Space** menu key and a **Done** menu key. The **Done** menu key completes the filename, removes the Alpha Editor and returns back to the **File**

Open dialog and menu, but does not cause the save to occur. You can also use **Enter** to complete the file name entry and this will cause the save to occur.

Key Path	Save, <various>, Save As..., 3
Restriction and Notes	Brings up the Alpha Editor. Editor created file name is loaded in the File name field of the Save As dialog.

Save As Type

This key corresponds to the **Save As Type** selection in the dialog. It follows the standard Windows® supported **Save As Type** behavior. It shows the current file suffix that corresponds to the type of file you have selected to save. If you navigated here from saving State, “State File (*.state)” is in the dialog selection and is the only type available under the pull down menu. If you navigated here from saving Trace, “Trace+State File (*.trace)” is in the dialog selection and is the only type available under the pull down menu. If you navigated here from exporting a data file, “Data File (*.csv)” is in the dialog and is available in the pull down menu. Modes can have other data file types and they would also be listed in the pull down menu.

Key Path	Save, <various>, Save As..., 4
Restriction and Notes	Pressing this key causes the pull down menu to list all possible file types available in this context. All types available are loaded in a 1-of-N menu key for easy navigation.

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. It follows the standard Windows® supported **Up One Level** behavior. When pressed, it causes the file and folder list to navigate up one level in the directory structure.

Key Path	Save, <various>, Save As..., 5
Restriction and Notes	When pressed, the file and folder list is directed up one level of folders and the new list of files and folders is displayed

Create New Folder

Save

This key corresponds to the icon of a folder with the “*” that is in the tool bar of the dialog. It follows the standard Windows® supported **Create New Folder** behavior. When pressed, a new folder is created in the current directory with the name **New Folder** and allows you to enter a new folder name using the Alpha Editor.

Key Path	Save, <various>, Save As..., 6
Restriction and Notes	Creates a new folder in the current folder and lets the user fill in the folder name using the Alpha Editor.

Cancel

This key corresponds to the **Cancel** selection in the dialog. It follows the standard Windows supported **Cancel** behavior. It causes the current **Save As** request to be cancelled.

Key Path	Save, <various>, Save As..., 7
Restriction and Notes	Pressing this key causes the Save As dialog to go away and auto return.

Recall

Recall functionality is common across multiple Modes and Measurements. These common features are described in this section.

The Recall feature prompts you to answer the questions: What do you want to recall? And to where do you want to recall it? Once these questions are answered the recall can occur. The options in this menu answer the question "What do you want to Recall?" The options are **State**, **Trace** and **Data**. (**Screen Image** can be saved, but not recalled.) The default paths for **Recall** are data type dependent and are the same as for **Save**.

Key Path	Recall
Remote Command Notes	No remote command directly controls the Recall Type that this key controls. The Recall type is a node in the :MMEM:LOAD command. An example is :MMEM:LOAD:STATe <filename>.

State

Accesses a menu that enables you to recall a Stated that has previously been saved. Recalling a saved state returns the analyzer as close as possible to the mode context and may cause a mode switch if the file selected is not for the current active mode. A State file can be recalled from either a register or a file. Once you pick the source of the recall in the State menu, the recall will occur.

When this key is pressed, the user has determined what they want to recall is **State**. Recalling **State** is used to return as close as possible to the mode context of the save. Recalling State may cause a mode switch if the file selected is not for the currently active mode. This menu key will not actually cause the recall, since the recall feature still needs to know from where to recall the state. **State** can be recalled from either a register or a file. Pressing this key will bring up the State menu that provides the user with the options of where to retrieve the state. For quick recalls, the State menu lists 6 registers to recall from or the user can select a file to recall from.

Mode	All
Key Path	Recall
Example	MMEM:LOAD:STAT "MyStateFile.state" This loads the state file data (on the default file directory path) into the instrument state.
Remote Command Notes	See .

Recall

Register 1 thru Register 6

Selecting any one of these register keys causes the State of the mode from the specified Register to be recalled. Only the Recall Type of State supports reading from registers. The other Recall Types can only read from files. Each of the register keys annotates whether it is empty or at what date and time it was last modified.

Registers are shared by all modes, so recalling from any one of the 6 registers may cause a mode switch to the mode that was active when the save to the Register occurred.

After the recall completes, the message “Register <register number> recalled” appears in the message bar.

Selecting any one of these register menu keys: **Register 1**, **Register 2**, **Register 3**, **Register 4**, **Register 5**, **Register 6** causes the state of the mode from the specified Register to be recalled. The registers are provided for easy saving and recalling, since the user does not have to specify a filename or navigate to a specific file. The date will follow the format specified in the Date Format setting under the **Control Panel**. The time will show hours, minutes and seconds.

Key Path	Recall, State
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Example	*RCL 1
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Key Path	Recall, State
----------	---------------

Example	*RCL 2
---------	--------

Key Path	Recall, State
----------	---------------

Example	*RCL 3
---------	--------

Key Path	Recall, State
----------	---------------

Example	*RCL 4
---------	--------

Key Path	Recall, State
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Example	*RCL 5
---------	--------

Key Path	Recall, State
Example	*RCL 6

From File\ File Open

Brings up the **File Open** standard Windows® dialog and its corresponding **File Open** key menu.

When you first enter this dialog, the State File default path is in the **LookIn:** box in this File Open dialog. The File Open dialog is loaded with the file information related to the State Save Type. The first *.state file is highlighted. The only files that are visible are the *.state files and the Files of type is *.state, since .state is the file suffix for the State Save Type.

Key Path	Recall, State
Restriction and Notes	Brings up Open dialog for recalling a State Save Type

Open

Recalling State function first must verify 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, and then loading the State from the saved state file to as close as possible to the context in which the save occurred. You can open state files from any mode, so recalling a State File switches to the mode that was active when the save occurred. After switching to the mode of the saved state file, mode settings and data (if any for the mode) are loaded with values from the saved file. The saved measurement of the mode becomes the newly active measurement and the data relevant to the measurement (if there is any) is recalled.

If there is a mismatch between file version or model number or instrument version or model number, the recall still tries to recall as much as possible and it returns a warning message of what it did.

NOTE No Trace data is loaded when recalling a State File. Measurements that support loading of trace data will include a Trace key in the Recall menu and will load State + Trace data from .trace files under that key.

SCPI Command :MMEMory:LOAD:STATe <filename>

Recall

Example	:MMEM:LOAD:STAT "myState.state" recalls the file myState.state on the default path
Remote Command Notes	Although the trace data is included in the .state file it is not recalled; that is left for .trace files only for measurements that support recalling of trace data. Errors are generated if the specified file is empty or does not exist, or there is a file type mismatch.
Key Path	Recall, State, From File...

The state of a mode includes all of the variables affected by doing a full preset. It not only recalls Mode Preset settings, but it also recalls all of the mode persistent settings and data if the mode has either. Each mode determines whether data is part of mode state and if the mode has any persistent settings. **Recall State** also recalls all of the **Input/Output** system settings, since they are saved with each State File for each mode.

The **Recall State** function does the following:

Verifies that the file is recallable on this instrument using the version number and model number.

Aborts the currently running measurement.

Clears any pending operations.

Switches to the mode of the selected Save State file.

Sets mode State and Input/Output system settings to the values in the selected Saved State file.

Limits settings that differ based on model number, licensing or version number.

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

Trace (+State)

When this key is pressed, the user has determined what they want to recall is **Trace**. Trace files include the state of the mode they were saved from as well as the trace data, with internal flags to indicate which trace the user was trying to save which may include ALL traces. They are otherwise identical to State files. Recalling **Trace** may cause a mode switch if the file selected is not for the currently active mode.

Not all modes support saving of trace data with the state; and for modes that do, not all measurements do. The **Trace** key is grayed out for measurements that do not support trace recall. It is blanked for modes that do not support trace recall.

This softkey will not actually cause the recall, since the recall feature still needs to know from which file to recall the trace and which trace to recall it into. Pressing this key will

bring up the Recall Trace menu that provides the user with the options of where to retrieve the trace.

Mode	SA
Example	MMEM:LOAD:TRAC TRACE2,"MyTraceFile.trace" This loads the trace file data (on the default file directory path) into the specified trace.
Remote Command Notes	See .
Key Path	Recall

To Trace

These softkey selections let you pick which Trace to recall the saved trace into; either 1, 2, 3, 4, 5, or 6. Not all modes have the full 6 traces available. The default is trace 1. If the.trace file is an "all trace" file, "To Trace" is ignored and the traces each go back to the trace they were saved from.

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. In order to trigger a recall of the selected Trace, you must select the **Open** key in the Recall Trace menu.

Mode	SA
Key Path	Save, Data, Trace

Open...

Pressing **Open** brings up the File Open standard Windows dialog and its corresponding File Open softkey menu. When the user navigates to this selection, they have already determined they are recalling **Trace** and now they want to specify from which file to do the recall.

When the user first enters this dialog, the State File default path is in the **LookIn:** box in this **File Open** dialog. The **File Open** dialog is loaded with the file information related to the State Save Type. The first *.trace file is highlighted. Also, the only files that are visible are the *.trace files and the Files of type is *.trace, since .trace is the file suffix for the Trace Save Type.

Mode	SA
Key Path	Recall, Trace

Recall

Restriction and Notes

Brings up Open dialog for recalling a Trace Save Type

Open

Recalling **Trace** first must 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, loads the state from the saved state file to as close as possible to the context in which the save occurred. Users 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 wipe out 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.

In every other way a Trace load is identical to a State load. See section for details.

Key Path

Recall, Trace, Open

Restriction and Notes

Auto return to the Trace menu and the Open dialog goes away.
Advisory Event “Recalled File <file name>” after recall is complete.

SCPI Command

```
:MMEMory:LOAD:TRACe  
TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6, <filename>
```

Example

```
:MMEM:LOAD:TRAC TRACE2, "myState.trace" recalls the file  
myState.trace on the default path; if it is a “single trace” save file,  
that trace is loaded to trace 2, and will is set to be not updating.
```

Data (Mode Specific)

Importing a data file loads data that was previously saved from the current measurement or from other measurements and/or modes that produce the same type of data. The Import Menu only contains Data Types that are supported by the current measurement.

For any given measurement, the Export Data and Import Data menus match, but keys in Import Data are blanked if the data type is supported for Save but not for Recall.

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 will occur as soon as the Open softkey is pressed. See section File Open Dialog and Menu for more details.

Mode	SA VSA
Key Path	Recall
Remote Command Notes	No SCPI command directly controls the Data Type that this key controls. The Data Type is included in the MMEM:LOAD commands.
Preset	<mode specific>; Is not affected by Preset, but is reset during Restore Mode Defaults and survives subsequent running of the mode.

Trace

This key selects the **Traces** as the data type to be imported with this recall request. It brings up the Trace Menu that lets you select which Trace to import the data into.

This key is grayed out when measurements are running that do not support trace importing.

For Vector Signal Analyzer Mode:

- the trace data is loaded into the selected data register. Trace data registers are temporary storage places for trace data. They allow you to view past results next to current measurement results, and are also used in some functions like user defined filters. They are measurement global, so you can import data into a register while in the Digital Demod measurement and view it later while in the Vector measurement. Data registers are cleared when the measurement application is terminated, but not when you change Modes and return.
- If the recalled file was saved with header information, the trace will initially be displayed with the same formatting and scaling as it had when it was saved. If headers are not saved, the scaling and format are set to defaults when the trace is recalled.
- The following trace data formats may be imported:
 - Text and comma-separated variable (CSV)
 - Text
 - SDF.
- Option 200 also allows import of these additional formats:
 - Matlab 4

Recall

Matlab 5
Matlab HDF5
N5110A compatible binary

Mode	SA Analog Demod VSA
Example	MMEM:LOAD:TRAC:DATA TRACE2,"MyTraceFile.csv" This loads the trace file data (on the default file directory path) into the specified trace.
Remote Command Notes	See .
Dependencies	Trace data is not available from all Measurements. In that case, the key will be grayed out. The key will not show if no measurements in the Mode support it.
Preset	1; not part of Preset, but is reset by Restore Mode Defaults and survives power cycles
State Saved	Saved in State
Key Path	Recall, Data

Trace 1, 2, 3, 4, 5, 6

These keys let you pick which Trace to import the data into; either **1, 2, 3, 4, 5** or **6**. The default is **1**.

Once selected, the key returns back to the Import Data menu and the selected Trace number is annotated on the key. Now you have selected exactly what needs to be imported. In order to trigger a import of the selected trace, you must select the **Open** key in the Import Data menu.

An example of using this menu is: If you select 4 and continue to the File Open dialog, then import Trace 4 from the file selected or entered in **File Name** option in the File Open dialog.

Mode	SA VSA
Key Path	Recall, Data, Trace

Display in Selected Trace

In Vector Signal Analyzer Mode, data registers are used as temporary storage places for trace data. A register may be displayed in any trace. If "Display in Selected Trace" softkey is set to "Yes" then the data register into which the file is recalled is then assigned to the currently selected trace.

Mode	VSA
------	-----

Example	!Related command: MMEM:LOAD:TRAC:DATA D1,"TRC1.TXT",TXT !This command explicitly puts the data in the specified trace.
Key Path	Recall, Data (Import), Trace (to)

Capture Buffer

Capture Buffer functionality is not available for all measurements. The captured data is raw data (unprocessed).

Mode	WCDMA
Example	MMEM:LOAD:CAPT "MyCaptureData.bin" This loads the file of capture data (on the default file directory path) into the instrument.
Remote Command Notes	See .
Dependencies	Capture buffer data is not available from all Measurements. In that case, the key will be grayed out. The key will not show if no measurements in the Mode support it.
Key Path	Recall, Data

Zone Map

A map file contains zone definitions that will help simplify making measurements of frequently used signals. The OFDMA frame structure can contain multiple-zone definitions for the uplink and downlink subframes and multiple data burst allocations. You can recall map files in which you have saved complicated OFDMA frame analysis zone definitions; this can save you time and ensure the accuracy of repeat measurements. Map files are also useful for recreating measurement settings so they can be used by other users.

Mode	OFDMA WIMAX
Example	MMEM:LOAD:ZMAP "MyZonemapFile.omf" This loads the file of zone map data (on the default file directory path) into the custom map.
Remote Command Notes	See .

Recall

Dependencies	Zone map data is not available from all Measurements. In that case, the key will be grayed out. The key will not show if no measurements in the Mode support it.
Key Path	Recall, Data

Recorded Data

This allows you to recall previously saved, recorded data for analysis.

This feature is only available with 89601X VSA Option 200 and Option G01.

Mode	VSA
Example	MMEM:LOAD:REC "MyRecording.sdf"
Notes	Available file types are: <ul style="list-style-type: none">• CSV (Comma delimited) (*.csv)• MAT-File (*.mat)• MAT-File (Version 4) (*.mat)• MAT-File (HDF5) (*.mat;*.hdf;*.h5)• N5110A Waveform (*.bin)• SDF (Fast) (*.sdf;*.dat)• SDF (Export) (*.sdf;*.dat)• Text (Tab delimited) (*.txt)
Key Path	Recall, Data (Import)

Open...

Pressing **File Open** brings up the File Open standard Windows dialog and the File Open key menu. When the user navigates to this selection, they have already determined they are recalling a specific Data Type and now they want to specify which file to open.

When you first enter this dialog, the path is in the **Look In:** field in this **File Open** dialog depends on which import data type you navigated here from.

The only files that are visible are those specific to the file type being recalled.

Key Path	Recall, Data
Restriction and Notes	Brings up Open dialog for recalling a <mode specific> Save Type

Open

The import starts by checking for errors. Then the import can start. For all data types, the actual import starts by aborting the currently running measurement. Then the import does data type specific behavior:

Trace Import: A trace cannot be imported if the trace points in the file do not match the sweep points in the mode. If this happens, an error is generated. When a trace is imported, then **Trace Update** is always turned OFF for that trace and **Trace Display** is always turned ON. The trace file has meta data. If the meta data in the file does not match the corresponding SA state, the dirty marker is displayed.

Mode	SA
SCPI Command	:MMEMory:LOAD:TRACe:DATA TRACE1 TRACE2 TRACE3 TRACE4 TRACE5 TRACE6,<filename>
Example	:MMEM:LOAD:TRAC DATA TRACE2,"myTrace2.csv" imports the 2nd trace from the file myTrace2.csv in the default path.
Remote Command Notes	Errors are reported if the file is empty or missing, or if the file type does not match.

Mode	VSA
SCPI Command	:MMEMory:LOAD:TRACe:DATA D1 D2 D3 D4 D5 D6,<filename>[,CSV TXT SDF]
SCPI Example	MMEM:LOAD:TRAC:DATA D1,"TRC1.TXT",TXT
Remote Command Notes	If the file format parameter is not included in the SCPI command, the file format is determined by the file name extension. If this is not sufficient, the file is scanned to determine the format.
Key Path	Recall, Data (Import), Trace (to), Open . . .

Recall captured data for reuse in demod measurements using the Load Capture Buffer functionality. This function is enabled for 'Code Domain' and 'Modulation Accuracy' measurements only.

Mode	WCDMA
SCPI Command	:MMEMory:LOAD:CAPTured <filename>
Restriction and Notes	Errors are reported if the file is empty or missing, or if the file type does not match.
Key Path	Recall, Data, File Open
Example	:MMEM:LOAD:CAPT "My Documents\WCDMA\data\IQ\captureBuffer\myCaptureBuffer.bi n"

Recall

Mode	VSA
SCPI Command	MMEMory:LOAD:RECORDing <filename>
SCPI Example	MMEM:LOAD:REC "MyRecording.sdf"
Key Path	Recall, Data (Import), Recorded Data, Open . . .

Mode	WIMAXOFDMA
SCPI Name	Recall Zone Map
SCPI Command	:MMEMory:LOAD:ZMAP <filename>
Example	:MMEM:LOAD:ZMAP "myZoneMap.omf" recalls the Zone Map data from the file myZoneMap.omf on the default directory to the Custom Map for Modulation Analysis measurement.
Key Path	Recall, Data, Zone Map

File Open Dialog and Menu

The **File Open** is a standard Windows dialog and has a **File Open** key menu. Each key in this menu corresponds to the selectable items in the **File Open** dialog box. The menu keys can be used for easy navigation between the selections within the dialog or the standard **Tab** and **Arrow** keys can be used for dialog navigation. When you navigate to this selection, you have already limited the file recall type and now you want to specify which file to open.

Open

This selection and the **Enter** key when a filename has been selected or specified actually cause the load to occur. **Open** loads the specified or selected file to the previously selected recall type of either **State** or a specific import data type.

Restriction and Notes	Advisory Event "File <file name> recalled" after recall is complete.
-----------------------	--

File/Folder List

This menu key navigates to the center of the dialog that contains the list of files and

folders. Once here the user can get information about the file.

Key Path	Recall, <various>, Open...
Restriction and Notes	Pressing this key navigates the user to the files and folders list in the center of the dialog.

Sort

Pressing this key brings up the Sort menu that allows the user a way to sort the files within the File Open scope. Only one sorting type can be selected at a time and the sorting happens immediately.

Key Path	Recall, <various>, Open...
Remote Command Notes	No SCPI command directly controls the sorting.

By Date

This allows the user to sort the list of files within the scope of the **File Open** dialog in ascending or descending data order. The date is the last data modified.

Key Path	Recall, <various>, Open..., Sort
Restriction and Notes	Files in File Open dialog are sorted immediately in the selected order

By Name

This allows the user to sort the list of files within the scope of the **File Open** dialog in ascending or descending order based on the filename.

Key Path	Recall, <various>, Open..., Sort
Restriction and Notes	Files in File Open dialog are sorted immediately in the selected order

By Extension

This allows the user to sort the list of files within the scope of the **File Open** dialog in

Recall

ascending or descending order based on the file extension for each file.

Key Path	Recall, <various>, Open..., Sort
Restriction and Notes	Files in File Open dialog are sorted immediately in the selected order

By Size

This allows the user to sort the list of files within the scope of the **File Open** dialog in ascending or descending order based on file size.

Key Path	Recall, <various>, Open..., Sort
Restriction and Notes	Files in File Open dialog are sorted immediately in the selected order

Ascending

This causes the display of the file list to be sorted, according to the sort criteria above, in Ascending order.

Key Path	Recall, <various>, Open..., Sort
Restriction and Notes	Files in File Open dialog are sorted immediately in the selected order

Descending

This causes the display of the file list to be sorted, according to the sort criteria above, in Descending order.

Key Path	Recall, <various>, Open..., Sort
Restriction and Notes	Files in File Open dialog are sorted immediately in the selected order

Files Of Type

This menu key corresponds to the Files Of Type selection in the dialog. It follows the standard Windows supported Files Of Type behavior. It shows the current file suffix that corresponds to the type of file the user has selected to save. If the user navigated here from recalling State, "State File (*.state)" is in the dialog selection and is the only type available

in the pull down menu. If the user navigated here from recalling Trace, “Trace+State File (*.trace)” is in the dialog selection and is the only type available under the pull down menu. If the user navigated here from importing a data file, “Data File (*.csv)” is in the dialog and is the only type available in the pull down menu. Modes can have other data file types and they would also be listed in the pull down menu.

Key Path	Recall, <various>, Open...
Restriction and Notes	Pressing this key causes the pull down menu to list all possible file types available in this context.

Up One Level

This menu key corresponds to the icon of a folder with the up arrow that is in the tool bar of the dialog. It follows the standard Windows supported **Up One Level** behavior. When pressed, it causes the file and folder list to navigate up one level in the directory structure.

Key Path	Recall, <various>, Open...
Restriction and Notes	When pressed, the file and folder list is directed up one level of folders and the new list of files and folders is displayed.

Cancel

This menu key corresponds to the **Cancel** selection in the dialog. It causes the current **File Open** request to be cancelled. It follows the standard Windows supported **Cancel** behavior.

Key Path	Recall, <various>, Open...
Restriction and Notes	Pressing this key causes the Open dialog to go away and auto return.

Recall

AMPTD Y Scale (Amplitude)

This menu has controls for the input signal conditioning as well as the Y-scaling of trace data. Input signal conditioning actually affect the input signal and the associated measurement quality, whereas Y-scaling is non-destructive of data. Even if the data is scaled so as to be clipped or completely off the display, the marker readouts are still correct and accurate data may still be retrieved via SCPI.

Mode	VSA
Key Path	Front Panel

Range

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

Mode	VSA
Remote Command	<code>[:SENSE] :POWer [:RF] :RANGe <real></code> <code>[:SENSE] :POWer [:RF] :RANGe?</code>
Example	POW:RANG 25 POW:RANG?
Notes	The parameter is interpreted as dBm
Preset	20
State Saved	Saved in instrument state.
Min	depends on model and preamp options
Max	depends on model and preamp options
Key Path	AMPTD/YScale

Y Axis Scaling

Y axis scaling allows you to view the entire range of the data or zoom in on a range of interest. Scaling does not affect measurement setup, and rescaling can be done at any time on paused or complete measurements and the results of the rescaling are immediately visible. Y scaling can be made to track range setting for convenience in setting up measurements.

Mode	VSA
Key Path	AMPTD Y-Scale

Select Trace

This function is a duplicate of the same function found on the Trace/Detector menu. See the description there for details. It is placed here to allow you to conveniently choose which trace the Y scaling applies.

Mode	VSA
Key Path	AMPTD Y-Scale, Y Axis Scaling

Y Auto Scale

This immediate action key causes the Y reference value and Scale per Division to change so as to display the full trace without clipping.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:DISPlay:<meas>:TRACe [1] 2 3 4 : Y [: SCALe] : AUTO : ONCE
Example	:DISP:VECT:TRAC1:Y:AUTO:ONCE
Key Path	AMPTD/YScale

Y Reference Value

This function controls the Y value of the selected trace at the Reference Position (see below). It has no effect on hardware input settings.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:DISPlay:<meas>:TRACe [1] 2 3 4 :Y[:SCALE] :RLEVel <real> :DISPlay:<meas>:TRACe [1] 2 3 4 :Y[:SCALE] :RLEVel?
Example	DISP:VECT:TRAC:Y:RLEV 20 DISP:VECT:TRAC:Y:RLEV?
Dependencies/Couplings	None. This does not affect any hardware input settings, like Range does.
Preset	Depends on trace
State Saved	Saved in instrument state.
Min	-9.9E+37
Max	9.9E+37
Key Path	AMPTD/YScale

Y Scale Per Division

This controls the Y scale per division of the selected trace.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:DISPlay:<meas>:TRACe [1] 2 3 4 :Y[:SCALE] :PDIVision <real> :DISPlay:<meas>:TRACe [1] 2 3 4 :Y[:SCALE] :PDIVision?
Example	DISP:VECT:TRAC:Y:PDIV 10 DISP:VECT:TRAC:Y:PDIV?
Dependencies/Couplings	None.
Preset	Depends on trace
State Saved	Saved in instrument state.

Min	-9.9E+37
Max	9.9E+37
Key Path	AMPTD/YScale

Couple Ref to Range

When Couple Ref to Range is on, a Y scaling is adjusted when the Range changes. For example, on traces with Y units of dBm, the reference value changes by the same amount in dB as the Range does. On a trace with Y units of Volts, the Per Division setting changes by a factor of approx. 1.25 when the Range changes by 2 dB. This function may be turned on or off on for each individual trace.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:DISPlay:<meas>:TRACe [1] 2 3 4 : Y [: SCALE] : RLEVel : AUTO OFF ON 0 1 :DISPlay:<meas>:TRACe [1] 2 3 4 : Y [: SCALE] : RLEVel : AUTO?
Example	DISP:VECT:TRAC1:Y:RLEV:AUTO ON DISP:VECT:TRAC1:Y:RLEV:AUTO?
Notes	Range coupling is not available for Phase and Group delay traces.
Preset	1
State Saved	Saved in instrument state.
Range	On Off
Key Path	AMPTD/YScale

Y Reference: Position

This determines the position of the reference line for Y scaling for the selected trace. It may be set to the top, bottom, or center of the grid.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA

Analyzer Setup Functions
AMPTD Y Scale (Amplitude)

Remote Command	:DISPlay:<meas>:TRACe [1] 2 3 4 :Y[:SCALe] :RPOSition TOP CENTer BOTTom :DISPlay:<meas>:TRACe [1] 2 3 4 :Y[:SCALe] :RPOSition?
Example	DISP:VECT:TRAC1:Y:RPOS TOP DISP:VECT:TRAC1:Y:RPOS?
Dependencies/Couplings	Changing trace format or data can affect this. Each format "remembers" its reference position.
Preset	Depends on trace format and trace data. Top for LogMag or most LinearMag traces, middle for Real, Imaginary, Vector displays, Eye diagrams, Phase, Delay, Bottom for Linear Mag EVM
State Saved	Saved in instrument state.
Range	Top Ctr Bottom
Key Path	AMPTD/YScale

Y Unit Preference

This determines the preferred Y unit for the selected trace. You can select Peak, RMS, Power units, or an automatic selection. The automatic selection is to show Power units for frequency domain data and Peak units for time domain data.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:DISPlay:<meas>:TRACe [1] 2 3 4 :Y:UNIT:PREFeren ce AUTO PEAK RMS POWer MRMS :DISPlay:<meas>:TRACe [1] 2 3 4 :Y:UNIT:PREFeren ce?
Example	DISP:VECT:TRAC1:Y:UNIT:PREF PEAK DISP:VECT:TRAC1:Y:UNIT:PREF?
Preset	AUTO
State Saved	Saved in instrument state.
Range	AUTO PEAK RMS POW MRMS
Key Path	AMPTD/YScale

The following SCPI only command can be used to determine exactly which Y unit was chosen based on the setting of the above:

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:DISPlay:<meas>:TRACe [1] 2 3 4 :Y:UNIT?
Example	DISP:VECT:TRAC1:Y:UNIT?
Key Path	AMPTD/YScale

Y Log Ratio

This property is only used if the Trace Format is set to LogMag (Linear Unit). In this format type, you set the Y Log Ratio instead of Y Scale Per Division to determine Y scaling. It sets the ratio of the top of the Y axis to the bottom.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:DISPlay:<meas>:TRACe [1] 2 3 4 :Y:LRATio <real> :DISPlay:<meas>:TRACe [1] 2 3 4 :Y:LRATio?
Example	DISP:VECT:TRAC1:Y:LRAT 10000 DISP:VECT:TRAC1:Y:LRAT?
Notes	This is grayed out if the trace format is not Log Mag (linear unit).
Preset	100000
State Saved	Saved in instrument state.
Min	1.001
Max	100e6
Key Path	AMPTD/YScale

Vector Horiz Center

The Vector trace formats are I-Q and Constellation. When you are in one of these formats you set the vertical (imaginary) axis scaling with the Y Reference Value, Y Reference

Position, and Y Scale Per Division properties. The scaling of the horizontal axis is set so as to maintain an aspect ratio of 1:1. The Vector Horiz Center property is used to set the position of the origin.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:DISPlay:<meas>:TRACe[1] 2 3 4:VHCenter <real> :DISPlay:<meas>:TRACe[1] 2 3 4:VHCenter?
Example	DISP:DDEM:TRAC1:VHC 0.2 DISP:DDEM:TRAC1:VHC?
Preset	0
State Saved	Saved in instrument state.
Min	-9.9e37
Max	9.9e37
Key Path	AMPTD/YScale

Copy Y Scale

This front-panel only function copies the following Y scaling information from the selected trace to another:

- Y reference Position
- Y Reference Value
- Y Unit Preference
- Vector Horiz Center
- Couple Ref to Range
- Y Log Ratio
- Y Reference Line

Mode	VSA
Key Path	AMPTD Y-Scale, Y Axis Scaling

Reference Line

This controls whether the Y reference line is visible or not.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:DISPlay:<meas>:TRACe [1] 2 3 4 :RLINe OFF ON 0 1 :DISPlay:<meas>:TRACe [1] 2 3 4 :RLINe?
Example	DISP:VECT:TRAC1:RLIN ON DISP:VECT:TRAC1:RLIN?
Preset	OFF
State Saved	Saved in instrument state.
Key Path	AMPTD/YScale

BW (Bandwidth)

The BW key allows you to control the resolution bandwidth of the spectrum measurement result, as well as the shape of the resolution bandwidth filter (controlled by the FFT windowing function).

Mode	VSA
Key Path	Front Panel

Res BW

This key allows you to select the resolution bandwidth of the measurement. Res BW is mathematically related to Time length and Window type, so changing one of these, directly or indirectly, must change at least one other.

Res BW and Time length are related by the following equation:

$$\text{Res BW} = \text{ENBW} / T$$

where:

ENBW is the normalized effective noise bandwidth of the Window (see the FFT Window topic for more details).

T is the time record length.

Therefore, **if you change Res BW, Main Time must also change**, and vice versa. (If the Gate function is on, then it is Gate Length, not Main Time, that is related to Res BW by the above equation.)

For convenience, Res BW is by default also coupled to Span (but not vice versa). This coupling may be turned off. See the Res BW Coupling section for more details.

Limits:

The minimum Res Bw to Span ratio is related to the maximum Main Time length (q.v.), and is given by:

$$\text{ENBW} / 409600 \text{ if Freq points state parameter is set to Auto}$$

$$\text{ENBW} / (\text{Freq Points} - 1) \text{ if Freq points parameter is manually set}$$

The maximum Res BW to Span ratio is related to the minimum time record size (16 points for most windows, 17 points for Flat Top), and is given by:

$$\text{ENBW} / 12.5$$

$$(\text{ENBW} / 13.28125 \text{ for Flat Top window})$$

See the Main Time topic for more on relationships between Res BW and time.

Measurement	<meas>:=VECTor ADEMod
Mode	VSA
Remote Command	[:SENSe] :<meas>:BANDwidth BWIDth[:RESolution] <bandwidth> [:SENSe] :<meas>:BANDwidth BWIDth[:RESolution]?
Example	VECT:BWID 200 KHZ VECT:BWID?
Notes	Key blanked in any other measurement than Vector or Analog Demod
Dependencies/Couplings	Changing Main Time or Gate Length changes Res BW. See Res BW Coupling for other changes that can affect (or be affected by) Res BW
Preset	300 kHz
State Saved	Saved in instrument state.
Min	-9.9e37
Max	9.9e37
Key Path	BW

Res BW Coupling

This property controls how Res BW is affected by other parameters. The three possible settings are:

Span: (default) This setting keeps the ratio of Res BW:Span constant whenever the Span is changed. However, you can change the Res BW at will, and doing so establishes a new Res BW:Span ratio.

Min: This setting is only available when the Freq Points property is manually set, and is disabled (forceful grey out) when Freq Points is Auto. It maintains the RBW at the minimum possible value given the settings for Freq Points, Span, and Window. Res BW coupling is changed from Min to Span if you manually set Res BW.

Fixed: This setting attempts to keep the Res BW setting fixed as Span, Freq Points, or FFT Window type change. Changing FFT Window will cause Main Time (or Gate) length to change in order to keep the Res BW Fixed. Res BW coupling is forced to Fixed mode any time you turn time the Gate function on or manually set Main Time length.

If a requested change to Res BW or Time Length (Main or Gate) would cause the Res BW to go outside the minimum or maximum Res BW: Span limits (see the main Res BW section for specifics), the Res BW is clipped at the appropriate limit. The Time length is then set to according to the limited Res BW.

In Fixed coupling mode, if increasing the Span would cause the new Res BW:Span to drop below the minimum, or if decreasing Span would cause the new Res BW: span to exceed the maximum, the requested Span is accepted and then the Res BW is changed to the limiting value. The associated Time length is updated.

In Fixed or Span coupling, increasing Freq Points does not cause the Main (or Gate) Time Length to increase. It only adds zero padding to the array that is used in the FFT to calculate the Spectrum. Therefore, it will not affect Res BW. If decreasing Freq Points decreases the maximum time length below the current Main Time, then the Main Time length is clipped to the new limits. If Gating is on, the Gate Delay is first limited, then the Gate Length. The Res BW is then updated as a result of the Time changes.

In Fixed or Span coupling, changing the Window Type will not affect RBW unless it falls outside the limits calculated using the new window. Then the Res BW is clipped at the appropriate limit. The associated Time length is also updated.

Measurement	<meas>:=VECTor ADEMod
Mode	VSA
Remote Command	[:SENSE] : <meas> : BANDwidth BWIDth [:RESolution] : COUPle SPAN MIN FIXed [:SENSE] : <meas> : BANDwidth BWIDth [:RESolution] : COUPle?
Example	VECT:BWID:COUP FIX VECT:BWID:COUP?
Notes	Blanked when in any other measurement than Vector or Analog DemodMIN is not available if Freq Points is set to Auto and trying to set it generates error -221 Settings conflict
Dependencies/Couplings	See narrative above table and also Res BW section
Preset	SPAN
State Saved	Saved in instrument state.
Range	Span Min Fixed
Key Path	BW

FFT Window

This key allows you to choose the Window function that is applied to the time data prior to the FFT calculation used for Spectrum and PSD displays. Four windows are available.

Window name	Common usage	Normalized ENBW (Hz-s)
Uniform	Transient or self-windowing signals, signals that are periodic within a time record length.	1.0
Hanning	Frequency resolution	1.5
Gaussian	High dynamic range	2.21536
Flat Top	High amplitude accuracy	3.8194

The normalized ENBW is the equivalent noise bandwidth, that is, the width of a rectangular filter that passes the same amount of white noise as the window. It is used to define the resolution bandwidth.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	[:SENSe] :<meas>:FFT:WINDow [:TYPE] UNIForm HANNing GAUSSian FLATtop [:SENSe] :<meas>:FFT:WINDow [:TYPE] ?
Example	VECT:FFT:WIND GAUS VECT:FFT:WIND?
Dependencies/Couplings	See Res BW and Res BW Coupling sections
Preset	FLAT
State Saved	Saved in instrument state.
Range	Uniform Hanning Gaussian (High Dyn Rng) Flat Top (High Amptd Accy)
Key Path	BW

FREQ Channel

Frequency parameters for any vector measurement consist of 2 pairs of properties: Center Frequency and Span or Start Frequency and Stop Frequency. These behave much as they do in any other application, but there is the additional constraint that the span is limited to much less than the center frequency range.

If you change center frequency the start and stop frequencies change by the same amount.

If you change span, start frequency and stop frequency are changed by 1/2 the span change.

If you change start frequency, stop frequency remains fixed and span and center frequency are refigured accordingly. Changing stop frequency has similar behavior.

Limits:

If you change the start frequency such that it will equal or exceed the stop frequency, the new start frequency will be accepted if possible and the stop frequency will be set to min span above the start. Similarly if you attempt to set the stop below the start, the start frequency will move to a min span below the new stop frequency.

If you reduce the start frequency beyond a max span below the stop, the stop frequency will be "dragged along" such that it will be a max span above the new start frequency, and similarly increasing the stop frequency will drag the start frequency along if you attempt to increase the span beyond the maximum.

Stop frequency may be 1/2 span above the maximum center frequency, but frequency-domain traces are blanked above the maximum center frequency.

Start frequency may be 1/2 span below the minimum center frequency, but frequency-domain traces are blanked below the minimum center frequency.

Pressing the Freq hardkey changes the active function to Center Frequency.

Mode	VSA
Key Path	Front Panel

Center Freq

Sets the frequency of the display Center.

Mode	VSA
------	-----

Remote Command	<code>[:SENSe] :FREQuency:CENTer <freq></code> <code>[:SENSe] :FREQuency:CENTer?</code>
Example	<code>FREQ:CENT 985 MHZ</code> <code>FREQ:CENT?</code>
Dependencies/Couplings	Start Freq, Stop Freq, and Span. See narrative under FREQ Channel heading for details.
Preset	1 GHz
State Saved	Saved in instrument state.
Min	20 Hz
Max	Depends on frequency range option.
Key Path	FREQ Channel

Start Freq

Sets the frequency of the display Start.

Mode	VSA
Remote Command	<code>[:SENSe] :FREQuency:STARt <freq></code> <code>[:SENSe] :FREQuency:STARt?</code>
Example	<code>FREQ:STAR 980 MHz</code> <code>FREQ:STAR?</code>
Dependencies/Couplings	Stop Freq, Center Freq, and Span. See narrative under FREQ Channel heading for details.
Preset	Depends on span option. It is 1/2 max span below 1 GHz
State Saved	Saved in instrument state.
Min	-9.9e37
Max	9.9e37
Key Path	FREQ Channel

Stop Freq

Sets the frequency of the display Stop.

Mode	VSA
Remote Command	<code>[:SENSe] :FREQuency:STOP <freq></code> <code>[:SENSe] :FREQuency:STOP?</code>
Example	<code>FREQ:STOP 990 MHz</code> <code>FREQ:STOP?</code>
Dependencies/Couplings	Start Freq, Center Freq, and Span. See narrative under FREQ Channel heading for details.
Preset	Depends on span option. It is 1/2 max span above 1 GHz
State Saved	Saved in instrument state.
Min	-9.9e37
Max	9.9e37
Key Path	FREQ Channel

CF Step

This key controls the amount the center frequency changes if it is the active function and the user presses the Up or Down arrow key. Note: the start and stop frequency also change by the amount of the CF Step if the Up/Down arrow keys are used to change them; but the key is mainly used is in connection with stepping the center frequency, so the legacy key name has been retained. The step size in Auto mode is 1/10th the span. It can be set to any value in manual mode.

Mode	VSA
Remote Command	<code>[:SENSe] :FREQuency:CENTer:STEP [:INCRement] <freq></code> <code>[:SENSe] :FREQuency:CENTer:STEP [:INCRement] ?</code> <code>[:SENSe] :FREQuency:CENTer:STEP:AUTO OFF ON 0 1</code> <code>[:SENSe] :FREQuency:CENTer:STEP:AUTO?</code>
Example	<code>FREQ:CENt:STEP 1 MHZ</code> <code>FREQ:CENt:STEP?</code> <code>FREQ:CENt:STEP:AUTO ON</code> <code>FREQ:CENt:STEP:AUTO?</code>

Dependencies/Couplings	1/10th Span when auto is turned on
Preset	Depends on span option; 1/10th default span.
State Saved	Saved in instrument state.
Min	-9.9e37
Max	9.9e37
Key Path	FREQ Channel

Source

The Source function is not available for this mode.

Mode	VSA
Key Path	Front Panel

SPAN X Scale

This menu has softkeys for selecting measurement span and also for scaling of the X axis.

Mode	VSA
Key Path	Front Panel

Span

This controls the frequency span of the measurement. This is the full span that is displayed on a spectrum display. The actual IF bandwidth that the time record sees is 1.28 times the span. See the **FREQ Channel** section for details on how this interacts with start, stop, and center frequencies.

Mode	VSA
Remote Command	[:SENSe] :FREQuency:SPAN <freq> [:SENSe] :FREQuency:SPAN?
Example	FREQ:SPAN 10 MHZ FREQ:SPAN?
Dependencies/Couplings	Start Freq and Stop Freq. See narrative under FREQ Channel heading for details.
Preset	depends on span option
State Saved	Saved in instrument state.
Min	2 Hz
Max	depends on span option
Key Path	SPAN/XScale

Full Span

This immediate action key changes the span to the maximum available. The center frequency remains unchanged, regardless of whether the Frequency Annotation property is Start/Stop or Center/Span.

Mode	VSA
Remote Command	[:SENSe] :FREQuency :SPAN :FULL
Example	FREQ:SPAN:FULL
Notes	The label on the softkey gives the full span available, which depends on span option.
Dependencies/Couplings	Changes span to maximum while keeping the center frequency constant. Start and Stop frequency are affected
Key Path	SPAN/XScale

Signal Track

From the point of view of a spectrum display, this function, when turned on, attempts to keep the largest magnitude signal in the center of the screen. It is the equivalent of manually doing a single acquisition, doing a marker to peak search on a spectrum trace, then copying the marker position to the center frequency and repeating. (It is not necessary to be viewing a spectrum display for this function to work.)

Mode	VSA
Remote Command	[:SENSe] :VECTor ADEMod :FREQuency :CENTer :TRACk OFF ON 0 1 [:SENSe] :VECTor ADEMod :FREQuency :CENTer :TRACk?
Example	VECT:FREQ:CENT:TRAC ON VECT:FREQ:CENT:TRAC?
Dependencies/Couplings	Unavailable if averaging is turned on.
Preset	0
State Saved	Saved in instrument state.
Range	On Off
Key Path	SPAN/XScale

X Axis Scaling

By default, the X axis of a trace is scaled to show all the available data in the trace. (The exception is that in spectrum displays, the edges of the spectrum that may contain aliases are not shown by default.) However, the X axis can be manually scaled in order to zoom in on a subset of the X values, or to set the X scaling to more convenient numbers. X scaling may be changed even when a measurement is paused or completed, and the display will be updated immediately, using the existing trace data. No measurement parameters are affected and no new measurement is made. X scaling is unique to each trace.

Scaling is based on a reference position, which may be on the left of the grid, in the center, or on the right. The X reference value is assigned to this position. The X Width is the difference between the X value on the right side of the grid and the X value on the left. If the reference is in the center, the right and left are half of the X width away.

If X scaling is set such that the left or right axis boundary falls outside the X range of the available data, the trace is shown correctly on that portion of the display where it belongs.

For Vector displays (I-Q and Constellation) the X axis is actually perpendicular to the screen, and the screen's horizontal axis is used for the real part of the Y values. In this case, the X scaling can still be used to only display a portion of the data. In the case of the X reference position, left means the least positive or most negative X value, and right means the most positive or least negative value. For example, when looking at a 10 ms time record of a QPSK signal, you could set the X reference position to left, the X reference value to 4 ms and the X width to 1 ms in order to see just the portion of the signal between 4 and 5 ms. This same portion would be shown if IQ format were chosen (even though the time axis is not visible in this case).

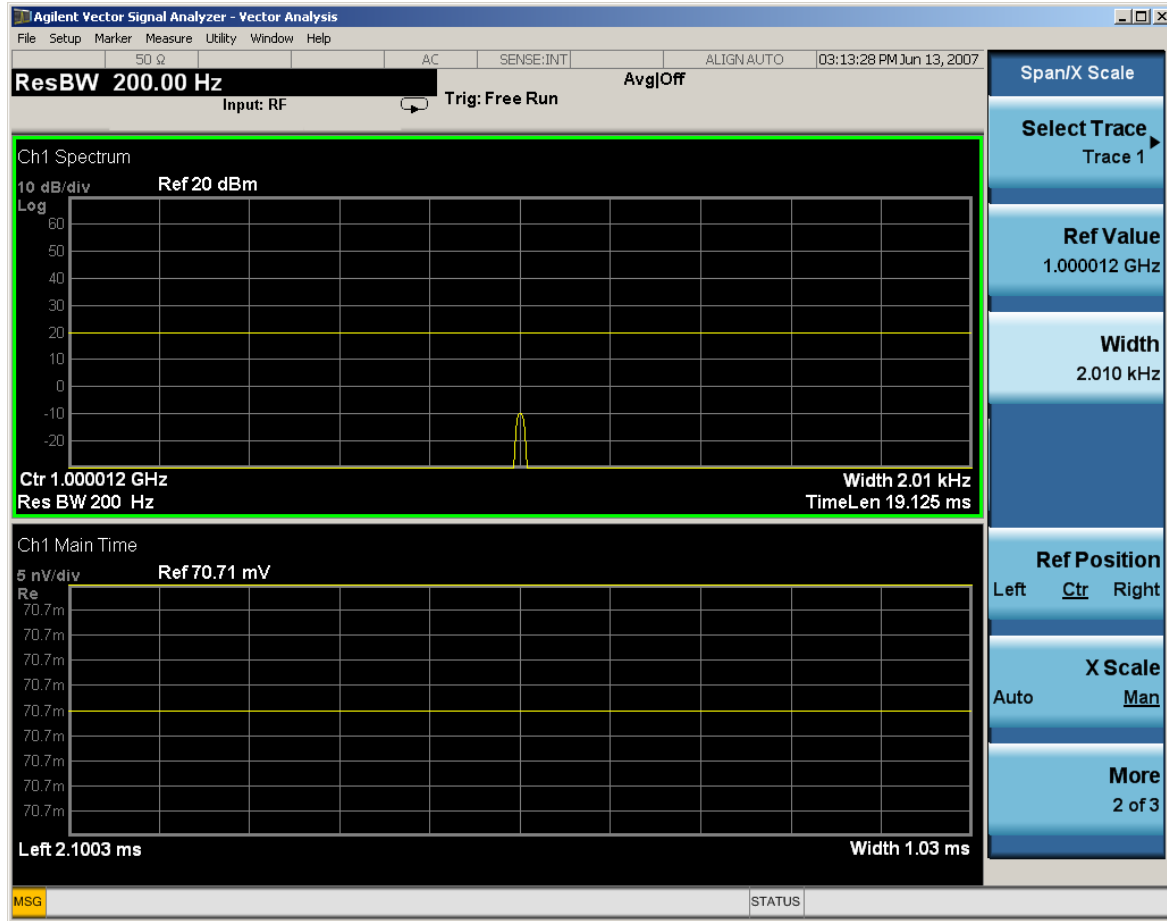
For Symbol tables, which are not graphed but displayed in alphanumeric, X scaling can also be used to display a portion of the complete data. For example, you can set the X reference position to left, the X reference value to 20 symbols, and the X width to 10 symbols to see symbols 20 through 30. If then change the X reference position to center, you will see symbols 15 through 25, and if you change the X reference position to right you will see symbols 10 through 20.

Annotation for the X axis is just below the grid on the left and right side. It is based on whether the X Scaling is Auto or Man. If it is Auto, then the left side is annotated with either "Center" or "Start", and the right side is annotated with either "Span" or "Stop" followed by the appropriate numbers and units. The Center/ Span pair is only used for Spectrum or PSD traces, and only if the Freq Annotation property is Center/Span (see Freq Annotation under the FREQ key).




If X Scaling is Man, the annotation for the left side is "Left | Ctr | Right <x_reference_value> <unit>" (depending on the X reference position), and on the right side the annotation is "Width <x_width> <unit>". Shown below is an illustration of two of these manual X scale annotations:

Analyzer Setup Functions
SPAN X Scale



or Vector displays, the X axis annotation is replaced by annotation for the real part of the Y value, each annotation consisting of number followed by a unit (usually volts). F

Mode	VSA
Key Path	SPAN X Scale

Select Trace

This function is a duplicate of the same function found on the Trace/Detector menu. See the description there for details. It is placed here to allow you to conveniently choose which trace the X scaling applies.

Mode	VSA
------	-----

Key Path **SPAN X Scale, X Axis Scaling**

X Scale

If this function is set to Auto, it causes the trace to display all available trace data. (Exception: the display of the outer edges of a spectrum which may contain aliases is governed by the All Frequency Points function setting – see below.). The annotation is updated as needed, but the X Reference Value and X Width keys are grayed out and not updated. When this function is set to Man, the X Reference Value and X Width softkey readbacks are updated with the current values.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:DISPlay:<meas>:TRACe [1] 2 3 4 :X [:SCALe] :COUPle OFF ON 0 1 :DISPlay:<meas>:TRACe [1] 2 3 4 :X [:SCALe] :COUPle?
Example	:DISP:VECT:TRAC1:X:COUP ON DISP:VECT:TRAC1:X:COUP?
Dependencies/Couplings	Forced to Man if X Reference Value or X Width is set by user.
Preset	1
State Saved	Saved in instrument state.
Range	Auto Man
Key Path	SPAN/XScale

X Reference Value

This function controls the X value of the selected trace at the chosen X Reference Position (see below). It has no effect on hardware input settings.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA

Remote Command	:DISPlay:<meas>:TRACe [1] 2 3 4 :X[:SCALe] :RLEVel <real> :DISPlay:<meas>:TRACe [1] 2 3 4 :X[:SCALe] :RLEVel?
Example	DISP:VECT:TRAC:X:RLEV 1e9 DISP:VECT:TRAC:X:RLEV?
Dependencies/Couplings	If X Scale is set to Auto, the X Reference Value is determined by the trace data and this key is grayed out.
Preset	Depends on trace
State Saved	Saved in instrument state.
Min	-9.9E+37
Max	9.9E+37
Key Path	SPAN/XScale

X Width

This sets the width of the X axis that is displayed for the selected trace. The X width may be set less than the Span for frequency-domain traces, allowing you to zoom in on just a portion of the measured values. Likewise it may be less than time span covered by time-domain data This plus the X Reference Value and X Reference Position control the range of X values that may be displayed on a trace. For example, if the X Reference position is Center, the X Reference value is 1 GHz and the X Width is 20 MHz.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:DISPlay:<meas>:TRACe [1] 2 3 4 :X[:SCALe] :SPAN <real> :DISPlay:<meas>:TRACe [1] 2 3 4 :X[:SCALe] :SPAN?
Example	DISP:VECT:TRAC:X:SPAN 10e6 DISP:VECT:TRAC:X:SPAN?
Dependencies/Couplings	If X Scale is set to Auto, the X Width is determined by the trace data and this key is grayed out.
Preset	Depends on trace
State Saved	Saved in instrument state.
Min	-9.9E+37
Max	9.9E+37

Key Path **SPAN/XScale**

X Reference Position

This determines the position from which the X scaling is calculated for the selected trace. It may be set to the left side, center, or right side of the grid.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:DISPlay:<meas>:TRACe[1] 2 3 4:X[:SCALe]:RPOSition LEFT CENTer RIGHT :DISPlay:<meas>:TRACe[1] 2 3 4:X[:SCALe]:RPOSition?
Example	DISP:VECT:TRAC1:X:RPOS LEFT DISP:VECT:TRAC1:X:RPOS?
Dependencies/Couplings	If X Scale is set to Auto, the X Reference Position is determined by the trace data and this key is grayed out.
Preset	CENT
State Saved	Saved in instrument state.
Range	Left Ctr Right
Key Path	SPAN/XScale

All Frequency Points

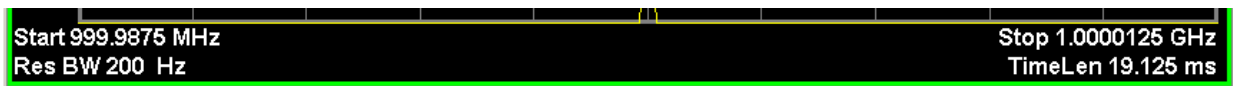
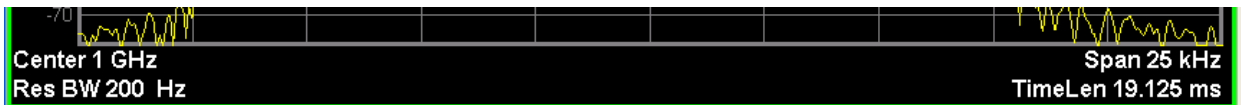
Spectrum trace data (and PSD) are based on the FFT algorithm. By default, the outer edges of the spectrum are not displayed because they may show spurious results that are aliases of real signals that are not completely filtered out by the IF filter. For example, in the case of a 1024 point FFT only 801 points are displayed. If you want to view the additional FFT points at the edges of spectral displays, turn this function on. It is global to all traces, not specific to a single trace.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA

Remote Command	:DISPlay:<meas>:AFPoints OFF ON 0 1 :DISPlay:<meas>:AFPoints?
Example	DISP:VECT:AFP ON DISP:VECT:AFP?
Notes	ac
Dependencies/Couplings	Only applies if trace is showing Spectrum or PSD results.
Preset	OFF
State Saved	Saved in instrument state.
Range	On Off
Key Path	SPAN/XScale

Freq Annotation

This controls how Spectrum and PSD traces are annotated when their X Scale is set to Auto. If Freq Annotation is set to Center/Span, the X-axes on windows containing frequency domain traces are labeled with the center frequency on the left and the span on the right. If the Freq Annotation is set to Start/Stop, then the start and stop frequencies appear in place of center and span. If the X Scale is manual, then this annotation style does not apply.



Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:DISPlay:<meas>:FANNotation CSPan SSTop :DISPlay:<meas>:FANNotation?
Example	DISP:VECT:FANN CSP DISP:VECT:FANN?
Preset	CSP
State Saved	Saved in instrument state.

Range Center/Span | Start/Stop
Key Path **SPAN/XScale**

Copy X Scale

This front-panel only function copies the following X scaling information from the selected trace to another:

- X reference Position
- X Reference Value
- X Width
- X Scale (Auto/Man)

Mode VSA
Key Path **SPAN X Scale, X Axis Scaling**

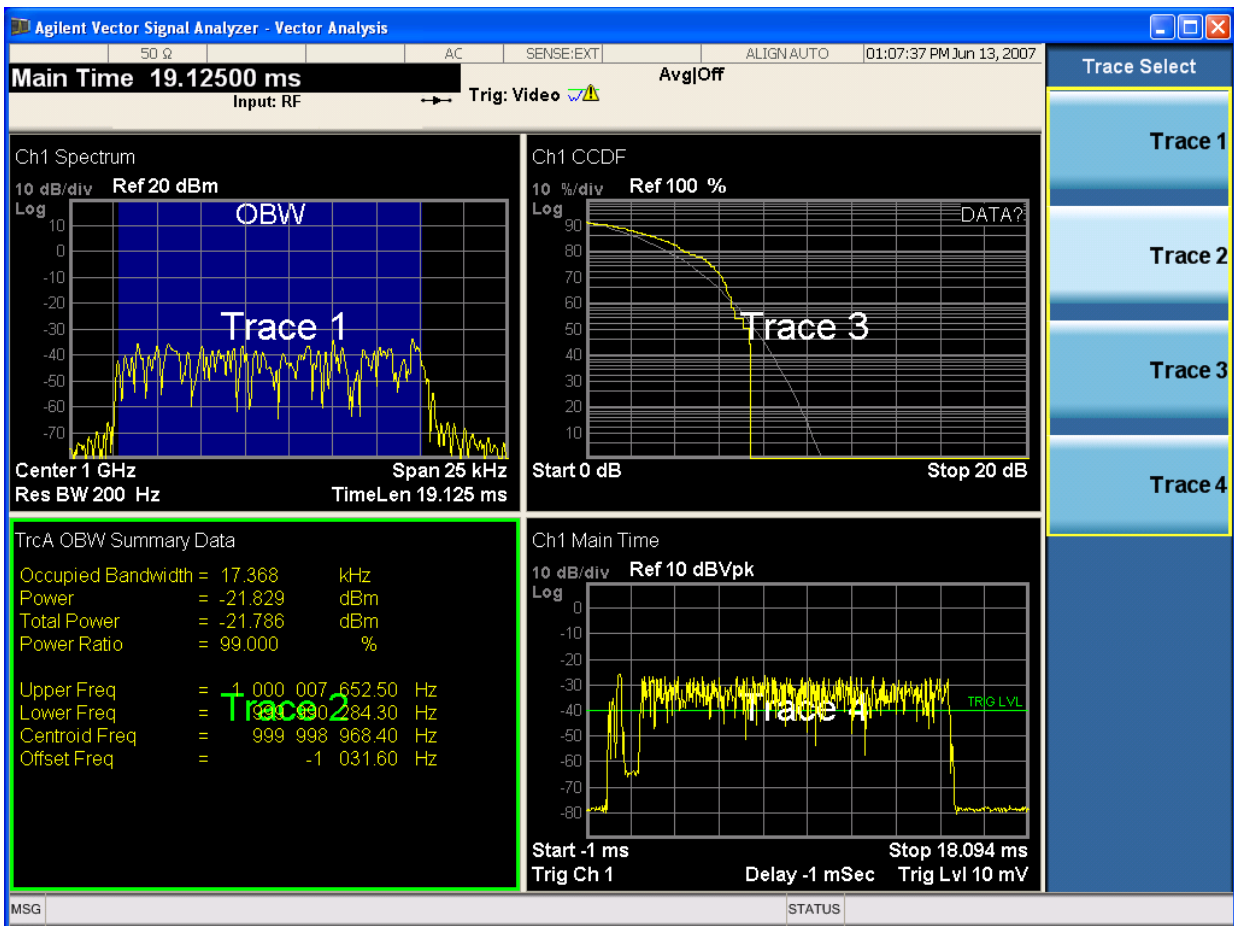
Trace/Detector

This key accesses a menu allowing you to select various trace parameters for all VSA measurements.

Mode	VSA
Key Path	Front Panel

Select Trace

This softkey brings up a menu that allows you to select the trace that is to receive the action of all successive trace-specific commands like scaling, assignment of trace data, etc. The selected trace is outlined in green and is always made visible. While the Select Trace menu is showing, Each visible trace is annotated in the middle with its own trace number, as shown: below. The trace number annotations disappear when any other menu is showing.



Grid 2x2 layout showing trace annotations when Trace Select dialog is active

This softkey also appears in the X and Y scaling menus. There is only one selected trace at any time. If you change which trace is selected, that change is reflected in this softkey/menu wherever it appears. Other ways to select a trace include use of the Next Window key, clicking within a trace window with a mouse cursor, and issuing a trace-specific SCPI command.

There is no SCPI command associated with this function. Instead, SCPI commands that are trace-specific have an index on the TRACe node that determines the selected trace. Using such a command has the side effect that the trace addressed by the SCPI command becomes the selected trace for any front panel interaction.

Mode	VSA
Notes	No SCPI. Front panel only.
Dependencies/Couplings	Affects any trace-specific commands

Range	Trace 1 Trace 2 Trace 3 Trace 4 Trace 5 Trace 6
Key Path	Trace/Detector (also Span / X Scale or AMPTD ? Y Scale)

Data

This accesses a menu of Trace data choices for the selected trace. A VSA Measurement may produce many different results from a single scan; either a graph or a table. In addition, the ACP and OBW functions can be enabled on any trace showing a frequency-domain result, and produce Summary table results. Any of these results may be assigned to a trace and displayed. See the individual measurement PDs for a list of all Trace results that are available for each measurement.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:DISPlay:<meas>:TRACe [1] 2 3 4 :FEED <string> :DISPlay:<meas>:TRACe [1] 2 3 4 :FEED?
Example	DISP:VECT:TRAC1:FEED "Spectrum1" DISP:VECT:TRAC1:FEED?
Preset	Depends on trace number and measurement
State Saved	Saved in instrument state.
Range	see table above and in individual Measurement PDs
Key Path	Trace/Detector, Data

The following Trace Data types are available in all measurements:

Soft Key Name	SCPI string form
No Data	"No Data"
Spectrum	"Spectrum1"
Inst Spectrum	"Inst Spectrum1"
Raw Main Time	"Raw Main Time1"
OBW Summary Trace 1	"OBW Summary Trc1"
OBW Summary Trace 2	"OBW Summary Trc2"
OBW Summary Trace 3	"OBW Summary Trc3"

Soft Key Name	SCPI string form
OBW Summary Trace 4	"OBW Summary Trc4"
ACP Summary Trace 1	"ACP Summary Trc1"
ACP Summary Trace 2	" ACP Summary Trc2"
ACP Summary Trace 3	" ACP Summary Trc3"
ACP Summary Trace 4	" ACP Summary Trc4"

The complete list of Trace Data names that may be assigned using the above SCPI can be obtained by using the following SCPI query:

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:DATA[1] 2 3 4:NAMes?
Example	CALC:VECT:DATA:NAM?
Notes	Query only. Returns a comma-separated list of trace data names that may be used in DISPLAY:<meas>:TRACe[1] 2 3 4:FEED "<string>". The list is the same regardless of trace index.

Spectrum

This key assigns the selected trace to display the Spectrum data result.

The Spectrum trace data displays the spectrum of the selected channel. The spectrum computation displays frequency on the x axis and amplitude on the y axis.

The following formulas show how the analyzer calculates spectrum information:

Key: F = Fast Fourier Transform (FFT)
AF = Averaged spectra
AT = Averaged time
f = Instantaneous spectra
t = Instantaneous time
W = Windowing function
n = Average number
c = Correction trace (from calibration)
 $f[n]^2 = f[n] \times \text{conjugate}(f[n])$
× = multiplication

No Average

$$f = F(W \times t) \times c$$

rms Average

$$AF[n] = \frac{1}{n} \text{sum} (f [n]^2)$$

rms Exponential AF[n]Average

$$AF[n] = \frac{1}{n} (f [n]^2) + \frac{n-1}{n} AF[n-1]$$

where $1 \leq n \leq \text{number of averages}$

Continuous Peak Hold Average

$$AF[n] = \text{MAX} (AF[n-1], f [n]^2)$$

Time Average

$$AF[n] = F\{W \times AT[n]\} \times c$$

where $AT[n] = \frac{1}{n} \text{sum} (t [n])$

Time Exponential Average

$$AF[n] = F\{W \times AT[n]\} \times c$$

where $AT[n] = \frac{1}{n} t [n] + \frac{n-1}{n} AT[n-1]$
and $1 \leq n \leq \text{number of averages}$

As shown in the previous formulas, the spectrum may be a linear spectrum or power spectrum as follows:

If the average is...	then the spectrum is...
Averaging OFF	Linear
rms Average	Power
Continuous peak	Power

Linear spectra contain magnitude and phase (real and imaginary) information. Remember however, that scalar measurements (produced by the Spectrum Analyzer application) do not provide phase information. Therefore, for scalar measurements, linear spectra have no phase information.

Power spectra contain only magnitude (real) information. This occurs with rms averages, for instance, because the results of the FFT are squared. Remember that the FFT yields both real and imaginary information. When the analyzer squares the results of the FFT, the imaginary part becomes zero.

See also Trace/Detector, Data

Mode	VSA
Key Path	Trace/Detector, Data

Inst Spectrum

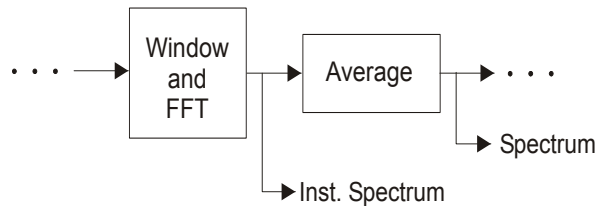
This key assigns the selected trace to display the Inst. Spectrum data result.

Inst Spectrum trace data displays the instantaneous spectrum for the selected input channel. Instantaneous spectrum is computed before data is averaged, which allows you see spectrum data before the data is averaged with other spectrum data.

Note

Inst Spectrum is not available when analog or digital demodulation is selected.

The following block diagram is a portion of the block diagram shown under Vector Block Diagram. It shows where, in the block diagram, spectrum and instantaneous spectrum are created.



This measurement calculation is useful for these types of averaged measurements:

- rms
- rms exponential
- Continuous peak hold

If averaging is off, the spectrum and instantaneous spectrum display the same information.

See also Trace/Detector, Data

Mode	VSA
Key Path	Trace/Detector, Data

Main Time

This key assigns the selected trace to display the Main Time data result.

Note that Main Time is not available when analog or digital demodulation is selected.

Main Time versus Gate Time

The term is used to differentiate between the "main" time record and the "gate" time record when time gating is on.

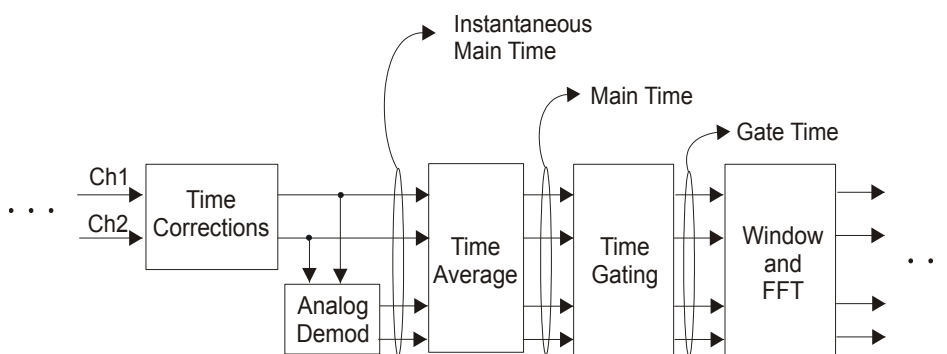
A time record is the basic building block of the Fast Fourier Transform (FFT). The FFT takes the time-domain information in the time record and transforms it into the frequency domain.

When time gating is on, you can identify a portion of the main time-record to be used by the FFT. The term "main time-record" identifies the entire time record; the term "gate time-record" identifies the portion selected by the gate.

Selecting the Main Time trace data displays the entire time record--the main time-record. Selecting the Gate Time trace data displays that portion of the main time-record marked by the gate--the gate time-record.

The following block diagram is a portion of the block diagram shown under Vector Block Diagram. It shows the blocks that create main time and gate time.

Note that the Analog Demodulation block is available only when analog demodulation is enabled



There are many reasons why you may want to view the main time record. Here are just a few:

- To verify that there is an input signal.
- To see the characteristics of the input signal.
- To help in manually setting the input range.

Time Records and Span

If you set the analyzer to full span, the time data you see is the actual input time-record. This is raw input data--the signal from which all subsequent measurements are based.

If you set the instrument to measure a specific bandwidth (something less than full span), the time data you see is the raw input data after it has been filtered (to provide alias protection) and decimated (to obtain the desired span).

Time Records and Averaging

If rms or continuous peak-hold averaging is on, the analyzer displays the most recent time record. The analyzer does not show an averaged time waveform, because all averaging is done after the time data has been transformed to the frequency domain.

If time averaging is on, the analyzer displays the averaged time-record. In other words, the time record has been averaged with previous time records.

How the Analyzer Displays the Time Record

It is important to remember that although the time record looks like an oscilloscope display, the analyzer is not a digital oscilloscope.

The time record represents samples of a waveform. The samples have enough information to accurately reconstruct the input signal--but the human eye may not properly perform the reconstruction. In fact, for frequencies that are higher than about ten percent of the frequency span, there will be noticeable visible distortion.

The analyzer's anti-alias filters will cause some ringing or distortion of square waves or transients when viewed in the time domain.

See also Trace/Detector, Data

Mode	VSA
Key Path	Trace/Detector, Data

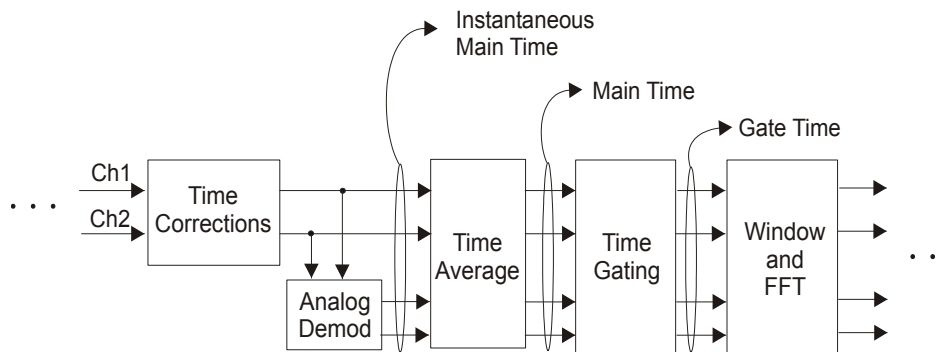
Inst Main Time

This key assigns the selected trace to display the Inst Main Time data result.

Inst Main Time trace data displays the instantaneous time-domain data for the selected input channel.

Note that Inst Main Time is not available when analog or digital demodulation is selected.

The following block diagram is a portion of the Vector Signal Analyzer block diagram. It shows how Instantaneous Main Time is derived.



Notice that Instantaneous Main Time shows you time data before time averaging. If time averaging is off, Instantaneous Main Time is identical to Main Time.

See also Trace/Detector, Data

Mode	VSA
Key Path	Trace/Detector, Data

Gate Time

This key assigns the selected trace to display the Gate Time data result.

Gate Time trace data displays the selected channel's gate time-record.

Note that Gate Time is not available when analog or digital demodulation is selected.

If time gating is on, Gate Time displays the portion of the main time-record marked by the gate-- this portion is called the gate record (if time gating is off, Gate Time displays nothing).

As a reminder, if time gating is on, the Fast Fourier Transform (FFT) uses the gate time-record, which can be all or a portion of the main time-record, to compute frequency information such as spectrum, frequency response, coherence, and correlation.

See also Trace/Detector, Data

Mode	VSA
Key Path	Trace/Detector, Data

Raw Main Time

This key assigns the selected trace to display the Raw Main Time data result.

Raw Main Time is the raw data read from the input hardware or playback file. It is similar to Main Time with the following exceptions:

- This data has not had time corrections applied, so it displays a "CAL?" trace LED.
- The data has not gone through the analyzer's software resampling filters, so is generally not sampled at the specified sample rate.
- The data has a wider bandwidth than the measurement span would indicate.

Raw Main Time data is useful in the following situations:

- When you use Channel, IF Magnitude, or Magnitude trigger types, the input hardware

detects the trigger, so Raw Main Time sometimes gives a better indication of what caused the trigger.

- When you play back a recording, the Raw Main Time measurement data allows you to see exactly the samples that are saved in the recording, with no filtering applied or settling removed.

See also Trace/Detector, Data

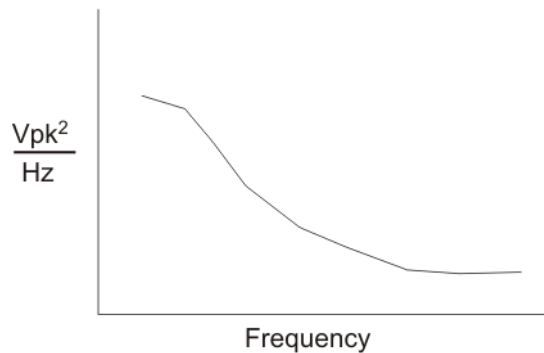
Mode	VSA
Key Path	Trace/Detector, Data

PSD (Power Spectral Density)

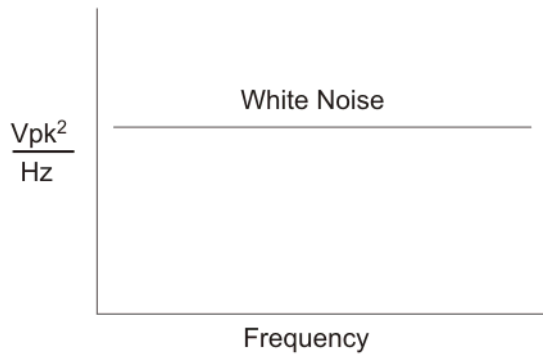
This key assigns the selected trace to display the Power Spectral Density (PSD) data result.

PSD trace data displays the power spectral density (PSD) of the selected channel.

The definition of PSD yields y-axis units of V_{pk}^2/Hz and x-axis units of frequency:



PSD is used for noise measurements. It shows the power density of a signal as a function of frequency. In general, noise may have any arbitrary frequency content, resulting in a variety of possible PSD shapes. Noise that has equal power density at all frequencies is called white noise:



The definition of PSD is power per Hertz. In other words, power is divided by the measurement bandwidth, which in this analyzer is the resolution bandwidth (ResBW), as follows:

$$\frac{V_{pk}^2}{RBW} = \frac{V_{pk}^2}{Hz}$$

Units of V_{pk}^2/Hz assumes the signal is referenced to 1 ohm. That is, because no resistance is specified, the signal is interpreted as a voltage across a one ohm resistor, with the power in the resistor equal to V_{pk}^2 .

You can select units of dBm/Hz to take into account the analyzer's input impedance. PSD defaults to these units. The analyzer calculates dBm/Hz as follows:

$$\frac{dBm}{Hz} = 10 \log \left[\frac{\frac{V_{rms}^2}{Z} \times 1000}{RBW} \right]$$

where:

RBW = resolution bandwidth (Hz)

Z = input impedance

See also Trace/Detector, Data

Mode	VSA
Key Path	Trace/Detector, Data

CCDF (Complementary, Cumulative Density Function)

This key assigns the selected trace to display the CCDF data result.

CCDF trace data displays the complementary, cumulative density function (CCDF) for the selected input channel.

The complementary, cumulative density function (CCDF) is a statistical-power calculation and can be performed only on time-domain data. As its name suggests, CCDF is the complement of CDF, and is defined as follows:

$$\begin{aligned} \text{CDF}(K) &= \text{Probability}(x \leq K) \\ \text{CCDF}(K) &= \text{Probability}(x > K) \end{aligned}$$

CCDF provides better resolution than CDF for low probability signals, especially when log format is used for the y-axis.

The analyzer plots CCDF using units of percent (%) for the y-axis and power (dB) for the x-axis. Power on the x-axis is relative to the signal average power, so 0 dB is the average power of the signal. Therefore, a marker readout of

Trace A Marker 2 dB 12 %

means there is a 12% probability that the signal power will be 2 dB or more above the average power.

CCDF Calculation:

Calculate the RMS value for all measured samples; this becomes the 0 dB point at the left end of the x-axis.

Normalize all samples to the RMS value in units of dB.

Determine which x-axis bin each sample belongs in between 0 and 20 dB.

Calculate the total number of samples that are greater than or equal to each x-axis bin and plot as a percent of the number of samples measured.

Samples Used in the Power Measurement

For the Demod Off and Analog demod modes, the analyzer computes CCDF using all samples in the current time record (all points in the active trace). Each successive time record adds additional samples to the CCDF measurement.

For WLAN - OFDM and -DSSS demod modes, the analyzer computes CCDF using all samples specified within the measurement interval.

Restarting the Power Measurement

Selecting CCDF, restarting the measurement, or changing most measurement parameters restarts the CCDF measurement. For example, changing the range or center frequency resets the number of samples used in the CCDF measurement to zero and restarts the CCDF measurement.

Tips

Note the following when making CCDF measurements:

- For best results, set the analyzer's displayed frequency span to include all the energy of your signal. In other words, make sure the displayed frequency span includes the entire bandwidth of the measured signal.
- The CCDF measurement does not restart:
 - After a calibration
 - After you continue a paused measurement
- Many channel specific changes restart the CCDF measurement on both channels, such as changing the gate delay, or input coupling.
- The analyzer displays DATA? if the average power drifts 8 to 10 dB from the average power measured in the first time record. For example, the analyzer would display DATA? if you measured a transmitter signal that was off when the CCDF measurement started but then turned on later in the measurement.
- CCDF measurements are disabled during time averaging.

See also Trace/Detector, Data

Mode	VSA
Key Path	Trace/Detector, Data

CDF (Cumulative Density Function)

This key assigns the selected trace to display the CDF data result.

CDF trace data displays the Cumulative Density Function (CDF) for the selected input channel. CDF is computed by integrating the PDF (Probability Density Function). CDF is explained in online help for the CCDF trace data^{3/4}for further details, see that topic

See also Trace/Detector, Data

Mode	VSA
Key Path	Trace/Detector, Data

PDF (Probability Density Function)

This key assigns the selected trace to display the PDF data result.

PDF trace data displays the Probability Density Function of the selected channel. PDF indicates the probability that a given level has occurred.

PDF is equivalent to a normalized histogram. A histogram shows how the amplitude of a signal is distributed between its maximum and minimum values. Amplitude is displayed on the X-axis, and number of counts on the Y-axis.

The number of averages for a histogram determines the number of counts in the histogram; in other words, how many records are measured^¾the records are not "averaged". If averaging is off or if exponential averaging is selected, the measurement continues indefinitely. Keep in mind that the accuracy of the histogram is dependent on the frequency span, time-record length, and number of averages (if averaging is on).

Histograms are used for such things as determining the statistical properties of noise and monitoring the performance of electromechanical positioning systems.

PDF trace data is normalized by multiplying the number of averages by the number of points in the time record, then dividing this value by the DV spacing on the X-axis. The probability of a signal falling between two points is equal to the integral of the curve between those points.

PDF trace data displays the number of points used in its computation above the trace (Pts:). It also displays the average level (Avg:) above the trace.

See also Trace/Detector, Data

Mode	VSA
Key Path	Trace/Detector, Data

Auto Correlation

This key assigns the selected trace to display the Power Spectral Density (PSD) data result.

Auto Correlation trace data displays the autocorrelation for the selected input channel. Autocorrelation is a form of correlation, a measure of the similarity between two signals.

Note that Auto Correlation is not available when digital demodulation is selected.

Tips

— Use ac coupling only. Correlation measurements are disturbed by dc offsets in the

signal.

- Some types of averaging may be useful -- rms averaging does not affect correlation measurements, but you can use time averaging to reduce noise, if you can provide a consistent trigger. However, averaging is usually unnecessary to make good correlation measurements.
- Use appropriate triggering and trigger delays. This is especially true for time averaging.
- Use a random noise source for delay measurements. Correlation measurements provide the ability to resolve time differences between waveforms that appear to be random.
- Waveforms on the correlation trace may not appear as they do in the time trace. This is particularly noticeable when you are using correlation to extract synchronous signals from noise. The different shape of some waveforms is a direct result of the mathematical definition of correlation. For example, a correlated square wave appears as a triangle wave. It's important to remember that the period of the waveform is preserved even if the correlation waveform looks different.
- To avoid wrap-around effects, correlation produces a time record one-half the length of the measurement time-record.

Theory of Operation

Autocorrelation is a form of correlation, a measure of the similarity between two signals. Correlation is performed by multiplying two signals together at each instant in time and summing all the products. If the signals are identical, every product is positive and the resulting sum is large.

If, however, the two signals are dissimilar, then some of the products are positive and some are negative. In this case, the final sum is smaller because the products tend to cancel.

Autocorrelation performs a time-shifted, "averaged" correlation on a single signal. The signal is correlated with time-shifted versions of itself. Furthermore, the products from each time-shift are averaged by dividing each final sum by the number of products contributing to it.

$$R_{xx}(\tau) = \lim_{T \rightarrow \infty} \frac{1}{T} \int_{\text{conj}} [x(t)] \times x(t + \tau)] dt$$

where: R_{xx} = autocorrelation function

= amount of time shift

= infinity

$x()$ = signal to be correlated

intgrl = integration

conj = conjugation

T = time

= multiplication

That is, the autocorrelation function is found by taking a signal, multiplying it by the same signal displaced (τ) units in time, and averaging the product over all time.

Duality With the Power Spectrum

For simplicity and speed, this analyzer performs the autocorrelation operation by taking advantage of its duality with the power spectrum:

$$\frac{V_{pk}^2}{RBW} = \frac{V_{pk}^2}{Hz}$$

Thus,

$$\begin{aligned} R_{XX}(\tau) &= I_{FFT} [G_{XX}(f)] \\ &= I_{FFT} [\text{conj}(F[r \times t]) \times F(t)] \end{aligned}$$

where: I_{FFT} = Inverse FFT
conj = conjugation
 \times = multiplication
 r = half size of the rectangular window
(thus the result is $\frac{1}{2}$ the original time length)

When to use Auto Correlation

Auto correlation is useful for detecting echoes in a signal. For random noise, an echo appears as an impulse -- if there is more than one echo, you will see multiple peaks on the auto correlation trace. Keep in mind that an echo appears as an impulse only if the delayed signal has not been filtered. The impulse broadens as the original random noise signal is filtered -- in fact, the width of each peak is inversely proportional to the bandwidth of the signal.

To determine the time delay (in seconds) of an echo, you can move the marker to the peak of the echo. Note that there is always a correlated peak at zero lag -- this peak marks the original excitation signal. Any other peaks let you know that the excitation signal also appeared at another time relative to the original signal. The amplitude value at the zero lag point is the total power in the time record.

This function is also useful for isolating low-level periodic signals from noise. A sine wave signal shows up as a sine wave in auto correlation. A square wave signal shows up as a triangular wave of the same frequency.

Auto correlation is a single-channel measurement. If you have the original signal on one channel and the delayed version on another, use cross correlation.

Auto Correlation and Averaging

The following formulas show how the analyzer calculates auto correlation for different averaging functions:

Key: F = Fast Fourier Transform (FFT)
 AC = Averaged correlation

AT = Averaged time
 t = Instantaneous time
 c = Instantaneous correlation
 r = 1/2 width rectangular window
 = multiplication
 n = Average number

No Average $c = I(\text{conj}(F\{r\ t\}) F[t])$

rms Average $c = I(\text{conj}(F\{r\ t\}) F[t])$

rms Expon. $c = I(\text{conj}(F\{r\ t\}) F[t])$

Average

Continuous

Peak Hold $c = I(\text{conj}(F\{r\ t\}) F[t])$

Average

Time AC $[n] = I(\text{conj}(F\{r\ AT[n]\}) F(AT[n]))$

Average

where: $AT[n] = \frac{1}{n} \sum_{\text{Time}} (t[n])$

Expon. AC $[n] = I(\text{conj}(F\{r\ AT[n]\}) F(AT[n]))$

Average

where: $AT[n] = \frac{1}{n} t[n] + \frac{n-1}{n} AT[n-1]$ and: $1 < n < \text{number of averages}$

See also Trace/Detector, Data

Mode	VSA
Key Path	Trace/Detector, Data

Format

This accesses a menu that allows you to choose the format of the selected trace. Any format may be assigned to any trace. For symbol tables and tabular data the format choice is ignored. If the data doesn't have defined symbol times, Constellation format is the same as I-Q, Eye formats are the same as Real or Imaginary, and Trellis format is the same as Unwrapped Phase.

The formats are:

Format name	Description
Log Mag (dB)	Data is converted to decibel units and shown on a linear Y axis
Linear Mag (Abs Value)	Magnitude of the data is shown on a linear Y axis
Real (I)	Real part of data is shown on a linear Y axis
Imaginary (Q)	Imaginary part of data is shown on linear Y axis
I-Q	Real part of data is shown on horizontal axis, imaginary part is shown on vertical axis, Independent variable (X axis) is normal to display
Constellation	Same as I-Q, but for data with symbols defined, only the symbol points are shown as dots with no connecting lines.
Wrap Phase	Phase of complex data, limited to ± 180 deg, is shown on Y axis
Unwrap Phase	Phase of complex data is shown "unwrapped", that is, without discontinuities. Not limited to ± 180 degrees.
I-Eye	Real part of data is shown with X axis segmented (generally into 2 symbol segments) and each segment is overlaid to show signal crossings at symbol boundaries
Q-Eye	Same as I-eye but imaginary part of data is shown
Trellis	Same as I-eye but uses unwrapped phase of data
Group Delay	Useful for frequency response displays. Shows the derivative of phase response with respect to frequency.
Log Mag (Linear Unit)	Displays data with a logarithmic Y axis, but marker read outs are in linear magnitude units.

Measurement <meas>:=VECTor | ADEMod | DDEMod | W11A | W11B

Mode VSA

Remote Command :DISPlay:<meas>:TRACe [1] | 2 | 3 | 4 :FORMat
MLOG | MLINear | REAL | IMAGinary | VECTor | CONS | PHASe | UPHa
se | IEYE | QEYE | TRELlis | GDElay | MLGLinear
:DISPlay:<meas>:TRACe [1] | 2 | 3 | 4 :FORMat?

Example DISP:DDEM:TRAC2:FORM MLIN

DISP:DDEM:TRAC2:FORM?

Preset Depends on trace and measurement

State Saved	Saved in instrument state.
Range	Log Mag (dB) Linear Mag (Abs Value) Real (I) (Lin) Imaginary (Q) (Lin) I-Q Constellation Wrap Phase Unwrap Phase I-Eye Q-Eye Trellis-Eye Group Delay Log Mag (Linear Unit)
Key Path	Trace/Detector, Format

Digital Demod Trace Setup

This key accesses a menu of settings that control certain elements of displays of digitally demodulated trace data.

Mode	VSA
Key Path	Trace/Detector

Symbol Shape For all time-domain displays except IQ diagrams, Symbol Shape lets you display dots, bars, or nothing (none) at symbol locations (if the trace contains demodulated time-domain data). This key allows you to select the symbol shape for the selected trace.

If you select bars, vertical lines (bars) are drawn from the baseline to the symbol location on the trace. The baseline is 0 for all traces that have coordinates other than log (dB). The baseline is the bottom of the trace box for traces that have log (dB) coordinates.

With IQ diagrams, displaying vertical bars is meaningless. Therefore, selecting bars displays dots in IQ diagrams.

With constellation diagrams, selecting none is the same as selecting bars--you cannot turn off the dots in a constellation diagram.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:DISPlay:<meas>:TRACe [1] 2 3 4 :DDEMod:SYMBol BARS DOTS OFF :DISPlay:<meas>:TRACe [1] 2 3 4 :DDEMod:SYMBol?
Example	DISP:DDEM:TRAC2:DDEM:SYMB DOTS DISP:DDEM:TRAC2:DDEM:SYMB?

Preset	BARS
State Saved	Saved in instrument state.
Range	Bars Dots None
Key Path	Trace/Detector, Digital Demod Trace Setup

Ideal State Shape Digital Demodulation shows you the location of all ideal symbol states in an I-Q or constellation diagram. This key lets you choose between a cross, circle, or none to represent the ideal state on the selected trace.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:DISPlay:<meas>:TRACe [1] 2 3 4 :DDEMod:SYMBol :SHAPE CIRClE CROSS OFF :DISPlay:<meas>:TRACe [1] 2 3 4 :DDEMod:SYMBol :SHAPE?
Example	DISP:DDEM:TRAC2:DDEM:SYMB:SHAP CIRC DISP:DDEM:TRAC2:DDEM:SYMB:SHAP?
Preset	CIRC
State Saved	Saved in instrument state.
Range	Circle Cross None
Key Path	Trace/Detector, Digital Demod Trace Setup

Ideal State Size Determines the ideal state size, as a percentage of the maximum ideal state distance from the origin (the same way Error Vector Magnitude is defined). Ideal states are shown as circles or crosses in Vector and constellation diagrams, as determined by the Ideal State Shape setting.

The ideal state is where symbols occur if your signal is without error. Showing the ideal states gives a visual indication of the quality of your signal.

You can use this feature to determine if symbols have an EVM above a specified Value. For example, to see if any symbols have an EVM greater than 10%, set the state size to 10% and select Circle as the shape. Any symbols that fall outside of the circle (other than SYNC

or PILOT symbols) have an EVM greater than 10%.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:DISPlay:<meas>:TRACe [1] 2 3 4 :DDEMod:SYMBol:SIZE E <real> :DISPlay:<meas>:TRACe [1] 2 3 4 :DDEMod:SYMBol:SIZE E?
Example	DISP:DDEM:TRAC2:DDEM:SYMB:SIZE 10 DISP:DDEM:TRAC2:DDEM:SYMB:SIZE?
Notes	Parameter is interpreted as a percent, e.g., if you want the ideal size to be 10% send 10, not 0.1
Preset	5
State Saved	Saved in instrument state.
Min	0.1
Max	50
Key Path	Trace/Detector, Digital Demod Trace Setup

Symbol Table Format This allows you to choose the format in which symbol table data is displayed, when the modulation format encodes 4 or more bits per symbol. You may choose binary or hexadecimal. Binary symbol data is padded with leading zeros to make a multiple of 4 bits before conversion to hexadecimal. For example, for 16 QAM format, each 4-bit symbol will be displayed as 2 hex digits.

Binary Format: The symbol data bit format is binary and each character represents a binary digit. The number to the left of each row indicates the bit offset of the first bit in the row.

Hexadecimal Format: The symbol data bit format is hexadecimal and each character represents a hexadecimal digit. The number to the left of each row indicate the symbol offset of the first symbol in the row.

Note

Their must be at least 4 bits/symbol to use the hexadecimal format, that is, symbols that have less than 4 bits/symbol will only be displayed in binary format regardless of the Symbol Table Format setting

This parameter is valid only when:

The active trace is a symbol table, and

The current demodulation format supports hexadecimal, the demodulation format's

bits/symbol is equal to or greater than four.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:DISPlay:<meas>:TRACe [1] 2 3 4 :DDEMod:SYMBol:FOR Mat HEXadecimal BINary :DISPlay:<meas>:TRACe [1] 2 3 4 :DDEMod:SYMBol:FOR Mat?
Example	DISP:DDEM:TRAC2:DDEM:SYMB:FORM BIN DISP:DDEM:TRAC2:DDEM:SYMB:FORM?
Preset	HEX
Range	Hex Binary
Key Path	Trace/Detector, Digital Demod Trace Setup

Eye Length This property controls how wide (in symbol periods) the eye and trellis diagrams are, for the selected trace.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:DISPlay:<meas>:TRACe [1] 2 3 4 :DDEMod:EYE:COUNT <real> :DISPlay:<meas>:TRACe [1] 2 3 4 :DDEMod:EYE:COUNT?
Example	DISP:DDEM:TRAC2:DDEM:EYE:COUN 3 DISP:DDEM:TRAC2:DDEM:EYE:COUN?
Preset	2
State Saved	Saved in instrument state.
Min	0.1
Max	40
Key Path	Trace/Detector, Digital Demod Trace Setup

Time Unit This property lets you select the time units that are applied to x-axis annotations and marker readouts for the selected trace, whenever it is assigned data with (demodulation) symbol information. The available measurement units are sym (symbols) or sec (seconds).

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:DISPlay:<meas>:TRACe [1] 2 3 4 :DDEMod:UNIT:TIME SEC SYMBol :DISPlay:<meas>:TRACe [1] 2 3 4 :DDEMod:UNIT:TIME?
Example	DISP:VECT:TRAC2:DDEM:UNIT:TIME SYMB DISP:VECT:TRAC2:DDEM:UNIT:TIME?
Preset	SYMB
State Saved	Saved in instrument state.
Range	sym sec
Key Path	Trace/Detector, Digital Demod Trace Setup

Freq Unit This property lets you select the frequency units that are applied to x-axis annotations and marker readouts for the selected trace, whenever it is assigned data with (demodulation) carrier information. The available measurement units are carrier or Hz.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:DISPlay:<meas>:TRACe [1] 2 3 4 :DDEMod:UNIT:FREQuency CARRier HZ :DISPlay:<meas>:TRACe [1] 2 3 4 :DDEMod:UNIT:FREQuency?
Example	DISP:VECT:TRAC2:DDEM:UNIT:FREQ CARR DISP:VECT:TRAC2:DDEM:UNIT:FREQ?
Preset	CARR
State Saved	Saved in instrument state.
Range	carrier Hz
Key Path	Trace/Detector, Digital Demod Trace Setup

Copy to Data Register

This key accesses a menu of immediate execute keys, each of which copies the selected trace to a particular data register. Data registers can be displayed in any trace. They are measurement global, so you can copy data to a register while in the Digital Demod measurement and view it later while in the Vector measurement. Data registers are cleared when the VSA Application is exited and reentered, but not when you change Modes and return.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:DISPlay:<meas>:TRACe [1] 2 3 4 : COPY D1 D2 D3 D4 D5 D6
Example	DISP:VECT:TRAC:COPY D1
Key Path	Trace/Detector

The following SCPI provides means to determine if a Data Register is empty, and to erase the data from any or all Data Registers.

Mode	VSA
Remote Command	:CALCulate:DATA:REGister [1] 2 3 4 5 6 : EMPTY?
Example	CALC:DATA:REG2:EMPT?
Notes	Query only: returns 1 if a Data Register has no trace data assigned to it.
Key Path	SCPI only

Mode	VSA
Remote Command	:CALCulate:DATA:REGister [1] 2 3 4 5 6 : REMove

Example	CALC:DATA:REG2:REM
Notes	Removes trace data assigned to specified Data Register.
Dependencies/Couplings	If Data Register is assigned to a trace, the trace data is changed to No Data
Key Path	SCPI only

Mode	VSA
Remote Command	:CALCulate:DATA:REGister:ALL:REMove
Example	CALC:DATA:REG:ALL:REM
Notes	Removes trace data assigned to all Data Registers.
Dependencies/Couplings	If Data Register is assigned to a trace, the trace data is changed to No Data
Key Path	SCPI only

Phase/Delay Properties

This key accesses a menu of properties that affect the selected trace when displayed using phase or delay formats

Mode	VSA
Key Path	Trace/Detector

Phase/Trellis Offset This is only used if the trace Format is Wrap Phase, Unwrap Phase or Trellis. For Unwrap Phase or Trellis displays, the phase offset value is added to the existing phase at each point. For example, If you are viewing an Unwrapped Phase trace, setting the Phase/Trellis Offset to 5 degrees moves the entire trace up 5 degrees (and changes the value displayed by a marker by the same amount). For Wrap Phase displays the phase offset only affects the phase wrap point, not the underlying data. The point at which the phase wraps is 180 degrees plus the phase offset. For example, suppose you have a marker on a Wrap Phase display whose phase offset is 0 and the marker is showing -3 degrees. The trace data will all be confined within (-180, 180] degrees. If you then change the phase offset to 180 degrees, then the Wrap Phase display will show values within the interval (0, 360] degrees and the marker value will be displayed as 357 degrees, which is

the wrapped equivalent of -3 degrees.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:DISPlay:<meas>:TRACe [1] 2 3 4 :FORMat:PHASe:OFFSet <real> :DISPlay:<meas>:TRACe [1] 2 3 4 :FORMat:PHASe:OFFSet ?
Example	DISP:DDEM:TRAC3:FORM:PHAS:OFFS 31 DISP:DDEM:TRAC3:FORM:PHAS:OFFS?
Preset	0
State Saved	Saved in instrument state.
Min	$-1E+8$
Max	$1E+8$
Key Path	Trace/Detector, Phase Delay Properties

Unwrap Phase Ref Unwrapped phase lets you designate the point (x-axis) value about which phase values are to be unwrapped. That is, the phase at the designated reference will be within -180 to 180 degrees, and phase will vary smoothly without jumps around that point.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:DISPlay:<meas>:TRACe [1] 2 3 4 :FORMat:PHASe:UNWRa p:REFerence <real> :DISPlay:<meas>:TRACe [1] 2 3 4 :FORMat:PHASe:UNWRa p:REFerence?
Example	DISP:DDEM:TRAC3:FORM:PHAS:UNWR:REF 24.5E6 DISP:DDEM:TRAC3:FORM:PHAS:UNWR:REF?
Preset	0
State Saved	Saved in instrument state.
Min	$-9.9e37$
Max	$9.9e37$
Key Path	Trace/Detector, Phase Delay Properties

Group Delay Aperture The value of Delay Aperture is used when the trace format is Group Delay. The aperture is specified as a percentage of the current frequency span for frequency-domain data. It is specified as a percentage of the time-record length for time-domain data.

When group delay is calculated for a given point (which can be a time- or frequency-domain point), the aperture is centered at that point. Larger apertures decrease resolution, but they increase the smoothing of the group-delay trace.

The point plotted for group delay is located between the data points used to calculate it. For example, in the frequency domain, the group delay for 100 Hz may be calculated by measuring the change in phase between 90 and 110 Hz. If you had specified a start frequency of 90 Hz, 100 Hz would be the first point with group delay data. This results in a trace that does not extend to the edges of the screen (more noticeable as the delay aperture increases).

Note that the smallest aperture that you can select depends on the number of frequency points. If you select an invalid aperture, the analyzer automatically selects the smallest valid aperture.

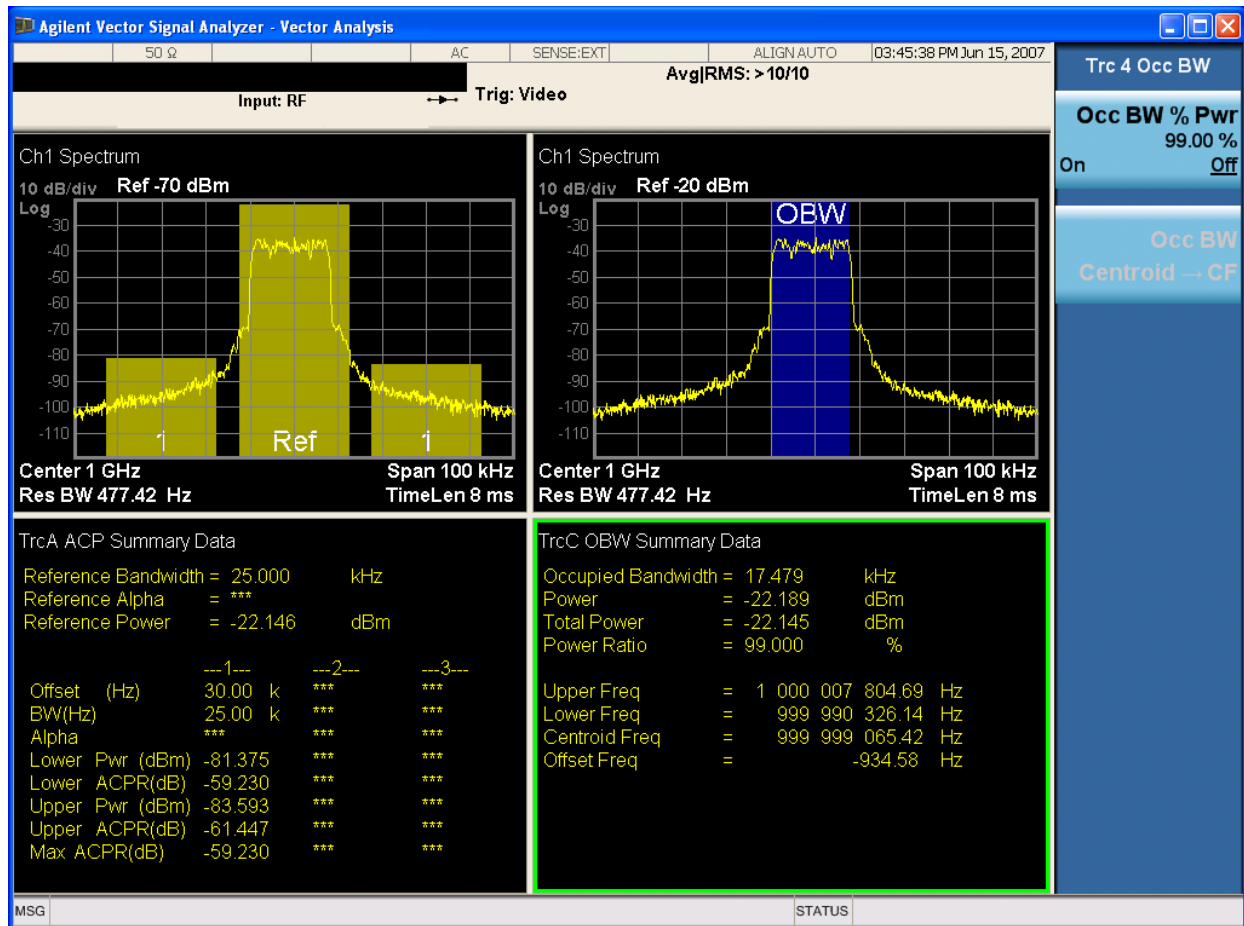
Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:DISPlay:<meas>:TRACe [1] 2 3 4 : FORMat : DELay : APERTur e <real> :DISPlay:<meas>:TRACe [1] 2 3 4 : FORMat : DELay : APERTur e?
Example	DISP:DDEM:TRAC3:FORM:DEL:APER 1 DISP:DDEM:TRAC3:FORM:DEL:APER?
Notes	Parameter is interpreted as a percent, e.g., if you want the group delay aperture to be 1% send 1, not 0.01
Preset	0.5
State Saved	Saved in instrument state.
Min	0.00390625
Max	16
Key Path	Trace/Detector, Phase Delay Properties

ACP Setup

The adjacent channel power (ACP) function calculates the power in a reference band of frequencies as well as bands of frequencies offset from the reference, and calculates the ratio of each offset band to the reference band power.

The ACP key accesses a menu of functions that allow you to define and turn on the ACP function on the selected trace. One reference channel and up to 5 offset frequencies may be defined, and ACP will be calculated for bands both above and below the reference frequency for each offset.

An ACP measurement may be defined for each trace, although it will only be active on frequency-domain trace data. The reference and offset frequency bands defined by the ACP measurement are shown as gold bars overlaying the trace display. To see tabular data showing power and power ratio results, you may assign the ACP Summary (Trace n) to a different trace. For example, you can assign Spectrum data to trace 1, turn on and define an ACP measurement on trace 1, assign the ACP Summary (Trace 1) to trace 2, and use a 2x2 display to view both at the same time, as shown below



The summary data may be retrieved programmatically using FETCh? or the CALCulate:<meas>:DATA:TABLE commands. See the Data Queries section under

Common Functions for more details.

Mode	VSA
Key Path	Trace/Detector

ACP Summary for Trace 1 Select trace for assignment of ACP Data.

See also ACP Setup

Mode	VSA
Key Path	Trace/Detector, Data, ACP, Channel n

ACP Summary for Trace 2 Select trace for assignment of ACP Data.

See also ACP Setup

Mode	VSA
Key Path	Trace/Detector, Data, ACP, Channel n

ACP Summary for Trace 3 Select trace for assignment of ACP Data.

See also ACP Setup

Mode	VSA
Key Path	Trace/Detector, Data, ACP, Channel n

ACP Summary for Trace 4 Select trace for assignment of ACP Data.

See also ACP Setup

Mode	VSA
Key Path	Trace/Detector, Data, ACP, Channel n

ACP On/Off This softkey turns the ACP function on or off for the selected trace

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:TRACe [1] 2 3 4 :ACPpower:STATe OFF ON 0 1 :CALCulate:<meas>:TRACe [1] 2 3 4 :ACPpower:STATe?
Example	CALC:VECT:TRAC1:ACP:STATE ON CALC:VECT:TRAC1:ACP:STATE?
Preset	0
State Saved	Saved in instrument state.
Key Path	Trace/Detector, ACP

Carrier Freq This key allows you to enter the carrier frequency of the reference channel for the ACP measurement. The carrier frequency is relative to the center frequency of the measurement. There is only one available reference carrier.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:TRACe [1] 2 3 4 :ACPpower:CARRier:FREQue ncy <freq> :CALCulate:<meas>:TRACe [1] 2 3 4 :ACPpower:CARRier:FREQue ncy?
Example	CALC:VECT:TRAC1:ACP:CARR:FREQ 100 KHZ CALC:VECT:TRAC1:ACP:CARR:FREQ?
Preset	0
State Saved	Saved in instrument state.
Min	-9.9e37
Max	9.9e37
Key Path	Trace/Detector, ACP

Carrier Meas Noise BW This key allows you to define the measurement noise bandwidth of the reference channel.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:TRACe[1] 2 3 4:ACPpower:CARRier:BANDwidth BWIDth:INTEgration <bandwidth> :CALCulate:<meas>:TRACe[1] 2 3 4:ACPpower:CARRier:BANDwidth BWIDth:INTEgration?
Example	CALC:VECT:TRAC1:ACP:CARR:BAND:INT 1 MHZ CALC:VECT:TRAC1:ACP:CARR:BAND:INT?
Preset	1000000
State Saved	Saved in instrument state.
Min	-9.9e37
Max	9.9e37
Key Path	Trace/Detector, ACP

Carrier RRC Weighting This key turns on or off RRC weighting for the reference (carrier) power measurement.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:TRACe[1] 2 3 4:ACPpower:CARRier:FILTer:RRC:STATe OFF ON 0 1 :CALCulate:<meas>:TRACe[1] 2 3 4:ACPpower:CARRier:FILTer:RRC:STATe?
Example	CALC:VECT:TRAC1:ACP:CARR:FILT:RRC:STAT ON CALC:VECT:TRAC1:ACP:CARR:FILT:RRC:STAT?
Preset	0
State Saved	Saved in instrument state.
Key Path	Trace/Detector, ACP

Carrier Filter Alpha This key allows you to adjust the alpha of the RRC filter for the reference (carrier) power measurement.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:TRACe [1] 2 3 4 :ACPpower:CARRier:FILTer:RRC:ALPHa <real> :CALCulate:<meas>:TRACe [1] 2 3 4 :ACPpower:CARRier:FILTer:RRC:ALPHa?
Example	CALC:VECT:TRAC1:ACP:CARR:FILT:RRC:ALPH 0.22 CALC:VECT:TRAC1:ACP:CARR:FILT:RRC:ALPH?
Preset	0.35
State Saved	Saved in instrument state.
Min	0
Max	1
Key Path	Trace/Detector, ACP

Offsets The ACP measurement compares power in frequency bands offset from the carrier to power in the reference channel (centered on the carrier). Up to 5 offsets may be defined. The offsets are designated by letters A through E. Each offset is defined by an offset frequency, bandwidth, and optional RRC weighting. An offset actually defines two bands, one above the reference frequency and one below. Each band is used individually in the ACP calculation. RRC weighting may only be turned on or off for all offsets, but each offset may have its own RRC filter alpha. A filter alpha of 0 is the same as no RRC weighting.

The Offsets key accesses a menu that has a key for each offset, and also an Offset RRC weighting on/off key. Each offset key shows a summary of its current parameters. Pressing one of the Offset A|B|C|D|E keys accesses a menu for adjusting its parameters

Mode	VSA
Key Path	Trace/Detector,ACP,Offsets

Offset Freq This key turns ACP analysis on or off for a selected offset, and sets the offset frequency (which is relative to the carrier frequency).

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:TRACe [1] 2 3 4 :ACPpower:OFFSet:LIST :FREQuency <freq>, ... :CALCulate:<meas>:TRACe [1] 2 3 4 :ACPpower:OFFSet:LIST :FREQuency? :CALCulate:<meas>:TRACe [1] 2 3 4 :ACPpower:OFFSet:LIST :STATe OFF ON 0 1, ... :CALCulate:<meas>:TRACe [1] 2 3 4 :ACPpower:OFFSet:LIST :STATe?
Example	CALC:VECT:TRAC1:ACP:OFFS:LIST:FREQ 1 MHZ,1 MHZ,500 KHZ,500 KHZ,1 MHZ CALC:VECT:TRAC1:ACP:OFFS:LIST:FREQ? :CALC:VECT:TRAC1:ACP:OFFS:LIST:STAT ON,OFF,OFF,ON,OFF
Notes	If you send fewer than 5 frequencies in the parameter list, then the remaining offsets frequencies are set to 0.
Remote Command Notes	You may send a single on/off parameter, or a comma-separated list of up to 5 parameters. These enable/disable each of the Offsets in sequence. Any remaining Offsets are disabled.
Preset	3000000,0,0,0,0 1,0,0,0,0
State Saved	Saved in instrument state.
Min	-9.9E+37
Max	9.9E+37
Key Path	Trace/Detector,ACP,Offsets,Offset A B C D E

Offset Meas Noise BW This key allows you to set the measurement noise bandwidth for the power measurement of a selected offset band.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA

Remote Command	:CALCulate:<meas>:TRACe [1] 2 3 4:ACPpower:OFFSet:LIST:BANDwidth BWIDth:INTEgration <bandwidth>,...
	:CALCulate:<meas>:TRACe [1] 2 3 4:ACPpower:OFFSet:LIST:BANDwidth BWIDth:INTEgration?
Example	CALC:VECT:TRAC1:ACP:OFFS:LIST:BAND:INT 1 MHZ,2 MHZ,3 MHZ,4 MHZ,5 MHZ CALC:VECT:TRAC1:ACP:OFFS:LIST:BAND:INT?
Notes	If you send fewer than 5 bandwidth parameters in the list, then Measurement Noise Bandwidths for the remaining Offsets are set to 0.
Preset	1000000,0,0,0,0
State Saved	Saved in instrument state.
Min	-9.9e37
Max	9.9e37
Key Path	Trace/Detector,ACP,Offsets,Offset A B C D E

Offset Filter Alpha This key allows you to adjust the alpha of the RRC filter for the power measurement of the selected offset band.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:TRACe [1] 2 3 4:ACPpower:OFFSet:LIST:FILTer:RRC:ALPHa <real>,...
	:CALCulate:<meas>:TRACe [1] 2 3 4:ACPpower:OFFSet:LIST:FILTer:RRC:ALPHa?
Example	CALC:VECT:TRAC1:ACP:OFFS:LIST:FILT:RRC:ALPH 0.22,0.22,0.22,0.22,0.22 CALC:VECT:TRAC1:ACP:OFFS:LIST:FILT:RRC:ALPH?
Notes	You may send a single Filter Alpha for Offset A, or a comma-separated list of up to 5 Filter Alpha parameters. These are assigned in sequence to the Offsets. Alpha for any remaining Offsets will be set to 0.
Preset	0.35,0.35,0.35,0.35,0.35

State Saved	Saved in instrument state.
Min	0
Max	1.0
Key Path	Trace/Detector,ACP,Offsets,Offset A B C D E

Offset Relative Limit This key enables you to turn on/off a relative limit test and set the limit for the selected offset. The test shows a failure if the power in either the upper or lower band at the selected offset exceeds the reference power plus the relative test limit. For example, if the test limit is -60 , the reference power is -4.5 dBm, a test failure would be shown if the power in the lower or upper band exceeds -64.5 dBm.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:TRACe[1] 2 3 4:ACP:OFFSet:LIST:RCARrier <real1>,... :CALCulate:<meas>:TRACe[1] 2 3 4:ACP:OFFSet:LIST:RCARrier? :CALCulate:<meas>:TRACe[1] 2 3 4:ACP:OFFSet:LIST:RCARrier:TEST OFF ON 0 1,... :CALCulate:<meas>:TRACe[1] 2 3 4:ACP:OFFSet:LIST:RCARrier:TEST?
Example	CALC:VECT:TRAC1:ACP:OFFS:LIST:RCAR -50, -55, -60, -65, -80 CALC:VECT:TRAC1:ACP:OFFS:LIST:RCAR? CALC:VECT:TRAC1:ACP:OFFS:LIST:RCAR:TEST 1, 1, 1, 1, 1 CALC:VECT:TRAC1:ACP:OFFS:LIST:RCAR:TEST ?
Notes	You may send a single Limit for Offset A, or a comma-separated list of up to 5 limit parameters. These are assigned in sequence to the Offset frequencies, with the remaining limits being set to 0.

Remote Command Notes	You may send a single on/off parameter, or a comma-separated list of up to 5 parameters. These turn the Limit Test on or off for each of the Offsets in sequence. For any remaining Offsets the Limit test will be turned off.
Preset	-120,-120,-120,-120,-120 0,0,0,0,0
State Saved	Saved in instrument state.
Min	50
Max	-200
Key Path	Trace/Detector,ACP,Offsets

RRC Weighting (All Offsets) This key turns on or off RRC weighting for the power measurement for all offsets. If RRC weighting is turned on, but you wish to exclude RRC weighting for a particular offset, set its filter alpha to 0.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:TRACe [1] 2 3 4 :ACPpower:OFFSet :FILTer: RRC:STATe OFF ON 0 1 :CALCulate:<meas>:TRACe [1] 2 3 4 :ACPpower:OFFSet :FILTer: RRC:STATe?
Example	CALC:VECT:TRAC1:ACP:OFFS:FILT:RRC:STAT ON CALC:VECT:TRAC1:ACP:OFFS:FILT:RRC:STAT?
Preset	0
State Saved	Saved in instrument state.
Key Path	Trace/Detector,ACP,Offsets

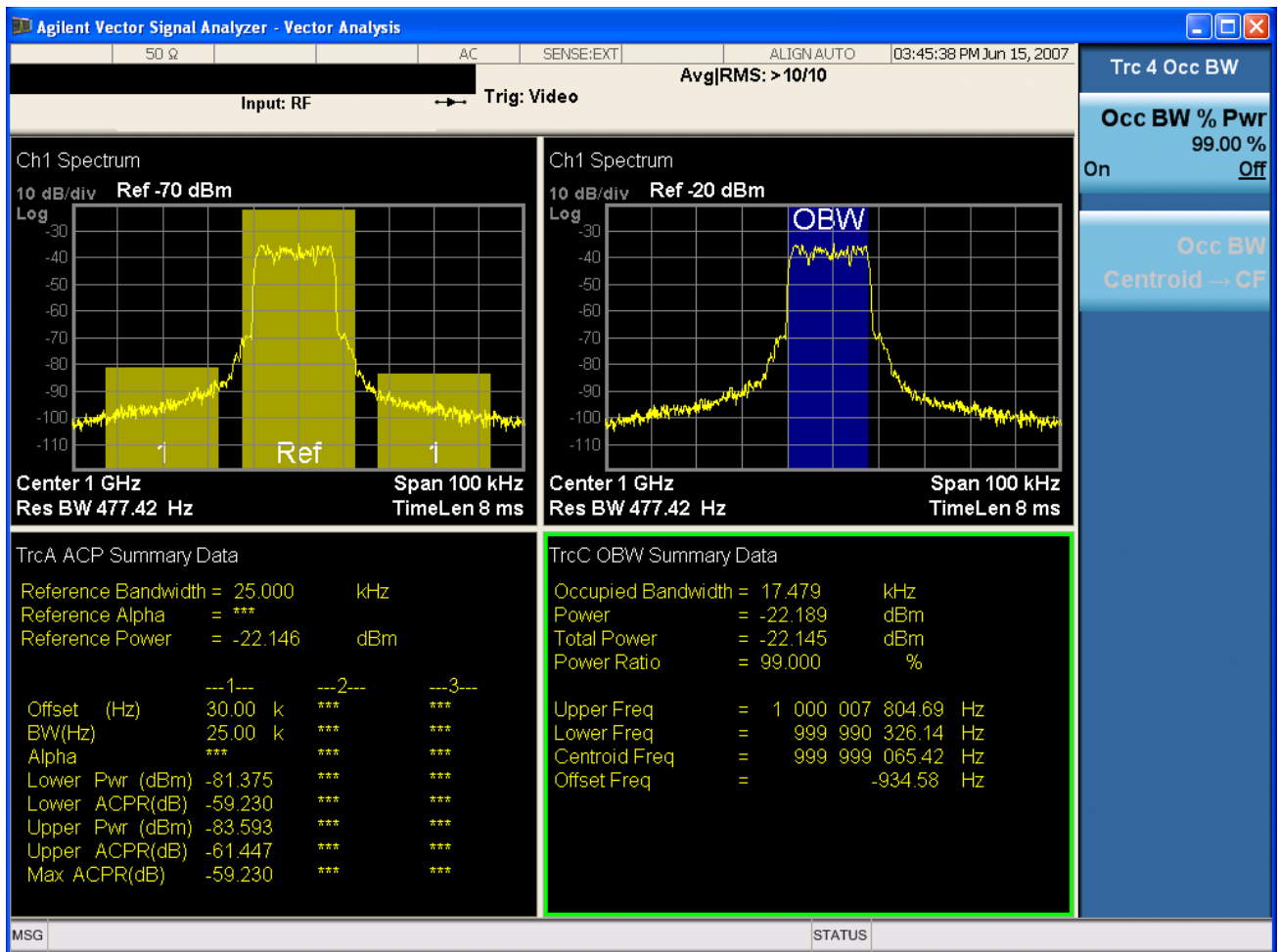
OBW Setup (Occupied Bandwidth)

The occupied bandwidth (OBW) function finds and displays the band of frequencies that contain a specified percentage of the total power within the measurement span.

The OBW key accesses a menu of functions that allow you to define and turn on the OBW

function on the selected trace.

An OBW measurement may be defined for each trace, although it will only be active on frequency-domain trace data. The band defined by the OBW measurement is shown as a blue bar overlaying the trace display. To see tabular data showing the frequencies of the band limits, the total power, etc. you may assign the OBW Summary (Trace n) to a different trace. For example, you can assign Spectrum data to trace 3, turn on OBW on trace 3, and assign the OBW Summary (Trace 3) to trace 4, as shown below.



The summary data may be retrieved programmatically using FETCh? or the CALCulate:<meas>:DATA:TABLE commands. See the Data Queries section under Common Functions for more details.

Mode VSA
Key Path Trace/Detector

OBW Summary for Trace 1 Select trace for assignment of OBW Data.

See also: OBW Setup (Occupied Bandwidth)

Mode	VSA
Key Path	Trace/Detector, Data, OBW, Channel n

OBW Summary for Trace 2 Select trace for assignment of OBW Data

See also: OBW Setup (Occupied Bandwidth).

Mode	VSA
Key Path	Trace/Detector, Data, OBW, Channel n

OBW Summary for Trace 3 Select trace for assignment of OBW Data

See also: OBW Setup (Occupied Bandwidth).

Mode	VSA
Key Path	Trace/Detector, Data, OBW, Channel n

OBW Summary for Trace 4 Select trace for assignment of OBW Data

See also: OBW Setup (Occupied Bandwidth).

Mode	VSA
Key Path	Trace/Detector, Data, OBW, Channel n

OBW Power The OBW Power key is used to specify the percentage of power used to determine the occupied BW, and to turn the OBW function on or off for the selected trace.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
-------------	--

Mode	VSA
Remote Command	:CALCulate:<meas>:TRACe [1] 2 3 4:OBWidth:PERCent <real> :CALCulate:<meas>:TRACe [1] 2 3 4:OBWidth:PERCent? :CALCulate:<meas>:TRACe [1] 2 3 4:OBWidth:STATe OFF ON 0 1 :CALCulate:<meas>:TRACe [1] 2 3 4:OBWidth:STATe?
Example	CALC:VECT:TRAC1:OBW:PERC 99 CALC:VECT:TRAC1:OBW:PERC? CALC:VECT:TRAC1:OBW:STAT ON CALC:VECT:TRAC1:OBW:STAT?
Notes	Parameter is interpreted as a percent, e.g., if you want the OBW to be 95% send 95, not 0.95
Preset	99.0 0
State Saved	Saved in instrument state.
Min	1
Max	100
Key Path	Trace/Detector, OBW

OBW Centroid > CF This softkey is used to copy the centroid of the occupied bandwidth to the Center Frequency. It only works if the currently selected trace has data compatible with the OBW function, and OBW is turned on.

This is a front-panel function only.

You can read the OBW centroid using the following SCPI-only query and use the result to set the center frequency.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:TRACe [1] 2 3 4:OBWidth:CENTroid?
Example	CALC:VECT:TRAC1:OBW:CENT?

Notes Query only. Returns NaN (9.91E+37) if the OBW function is not active for the selected trace, or is not supported for the trace data assigned to the selected trace.

BW Limit This turns on or off limit testing for the Occupied BW test for the selected trace, and allows you to define the limit. Test pass or fail status appears in the OBW Summary table associated with the trace.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:TRACe [1] 2 3 4 :OBwidth:LIMit:FBLimit <freq> :CALCulate:<meas>:TRACe [1] 2 3 4 :OBwidth:LIMit:FBLimit? :CALCulate:<meas>:TRACe [1] 2 3 4 :OBwidth:LIMit [:TEST] OFF ON 0 1 :CALCulate:<meas>:TRACe [1] 2 3 4 :OBwidth:LIMit [:TEST] ?
Example	CALC:VECT:TRAC1:OBW:LIMIT:FBL 10 MHZ CALC:VECT:TRAC1:OBW:LIMIT:FBL? CALC:VECT:TRAC1:OBW:LIMIT:TEST ON CALC:VECT:TRAC1:OBW:LIMIT:TEST?
Preset	1000000 0
State Saved	Saved in instrument state.
Min	-9.9e37
Max	9.9e37
Key Path	Trace/Detector, OBW

Register

Accesses a menu that allows you to select registers for assignment of trace data.

Mode	VSA
Key Path	Trace/Detector, Data

Data 1 Select register 1 for assignment of trace data.

Mode VSA
Key Path Trace/Detector, Data, Register

Data 2 Selects register 1 for assignment of trace data.

Mode VSA
Key Path Trace/Detector, Data, Register

Data 3 Selects register 1 for assignment of trace data.

Mode VSA
Key Path Trace/Detector, Data, Register

Data 4 Selects register 1 for assignment of trace data.

Mode VSA
Key Path Trace/Detector, Data, Register

Data 5 Selects register 5 for assignment of trace data.

Mode VSA
Key Path Trace/Detector, Data, Register

Data 6 Selects register 6 for assignment of trace data.

Mode	VSA
Key Path	Trace/Detector, Data, Register

Trace Indicator Info

This softkey allows you to get more information about why a trace indicator is showing. A trace indicator appears in the upper right corner of a trace display to announce exceptional conditions. When such an indicator is showing on the selected trace, pressing this key causes more information about the condition to appear in the message area. This is a front-panel only function. The SCPI commands for querying the Trace Indicator and the Trace Indicator Info for a particular trace are:

```
CALC:<meas>:DATA[1]|2|3|4:HEAD:STR? "TrcLedStr"
```

```
CALC:<meas>:DATA[1]|2|3|4:HEAD:STR? "TrcLedReason"
```

Mode	VSA
Key Path	Trace/Detector

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 which 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 is meas local key, so its 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.

Example :COUP ALL

Remote Command Notes :COUPle ALL puts all Auto/Man parameters in Auto mode (equivalent to pressing the **Auto Couple** 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.

Auto Couple

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 softkeys that control the Input/Output parameters of the instrument.

Input choices include the RF input and the Amplitude Reference (50 MHz, 4.8 GHz or 300 MHz comb signal). You can also specify the input impedance for unit conversions.

Other functions related to the input/output connections can be found under **Trig** (trigger input controls) and **System** (LAN and other I/O bus configurations) and **Amplitude** (optional internal preamp).

NOTE The functions in the Input/Output menu are common to all Modes (applications). They are “global”. But individual functions are only available in a mode if they makes sense. They will be grayed out.

SCPI Command	<code>[:SENSe] :FEED RF AREFERENCE</code> <code>[:SENSe] :FEED?</code>
Preset	This setting is unaffected by a Preset or power cycle. It survives 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 state

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 Preset and 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.

Example	<code>[:SENSe] :FEED RF</code>
Key Path	Input/Output

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, dB μ V, dB μ A, 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 ohm. Setting the computational input impedance to 75 ohm is useful when using a 75 ohm to 50 ohm adapter to measure a 75 ohm device on an analyzer with 50 ohm input impedance.

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

SCPI Command	<code>[:SENSe] :CORRection:IMPedance [:INPut] [:MAGNitude] 50 75 [:SENSe] :CORRection:IMPedance [:INPut] [:MAGNitude] ?</code>
Example	<code>CORR:IMP 75</code> sets the input impedance correction to 75 ohms. <code>CORR:IMP?</code>
Preset	This is unaffected by Preset but is set to 50 Ω on a “Restore Input/Output Defaults” or “Restore System Defaults->All” Some instruments/options may have 75 Ω available.
State Saved	Saved in State
Key Path	Input/Output, RF

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 less than 10 MHz but the amplitude accuracy is not specified. To accurately see a signal of less than 10 MHz, you must switch to DC coupling.

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 External Mixer 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).

Selecting Input Coupling

N6020A Option	AC Frequency Range	DC Frequency Range
Option 503	10 MHz to 3.6 GHz	3 Hz to 3.6 GHz
Option 507	10 MHz to 7.0 GHz	3 Hz to 7.0 GHz
Option 508	10 MHz to 8.4 GHz	3 Hz to 8.4 GHz
Option 513	10 MHz to 13.6 GHz	3 Hz to 13.6 GHz
Option 526	10 MHz to 26.5 GHz	3 Hz to 26.5 GHz

SCPI Command	:INPut:COUPling AC DC :INPut:COUPling?
Example	INP:COUP DC
Preset	AC
State Saved	Saved in State
Key Path	Input/Output, RF

RF Calibrator

Lets you choose a calibrator signal to look at or turns the calibrator “off” (meaning switches back to the selected input). If one of the three calibrator signals (50 MHz, -25 dBm, the 4.8GHz internal amplitude reference or the 300 MHz comb signal) is chosen (as opposed to OFF), the analyzer routes the selected internal amplitude reference as the input signal, while leaving the input selection in the menus (RF, Ext Mix or I/Q) unchanged.

Input/Output

The 50 MHz internal reference and the 300 MHz comb signal are available with all the frequency options. The 4.8GHz internal reference is only available with 507, 508, 513, 526.

This function presets to OFF on a Mode Preset, which causes the internal circuitry to switch back to the selected input (RF, Ext Mix or I/Q).

SCPI Command	<code>[:SENSe] :FEED:AREFERENCE REF50 REF4800 COMB OFF</code> <code>[:SENSe] :FEED:AREFERENCE?</code>
Example	<code>FEED:AREF REF50</code> selects the 50 MHz amplitude reference as the signal input. <code>FEED:AREF REF4800</code> selects the 4.8GHz amplitude reference as the signal input <code>FEED:AREF COMB</code> selects the 300 MHz comb modulated signal as the signal input <code>FEED:AREF OFF</code> turns the calibrator “off” (meaning switches back to the selected input – RF, ExtMix or I/Q)
Dependencies	Selecting an input (RF, Ext Mix or I/Q) turns the Calibrator OFF. This is true whether the input is selected by the softkeys or with the <code>[:SENSe] :FEED</code> command.
Preset	OFF
State Saved	Saved in State
Key Path	Input/Output

50 MHz

Selects the 50 MHz internal reference as the input signal. This choice is available in all options: 503, 507, 508, 513, 526.

Key Path	Input/Output, RF Calibrator
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4.8 GHz

Selects the 4.8GHz internal reference as the input signal.

Key Path	Input/Output, Amptd Ref
----------	--------------------------------

Input/Output

grayed out and you would have a choice of MS or BTS.

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.
Key Path	Input/Output

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.)

Please 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/loss.

SCPI Command	<code>[:SENSE] :CORRection:SA[:RF]:GAIN <rel_ampl></code> <code>[:SENSe] :CORRection:SA[:RF]:GAIN?</code>
Example	<code>CORR:SA:GAIN 10</code> sets the Ext Gain value to 10 dB <code>CORR:SA:GAIN -10</code> sets the Ext Gain value to -10 dB (that is, an attenuation of 10 dB)
Dependencies	The reference level limits are determined in part by the External Gain/Atten, Max Mixer Level, RF Atten. This key is grayed out in many application Modes.
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 State
Min	-81.90 dB
Max	81.90 dB
Key Path	Input/Output, Ext Gain

MS

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

SCPI Command	<code>[[:SENSE]:CORREction:MS[:RF]:GAIN <rel_ampl></code> <code>[[:SENSE]:CORREction:MS[:RF]:GAIN?</code>
Example	<code>CORR:MS:GAIN 10</code> sets the Ext Gain value to 10 dB <code>CORR:MS:GAIN -10</code> sets the Ext Gain value to -10 dB (that is, a loss of 10 dB.)
Dependencies	The reference level limits are determined in part by the External Gain, Max Mixer Level, RF Atten This key is grayed out in the SA Mode.
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 State
Min	-50 dB
Max	50 dB
Key Path	Input/Output, Ext Gain

BTS

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

SCPI Command	<code>[[:SENSE]:CORREction:BTS[:RF]:GAIN <rel_ampl></code> <code>[[:SENSE]:CORREction:BTS[:RF]:GAIN?</code>
Example	<code>CORR:BTS:GAIN 10</code> sets the Ext Gain value to 10 dB <code>CORR:BTS:GAIN -10</code> sets the Ext Gain value to -10 dB (that is, a loss of 10 dB.)
Dependencies	The reference level limits are determined in part by the External Gain, Max Mixer Level, RF Atten This key is grayed out in the SA Mode.
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 State
Min	-50 dB

Input/Output

Max	50 dB
Key Path	Input/Output, Ext Gain

Restore Input/Output Defaults

This selection causes the group of *settings* and *data* associated with **Input/Output** key to be a reset to their default values. 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.

Example	:SYST:DEF INP presets all the Input/Output variables to their factory default values.
Remote Command Notes	Please refer to the Utility Functions section for information about Restore System Defaults and the complete description of the :SYSTem:DEFault INPut: command.
Key Path	Input/Output

Data Source

Gives you the choice of either using a hardware input signal as the input or raw data stored in a data storage buffer from an earlier acquisition. You can also share raw data across certain measurements that support this feature. The measurements must be capable of storing raw data. There are three choices under this menu. You can select “Inputs” which is the same as selecting one of the inputs from the input port, for example RF, AREF, I/Q, EXTMixer or IFALign. Selecting “Capture Buffer” allows you to use data that has been stored earlier in the same measurement or from a previous measurement using the “Current Meas -> Capture Buffer” feature. Selecting “Recorded Data” allows you to playback long data capture records stored in the record buffer.

When you make a recording (see **Record Data Now** below) or when you recall a recording (see the Recall section) the data source is automatically set to Recorded Data. You can toggle the data source between Inputs and the current Recording (if there is one). That is, the recording remains in memory until it is replaced by a new recording, or the application is closed.

SCPI Command	<code>[:SENSe] :FEED:DATA INPut STORed RECorded</code> <code>[:SENSe] :FEED:DATA?</code>
SCPI Example	<code>FEED:DATA REC</code> <code>FEED:DATA?</code>
Dependencies	Not all inputs are available in all modes. Unavailable keys are grayed out.

Remote Command Notes	INPutS = Inputs STORed = Capture Buffer RECOreded = Record Data Buffer
Preset	This is unaffected by Preset but is set to INPut on a “Restore Input/Output Defaults” or “Restore System Defaults->All”
State Saved	Saved in state
Key Path	Input/Output

Inputs

Sets the measurement to use the input selections (RF, AREF, EXTMix, I/Q)

Example	FEED:DATA INP causes the measurement to look at the input selection
Key Path	Input/Output, Data Source

Capture Buffer

Some WCDMA and demod measurements support this feature. This allows sharing of the raw data across certain measurements. If you want to make another measurement on the same signal, you would store that raw data using the “Current Meas -> Capture Buffer” key. Then the data is available for the next measurement to use. You must have raw data stored in the instrument memory before the Capture Buffer choice is available for use.

If you switch to a measurement that does not support this feature, then the instrument switches to use “Inputs” and grays out this key. If the grayed out key is pressed, it generates a message.

Example	FEED:DATA STOR causes stored measurement data to be used with a different measurement that supports this.
Dependencies	Grayed out in the SA measurement.
Key Path	Input/Output, Data Source

Recorded Data

Input/Output

Directs the instrument to get data from the record data buffer in the measurement, rather than from the RF Input Signal.

Example	FEED:DATA REC causes the measurement to extract data from the record data buffer
Dependencies	Grayed out in the SA measurement.
Key Path	Input/Output, Data Source

Current Meas -> Capture Buffer

Pressing this key stores the raw data of one measurement in the internal memory of the instrument where it can then be used by a different measurement by pressing “Stored Data”. When raw data is stored, then data source selection switch automatically changes to “Stored Data”. Stored raw data cannot be directly accessed by a user. There is no save/recall function to save the raw data in an external media. However if you want to get the stored raw data, you must first perform a measurement using the stored raw data. Now you can access the used raw data, which is the same as stored raw data, using the FETCh or READ commands.

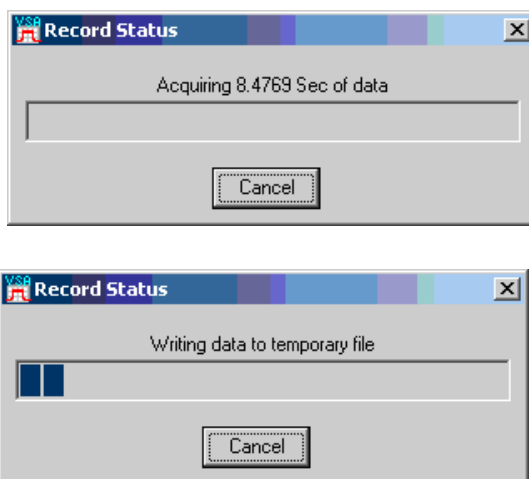
SCPI Command	[:SENSE] :FEED:DATA:STORe
Example	FEED:DATA:STOR stores recorded data
Dependencies	Grayed out in the SA measurement.
Remote Command Notes	This is command only, there is no query
Key Path	Input/Output, Data Source

Record Data Now

This causes the data source to change to Inputs (if it is not already set) and a recording is made with the current instrument setup. The length of the recording must be specified in advance. See .

This key changes to **Abort Recording** once the recording process has started. It changes back when the recording is complete.

The following dialogs shows the progress of the recording:



This key is also available in the Sweep/Control menu.

SCPI Command	<code>[:SENSE] :RECOrding :INITiate [:IMMediate]</code>
SCPI Example	REC:INIT
Key Path	Input/Output, Data Source
Couplings	Changes Data source to Recorded Data.
Dependencies	Grayed out in the SA measurement.
Remote Command Notes	This is command only, there is no query. See the Recall functionality to access previously saved data.

SCPI Command	<code>[:SENSE] :RECOrding :ABORT</code>
SCPI Example	REC:ABOR
Key Path	Input/Output, Data Source
Remote Command Notes	This is command only, there is no query. The command does nothing if it is sent when there is no recording in progress.

Record Length

This specifies the length of the next recording. (You cannot use this to modify the length of the current recording.) The length defaults to seconds, but you can also specify it in points

Input/Output

at the current sample rate, or in time records at the current time record length.

Mode	VSA
SCPI Command	[:SENSe] :RECORDing:LENGth <real>, SEConds RECords POINTs
SCPI Command	[:SENSe] :RECORDing:LENGth:STATe MAX MANUal [:SENSe] :RECORDing:LENGth:STATe?
SCPI Example	REC:LENG 20,REC REC:LENG 4.1E-4,SEC REC:LENG:STAT MAX REC:LENG:STAT?
Key Path	Input/Output, Data Source
Default Unit/Terminator	None. The unit must be specified.
Preset/Default	50 Records, Manual
State Saved	No
Min	0
Max	Depends on memory available
Remote Command Notes	The length command does not have a query form. Length information is queried using the following two commands. If set to MAX, all of the available "recording memory" is used.

Mode	VSA
Remote Command	[:SENSe] :RECORDing:LENGth:VALue?
SCPI Example	REC:LENG:VAL?
Preset/Default	50 Records
Remote Command Notes	Query Only Returns the first (numeric) parameter of the most recent [:SENSe] :RECORDing:LENGth command.

Mode	VSA
Remote Command	[:SENSe] :RECORDing:LENGth:UNIT?
SCPI Example	REC:LENG:UNIT?

Remote Command Notes	Query Only
	Returns the second parameter of the most recent [:SENSE]:RECORDing:LENGth command. Possible values are SEC REC POIN. If no second parameter was sent, then the return value is SEC.

Freq Ref In

Specifies the frequency reference as being the internal reference, external reference or sensing the presence of an external reference. 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, an error condition detected message is generated. When the external signal becomes valid, the error is cleared.

If Sense is selected, the instrument checks whether a signal is present at the external reference connector and will automatically switch to the external reference when a signal is detected. When no signal is present, it automatically switches to the internal reference. No message is generated as the reference switches between 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 2 in the Questionable Frequency register will be true and an error condition detected message is generated. When lock is regained, Status bit 2 in the Questionable Frequency register will be cleared and an error message is cleared will be sent.

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.

SCPI Command	[:SENSE]:ROSCillator:SOURce:TYPE INTernal EXTernal SENSe [:SENSE]:ROSCillator:SOURce:TYPE?
Preset	This is unaffected by Preset but is set to SENSe on a "Restore Input/Output Defaults" or "Restore System Defaults->All".
State Saved	Saved in State.
Key Path	Input/Output
SCPI Status Bits/OPC Dependencies	STATus:QUEStionable:FREQuency bit 2 set if unlocked.

SCPI Command	<code>[[:SENSe]:ROSCillator:SOURce?</code>
Remote Command Notes	The query <code>[SENSe]:ROSCillator:SOURce?</code> returns the current switch setting. This means: <ol style="list-style-type: none">1. If it was set to <code>SENSe</code> but there is no external reference so the instrument is actually using the internal reference, then this query returns <code>INTernal</code> and not <code>SENSe</code>.2. If it was set to <code>SENSe</code> and there is an external reference present, the query returns <code>EXTernal</code> and not <code>SENSe</code>.3. If it was set to <code>EXTernal</code>, then the query returns “<code>EXTernal</code>”4. If it was set to <code>INTernal</code>, then the query returns <code>INTernal</code>
Preset	<code>SENSe</code>

Sense

The external reference is used if a valid signal is sensed at the Ext Ref input. Otherwise the internal reference is used.

Example	<code>:ROSC:SOUR:TYPE SENS</code>
Key Path	Input/Output, Freq Ref In

Internal

The internal reference is used.

Example	<code>:ROSC:SOUR:TYPE INT</code>
Key Path	Input/Output, Freq Ref In

External

The external reference is used.

Example	:ROSC:SOUR:TYPE EXT
Key Path	Input/Output, Freq Ref In

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 or external reference.)

For the instrument to stay locked, the value entered must be within 5 ppm of the actual ext ref 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.

SCPI 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.
Preset	This is unaffected by Preset but is set to 10 MHz on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Min	EXA: 10 MHz MXA: 1 MHz
Max	EXA: 10 MHz MXA: 50 MHz
Key Path	Input/Output, Freq Ref In
Default Terminator	Hz

Output Config

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

Trig Out (1 and 2)

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

SCPI Command	:TRIGger TRIGger1 TRIGger2[:SEquence]:OUTPut HSWP MEASuring MAIN GATE GTRigger OEVEN OFF :TRIGger TRIGger1 TRIGger2[:SEquence]:OUTPut?
Example	TRIG:OUTP HSWP
Preset	Trigger 1: Sweeping (HSWP) Trigger 2: Gate This is unaffected by 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
Key Path	Input/Output, Output Config

Polarity

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

SCPI Command	:TRIGger TRIGger1 TRIGger2[:SEquence]:OUTPut:POLarity POSitive NEGative :TRIGger TRIGger1 TRIGger2[:SEquence]:OUTPut:POLarity?
Example	TRIG1:OUTP:POL POS
Preset	This is unaffected by Preset but is set to POSitive on a “Restore Input/Output Defaults” or “Restore System Defaults->All”
State Saved	Saved in state
Key Path	Input/Output, Output Config, Trig 1 Output

Sweeping (HSWP)

Selects the Sweeping trigger signal to be output to the Trig 1 Out connector. This signal has historically been known as “HSWP” but care should be taken to understand that in this analyzer, its function does not exactly match other products behavior.

Example	TRIG1:OUTP HSWP
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Key Path Input/Output, Output Config, Trig 1 Output

Measuring

Selects the Measuring trigger signal to be output to the Trig 1 Out connector. This signal is true while the Measuring status bit is true.

Example TRIG1:OUTP MEAS

Key Path Input/Output, Output Config, Trig 1 Output

Main Trigger

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

Example TRIG1:OUTP MAIN

Key Path Input/Output, Output Config, Trig 1 Output

Gate Trigger

Selects the gate trigger signal to be output to the Trig 1 Out connector. This is the source of the gate timing, not the actual gate signal.

Example TRIG1:OUTP GTR

Key Path Input/Output, Output Config, Trig 1 Output

Gate

Selects the gate signal to be output to the Trig 1 Out connector. The gate signal has been delayed and its length determined by delay and length settings. When the polarity is positive, a high on the Trig 1 Out represents the time the gate is configured to pass the signal.

Example TRIG1:OUTP GATE

Key Path Input/Output, Output Config, Trig 1 Output

Odd/Even Trace Point

Selects either the odd or even trace points as the signal to be output to the Trig 1 Out

Input/Output

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.

Example	TRIG1:OUTP OEV
Key Path	Input/Output, Output Config, Trig 1 Output

Off

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

Example	TRIG1:OUTP OFF
Key Path	Input/Output, Output Config, Trig 1 Output

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.

SCPI Command	<code>:FORMat [:TRACe] [:DATA] ASCii REAL,32 REAL,64</code> <code>:FORMat [:TRACe] [:DATA] ?</code>
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Remote Command Notes	The query response is: ASCii: ASC,8 REAL,32: REAL,32 REAL,64: REAL,64
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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 mdBm (.001 dBm).

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.
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Preset	ASCii
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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.

SCPI Command	:FORMat:BORDER NORMal SWAPped
	:FORMat:BORDER?
Preset	NORMal

Source

This mode does not have any Source control functionality.

Key Path

Front panel key

Source

View/Display

This menu contains keys that allow control over the way data is displayed. The Layout key is described here. Other keys specific to measurements will be described in their own descriptions.

The View/Display key opens up the View menu for the current measurement. This menu includes the **Display** key for controlling items on the display. The Display functions are common across multiple Modes and Measurements and are described in this section. See each measurement description for information on data views that are unique to that Measurement.

Views are different ways of looking at data, usually different ways of looking at the same data, especially when the data represents a time record that is being digitally processed with an FFT and/or other digital signal processing algorithms. In some modes, like the Spectrum Analyzer mode, we are mostly concerned with swept spectrum analysis, and those views may represent different ways of looking at the same signal.

Mode	VSA
Key Path	Front Panel

Display

This is a menu common to all measurements for configuring items on the display. Keys not relevant to a given measurement should be grayed out. Keys not relevant to any measurement in a mode should be blanked. The Display menu settings are specific to the measurement selected under the **Meas** key, except for those settings under the **System Display Settings** key.

Key Path	View/Display
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Annotation

Turns on/off various parts of the display annotation. The annotation is divided up into four categories:

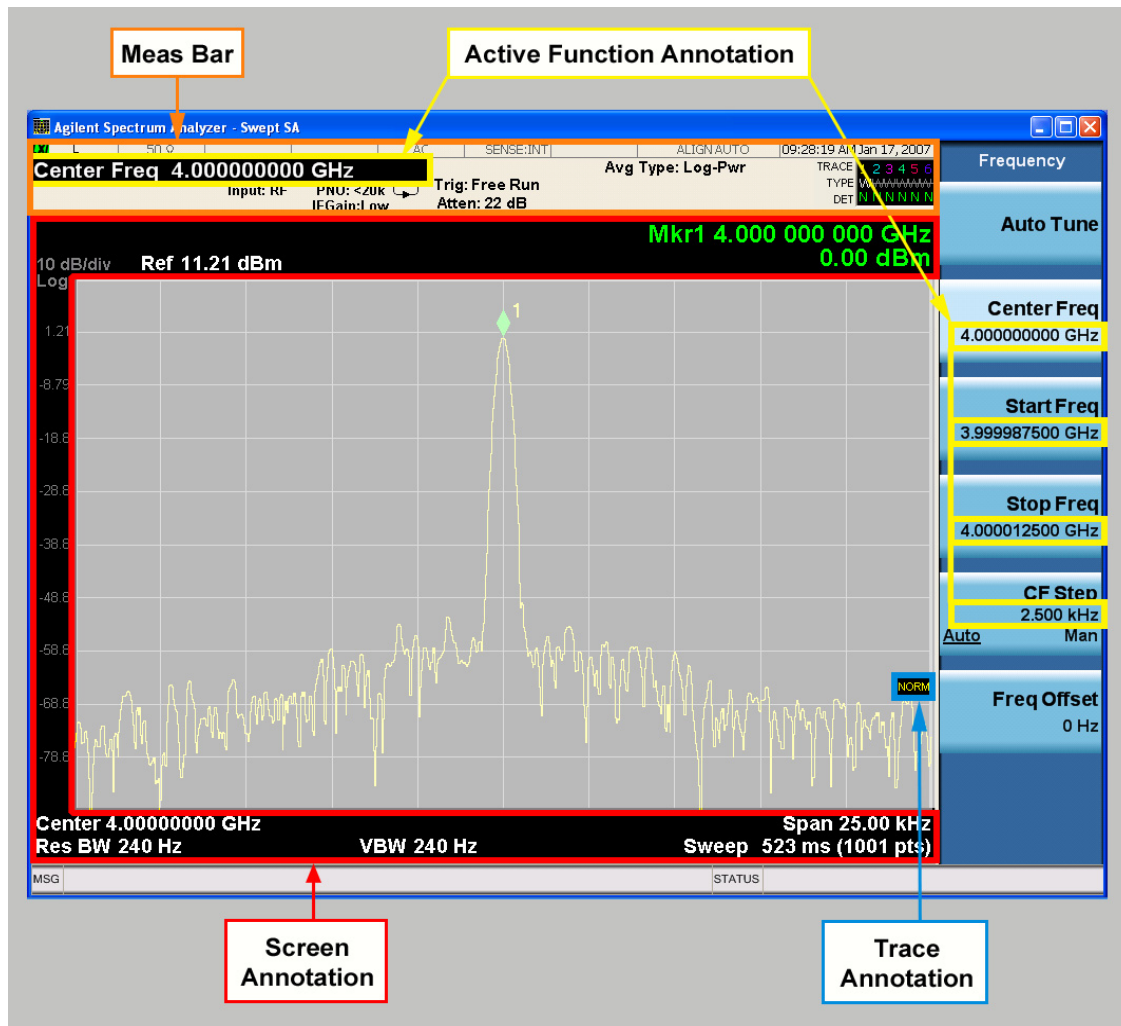
1. **Meas Bar:** This is the measurement bar at the top of the screen. When the Meas Bar is off, the graticule area expands to fill the area formerly occupied by the Meas Bar.
2. **Screen Annotation:** this is the annotation and annunciation around the graticule, including any annotation on lines (such 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.
3. **Trace annotation:** these are the labels on the traces, showing their detector (or their

View/Display

math mode).

4. Active Function annotation: this is the active function display in the meas bar, and all of the active function values displayed on softkeys.

See figure below. Each type of annotation can be turned on and off individually.



Key Path

View/Display, Display

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.

SCPI Command	<code>:DISPlay:ANNotation:MBAR[:STATe] OFF ON 0 1</code> <code>:DISPlay:ANNotation:MBAR[:STATe]?</code>
Example	DISP:ANN:MBAR OFF
Dependencies	Grayed out and forced to OFF when System Display Settings, Annotation is set to Off.
Preset	On This should remain Off through a Preset when System Display Settings, Annotation is set to Off.
State Saved	Saved in instrument state.
Key Path	View/Display, Display, Annotation

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.

SCPI Command	<code>:DISPlay:ANNotation:SCREen[:STATe] OFF ON 0 1</code> <code>:DISPlay:ANNotation:SCREen[:STATe]?</code>
Example	DISP:ANN:SCR OFF
Dependencies	Grayed out and forced to OFF when System Display Settings, Annotation is set to Off.
Preset	On This should remain Off through a Preset when System Display Settings, Annotation is set to Off
State Saved	Saved in instrument state.
Key Path	View/Display, Display, Annotation

Trace

Turns on and off the labels on the traces, showing their detector (or their math mode) as described in the Trace/Detector section.

If trace math is being performed with a trace, then the trace math annotation will replace

the detector annotation.

SCPI Command	:DISPlay:ANNotation:TRACe[:STATe] ON OFF 1 0 :DISPlay:ANNotation:TRACe[:STATe]?
Example	DISP:ANN:TRAC OFF
Preset	Off
State Saved	Saved in instrument state.

Active Function Values On/Off

Turns on/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.

SCPI Command	:DISPlay:ACTivefunc[:STATe] ON OFF 1 0 :DISPlay:ACTivefunc[:STATe]?
Example	DISP:ACT OFF
Dependencies	Grayed out and forced to OFF when System Display Settings, Annotation is set to Off.
Preset	On This should remain Off through a Preset when System Display Settings, Annotation is set to Off
State Saved	Saved in instrument state.
Key Path	View/Display, Display, Annotation

Title

Displays menu keys that enable you to change or clear a title on your display.

Key Path	View/Display, Display
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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**.

Mode	All
Example	DISP:<your_measurement>:ANN:TITL:DATA "This Is My Title"
State Saved	Saved in instrument state.
Key Path	View/Display, Display, Title

Mode	SA, with Swept SA Measurement active
SCPI Command	:DISPlay:ANNotation:TITLe:DATA <string> :DISPlay:ANNotation:TITLe:DATA?
Example	DISP:ANN:TITL:DATA "This Is My Title" Sets the title to: This Is My Title This example is for the Swept SA measurement in the Spectrum Analyzer mode. The SANalyzer <measurement> name is not used.
Preset	No title (measurement name instead)
State Saved	Saved in instrument state.
Key Path	View/Display, Display, Title

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.

Example	DISP:ANN:TITL:DATA "" clears any existing title characters.
Remote Command Notes	Use the :DISPlay:ANNotation:TITLe:DATA <string> command with an empty string.
Preset	Performed on Preset.
Key Path	View/Display, Display, Title

Graticule

View/Display

Pressing Graticule turns the display graticule On or Off. It also turns the graticule y-axis annotation on and off.

SCPI Command	<code>:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe] OFF ON 0 1 :DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe]?</code>
Example	<code>DISP:WIND:TRAC:GRAT:GRID OFF</code>
Preset	On
State Saved	saved in instrument state
Key Path	View/Display, Display

Display Line

Activates an adjustable horizontal line that is used as a visual reference line. The line's vertical position corresponds to its amplitude value. The value of the display line (for example, "-20.3 dBm") appears above the line itself on the right side of the display in the appropriate font.

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.

SCPI Command	<code>:DISPlay:WINDow[1]:TRACe:Y:DLINe <ampl> :DISPlay:WINDow[1]:TRACe:Y:DLINe? :DISPlay:WINDow[1]:TRACe:Y:DLINe:STATe OFF ON 0 1 :DISPlay:WINDow[1]:TRACe:Y:DLINe:STATe?</code>
Example	<code>DISP:WIND:TRAC:Y:DLIN:STAT ON DISP:WIND:TRAC:Y:DLIN:STAT -32 dBm</code>
Preset	Set the Display Line to Off and -25 dBm on Preset. 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.
State Saved	Saved in instrument state.

Min	$-\infty$ (minus infinity) in current units
Max	$+\infty$ (plus infinity) in current units
Key Path	View/Display, Display
Default Terminator	Depends on the current selected Y axis unit

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	View/Display, Display, System Display Settings
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Annotation Local Settings/All Off

This is a Mode Global override of the meas local annotation settings. When it is **All Off**, it forces Screen Annotation, Meas Bar, Trace and Active Function Values settings to be off for all measurements in all modes. In this case, **Screen, Meas Bar, Trace and Active Function Values** keys under the **Display, Annotation** menu are grayed out and forced to OFF. This provides the security based “annotation off” function of previous analyzers, hence it uses the legacy SCPI command.

When **Local Settings** has been selected, you are able to set the local annotation settings on a measurement by measurement basis.

SCPI Command	:DISPlay:WINDow[1]:ANNotation[:ALL] OFF ON 0 1 :DISPlay:WINDow[1]:ANNotation[:ALL]?
Example	:DISP:WIND:ANN OFF
Setup	:SYSTem:DEFault MISC
Preset	On (Set by Restore Misc Defaults)
State Saved	Not saved in instrument state.
Key Path	View/Display, Display, System Display Settings , Annotation

Theme

This key allows you to change the Display theme. This is similar to the **Themes** selection

View/Display

under **Page Setup** and **Save Screen Image**. The four themes are detailed below.

SCPI Command	<code>:DISPlay:THEMe</code> <code>TDCoLor TDMonochrome FCOLor FMONochrome</code> <code>:DISPlay:THEMe?</code>
Setup	<code>:SYSTem:DEFault MISC</code>
Preset	TDCoLor (Set by Restore Misc Defaults)
State Saved	Not saved in instrument state.
Key Path	View/Display, Display, System Display Settings
Remote Command Notes	TDCoLor – 3D is the standard color theme with filling and shading TDMonochrome – is similar to 3D color, but only black is used FCOLor – flat color is intended for inkjet printers to conserve ink. It uses a white background instead of black. FMONochrome – is like flat color, but only black is used
Example	<code>DISP:THEM TDM</code> sets the display theme to 3D Monochrome.

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.

SCPI Command	<code>:DISPlay:BACKlight ON OFF</code> <code>:DISPlay:BACKlight?</code>
Setup	<code>:SYSTem:DEFault MISC</code>
Preset	ON (Set by Restore Misc Defaults)
Key Path	View/Display, Display, System Display Settings

On

Turns the display backlight on.

Example	DISP:BACK ON
Key Path	View/Display, Display, System Display Settings, Backlight

Off

Turns the display backlight off.

Example	DISP:BACK OFF
Key Path	View/Display, Display, System Display Settings, Backlight

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.

SCPI Command	:DISPlay:BACKlight:INTensity <integer> :DISPlay:BACKlight:INTensity?
Example	DISP:BACK:INT 50
Setup	:SYSTem:DEFault MISC
Preset	100 (Set by Restore Misc Defaults)
Min	0
Max	100
Key Path	View/Display, Display, System Display Settings

Layout

This key allows you to choose the number and position of windows on the screen. Each window contains one trace. The selected trace is always visible and its window outlined in green. The Window zoom key toggles between multiple windows and a single window mode without changing the setting for Layout.

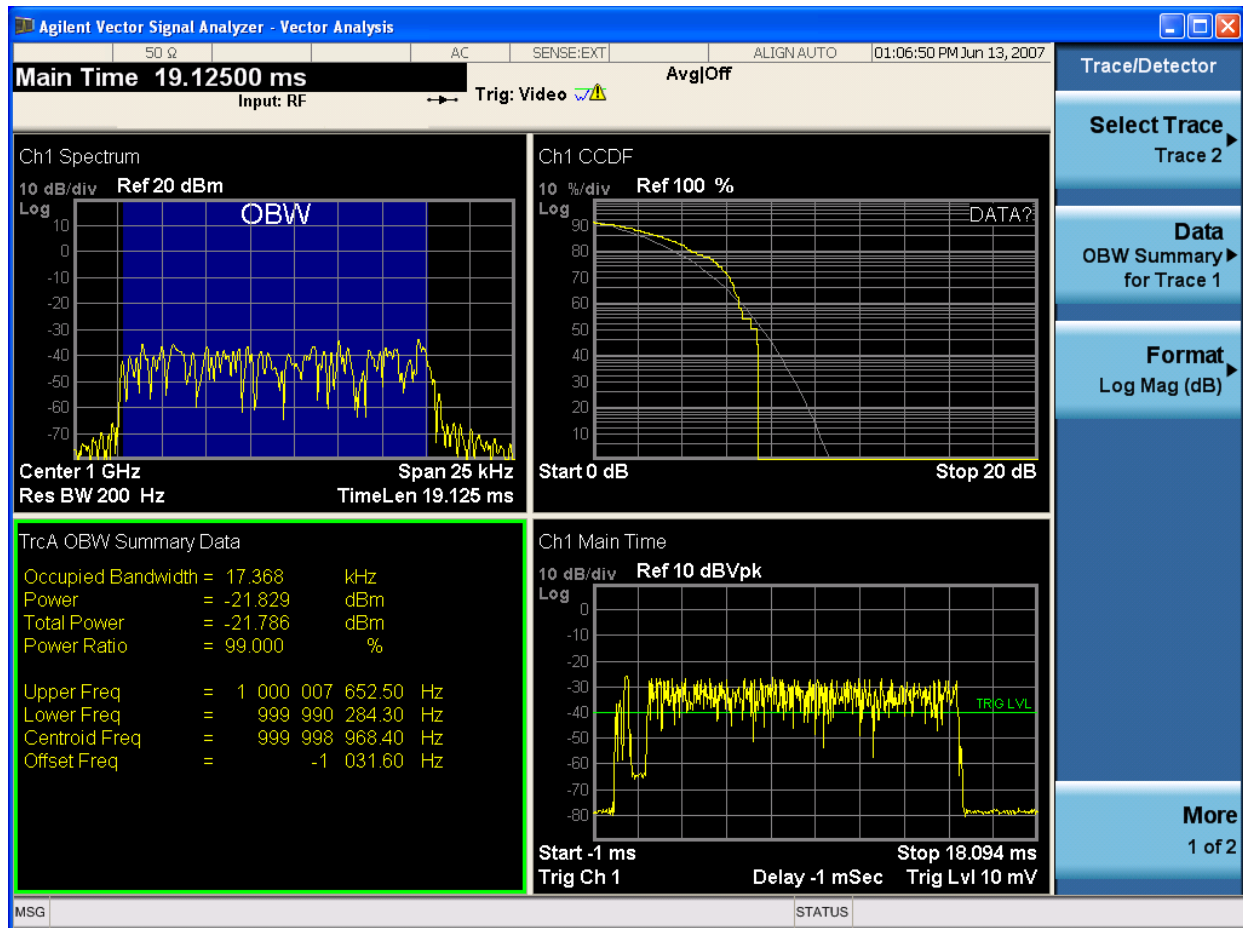
Single layout has one window.

Stack 2 layout has two windows, one on top of the other, that display either traces 1 (top) and 2 (bottom) or traces 3 and 4. The pair that is showing always includes the

View/Display

selected trace.

Stack 3 layout has three windows that display, top to bottom, traces 1, 2, 3 or traces 2, 3, 4. Grid 2x2 layout has 4 windows, arranged 2x2. They display (in order top to bottom, left to right) traces 1, 2, 3, and 4.

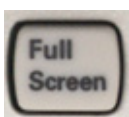


Grid 2x2 layout with Trace 2 selected

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:DISPlay:<meas>:WINDow:FORMat SINGLE TWO TRI QUAD :DISPlay:<meas>:WINDow:FORMat?
Example	DISP:VECT:WIND:FORM TWO DISP:VECT:WIND:FORM?
Dependencies/Couplings	If the window is currently zoomed, selecting a layout (even the current one) will switch it to tiled mode.

Preset	TWO QUAD QUAD QUAD QUAD QUAD QUAD
State Saved	Saved in instrument state.
Range	Single Stack 2 Stack 3 Grid 2x2
Key Path	View/Display

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.

SCPI Command	:DISPlay:FSCreen[:STATE] OFF ON 0 1 :DISPlay:FSCreen[:STATE] ?
State Saved	Not saved in state.
Key Path	Display

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

View/Display

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.

SCPI Command	<code>:DISPlay:ENABle OFF ON 0 1</code> <code>:DISPlay:ENABle?</code>
Example	<code>DISP:ENAB OFF</code>
Couplings	<code>DISP:ENAB OFF</code> turns Backlight OFF and <code>DISP:ENAB ON</code> turns Backlight ON. However, settings of Backlight do not change the state of <code>DISP:ENAB</code>
Preset	On Set by <code>SYST:DEF MISC</code> , but Not affected by <code>*RST</code> or <code>SYSTem:PRESet</code> .
State Saved	Not saved in instrument state.

Marker

The Marker hardkey displays the Marker menu. A marker can be placed on a trace to allow the value of the trace data at the marker position to be determined precisely. Markers can also be used in pairs to read the difference (or delta) between two data points. They can also be used to make power calculations over a band of frequencies or a time interval. See Marker Functions below for more details.

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 control mode is described below.

Pressing Marker always makes the selected maker's X position the active function.

If the currently selected marker is Off, pressing Marker sets it to Normal mode and places it at the center of the screen on the currently selected trace.

As a convenience, if there are no markers displayed on the current trace, pressing the marker hardkey (whenever the marker menu is already showing) selects the lowest numbered marker that is currently off and turns it on in normal mode on the selected trace. In other words, pressing the Marker hardkey twice will always turn on a marker on the selected trace if none was turned on before.

For more information see the Analyzer Setup, Marker for a description of this function.

Mode	VSA
Key Path	Front Panel

Select Marker

Specifies the selected marker. The selected marker is the one that is affected by the marker position and properties settings, peak search, and other marker functions. Several menus have a Select Marker key for convenience. Marker selection using any one of these is reflected in all others, i.e., there is only one selected marker for the whole measurement. If all markers are off, then marker 1 becomes the selected marker.

As a convenience, if no markers are displayed on the selected trace, selecting a marker that is off automatically turns it on in normal mode on the selected trace.

There is no SCPI function for selecting a marker. Instead, SCPI functions may explicitly include the index of the marker for which they are to apply. (Most SCPI marker functions that affect the state of a marker will also make it the selected marker for front panel commands.)

Mode	VSA
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State Saved	No
Range	1 2 3 4 5 6 7 8 9 10 11 12
Key Path	Marker or Marker> or Marker Function

Control Mode

The control mode of the selected marker is selected by pressing **Normal**, **Delta**, **Fixed**, or **Off**. The behavior of a marker under each control mode is described below the table. The current control mode is shown by highlighting the appropriate key.

The SCPI 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.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :MODE POSITION DELTA FIXed =OFF :CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :MODE?
Example	CALC:VECT:MARK1:MODE POS CALC:VECT:MARK1:MODE?
Dependencies/Couplings	When Delta mode is selected, or when the mode is changed from Delta to Off, the marker relative to the selected marker may be affected, as described in the text descriptions below.
Preset	=OFF
State Saved	Saved in instrument state.
Range	Normal Delta Fixed Off
Key Path	Marker

Normal (Position)

A marker in normal mode reports the trace data value (Y value) at a particular point on a trace. The marker's absolute X (and Z) position is specified by you in displayed units. The

marker symbol appears on the trace at the specified position and tracks the absolute Y value at that position as it changes from scan to scan. The absolute Y value is displayed in the marker readout area. In older instruments this was called Position mode, and the designation may still be used for backward compatibility.

For Control Mode SCPI command information see: Control Mode

Mode	VSA
Key Path	Marker

Delta

A marker set to delta mode reports the difference between Y values at two points. A delta marker is relative to an associated reference marker on the same trace. (The reference marker may be set on the Marker, Properties, Relative To menu). The reference marker is usually fixed, but may also be normal or delta. The X (and Z) position of a delta marker is specified as an offset from the reference marker position. The delta marker symbol tracks the absolute Y value just like a normal marker, but the marker readout displays the difference between the absolute Y values of the delta marker and its reference marker (absolute units are used even if the reference is itself a delta marker). Usually this is a straight difference in the current displayed units. For example, if the trace format is LogMag (dBm), the delta marker displays the difference in dB, thus showing a power ratio. But if the trace format is Real, then the delta marker shows a voltage difference, not a ratio. Exceptions for this are:

- When the trace format is Linear Mag or Log Mag (linear unit) the delta marker displays a voltage ratio, or (if the Y Axis unit is Power) a power ratio, rather than a difference.
- When either the marker or its reference has a marker function turned on, the delta marker always displays a ratio or its decibel equivalent. See Marker Function for more details on how delta markers work with marker functions. The type of ratio calculated (power or voltage) depends on the delta marker units; the reference marker value is converted as needed so it has compatible units.
- When the trace format is Wrap Phase, the delta marker readout is constrained to the wrapped phase display range, which is usually $(-180, +180]$ degrees. For example, if the absolute phase at marker 1 is 170 deg and its reference has phase of -170 deg, the delta will not show 340 deg, but -20 deg. Note that the Wrap Phase display range can be changed (see Trace/Detector, Phase/Delay Properties, Phase/Trellis Offset).

There is no current support for calculating deltas across traces (and this cannot be done at all unless the traces have the same domain and ranges).

By default, the reference marker for marker 1 is marker 2; for marker 2 is 3 and so on, but the reference marker may be changed. See the section on the "Relative To" softkey below.

The following coupling rules apply from the front panel, and also if the equivalent SCPI

commands are sent.

Pressing the Delta key causes the selected marker becomes a delta marker if it is not already. Also, the selected marker's reference is affected as follows:

- If the reference marker was off, it is turned on as a fixed marker.
- The reference marker is moved to the trace of the selected marker and set to the same position as the selected marker.
- If the delta marker has a marker function turned on, the reference marker takes on the same function (with the same band limits).

Exception: Pressing Delta when the selected marker's mode is not yet Delta does not move or change a reference marker that is already turned on (Normal, Delta, or Fixed) and on the same trace as the selected marker. It merely changes the selected marker's mode to Delta and shows the current offset between it and the reference. If you press Delta again (when the selected marker is already in Delta mode) then the reference is moved and modified as described above.

When a delta marker is changed to any other control mode, if its reference marker is fixed then the reference marker is also turned off.

If you move a delta marker to a different trace, it is forced to Normal mode, and if its reference is fixed, the reference is turned off.

A delta marker is forced to Normal mode if you turn its reference off, or if you move its reference to another trace. (In the latter case the reference is not turned off even if it is fixed.)

If you change the selected marker's reference (using the Marker, Properties, Relative To) the selected marker is forced to Delta mode. This change of the selected marker to Delta mode causes its new reference's control mode and position to change as described above.

For Control Mode SCPI command information see: [Control Mode](#)

Mode	VSA
Key Path	Marker

Fixed

Fixed markers are mainly used as reference markers for Delta markers. A fixed marker's X and Y Axis values may be directly or indirectly specified by you, and they remain fixed once specified, i.e. they do not follow the trace data value. These markers are represented on the display by an "X" rather than a diamond. If a marker is changed from off to fixed, the X and Y (and Z) values are chosen to put it in the center of the display. If the marker is

changed from some other type to fixed, the current X and Z values of the marker remain unchanged. The Y value is taken from the current trace data value and must be changed manually thereafter.

For Control Mode SCPI command information see: Control Mode

Mode	VSA
Key Path	Marker

Off

Turning a marker off makes it invisible, and also its annotation.

Turning a marker on (i.e. changing its control mode from Off to any other control mode) assigns the marker to the currently selected trace.

For Control Mode SCPI command information see: Control Mode

Mode	VSA
Key Path	Marker

Marker Position

Marker position is used to select which data point in a trace we want to read out with the marker (or where to locate a fixed marker). The marker position is primarily set in terms of the domain units, not trace points (although it can be set in terms of points via SCPI). The default active function when you press a marker hard key is the X position for the currently selected marker. The exception to this is when the selected marker is fixed. In that case there is no default active function (to prevent inadvertently changing a fixed marker's location).

Marker position is not defined when a marker's control mode is Off. When a marker is turned on in Normal or Delta mode, its X (and Z) values are set to the center of the trace data. If a marker is turned on in Fixed mode, its position is set so that it appears in the middle of the trace grid.

The Marker Position key branches to the Marker Position menu, which allows you to set any position variable relevant to the selected marker's control mode and trace format. For Normal and Delta markers, usually only Marker X is available. Marker Z is available for trace data with 2-dimensional domain. For Fixed markers, Y may also be set. If the trace format is Vector or Constellation, Marker Y controls the real (horizontal axis) value and Marker Y Imag controls the imaginary (vertical axis) value. The key (or the keys below it) is grayed out if the selected marker is off.

Mode	VSA
Key Path	Marker

Marker X

This sets the selected marker's X Axis value position in the current X Axis Scale unit. If the control mode is Off, the SCPI command has no effect other than to cause the marker to become selected. Note that the X value may change if the marker is moved to a trace with a different domain.

The Marker X position is absolute if the marker control mode is Normal or Fixed. If the control mode is Delta, then the X position is relative to the reference marker. The valid X positions are the actual data points in the trace; the marker cannot be located between points. If a SCPI command attempts to place the marker between two points, the X value snaps to the closest point.

Note that for Vector or Constellation format, the X axis is perpendicular to the screen (because the screen axes are used to show the real and imaginary parts of the Y value), so adjusting the X value in this case will only cause the marker to move horizontally if the real Y value changes. For Fixed markers on a trace with one of these formats, adjusting the X value will not cause horizontal motion of the marker at all. Instead, you use the Marker Y and Marker Y (imag) controls to move the marker horizontally and vertically.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :X <real> :CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :X?
Example	CALC:VECT:MARK:X 0.325 CALC:VECT:MARK:X?

Marker Functions
Marker

Notes	<p>Marker X will not go outside the bounds of the data unless it is Fixed. If you attempt to set it to a value outside the bounds it will be clipped at the closest limit, and error -222 Data Out of Range is generated.</p> <p>If suffix is sent, it must match the X units for the trace the marker is on. Otherwise, error -138, "Suffix not allowed" is generated.</p> <p>If you try to read or set the position of a Delta marker, remember that the position is in relative units.</p>
Dependencies/Couplings	See Coupling at the end of the Control Mode section. See also Couple Markers section.
Preset	None until marker is turned on.
State Saved	Saved in instrument state.
Min	Depends on trace data
Max	Depends on trace data
Key Path	Marker, Marker Position

SCPI only X position commands

Via SCPI , the marker position may also be set or queried in trace points. In this case, the position setting or reading is absolute regardless of control mode.

NOTE: The entered value in Trace Points is immediately translated into the current domain units for setting the value of the marker. The marker's value in domain 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 point 500, which happens at that time to correspond to 13 GHz, and then you change the Start Frequency so that point 500 is no longer 13 GHz, the marker will stay at 13 GHz, NOT at point 500.

If the trace the marker is on has a 2-dimensional domain, then the points are numbered in the following way:

Starting at the minimum X and Z position, this point is numbered 0. Each time you increment the point number, increment the X value to the next available value. When X reaches the maximum X position, then reset X to the minimum and increment the Z value. Then continue incrementing the X position in the same manner as before.

Note that for symbol tables, which have no axes, incrementing the X position in points moves the marker consecutively through all table entries.

Measurement	<code><meas>:=VECTor ADEMod DDEMod W11A W11B</code>
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Mode	VSA
Remote Command	:CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 [:X]:POSition <real> :CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 [:X]:POSition?
Example	CALC:VECT:MARK:POS 25 CALC:VECT:MARK:POS?
Notes	When a marker control mode is changed from off to any other mode, the X position is set to mid-screen.
Dependencies/Couplings	Same couplings as for Marker X value
Preset	None until marker is turned on.
State Saved	Saved in instrument state.
Min	Depends on trace data
Max	Depends on trace data

Marker X Unit may be queried via SCPI

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :X:UNIT?
Example	CALC:VECT:MARK:X:UNIT?
Notes	Query Only

Marker Y

This function only affects fixed markers. It allows you to set or read back the selected marker's Y Axis value in the current Y Axis Scale unit. Setting the Y value has no effect (other than to cause the marker to become selected) if the control mode is other than fixed. The query form generates an error if the control mode is Off. Note that the Y value may change if the Y-axis units change, either from a change in format of the trace the marker is on, or if the marker is moved to a different trace.

Marker Functions
Marker

If the selected marker is on a trace that is displayed with Vector or Constellation format, this function controls only the real part of the Y value (i.e., the horizontal axis value). Use the Marker Y (imag) control to change the imaginary (vertical) value. Marker Y and Marker Y Imag always set or get the rectangular form of Y, regardless of whether the marker readout is polar or rectangular.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12:Y[:REAL] <real> :CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12:Y[:REAL]?
Example	CALC:VECT:MARK2:Y 0.325 CALC:VECT:MARK2:Y?
Notes	You cannot set Y unless the marker type is fixed. If the marker becomes fixed after a marker function is turned on, it is set to whatever the Y value was when the marker became fixed. If suffix is sent, it must match the Y units for the trace the marker is on. Otherwise, error -138, "Suffix not allowed" is generated.
Dependencies/Couplings	Changes if marker is relative to a Delta marker that is turned on or re-zeroed (see Coupling of Delta and Reference Markers).
Preset	None until marker is turned on.
State Saved	Saved in instrument state.
Min	-9.9E+37
Max	9.9E+37
Key Path	Marker, Marker Position

Marker Y Unit may be queried via SCPI.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA

Remote Command	:CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :Y:UNIT?
Example	CALC:VECT:MARK:Y:UNIT?
Notes	Query Only

Marker Y Imag

This only affects fixed markers and is only available when the trace format is Vector or Constellation. It allows you to set or read back the selected marker's quadrature (imaginary) Y value in the current Y Axis Scale unit. It has no effect (other than to cause the marker to become selected) if the control mode is other than fixed, or if the current trace format is not complex. The query form generates an error if it is used for a marker that is not on a complex trace. Marker Y Imag is not affected by whether the marker readout is polar or rectangular.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :Y:IMAGinary <real> :CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :Y:IMAGinary?
Example	CALC:DDEM:MARK1:Y:IMAG 0.435 CALC:DDEM:MARK1:Y:IMAG?
Notes	Grayed out unless the marker is fixed and on a vector display. If suffix is sent, it must match the Y units for the trace the marker is on. Otherwise, an Invalid Suffix error is generated. Otherwise, error -138, "Suffix not allowed" is generated. If query is sent while the marker is on a trace whose format is not vector or constellation, NaN (9.91E+37) is returned.
Preset	None until marker is turned on.
State Saved	Saved in instrument state.
Min	Depends on trace format
Max	Depends on trace format
Key Path	Marker, Marker Position

Marker Z

For markers on traces with a 2-dimensional domain, this sets the selected markers Z Axis value in the current Z 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**, or if the trace has no Z domain. Note that the Z value may change or become irrelevant if the marker is moved to a trace with a different Z domain, or no Z domain.

Note that this Z value is affected if the SCPI command to set marker point position is used.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12:Z <real> :CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12:Z?
Example	CALC:OFDM:MARK:Z 12 CALC:OFDM:MARK:Z?
Notes	Marker Z will not go outside the bounds of the data unless it is Fixed. If you attempt to set it to a value outside the bounds it will be clipped at the closest limit, and error –222 Data Out of Range is generated. If suffix is sent, it must match the Z units for the trace the marker is on. Otherwise, error –138, "Suffix not allowed" is generated.
Dependencies/Couplings	See Coupling at the end of the Control Mode section. See also Couple Markers section.
Preset	None until marker is turned on.
State Saved	Saved in instrument state.
Min	Depends on trace data
Max	Depends on trace data
Key Path	Marker, Marker Position

Marker Z Unit may be queried via SCPI.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 : Z : UNIT?
Example	CALC:OFDM:MARK:Z:UNIT?
Notes	Query Only

Marker Properties

The Marker Properties key accesses a menu of common marker properties.

Mode	VSA
Key Path	Marker

Relative To

This key allows you to specify which marker is used as a reference for the selected marker when the selected marker's control mode is set to Delta. By default, the reference marker is numerically one higher than the selected marker, that is, marker 1 is relative to marker 2, marker 2 to marker 3, and so on. Marker 12 by default is relative to marker 1. This key allows you to change the reference marker from the default. Note that a marker cannot be made relative to itself.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :REFerence <integer> :CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :REFerence?
Example	CALC:VECT:MARK2:REF 4 CALC:VECT:MARK2:REF?

Notes	<p>The reference marker cannot be the same value as the selected marker, i.e., a marker cannot be relative to itself. The currently selected marker will not be an available choice in the relative to selection (i.e. the selected marker will appear grayed out).</p> <p>When queried a single value will be returned (the specified marker numbers relative marker).</p>
Dependencies/Couplings	See Coupling of Delta and Reference Markers above. The old reference remains as it was.
Preset	2 3 4 5 6 7 8 9 10 11 12 1
State Saved	Saved in instrument state.
Range	1 2 3 4 5 6 7 8 9 10 11 12
Key Path	Marker, Properties

Complex Format

This determines the format for the readout when a marker is placed on a complex display (vector or constellation). The choices are to read out in rectangular or polar coordinates. The readout format applies to the marker display and marker table only; there is no SCPI for reading out the marker value in polar form.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	<pre>:CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :CFO Rmat RECTangular POLar :CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :CFO Rmat?</pre>
Example	<pre>CALC:VECT:MARK1:CFOR RECT CALC:VECT:MARK1:CFOR?</pre>
Preset	RECT
State Saved	Saved in instrument state.
Range	Rect Polar
Key Path	Marker, Properties

Marker Trace

This key allows you to determine the trace to which a marker is assigned. By default, when a marker is turned on it is assigned to the currently selected trace. You may change that assignment using this control.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :TRACe <integer> :CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :TRACe?
Example	CALC:VECT:MARK3:TRAC 2 CALC:VECT:MARK3:TRAC?
Dependencies/Couplings	See Coupling of Delta and Reference Markers above..
Preset	Marker is assigned to currently selected trace when turned on.
State Saved	Saved in instrument state.
Range	Trace 1 Trace2 Trace 3 Trace 4
Min	1
Max	4
Key Path	Marker, Properties

Marker Count

This key enables the frequency counter algorithm on the selected marker. This algorithm can more precisely determine the frequency of a peak. The marker must be on a frequency domain trace, with data coming from hardware. Place the marker on a peak and enable the frequency counter. The marker readout then shows the calculated frequency rather than the marker X position. Only one marker can be counted at any time. Turning on marker count for any marker turns it off for all other markers.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA

Remote Command	:CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12:FCOunt [:STATe] OFF ON 0 1 :CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12:FCOunt [:STATe] ?
Example	CALC:VECT:MARK:FCO ON CALC:VECT:MARK:FCO?
Notes	Marker must be on a frequency-domain trace and data must be live, not recorded or simulated.
Preset	OFF
State Saved	Saved in instrument state.
Range	Off On
Key Path	Marker, Properties

The frequency counter result must be read back with the following SCPI command. The Marker X query command will only get the marker's data point position, which will not be as accurate as the frequency counter result.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12:FC Ount:X?
Example	CALC:VECT:MARK:FCO:X?
Notes	Query only. If the marker counter result is unavailable, NaN is returned.
Key Path	SCPI only

Marker Table

When the Marker Table is turned 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.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:MARKer:TABLE [:STATe] OFF ON 0 1 :CALCulate:<meas>:MARKer:TABLE [:STATe] ?
Example	CALC:VECT:MARK:TABL ON CALC:VECT:MARK:TABL?
Preset	OFF
State Saved	No
Range	Off On
Key Path	Marker

Couple Markers

Marker Coupling affects all currently displayed markers. In general when coupling is turned on then all Normal or Delta markers with the same (or equivalent) domain as the selected marker move in the same manner as the selected marker. Coupling is relative between markers on the same trace (so that their relative positions in the domain are maintained). Coupling can be absolute between markers on different traces that have equivalent domains. That is, they are forced have the same position in the domain, if possible. (As an example of equivalent domains, demodulated symbol positions can be derived from time by using the current symbol rate). When you move the selected marker, then others on related traces track it. This is to allow you to correlate different measurement results. For example, to you can place a marker at a particular symbol time on an error vector magnitude display, and have tracking markers on the symbol table and pre-demod time trace, showing you the symbol value and the actual time-varying signal value at the same point in time.

Absolute coupling is performed only for the lowest numbered Normal or Delta marker on each trace. All other markers on a trace couple relatively. When you turn on marker coupling, the subset of markers that have the same domain as the selected marker track it and all other markers remain at their current location. The absolutely coupled markers within this subset will be moved at this time to match the domain setting of the selected marker, with the relatively coupled markers following accordingly to maintain offsets within their respective traces. Those markers with different domains remain at their current location. When you select a marker with a different domain than the previously selected marker, then the subset of markers with that domain go through the same procedure.

Any marker that coupling would move outside its range of X values, will remain at the

Marker Functions
Marker

closest limiting value until the selected marker moves in such a way as to bring the coupled X value back into range. If the coupled markers are on data that do not have the same domain resolution, then they are positioned as close to each other as possible.

If markers change mode or trace, or trace data is changed below them, the coupling rules are immediately applied to the new set.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:MARKer:COUPle[:STATe] OFF ON 0 1 :CALCulate:<meas>:MARKer:COUPle[:STATe]?
Example	CALC:VECT:MARK:COUP ON CALC:VECT:MARK:COUP?
Preset	OFF
State Saved	Saved in instrument state.
Range	Off On
Key Path	Marker

All Markers Off

This function turns all markers off and sets the selected marker to 1.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:MARKer:AOFF
Example	CALC:VECT:MARK:AOFF:
Key Path	Marker

Peak Search

The Peak Search hardkey places the selected marker on the trace point with the maximum y-axis value for that marker's trace and displays a menu that allows markers to be easily moved among peaks on a trace. It also is used to perform the Peak Search function, as described below. Pressing Peak Search also makes the selected marker's X position the active function.

The peak search function causes the marker to move to the highest point in the trace. The highest point is the point with the largest y-axis value in the current trace format. If the format is complex (vector or constellation) then the point with the highest magnitude is chosen.

Pressing the Peak Search hard key always performs a Peak Search, with one exception: if the Peak Search menu is not showing but the selected marker is on (Normal, Delta, or Fixed), then pressing the Peak Search hardkey only displays the Peak Search menu. This allows you to select one of the other peak search functions without disturbing the selected marker's position. If you want to perform a peak search in this case, press the Peak Search hardkey again.

If the selected marker is Off, then pressing the Peak Search hardkey once not only shows the menu, but it turns on the selected marker in Normal mode, assigns it to the selected trace, and performs a peak search.

If any peak search SCPI command is invoked on a marker that is Off, the marker is first turned on in Normal mode and assigned to the selected trace. Then the peak search is performed.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :MAXimum
Example	CALC:VECT:MARK2:MAX
Notes	There is no softkey for this function. Instead, you press the Peak Search hardkey twice. (Pressing it once is sufficient if the Peak Search menu is showing, but twice guarantees that the function will be invoked) If peak search function is not invoked (because the response to pressing the hardkey was only to show the menu) then the following message is shown: "Press Peak Search again to perform a Peak Search."
Key Path	Peak Search (press hardkey twice if menu is not showing)

Next Peak (Next Lower Amptd)

This command moves the marker to the peak next lower in Y value than the peak it is currently on. If the format is complex (vector or constellation) then the marker moves to the closest point that has a lower magnitude than the marker's current position. If this function is invoked via SCPI on a marker that is off, the result is the same as if you sent a Peak Search command.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:MARKer[1] 2 3 4 5 6 7 8 9 10 11 12: MAXimum:NEXT
Example	CALC:VECT:MARK2:MAX:NEXT
Key Path	Peak Search

Next Higher Amptd

This command moves the marker to the peak next higher in Y value than the peak it is currently on. . If the format is complex (vector or constellation) then the marker moves to the closest point that has a higher magnitude than the marker's current position. If this function is invoked via SCPI on a marker that is off, the result is the same as if you sent a Peak Search command.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:MARKer[1] 2 3 4 5 6 7 8 9 10 11 12:M AXimum:PREVious
Example	CALC:VECT:MARK2:MAX:PREV
Key Path	Peak Search

Next Right

This command moves the marker to the next peak to the right of its current position. If the format is complex (vector or constellation) then the marker moves forward in time to the next peak. If this function is invoked via SCPI on a marker that is off, the result is the same as if you sent a Peak Search command.

A valid peak is one for which the displayed Y-axis values drop monotonically on both sides

of the local maximum at least 4% of the distance between the top and bottom of the display grid before the values begin to rise again.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12:MAXimum:RIGHT
Example	CALC:VECT:MARK2:MAX:RIGH
Key Path	Peak Search

Next Left

This command moves the marker to the next peak to the left of its current position. If the format is complex (vector or constellation) then the marker moves back in time to the next peak. If this function is invoked via SCPI on a marker that is off, the result is the same as if you sent a Peak Search command.

A valid peak is one for which the displayed Y-axis values drop monotonically on both sides of the local maximum at least 4% of the distance between the top and bottom of the display grid before the values begin to rise again.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12:MAXimum:LEFT
Example	CALC:VECT:MARK2:MAX:LEFT
Key Path	Peak Search

Mkr -> CF (Center Frequency)

This key is a duplicate of the key of the same name in the Mkr -> menu. It is placed in this menu as a convenience. See the description in the Marker To section.

Mode	VSA
Key Path	Peak Search

Continuous Peak Search

This key turns on Continuous Peak Search for the selected marker. This function be turned on for any marker independently of any other marker. This function moves the marker to the highest point on the trace each time the trace is updated. If the SCPI command refers to a marker that is off, it is turned on in Normal mode.

It is possible to have Couple Markers and Continuous Peak Search both on. If this is the case, it is recommended that Continuous Peak search be turned on for only one marker in any tracking set (that is, any set of markers with the same or equivalent domain). Otherwise, conflicts over marker position may arise that cause erratic marker movement.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :CPSea rch[:STATe] ON OFF 1 0 :CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :CPSea rch[:STATe] ?
Example	CALC:VECT:MARK1:CPS ON
Dependencies/Couplings	The Continuous Peak Search key is grayed out when the selected marker is a Fixed marker. Also, if Continuous Peak Search is on and the selected marker becomes a fixed marker, then Continuous Peak Search is turned off and the key grayed out. Continuous Peak Search is turned off when the selected marker is turned off.
Preset	OFF
State Saved	Saved in instrument state.
Range	Off On
Key Path	Peak Search

Min Search

This command moves the marker to the lowest Y value on the trace. If the format is complex (vector or constellation) then the marker moves to the lowest value in magnitude. If the SCPI command refers to a marker that is off, it is first turned on in Normal mode

and then set on the minimum point.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:MARKer[1] 2 3 4 5 6 7 8 9 10 11 12:MINimum
Example	CALC:VECT:MARK2:MIN
Key Path	Peak Search

Mkr -> Ref Lvl (Reference Level)

This function sets the Y axis reference value equal to the selected marker's Y value. For example, if the reference position is at the top of the screen, the whole trace is moved up so that the marker appears at the top of the screen. Note that this is a display scaling function only. The input range remains the same.

Mode	VSA
Key Path	Peak Search

Marker To

The Marker -> hardkey provides access to some convenient functions for copying the marker position to a number of frequency and Y-axis scaling parameters. These functions are available from the front panel only. No SCPI is provided, because you can already read the marker position via SCPI and then set any frequency or scaling parameter accordingly, with full accuracy.

Pressing the Marker -> hardkey always makes the selected marker's X position the active function.

If the selected marker is off, pressing the Marker -> hardkey turns on the selected marker in normal mode on the currently selected trace.

Mode	VSA
Key Path	Front Panel

Mkr -> CF (Center Frequency)

This function sets the center frequency equal to the selected marker's absolute frequency. The marker must be on a frequency-domain trace. The absolute marker frequency is used regardless of whether its control mode is Normal, Delta, or Fixed.

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.

Mode	VSA
Key Path	Marker To

Mkr -> CF Step

This function sets the center frequency step size equal to the selected marker's frequency. The marker must be on a frequency-domain trace. The absolute marker frequency is used regardless of whether its control mode is Normal, Delta, or Fixed.

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.

Mode	VSA
Key Path	Marker To

Mkr -> Start

This function sets the start frequency equal to the selected marker's frequency. The marker must be on a frequency-domain trace. The absolute marker frequency is used regardless of whether its control mode is Normal, Delta, or Fixed.

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.

Mode	VSA
Key Path	Marker To

Mkr -> Stop

This function sets the stop frequency equal to the selected marker's frequency. The marker must be on a frequency-domain trace. The absolute marker frequency is used regardless of whether its control mode is Normal, Delta, or Fixed.

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.

Mode	VSA
Key Path	Marker To

Mkr Delta -> Span

This function sets the start and stop frequencies to equal to the selected marker's frequency and that of its reference. That is, the measurement span is "zoomed in" so that

the selected marker and its associated reference appear on the extreme left and right of the display. The marker must be on a frequency-domain trace and its control mode must be Delta.

Mode	VSA
Key Path	Marker To

Mkr -> Ref Lvl

This function sets the Y axis reference value equal to the selected marker's Y value. For example, if the reference position is at the top of the screen, the whole trace is moved up so that the marker appears at the top of the screen. Note that this is a display scaling function only. The input range remains the same.

Mode	VSA
Key Path	Marker To

Counter -> CF (Center Frequency)

This function copies the frequency of the marker counter to the center frequency. The marker counter function must be on.

Mode	VSA
Key Path	Marker To

Mkr Delta -> CF (Center Frequency)

This function sets the center frequency equal to the difference in frequency between the selected Delta marker and its reference. The marker must be on a frequency-domain trace and the selected marker's control mode must be Delta.

Mode	VSA
Key Path	Marker To

Marker Function

This key accesses a menu of selectable marker functions for VSA measurements.

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.

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.

The Marker Function menu gives you access to power calculations in bands of frequencies or time intervals centered on a marker. It also allows you to make calculations like carrier to noise by combining delta markers with marker functions. Marker functions are generally available for time and frequency domain traces, and not for others. If the marker function calculation is undefined for particular trace data, then "---" is shown in place of a number in the result display and marker table, and `CALC:<meas>:MARK[n]:Y?` will return 9.91E+37 (NaN).

Pressing Marker Function always makes the selected marker's X position the active function.

If the selected marker is off, pressing the Marker Function hardkey turns on the selected marker in normal mode on the currently selected trace.

Measurement	<code><meas>:=VECTor ADEMod DDEMod W11A W11B</code>
Mode	VSA
Remote Command	<code>:CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :FUNct ion BPOwer BDENsity =OFF</code> <code>:CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :FUNct ion?</code>
Example	<code>CALC:VECT:MARK1:FUNC BPOW</code> <code>CALC:VECT:MARK1:FUNC?</code>
Notes	<code>:CALC:<meas>:MARK1:FUNC?</code> returns the current function type for marker 1. To return the result, use <code>:CALC:<meas>:MARK1:Y?</code>
Preset	<code>=OFF</code>
State Saved	Saved in instrument state.

Range Band Power | Band Density | Off
 Key Path **Marker Function**

Band/Interval Power

Turns on the Band/Interval Power function for the selected marker. This function calculates the power within the band centered on the marker. The function works generally with frequency spectra, PSD and time traces. On traces where band power is undefined, the result display shows "---" and CALC:<meas>:MARK[n]:Y? will return 9.91E+37 (NaN), although the band interval can still be defined.

Frequency-domain data

If the marker is on a frequency-domain trace, the result is total power within the band. This is true whether the underlying trace data is a power spectrum or power spectral density.

Time-domain data

If the marker is on a time-domain trace, the result is average power within the time interval, that is, the power at each time sample in the time interval is calculated, the powers are summed and the total divided by the number of samples.

Mode VSA
 Key Path **Marker Function**

Band Power Calculation

A band/interval power calculation result may be shown in dBm, dBVrms, Watts, Volts RMS Squared or Volts RMS. The table below shows the choice of display units if Band Power Calculation is set to Mean, depending on the current format and Y units of the trace the marker is on.

Trace data type	Trace Format	Y Unit	Result format
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Marker Functions
Marker Function

Spectrum, PSD, Time record	LogMag (dB)	Auto, Power	dBm
		Peak, RMS	dBVrms
		mRMS	dBmVrms
	Linear Mag, Real, Imag, Log Mag (lin)	Auto, Peak, RMS, mRMS	Vrms^2
	Linear Mag, Real, Imag, Log Mag(lin)	Power	W
	Wrap Phase, Unwrap Phase, Delay	Any	Vrms^2
Dimensionless (e.g., Frequency response, Impulse response, various Demodulation error types)	Vector, Constellation, Eye, Trellis	Any	blanked
	LogMag (dB)	Any	dBrms
	Linear Mag, Real, Imag, Wrap Phase, Unwrap Phase, Delay, Log Mag (lin)	Any	rms^2
General dimensions(e.g., Hz, %)	LogMag (dB)	Any	dB<unit>rms
	Linear Mag, Real, Imag, Wrap Phase, Unwrap Phase, Delay, Log Mag (lin)	Any	<unit>rms^2

If the Band Power Calculation is set to RMS, then the readout unit does not depend on trace format or Y unit. For Spectrums, PS and Time record traces the displayed unit is "Vrms" For general units, the unit abbreviation is shown followed by "rms".

The Band Power Calculation only controls the readout format for Normal and Fixed markers. For Delta markers, see the discussion below.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :FUNcti on:BPOWer:CTYPe MEAN RMS
	:CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :FUNcti on:BPOWer:CTYPe?
Example	CALC:VECT:MARK1:FUNC:BPOW:CTYP MEAN CALC:VECT:MARK1:FUNC:BPOW:CTYP?

Preset	MEAN
State Saved	Saved in instrument state.
Range	Mean RMS
Key Path	Marker Function, Band/Interval Power

Band/Interval Density

This function calculates the average power density within the band centered on the marker. The function works generally with frequency spectra, PSD and time traces. On traces where band power cannot reasonably be defined, the result display shows "---" and `CALC:<meas>:MARK[n]:Y?` returns NaN (9.91E+37), although the band interval can still be defined.

Frequency-domain data

If the marker is on a frequency-domain trace, the result is the band power (as computed above) divided by the bandwidth over which it is measured. This is true whether the underlying trace data is a power spectrum or power spectral density.

Time-domain data

If the marker is on a time-domain trace, the result is average power within the time interval (as computed above) divided by the equivalent noise bandwidth of the span.

Mode	VSA
Key Path	Marker Function

Band Density Calculation

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.

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.

A band/interval density calculation result may be shown in dBm/Hz, Volts RMS Squared or

Marker Functions
Marker Function

Volts RMS. The table below shows the choice of display units if Band Density Calculation is set to Mean, depending on the current format of the trace the marker is on.

Trace data type	Trace Format	Result format
Spectrum, PSD, Time record	LogMag (dB)	dBm/Hz
	Linear Mag, Real, Imag, Wrap Phase, Unwrap Phase, Delay, Log Mag (lin)	Vrms ² /Hz
Dimensionless (e.g., Frequency response, Impulse response, various Demodulation error types)	LogMag (dB)	dBrms/Hz
	Linear Mag, Real, Imag, Wrap Phase, Unwrap Phase, Delay, Log Mag (lin)	rms ² /Hz
General dimensions(e.g., Hz, %)	LogMag (dB)	dB<unit>rms/Hz
	Linear Mag, Real, Imag, Wrap Phase, Unwrap Phase, Delay, Log Mag (lin)	<unit>rms ² /Hz

If the Band Density Calculation is set to RMS, then the readout unit does not depend on trace format. For Spectrum, PSD and Time record traces the displayed unit is "Vrms/Hz" For general units, the unit abbreviation is shown followed by "rms/Hz".

The Band Density Calculation only controls the readout format for Normal and Fixed markers. For Delta markers, see the discussion below.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :FU Nction:BDENsity:CTYPe MEAN RMS :CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :FU Nction:BDENsity:CTYPe?
Example	CALC:VECT:MARK1:FUNC:BDEN:CTYP RMS CALC:VECT:MARK1:FUNC:BDEN:CTYP?
Preset	MEAN
State Saved	Saved in instrument state.
Range	Mean RMS
Key Path	Marker Function, Band/Interval Power

Band Adjust

These keys allow you to define the bandwidth around the marker. The band is always centered on the marker position. Entering the menu always sets Band/Interval Span as the active function

Mode	VSA
Key Path	Marker Function

Band/Interval Center

This function defines the center of the band. That is, it allows you to adjust the marker position in absolute units (regardless of whether the marker mode is Normal or Delta).

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :FUNction:BAND:CENTer <real> :CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :FUNction:BAND:CENTer?
Example	CALC:VECT:MARK2:FUNC:BAND:CENT 1.23E+09 CALC:VECT:MARK2:FUNC:BAND:CENT?
Preset	Center of screen
State Saved	Saved in instrument state.
Min	-9.9E+37
Max	9.9E+37
Key Path	Marker Function, Band Adjust

Band/Interval Span

Sets the width of the span for the selected marker. This function defines the span of

frequencies or time. The marker position does not change when you adjust the span.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :FUNction:BAND:SPAN <real> :CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :FUNction:BAND:SPAN?
Example	CALC:VECT:MARK2:FUNC:BAND:SPAN 1.23E+06 CALC:VECT:MARK2:FUNC:BAND:SPAN?
Preset	When marker turned on, 1/20th of current span or displayed time length
State Saved	Saved in instrument state.
Min	-9.9E+37
Max	9.9E+37
Key Path	Marker Function, Band Adjust

Band/Interval Left

This function adjusts the left side of the band. In order to remain centered in the band, the marker position must also change as you change the left edge. The right edge is unaffected.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :FUNction:BAND:LEFT <real> :CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12 :FUNction:BAND:LEFT?
Example	CALC:VECT:MARK2:FUNC:BAND:LEFT 1.23E+06 CALC:VECT:MARK2:FUNC:BAND:LEFT?
Dependencies/Couplings	Changes marker X to keep the marker centered in the band
Preset	When marker turned on, 1/40th of current span or displayed time length left of the marker position
State Saved	Saved in instrument state.
Min	-9.9E+37

Max	9.9E+37
Key Path	Marker Function, Band Adjust

Band/Interval Right

This function adjusts the right side of the band. In order to remain centered in the band, the marker position must also change as you change the right edge. The left edge is unaffected.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12:FUNction:BAND:RIGHT <real> :CALCulate:<meas>:MARKer [1] 2 3 4 5 6 7 8 9 10 11 12:FUNction:BAND:RIGHT?
Example	CALC:VECT:MARK2:FUNC:BAND:RIGHT 1.23E+06 CALC:VECT:MARK2:FUNC:BAND:RIGHT?
Dependencies/Couplings	Changes marker X to keep the marker centered in the band
Preset	When marker turned on, 1/40th of current span or displayed time length right of the marker position
State Saved	Saved in instrument state.
Min	-9.9E+37
Max	9.9E+37
Key Path	Marker Function, Band Adjust

Band Power and Delta Markers

When either a Delta marker or its reference has a band power function turned on, the Delta marker readout always shows a ratio calculation. The form of the ratio depends on the unit of the main marker when in Normal mode. If the Normal marker shows dB, Watts, or Volts², then when you change the marker to Delta the result will be a power ratio. If the Normal marker reads Volts (peak or rms) then the Delta marker result will be a voltage ratio. If the reference marker units are not compatible with the main marker, the reference marker is converted. For instance, if the main marker unit is Vrms and the reference unit is Vrms², the Delta marker will show the ratio of the main marker value and the square root of the reference value. If the main marker unit is dBm, then the

Marker Functions
Marker Function

reference marker value is converted to equivalent dBm units and the result is the difference between the two values with units of dB.

Dimensionless ratios are shown with units of "x". The base unit of the main marker determines whether the ratio is voltage or power.

If the reference marker function is Band Density and the main marker is not, then the ratio is not dimensionless, but has units of Hz (or dB-Hz) for power ratios, or rtHz for voltage ratios. When the main marker function is Band Density and the reference is not, the units are /Hz, dB/Hz, or /rtHz.

You can always get voltage ratio units if the main marker function calculation type is RMS rather than Mean.

Mode	VSA
Key Path	Marker Function

Measurement Functions are those for which all keys appear in the front panel key group marked "Measurement Functions".

Meas (Measure)

The **Meas** key accesses a menu of all measurement keys that are licensed for the 89601X VXA mode.

About Measurement Help for 89601X VXA

Remote measurement commands and query results common to all 89601VXA measurements are available in this Help topic, by pressing the **Meas** key with **Help** active. There are many remote commands documented in this topic, below.

NOTE When viewing **Meas** Help, you will need a mouse to view many of the remote command topics in the MEAS key topic, especially for :CALCulate subsystem SCPI commands. Select individual command topics in the Table of Contents to the left of the topic view pane.

Remote measurement commands and query results for individual measurements are only available under the specific measurement key, like **Analog Demod**, and are not available in this topic, see Note below:

NOTE Measurement functions and other operations differ 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 new measurement, then re-enter Help (press the Help key) and press the specific measurement key again.

Measurements available under the **Meas** key are specific to the current Mode.

Key Path	Front-panel key
----------	-----------------

Data Queries

89601 VXA measurements produce a rich variety of results which may be displayed in any of 4 traces. A result may consist of an array of X,Y trace data that is typically shown as a graph, or scalar results that are displayed as a table. The Symbol/Error result that is part of many demodulation measurements actually displays both a trace table (the error statistics) and trace data (the symbol information, which is not graphed but listed). The CALC:<meas>:DATA<n> commands allow you to retrieve any trace data or trace table. This family of commands also allow you to get information about the names of data results available and the units associated with them, as well as names and results of meta-data associated with traces.

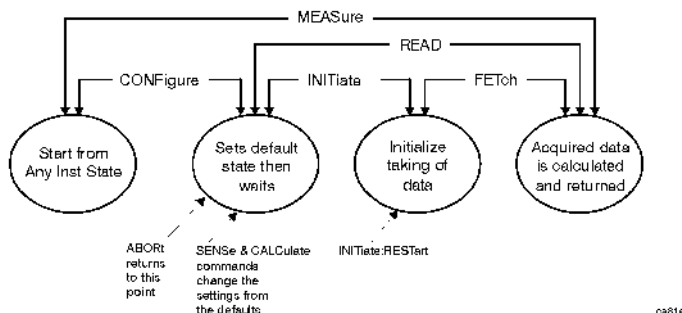
Command Interactions: MEASure, CONFigure, FETCh, INITiate and READ

Each 89601X measurement has a group of commands that work together to make the

measurement fast, but flexible.

NOTE The :MEASure command is only available for 89601X VXA Option B7R WLAN measurements. For all other measurements (options 205, AYA, etc.) you must use :CONFIgure and :READ or :CONFIgure and :INITiate and :FETCh.

Figure 5-1 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:NDEFault<measurement> 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.

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 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 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.

READ Commands:

: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)

NOTE Selected 89601 VXA results are available via the FETCh and READ SCPI interfaces. These commands refer to data results by arbitrary index number rather than by trace number.

89601 VXA-Specific :MEASure, :READ, :FETCh Commands

The SCPI MEASure, READ, and FETCh are typically offered by applications with focus on manufacturing test, where a fixed set of desired results is known in advance and seldom changes. The VSA measurements are many, due to a focus on development. Thus, for most VSA measurements there is no standard configuration that will yield a useful measurement 90% of the time. Therefore the MEASure function is not available for most measurements in the VSA Application. However, READ and FETCh may be implemented for select results. Note that these results will also still be available using the CALC:<meas>:DATA:TABLE family of commands.

ACP and OBW is available in all VSA measurements. To retrieve the ACP or OBW data, the function must be enabled on a frequency-domain trace and the associated summary data table must be assigned to another trace. Note however, the index n in the following commands is not trace number, but an index picked out of the tables shown below.

:FETCh:<meas>[n]?

:READ:<meas>[n]?

The results available for various values of n are shown below:

Table 5-1

Condition	n	Results Returned
Mode = VSA	Not specified or n=1	Reserved for selected results of VSA measurements. If not used for a particular measurement, no result is returned and error -114 Header suffix out of range is generated
Mode = VSA	2 – 50	Reserved for selected results of VSA measurements. If not used for a particular measurement, no result is returned and error -114 Header suffix out of range is generated

Table 5-1

<p>Mode = VSA, ACP on trace 1</p>	<p>51</p>	<p>ACP Summary for trace 1</p> <p>Returns 28 comma-separated scalar results, corresponding to the swept ACP results where possible; n/a elsewhere:</p> <p>Returns 28 comma-separated scalar results, in the following order.</p> <ol style="list-style-type: none"> 1. 0.0 2. Total carrier power (dBm) (same as item 4, because only 1 carrier supported) 3. 0.0 4. Reference carrier power (dBm) 5. Lower offset A - relative power (dB) 6. Lower offset A - absolute power (dBm) 7. Upper offset A - relative power (dB) 8. Upper offset A - absolute power (dBm) 9. Lower offset B - relative power (dB) 10. Lower offset B - absolute power (dBm) 11. Upper offset B - relative power (dB) 12. Upper offset B - absolute power (dBm) ... 21. Lower offset E - relative power (dB) 22. Lower offset E - absolute power (dBm) 23. Upper offset E - relative power (dB) 24. Upper offset E - absolute power (dBm) 25. n/a 26. n/a 27. n/a 28. n/a 29. Overall ACP test result summary (0 indicates at least 1 failure, 1 indicates all passed) <p>If any result is not available, NaN (9.91 E 37) is returned. This can happen if ACP is turned off (all results unavailable), or when an offset is entirely off-screen. In the case where it is partially off-screen, the measured result is returned, even though its validity is questionable.</p>
<p>Mode = VSA, ACP on trace 2</p>	<p>52</p>	<p>ACP Summary for trace 2</p> <p>see list for trace 1 summary</p>

Table 5-1

Mode = VSA, ACP on trace 3	53	ACP Summary for trace 3 see list for trace 1 summary
Mode = VSA, ACP on trace 4	54	ACP Summary for trace 4 see list for trace 1 summary
	57–60	no result returned; error –114, Header suffix out of range generated
Mode = VSA, OBW on trace 1	61	OBW Summary for trace 1 Returns 9 comma-separated scalar results, corresponding exactly to the items in the OBW Summary trace: 1. OBW (Hz) 2. Pwr (dBm) 3. Total Pwr (dBm) 4. Pwr Ratio (no unit, E.g. 0.99) 5. OBW upper freq (Hz) 6. OBW lower freq (Hz) 7. Centroid freq (Hz) 8. Offset freq (Hz) 9. OBW Test Result (0 for fail, 1 for pass) If the results are not available, NaN (9.91 E 37) is returned.
Mode = VSA, OBW on trace 2	62	OBW Summary for trace 2 see list for trace 1 summary
Mode = VSA, OBW on trace 3	63	OBW Summary for trace 3 see list for trace 1 summary
Mode = VSA, OBW on trace 4	64	OBW Summary for trace 4 see list for trace 1 summary

NOTE

:CALCulate subsystem SCPI is documented in separate sections following this topic. Select individual command topics in the Help Table of Contents to the left of the topic view pane, or you can use the "Next Topic" button at the top right corner to browse the topics.

:CALCulate:DATA (Remote Command Only)

Once measurement data result is assigned to a trace, the data can be retrieved by using one of the following commands (where <n> is the trace number and <meas> is the current VSA measurement).

:CALC:<meas>:DATA<n>?

:CALC:<meas>:DATA<n>:RAW?

The first form of the command retrieves the data as formatted on the display. For example, if (in a vector measurement) you have the Spectrum result in LogMag format on trace 1, then

:CALC:VECT:DATA1?

will return an array of spectrum amplitude (Y data) in units of dBm, and

:CALC:VECT:DATA1:RAW?

will return the Y data in its underlying units of Volts (peak) squared.

(To get data from displayed tables, see CALCulate:DATA:TABLE commands below.)

The CALC:<meas>:DATA commands get data from traces. There are many results available from a VSA application measurement, and only 4 traces in which to view them. View Preset commands are one way of displaying frequently-used results in standard trace locations. Or you may assign any measurement result to any trace using the softkeys under Trace/Detector, Data. The SCPI command for doing this is:

:DISP:<meas>:TRAC<n>:FEED "<data_name>"

For example, if (in a vector measurement) you wish to view the CCDF result in trace 4, you send:

:DISP:VECT:TRAC4:FEED "CCDF1"

(If the measurement has not run yet, use INIT:IMM to run it.) Then the CCDF data may be retrieved using

CALC:VECT:DATA4?

or

CALC:VECT:DATA4:RAW?

See the Data command (under Trace/Detector) and the View Preset commands (under View/Display) in this document as well as the PDs for each VSA measurement for more details on assigning data to traces.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:DATA[1] 2 3 4? [Y X XY [,OFF ON 0 1]]

Example CALC:VECT:DATA1?
 CALC:VECT:DATA1? Y,ON
 CALC:VECT:DATA1? X
 CALC:VECT:DATA1? XY

Notes Query only. This retrieves the data in the designated trace as displayed.

E.g., if Trace 1 is assigned Spectrum data and formatted as LogMag, then :CALC:VECT:DATA1? will return the Y data in dBm. If the X axis is scaled to show only a portion of the trace data, only the data shown will be returned.

The numeric format of the returned data is controlled by FORMat[:TRACe][:DATA] command

The optional parameters control what data is returned.

:CALC:VECT:DATA1? Y is the same as :CALC:VECT:DATA1? with no parameter. It returns an array of Y values.

:CALC:VECT:DATA1? X returns an array of X values that correspond to the Y values above.

:CALC:VECT:DATA1? XY returns interleaved X and Y data. I.e.: <x1><y1><x2><y2>...

Normally, this command only returns the data between the current X scale limits. If the optional ",OFF" or ",0" switch is included at the end of the command, then all data is returned (regardless of X scaling or the state of All Frequency Points).

Note: the X and Y parameters in this command refer to the display's horizontal and vertical axes. Normally the X axis is the independent variable, but if the display format is Constellation or IQ, then

CALC:<meas>:DATA<n>? [Y] returns the imaginary part of the data, and CALC:<meas>:DATA<n>? X returns the real part of the data. If you want the values of the independent variable, change to a non-vector format (such as Log Mag) and use CALC:<meas>:DATA<n>? X

:CALCulate:DATA:RAW (Remote Command Only)

Retrieves trace data in its underlying units, before the formatting calculation that converts it to displayed units. Underlying units are typically Volts peak (for signal results) or Volts peak squared (for power results). All data points are returned, whether or not they

are displayed.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:DATA[1] 2 3 4:RAW?
Example	CALC:VECT:DATA1:RAW?
Notes	Query only. This retrieves the unformatted Y data in the designated trace. If Y data is complex, it is returned as <y_real1><y_imag1><y_real2><y_imag2> etc.

:CALCulate:DATA:RAW:COMPLex (Remote Command Only)

This command is used to determine if the data retrieved by CALC:<meas>:DATA:RAW<n>? is complex.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:DATA[1] 2 3 4:RAW:COMPLex?
Example	CALC:VECT:DATA1:RAW:COMP?
Notes	Query only. Returns 1 if the trace data is complex, 0 if it is real.

:CALCulate:DATA:POINTs commands (Remote Command Only)

This query returns the number of points that will be returned by

CALCulate:<meas>:DATA<n>?

X axis scaling and whether All Frequency Points is on or off can affect this number.

Note: for the

CALCulate:<meas>:DATA<n>? XY

command there are 2 numbers returned per data point.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:DATA[1] 2 3 4:POINTs?

Example CALC:VECT:DATA1:POINTs?
 Notes Query only.

This query returns the number of points that will be returned by
 CALCulate:<meas>:DATA:RAW<n>?

Note: for complex trace data, there are 2 numbers returned per data point.

Measurement <meas>:=VECTor | ADEMod | DDEMod | W11A | W11B
 Mode VSA
Remote Command :CALCulate:<meas>:DATA[1] | 2 | 3 | 4:RAW:POINTs?
 Example CALC:VECT:DATA1:RAW:POINTs?
 Notes Query only.

:CALCulate:DATA:TABL (Remote Command Only)

Some traces have tabular data is associated with them. In fact, there may be only a table and no trace data. Each entry in the table consists of a name, a measured value, and units. The units are sometimes not shown. You can programmatically retrieve arrays of all the names, all the values, and all the units of a table. These arrays are all ordered so that corresponding indices have associated values, e.g., the 4th name in the names array corresponds to the 4th value in the results array. (Note that the array order may not be the same as the displayed order.) You can also get a particular result from the table by name. Here is a summary of the remote table data commands.

Command	Returns	Example
CALCulate:<meas>:DATA<n>:TABLe?	All table data results (as an array)	CALC:DDEM:DATA4:TABL?
CALCulate:<meas>:DATA<n>:TABLe? "<name>"	The table data result referred to by name	CALC:DDEM:DATA4:TABL? "EvmPeak"
CALCulate:<meas>:DATA<n>:TABLe:NAMEs?	Comma-separated list of all table data names	CALC:DDEM:DATA4:TABL:NAME?
CALCulate:<meas>:DATA<n>:TABLe:UNIT?	Comma-separated list of all table data units	CALC:DDEM:DATA4:TABL:UNIT?

For example, if within the Vector Analysis measurement, you have an OBW Summary Table displayed in trace 2, `CALC:DDEM:DATA2:TABL:NAM?` would return the table names as follows:

```
"Obw,Pwr,TotalPwr,PwrRatio,ObwUpper,ObwLower,Centroid,Offset"
```

and `CALC:DDEM:DATA2:TABL:UNIT?` would return the units. (A null string means the result is unitless.)

```
"Hz,Vrms^2,Vrms^2,,Hz,Hz,Hz,Hz"
```

You can then get all the table results by sending

```
CALC:DDEM:DATA2:TABL?
```

Result number 1 is Obw and has units of Hz, result number 2 is Pwr with units of Vrms², and so on.

You can also get individual table entries by asking for them by name. Any name returned from the `CALC:DDEM:DATA2:TABL:NAM?` query may be used. For example, to get TotalPwr you can send the following query:

```
CALC:DDEM:DATA2:TABL? "TotalPwr"
```

The following query gets data from a table shown in the designated trace. Tables shown on the display typically have the name of a parameter followed by its measured value

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:DATA [1] 2 3 4 :TABLe [:NUMBER] ? [<string>]
Example	CALC:DDEM:DATA2:TABL? "Obw"
Notes	Query only. If sent without a string specifier, this returns the entire table for the designated trace. If sent with a string specifier, returns a specific table entry in the designated trace. The string specifier must be delimited by single or double quotes. A list of valid strings can be obtained using <code>CALC:<meas>:DATA:TABL:NAM?</code> If an invalid string is sent, an error is generated.

The following query returns a comma-separated list of all the names of the table data entries for the designated trace. Each of names may be used (surrounded by quotes or

double quotes) as a parameter in the previous command. The names appear in the same order as the data returned by the CALC:<meas>:DATA<n>:TABL? query.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:DATA[1] 2 3 4:TABLE:NAMES?
Example	CALC:VECT:DATA1:TABL:NAM?
Notes	Query only. This retrieves the names of the table entries for the designated trace. Each of these names may be used in the CALC:<meas>:DATA:TABL? '<name>' command to access a single table entry.

The following query returns a comma-separated list of all the units for the table data entries for the designated trace. If a data result is unitless, an empty string appears in the list for that result. The units appear in the same order as the data returned by the CALC:<meas>:DATA<n>:TABL? query.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:DATA[1] 2 3 4:TABLE:UNIT?
Example	CALC:VECT:DATA1:TABL:UNIT?
Notes	Query only. This retrieves a list of units for table entries for the designated trace. The units are given in the order that the entries are sent from the :CALC:<meas>:DATA:TABL? command.

The following table data is available in all measurements when the ACP function is turned on and the associated summary table is shown in a trace:

Table 5-2

Result name	Displayed Unit	Remote Name	Remote Unit
Reference Bandwidth	Hz	RefBw	Hz
Reference Alpha		RefAlpha	
Reference Power	dBm	RefPwr	Vrms^2

Table 5-2

Offset	Hz	Offset1, Offset2, Offset3, Offset4, Offset5	Hz
BW	Hz	Bw1, Bw2, Bw3, Bw4, Bw5	Hz
Alpha		Alpha1, Alpha2, Alpha3, Alpha4, Alpha5	
Lower Pwr	dBm	LowPwr1, LowPwr2, LowPwr3, LowPwr4, LowPwr5	Vrms^2
Lower ACPR	dB	LowRatio1, LowRatio2, LowRatio3, LowRatio4, LowRatio5	
Upper Pwr	dBm	HiPwr1, HiPwr2, HiPwr3, HiPwr4, HiPwr5	Vrms^2
Upper ACPR	dB	HiRatio1, HiRatio2, HiRatio3, HiRatio4, HiRatio5	
Max ACPR	dB	MaxRatio1, MaxRatio2, MaxRatio3, MaxRatio4, MaxRatio5	

The following table data is available in all measurements when the OBW function is turned on and the associated summary table is shown in a trace:

Result name	Displayed Unit	Remote Name	Remote Unit
Occupied Bandwidth	Hz	Obw	Hz
Power	dBm	Pwr	Vrms^2
Total Power	dBm	TotalPwr	Vrms^2
Power Ratio	%	PwrRatio	
Upper Freq	Hz	ObwUpper	Hz
Lower Freq	Hz	ObwLower	Hz

Centroid Freq	Hz	Centroid	Hz
Offset Freq	Hz	Offset	Hz

:CALCulate:DATA:HEADer (Remote Command Only)

Trace data also has meta-data associated with it, called headers, which is visible if you export trace data in text format and . The headers have a name and a value. You can obtain header data by name from any trace by using the CALCulate:<meas>:DATA:HEADer commands.

The following query returns a comma-separated list of all the header names associated with the designated trace. Each of names may be used (surrounded by quotes or double quotes) as a parameter in the other CALC:<meas>:DATA<n>:HEAD queries.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:DATA[1] 2 3 4:HEADer:NAMes?
Example	CALC:VECT:DATA1:HEAD:NAM?
Notes	Query only. Returns a comma-separated list of header names.

This query returns whether the designated header on the designated trace may be queried as a number, or by a string only.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:DATA[1] 2 3 4:HEADer:TYPE? <string>
Example	CALC:VECT:DATA1:HEAD:TYPE? 'XDelta'
Notes	Query only. This retrieves the type of the named header for the designated trace. The name (delimited by single or double quotes) is one of the names returned by the CALC:<meas>:DATA:HEAD:NAMes? If a valid header name is passed in, the return value from this query is either STR or NUMB. NONE is returned if there is no such header.

This query gets a header by name from the designated trace and returns it as a string.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:DATA[1] 2 3 4:HEADer:STRing? <string>
Example	CALC:VECT:DATA1:HEAD:STR? 'WindowType'
Notes	Query only. This retrieves the named header for the designated trace. The name (delimited by single or double quotes) is one of the names returned by the CALC:<meas>:DATA:HEAD:NAMes? The return value is a string. If the requested header value is a numeric, or if there is no such header, an empty string is returned..

This query gets a numeric header by name from the designated trace and returns it in a format determined by the last FORM command.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:CALCulate:<meas>:DATA[1] 2 3 4:HEADer[:NUMBer]? <string>
Example	CALC:VECT:DATA1:HEAD? 'XDelta'
Notes	Query only. This retrieves the named header for the designated trace. This form of the HEAD? query is for headers whose type is NUMB (as determined by :CALC:<meas>:DATA:HEAD:TYPE?) The name parameter (delimited by single or double quotes) is one of the names returned by the CALC:<meas>:DATA:HEAD:NAMes? The format of the return data is determined by the FORMat[:TRACe][:DATA] command. If used to query a header whose type is STR, or there is no such header, NaN (9.91e37) is returned

Current Measurement Query (Remote Command Only)

This command returns the name of the measurement that is currently running.

Remote Command :CONFigure?

Example CONF?

Test current results against all limits (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.

Remote Command :CALCulate:CLIMits:FAIL?

Example CALC:CLIM:FAIL? queries the current measurement to see if it fails the defined limits.

Returns a 0 or 1: 0 it passes, 1 it fails.

Meas Setup

This key accesses a menu of keys that select measurement functions for the current VSA Measurement.

Mode	VSA
Key Path	Front Panel

Avg Number

This key allows you to turn averaging on or off, and set the number of scans (time records) whose measurement results will be averaged. Averaging can be done over spectrum results (RMS) or over time records (Time). A third kind of pseudo averaging displays the maximum value seen at each spectral line over the specified number of scans. See Average Type for a more detailed description of how measurement results are averaged.) For RMS or Time averaging, the process is similar. Each time an averaged result is displayed, it is the sum of the individual results taken since measurement restart, divided by the number of scans. (For Max averaging, there is no actual summation or division.) The Measurement Bar shows the number of scans and the Avg number setting; for example, if 4 scans have been taken and the Avg Number is 10, the Meas Bar shows "4/10". The measurement continues to take new scans until the number of scans is equal to the Avg Number setting, at which time the measurement stops if Sweep control is in Single Mode. Otherwise, the measurement continues, and the Average Mode setting determines how successive scans are added to the averaged result. See the Average Mode topic for details.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	[:SENSe] :<meas>:AVERage:COUNT <integer> [:SENSe] :<meas>:AVERage:COUNT? [:SENSe] :<meas>:AVERage [:STATe] OFF ON 0 1 [:SENSe] :<meas>:AVERage [:STATe] ?
Example	VECT:AVER:COUN 20 VECT:AVER:COUN? VECT:AVER ON VECT:AVER?

Restrictions and Notes	If an averaged measurement is idle because the scan count is equal to the Avg Number, and the Avg Number is increased, the measurement will resume until the new number of averages is satisfied.
Preset	20 OFF
State Saved	Saved in instrument state.
Min	1
Max	2147483648
Key Path	Meas Setup, More

Average Mode

The Average Mode determines what happens when the Sweep Mode is Continuous and the number of scans processed exceeds the Average Number (see above). If the Sweep Control is in Single mode, this setting has no effect.

When averaging is on and the number of scans is less than or equal to the Avg Number setting, a linear average is calculated as explained in the Avg Number topic. After the scan count exceeds the Avg Number setting, the measurement continues to take new scans. The Measurement Bar average indicator shows ">N/N" where N is the Avg Number.

If Average Mode is Exp then new results are averaged in exponentially. In other words, each succeeding average will be the weighted sum of the previous average, weighted by $(N-1)/N$, and the new measurement, weighted by $1/N$, where N is the Average Number setting. (For Max averaging, no weighting occurs; the result continues to be the max value seen at each spectral line for every previous scan since measurement restart.)

If Average Mode is Repeat, then the average buffer will be cleared after the average counter reaches the Average Number setting, and the average counter will be reset to 0. Then a new set of averages is taken. The measurement bar therefore continues to show "k/N" in the average indicator, where k is the number of scans since the last time the average buffer was cleared and N is the Avg Number. The averaged result is the sum of the last k results divided by k. (For Max averaging, no sum or division takes place, but the buffer is cleared as stated above. The averaged result is the max value seen over the last k scans.)

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	[:SENSE] :<meas>:AVERAge:TCONtrol EXPonential REPeat [:SENSE] :<meas>:AVERAge:TCONtrol?

Example	VECT:AVER:TCON EXP VECT:AVER:TCON?
Preset	EXP
State Saved	Saved in instrument state.
Range	Exp Repeat
Key Path	Meas Setup

Average Setup

This key accesses a menu allowing you to set Averaging parameters for all VSA measurements.

Mode	VSA
Key Path	Meas Setup

Average Type

	Measurement result averaged
RMS	Spectrum, PSD: Power is averaged for each spectral line (i.e., this is a mean-square average of voltage). For the Spectrum result only, if the display transform is linear or real, the RMS result is displayed.
Time	Main Time: Individual time samples in the current time record are averaged vectorially (not RMS) with corresponding points in previous time records.
Max	Spectrum, PSD: Not strictly an average. For each spectral line, power from the current measurement is compared to the average buffer value and the maximum is kept in the average buffer.

Some measurement results are inherently averaged, and are not affected by the Average controls. These are: CCDF, CDF, and PDF. They average continuously until the next measurement restart.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
-------------	--

Mode	VSA
Remote Command	[:SENSe] :<meas>:AVERAge:TYPE RMS TIME MAXimum [:SENSe] :<meas>:AVERAge:TYPE?
Example	VECT:AVER:TYPE RMS VECT:AVER:TYPE?
Preset	RMS
State Saved	Saved in instrument state.
Range	RMS Time Max
Key Path	Meas Setup, Average Setup

Fast Average

Fast average controls the display of average data. If fast averaging is off, then the display is updated after each time record is processed. If fast averaging is on, then the display is only updated after every M records, where M is the Update Rate (see below). For example, if the fast average count is 10, then the running average is only displayed every 10th time record.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	[:SENSe] :<meas>:AVERAge:FAST OFF ON 0 1 [:SENSe] :<meas>:AVERAge:FAST?
Example	VECT:AVER:FAST ON VECT:AVER:FAST?
Preset	ON
State Saved	Saved in instrument state.
Range	On Off
Key Path	Meas Setup, Average Setup

Update Rate

The Update Rate controls how often the display updates when fast averaging is turned on. If the Fast Averaging State is MAX then the display is updated only after the full Average Count is reached. Otherwise, the display is updated whenever the average count is a

multiple of the Update Rate..

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	[:SENSe] : <meas> : AVERage : FAST : URATe <integer> [:SENSe] : <meas> : AVERage : FAST : URATe ? [:SENSe] : <meas> : AVERage : FAST : URATe : AUTO OFF ON 0 1 [:SENSe] : <meas> : AVERage : FAST : URATe : AUTO ?
Example	VECT: AVER: FAST: URAT 20 VECT: AVER: FAST: URAT ? VECT: AVER: FAST: URAT: AUTO ON VECT: AVER: FAST: URAT: AUTO ?
Preset	10 MAN
State Saved	Saved in instrument state.
Min	1
Max	MaxInt
Key Path	Meas Setup, More, Average Setup

Mode Setup

This key accesses a menu allowing you to set various parameters for all VSA measurements.

Mode	VSA
Key Path	Front Panel

Spectrum

This function determines if the spectrum of the incoming data is mirrored or not. The actual mirroring is accomplished by conjugating the complex time data.

Mode	VSA
Remote Command	[:SENSe] :SPECTrum NORMal INVert [:SENSe] :SPECTrum?
Example	SPEC INV SPEC?
Preset	NORM
State Saved	Saved in instrument state.
Range	Normal Invert
Key Path	Mode

Fixed Equalization

Fixed Equalization allows you to apply a fixed FIR equalization filter to the time data, before it is used in further analysis. You define the filter by its frequency response rather than by its impulse response. The frequency response must be stored in a data register.

Mode	VSA
Key Path	Mode Setup

Fixed EQ Mode

This allows you to turn fixed equalization off, on in normal mode, or on in inverted mode. The effect of Normal mode is to divide the spectrum of the unequalized data by the frequency response in the data register. Invert mode multiplies instead of dividing.

Mode	VSA
Remote Command	<code>[[:SENSE]:CORREction:FEQualizer OFF NORMAl INVert [:SENSE]:CORREction:FEQualizer?</code>
Example	<code>CORR:FEQ NORM CORR:FEQ?</code>
Preset	OFF
State Saved	Saved in instrument state.
Range	Off Normal Invert
Key Path	Meas Setup,Fixed Equalization

Freq Response Register

This allows you to choose a register that contains the frequency response information for fixed equalization.

Mode	VSA
Remote Command	<code>[[:SENSE]:CORREction:FEQualizer:REGister D1 D2 D3 D4 D5 D6 [:SENSE]:CORREction:FEQualizer:REGister?</code>
Example	<code>CORR:FEQ:DATA D2 CORR:FEQ:DATA?</code>
Preset	D1
State Saved	Saved in instrument state.
Range	Data 1 Data 2 Data 3 Data 4 Data 5 Data 6
Key Path	Meas Setup,Fixed Equalization

Fixed Equalization Mapping

This read-only SCPI function allows you to determine if fixed equalization is applied using relative or absolute frequency mapping between the current measurement span and the span of the frequency response data in the chosen register.

If possible, the equalizer response is defined using the portion of the register data that falls within the current measurement span. For example, if the data register covers frequencies from 200 MHz to 236 MHz, and the measurement span is 6 MHz wide centered at 210 MHz, then the register data from 207 MHz to 213 MHz is used to define the equalizer response. This is an example of absolute frequency mapping.

If the same register data is used but measurement center frequency is then changed to 70 MHz, then relative frequency mapping must be used. The center frequency of the register data is mapped to the measurement center frequency, and an equivalent span of data is taken. In this example, register data from 215 MHz to 221 MHz is used as though it covered a frequency span of 67 MHz to 73 MHz.

Relative frequency mapping is used if some or all of the measurement span falls outside the data register's frequency span. It can be desirable when measuring across frequency converters, but can be surprising otherwise. Be careful to use a measurement span that is equal to or narrower than the span of the data register.

Mode	VSA
Remote Command	<code>[:SENSe] :CORRection:FEQualizer:RELative?</code>
Example	<code>CORR:FEQ:REL?</code>
Remote Command Notes	Returns 1 if fixed equalizer frequency mapping is relative; 0 otherwise.

Sweep / Control

This key displays a menu allowing you to control time-related measurement parameters, and to pause or resume the measurement.

For more information see the Measurement Functions, Sweep/Control for a description of this function.

Mode	VSA
Key Path	Front Panel

Main Time

This key allows you to control the length of the overall time record used in the measurement. Note that the Gate function (see below) allows you to analyze only a portion of the displayed Main Time. Time length and Res BW are related by the following equation:

$$\text{Res BW} = \text{ENBW} / T$$

where ENBW is the normalized effective noise bandwidth of the Window (see the FFT Window topic under BW for more details), and T is the time record length (in seconds).

Therefore, if you change Main Time, the Resolution bandwidth must also change, and vice versa.

Time record size (in sample points) can vary between 16 points and the full FFT size used for spectrum calculations. The FFT size is indirectly chosen by setting Freq Points (see below) and is equal to $(\text{Freq Points} - 1) * 1.28$.

Main Time length (in seconds) is the time record size times the sample period. The sample period for the Main Time result is $1/(1.28 * \text{Span})$.

Limits:

The maximum Main Time length is:

$$\text{Max FFT size} / (1.28 * \text{Span}) = (409600) / \text{Span if Freq points state parameter is set to Auto}$$

$$\text{FFT size} / (1.28 * \text{Span}) = (\text{Freq Points} - 1) / \text{Span if Freq points parameter is manually set}$$

Note that the minimum Res BW is related to maximum Main Time length.

The minimum Main Time length is

$$16 \text{ points} / (1.28 * \text{Span}) = 12.5 / \text{Span}$$

See Res BW and Res BW Coupling sections for details on couplings that can change Main Time length due to Res BW changes.

Measurement	<meas>:=VECTor ADEMod
Mode	VSA
Remote Command	[:SENSe] :<meas>:SWEep:TIME <time> [:SENSe] :<meas>:SWEep:TIME?
Example	VECT:SWE:TIME 3 MS VECT:SWE:TIME?
Restriction and Notes	This key is greyed out in measurements other than Vector or Analog Demod. The annotation is shown, however. In other measurements the time length is determined by number of symbols.
Dependencies/Couplings	Affected by Res BW, Span, Freq Points, and Window. See Res BW and Res BW coupling sections for details.
Preset	12.75e-6
State Saved	Saved in instrument state.
Key Path	Sweep Control

Pause / Resume

Pauses or resumes acquisition at the end of the current time record acquisition.

For more information see the Measurement Functions, Sweep/Control for a description of this function.

Mode	VSA
Key Path	Front Panel

Gate

This key accesses a menu of time gating control functions. Time gating lets you isolate a portion of a Main Time record to be used for downstream spectrum and statistical analysis (instead of the whole time record). The gate position may be changed during a stopped measurement and the instantaneous gate time and spectrum traces update immediately.

Averages are restarted when gate properties change. The windowing function used in gated measurements is the same as non-gated measurements.

For more information see the Measurement Functions, Sweep/Control, Gate for a description of this function.

Mode	VSA
Key Path	Front Panel

Gate

This boolean softkey turns time gating on or off

Measurement	<meas>:=VECTor ADEMod
Mode	VSA
Remote Command	[:SENSe] : <meas> : SWEep : EGATe : STATe OFF ON 0 1 [:SENSe] : <meas> : SWEep : EGATe : STATe ?
Example	VECT:SWE:EGAT:STAT ON VECT:SWE:EGAT:STAT?
Preset	0
State Saved	Saved in instrument state.
Key Path	Sweep/Control

Gate Length

This adjusts the time between the beginning and the end of the gate.

Measurement	<meas>:=VECTor ADEMod
Mode	VSA
Remote Command	[:SENSe] : <meas> : SWEep : EGATe [:SPAN] <time> [:SENSe] : <meas> : SWEep : EGATe [:SPAN] ?

Example	VECT:SWE:EGAT 2 MS VECT:SWE:EGAT?
Dependencies/Couplings	Gate length and delay are limited so that the gate always falls within the current time record. If the time record length decreases, the gate delay is limited first, then the gate length.
Preset	1/10 of default main time length
State Saved	Saved in instrument state.
Min	16 time samples
Max	Time record length
Key Path	Sweep/Control

Gate Delay

This adjusts the time between the start of the time record and the beginning of the gate .

Measurement	<meas>:=VECTor ADEMod
Mode	VSA
Remote Command	[:SENSe] :<meas>:SWEep:EGATe:DELay <time> [:SENSe] :<meas>:SWEep:EGATe:DELay?
Example	VECT:SWE:EGAT:DEL 500 US VECT:SWE:EGAT:DEL?
Dependencies/Couplings	Gate length and delay are limited so that the gate always falls within the current time record. If the time record length decreases, the gate delay is limited first, then the gate length.
Preset	0
State Saved	Saved in instrument state.
Min	0
Max	Time record length – gate length
Key Path	Sweep/Control

Freq Points

By default, the analyzer chooses the number of Freq Points displayed in Spectrum or PSD

displays, depending on the Res BW or Main Time length chosen. This softkey allows you to manually enter the number of displayed frequency points. Auto mode is recommended. The number of Freq Points is related to the number of FFT points used in spectrum calculations (which is always a power of 2).

$$\text{Freq Points} = (\text{FFT points})/1.28 + 1$$

Note that if All Frequency Points is turned on for a selected trace, then all computed FFT points are shown. (See SPAN/X scale, All Frequency Points.)

Measurement	<meas>:=VECTor ADEMod
Mode	VSA
Remote Command	[:SENSe] :<meas>:SWEep:POINts <integer> [:SENSe] :<meas>:SWEep:POINts? [:SENSe] :<meas>:SWEep:POINts:AUTO OFF ON 0 1 [:SENSe] :<meas>:SWEep:POINts:AUTO?
Example	VECT:SWE:POIN 801 VECT:SWE:POIN? VECT:SWE:POIN:AUTO ON VECT:SWE:POIN:AUTO?
Restriction and Notes	Keyboard entry or setting this by SCPI forces state to manual. Any entry other than a valid value is rounded up to the next available value (or limited to the maximum). This key is not shown in measurements other than Vector, Analog Demod or iDEN Power
Dependencies/Couplings	See Res BW Coupling section See Res BW Coupling section
Preset	801 1
State Saved	Saved in instrument state.
Range	51 101 201 401 801 1601 3201 6401 12801 25601 51201 102401 204801 409601
Key Path	Sweep

Trigger

Triggering is used to determine when a measurement should start taking data. There are several available trigger sources. For each trigger source, there are associated setup parameters. Typically, a trigger event is generated when a signal (or a characteristic of the signal) crosses a defined trigger level (or threshold) on a rising or falling slope. The measurement begins at a specified time delay from the trigger point. The delay may be negative, allowing pretrigger data to be taken. Each trigger source has associated its own trigger level, slope, and delay settings.

Mode	VSA
Key Path	Front Panel

Trig Reference Line

The trigger reference line appears (if enabled) when the trigger source is related to the measured signal. It shows the trigger level relative to the signal. This control allows you to show or hide the trigger reference line.

The trigger reference line, only appears on appropriately formatted time traces. For example, if Video (IF Envelope) trigger is selected, the trigger level line would appear on Main Time, Inst Main Time, or Raw Main Time traces that are formatted as Log Mag or Linear Mag.

Mode	VSA
Remote Command	:TRIGger[:SEquence]:RLINe OFF ON 0 1 :TRIGger[:SEquence]:RLINe?
Example	TRIG:RLIN ON TRIG:RLIN?
Preset	1
State Saved	Saved in instrument state.
Range	Show Hide
Key Path	Trigger

Hardware Trigger

When the Data Source is Inputs, this trigger menu appears. The menu gives you a choice of trigger sources. Once you select a trigger source, you can branch to the setup parameters for that source.

Measurement	<meas>:=VECTor ADEMod DDEMod W11A W11B
Mode	VSA
Remote Command	:TRIGger:<meas>[:SEQuence]:SOURce IMMediate VIDeo IF EXTernal1 :TRIGger:<meas>[:SEQuence]:SOURce?
Example	TRIG:VECT:SOUR IMM TRIG:VECT:SOUR?
Remote Command Notes	The enum IF is an alias for VIDEO.
Preset	IMM
State Saved	Saved in instrument state.
Range	Free Run Video (IF Envelope) External 1
Key Path	Trigger

Free Run

Free Run triggering, means each measurement scan starts as soon as possible, without regard to any signal characteristics or external triggering signal.

Mode	VSA
Key Path	Trigger

Video (IF Envelope)

Pressing this key, when it is not selected, selects Video (IF Envelope) triggering. The trigger condition is met when the magnitude of the signal you are measuring crosses the defined trigger level while satisfying the slope and holdoff conditions. (Specifically, the source for the trigger calculation is the IF signal, filtered only by the brickwall filter that defines the information bandwidth of the signal, Signal energy outside the information

bandwidth does not affect the triggering.)

Note: This is called Video triggering due to its similarity with swept analyzer zero span measurements being triggered on the video signal. However, in this case there is no video signal. Since the trigger condition applies to the full IF signal, this is also called IF envelope triggering.

If Video triggering is already selected then pressing this softkey accesses the video trigger setup functions, and changes the active function to Video Trigger Level.

Mode	VSA
Key Path	Trigger

Trigger Level Sets a level (in volts) that the magnitude of the IF signal must cross (with the correct slope) in order to generate a trigger. (Holdoff conditions must also be met.)

Mode	VSA
Remote Command	:TRIGger[:SEQuence]:VIDeo:LEVel <voltage> :TRIGger[:SEQuence]:VIDeo:LEVel?
Example	TRIG:VID:LEV 10 MV TRIG:VID:LEV?
Remote Command Notes	:TRIGger[:SEQuence]:IF:LEVel <voltage> may be used as an alias
Preset	10 mV
State Saved	Saved in instrument state.
Min	0
Max	9.9E+37
Key Path	Trigger,Video

Trig Slope Controls the trigger polarity. Positive means the trigger occurs when the rising magnitude crosses the trigger level. Negative means the trigger occurs when the falling magnitude crosses the trigger level.

Measurement Functions
Trigger

Mode	VSA
Remote Command	:TRIGger[:SEquence]:VIDeo:SLOPe POSitive NEGative :TRIGger[:SEquence]:VIDeo:SLOPe?
Example	TRIG:VID:SLOP POS TRIG:VID:SLOP?
Remote Command Notes	:TRIGger[:SEquence]:IF:SLOPe POSitive NEGative may also be used
Preset	POS
State Saved	Saved in instrument state.
Range	Pos Neg
Key Path	Trigger,Video

Trig Delay Controls the time delay from the trigger point to the actual start of the measurement data. This can be negative to get pretrigger data.

Mode	VSA
Remote Command	:TRIGger[:SEquence]:VIDeo:DELay <time> :TRIGger[:SEquence]:VIDeo:DELay? :TRIGger[:SEquence]:VIDeo:DELay:STATe OFF ON 0 1 :TRIGger[:SEquence]:VIDeo:DELay:STATe?
Example	TRIG:VID:DEL 10 MS TRIG:VID:DEL? TRIG:VID:DEL:STAT ON TRIG:VID:DEL:STAT?
Remote Command Notes	:TRIGger[:SEquence]:IF:DELay <time> may be used as an alias :TRIGger[:SEquence]:IF:DELay:STATe may also be used
Preset	0 0
State Saved	Saved in instrument state.
Min	-9.9E+37

Max 9.9E+37
Key Path Trigger,Video

Trig Holdoff Sets the trigger holdoff time.

Some form of trigger holdoff is available for most trigger types. Hold off can be defined in different ways, with possible variations depending on trigger slope setting.

Below Level: 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.

Above Level: 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.

Mode VSA

Remote Command :TRIGger[:SEQuence]:VIDeo:HOLDoff <time>
:TRIGger[:SEQuence]:VIDeo:HOLDoff?
:TRIGger[:SEQuence]:VIDeo:HOLDoff:STATe OFF|ON|0|1
:TRIGger[:SEQuence]:VIDeo:HOLDoff:STATe?

Example TRIG:VID:HOLD 1 US
TRIG:VID:HOLD?
TRIG:VID:HOLD:STAT ON
TRIG:VID:HOLD:STAT?

Remote Command Notes :TRIGger[:SEQuence]:IF:HOLDoff may be used as an alias
:TRIGger[:SEQuence]:IF:HOLDoff:STATe may be used as an alias

Preset 0
0

State Saved	Saved in instrument state.
Min	-9.9E+37
Max	9.9E+37
Key Path	Trigger,Video

Holdoff Type Sets the trigger holdoff type.

Some form of trigger holdoff is available for most trigger types. Hold off can be defined in different ways, with possible variations depending on trigger slope setting.

Below Level: 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.

Above Level: 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.

Mode	VSA
Remote Command	:TRIGger [:SEquence] :VIDeo:HOLDoff:TYPE BELow ABOVE :TRIGger [:SEquence] :VIDeo:HOLDoff:TYPE?
Example	TRIG:VID:HOLD:TYPE BEL TRIG:VID:HOLD:TYPE?
Remote Command Notes	:TRIGger[:SEquence]:IF:HOLDoff:TYPE can be used as an alias
Preset	BEL
State Saved	Saved in instrument state.
Range	Below Level Above Level
Key Path	Trigger,Video

External 1

Pressing this key, when it is not selected, selects the signal on the Trigger 1 input as the trigger signal. The trigger condition is met when the level of the external trigger signal crosses the defined trigger level while satisfying the slope and holdoff conditions.

Note that currently, the VSA Application does not support External 2 triggering.

If External 1 triggering is already selected then pressing this softkey accesses the external 1 trigger setup functions, and changes the active function to Ext 1 Trigger Level.

Mode	VSA
Key Path	Trigger

Trigger Level Sets a level (in volts) that the Trigger signal must cross (with the correct slope) in order to generate a trigger. (Holdoff conditions must also be met.)

Mode	VSA
Remote Command	:TRIGger[:SEquence]:EXTernal1:LEVel <voltage> :TRIGger[:SEquence]:EXTernal1:LEVel?
Example	TRIG:EXT1:LEV 10 MV TRIG:EXT1:LEV?
Preset	2 V
State Saved	Saved in instrument state.
Min	-9.9E+37
Max	9.9E+37
Key Path	Trigger,External 1

Trig Slope Controls the trigger polarity. Positive means the trigger occurs on a rising edge. Negative means the trigger occurs on a falling edge.

Mode	VSA
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Measurement Functions

Trigger

Remote Command	:TRIGger[:SEquence]:EXTernal1:SLOPe POSitive NEGative :TRIGger[:SEquence]:EXTernal1:SLOPe?
Example	TRIG:EXT1:SLOP POS TRIG:EXT1:SLOP?
Preset	POS
State Saved	Saved in instrument state.
Range	Pos Neg
Key Path	Trigger, External 1

Trig Delay Controls the time delay from the trigger point to the actual start of the measurement data. This can be negative to get pretrigger data.

Mode	VSA
Remote Command	:TRIGger[:SEquence]:EXTernal1:DELay <time> :TRIGger[:SEquence]:EXTernal1:DELay? :TRIGger[:SEquence]:EXTernal1:DELay:STATe OFF ON 0 1 :TRIGger[:SEquence]:EXTernal1:DELay:STATe?
Example	TRIG:EXT1:DEL 10 MS TRIG:EXT1:DEL? TRIG:EXT1:DEL:STAT ON TRIG:EXT1:DEL:STAT?
Preset	0 0
State Saved	Saved in instrument state.
Min	-9.9E+37
Max	9.9E+37
Key Path	Trigger, External 1

Trig Holdoff Sets the trigger holdoff time.

Some form of trigger holdoff is available for most trigger types. Hold off can be defined in

different ways, with possible variations depending on trigger slope setting.

Below Level: 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.

Above Level: 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.

Mode	VSA
Remote Command	:TRIGger[:SEquence]:EXTernal1:HOLDoff <time> :TRIGger[:SEquence]:EXTernal1:HOLDoff? :TRIGger[:SEquence]:EXTernal1:HOLDoff:STATe OFF ON 0 1 :TRIGger[:SEquence]:EXTernal1:HOLDoff:STATe?
Example	TRIG:EXT1:HOLD 1 US TRIG:EXT1:HOLD? TRIG:EXT1:HOLD:STAT ON TRIG:EXT1:HOLD:STAT?
Preset	0 0
State Saved	Saved in instrument state.
Min	-9.9E+37
Max	9.9E+37
Key Path	Trigger, External 1

Holdoff Type Sets the trigger holdoff type. See

Some form of trigger holdoff is available for most trigger types. Hold off can be defined in different ways, with possible variations depending on trigger slope setting.

Measurement Functions
Trigger

Below Level: 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.

Above Level: 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.

Mode	VSA
Remote Command	:TRIGger[:SEquence]:EXTernal1:HOLDoff:TYPE BELow ABOve :TRIGger[:SEquence]:EXTernal1:HOLDoff:TYPE?
Example	TRIG:EXT1:HOLD:TYPE BEL TRIG:EXT1:HOLD:TYPE?
Preset	BEL
State Saved	Saved in instrument state.
Range	Below Level Above Level
Key Path	Trigger, External 1

Mode

The Mode key allows you to select the available measurement applications. The application software must be loaded and license for it to be available. Measurement applications are a collection of measurement capabilities packaged together to provide an instrument personality that is specific to your measurement needs. Each mode software product is ordered separately by Model Number. The default measurement mode is the first listing in the menu.

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.

A list of the valid mode choices is returned with the INST:CAT? Query. Once an instrument mode is selected, only the commands that are valid for that mode can be executed.

Key Path	Mode
SCPI Command	:INSTrument [:SElect] SA BASIC ADEMOD NFIGURE PNOISE CDMA2K TDSCDMA VSA VSA8960 1 WCDMA WIMAXOFDMA :INSTrument [:SElect] ?
Example	:INST SA
Remote Command 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. Once an instrument mode is selected, only the commands that are valid for that mode can be executed.
Preset	Not affected by Preset. Set to SA following Restore System Defaults, if SA is the default mode.
State Saved	Saved in state

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.

Mode	:INSTrument:NSElect <integer>	:INSTrument[:SElect] <parameter>
------	----------------------------------	-------------------------------------

Mode

Analog Demod	234	ADEMODO
cdma2000	10	CDMA2K
GSM & EDGE	13	EDGEGSM
I/Q Analyzer (Basic)	8	BASIC
Noise Figure	219	NFIGURE
Phase Noise	14	PNOISE
Spectrum Analyzer	1	SA
TD-SCDMA	211	TDSCDMA
89601X VXA Signal Analyzer	100	VSA
89601 VSA	101	VSA89601
WCDMA with HSDPA/HSUPA	9	WCDMA
802.16 OFDMA (WiMAX/WiBro)	75	WIMAXOFDMA

SCPI Command	:INSTRUMENT:NSELECT <integer> :INSTRUMENT:NSELECT?
Example	:INST:NSEL 1
Preset	Not affected by Preset. Set to default mode (1 for SA mode) following Restore System Defaults.
State Saved	Saved in state

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.

SCPI Command	:INSTRUMENT:CATALOG?
Example	:INST:CAT?
Remote Command Notes	Query returns a quoted string of the installed and licensed modes separated with a comma. Example: "SA,PNOISE,WCDMA"

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

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

SCPI Command	:SYSTem:APPLication[:CURRent] [:NAME] ?
Example	:SYST:APPL?
Remote Command Notes	Query returns a quoted string which 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 Save is done.

Current Application Revision

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

SCPI Command	:SYSTem:APPLication[:CURRent] :REVision?
Example	:SYST:APPL:REV?
Remote Command Notes	Query returns a quoted string which 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 Preset
State Saved	Not saved in state, the value will be the selected application when Save is done.

Current Application Options

Returns a string which is the Options list of the currently selected application (mode).

SCPI Command	:SYSTem:APPLication[:CURRent]:OPTion?
Remote Command Notes	Query returns a quoted string which 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 Preset
State Saved	Not saved in state per se, value will be the selected application when Save is invoked
Example	:SYST:APPL:OPT?

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

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

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

Application Catalog Model Numbers

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

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

Application Catalog Revision

Returns the Revision of the provided Model Number.

SCPI Command	:SYSTem:APPLication:CATalog:REVision? <model>
Example	:SYST:APPL:CAT:REV? 'N9060A'
Remote Command 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 Preset
State Saved	Not saved in state.

Application Catalog Options

Returns a list of Options for the provided Model Number

SCPI Command	:SYSTem:APPLication:CATalog:OPTion? <model>
Example	:SYST:APPL:CAT:OPT? 'N9060A'

Mode

Remote Command 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 Preset
State Saved	Not saved in state.

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
Example	INST:SEL SA INST:NSEL 1

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
Example	INST:SEL BASIC INST:NSEL 8

Phase Noise

The Phase Noise mode provides pre-configured measurements for making general purpose measurements of device phase noise.

Key Path	Mode
Example	INST:SEL PNOISE or INST:NSEL 14

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
Example	INST:SEL NFIGURE Or INST:NSEL 219

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
Example	INST:SEL ADEMOM INST:NSEL 234

W-CDMA with HSDPA/HSUPA

Selects the W-CDMA with HSDPA/HSUPA 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
Example	INST:SEL WCDMA INST:NSEL 9

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
Example	INST:SEL WIMAXOFDMA INST:NSEL 75

GSM with EDGE

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
Example	INST:SEL EDGEGSM INST:NSEL 13

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
Example	INST:SEL CDMA2K INST:NSEL 10

TD-SCDMA

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
Example	INST:SEL TDSCDMA INST:NSEL 211

89601X VXA Signal Analyzer

The 89601X VXA Measurement Application provides vector signal analysis measurement capability. The Basic VXA Signal Analyzer provides 2 main measurements that allow you to measure the signal quality of many varieties of RF modulation:

- Analog Demodulation
- Vector Signal Analysis

Adding Option AYA provides flexible demodulation analysis for many digital signals, including support for the following communications formats: QAM, EDGE, WiMAX, W-CDMA, 2G, 3G, 3.5G, WLAN, digital video, and more.

Option B7R provides standard-specific measurements for analysis of 802.11 a/b/g WLAN OFDM and DSSS 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

Mode

re-access Help.

Key Path	Mode
Example	INST:SEL VSA INST:NSEL 100

89601A VSA

Selecting the 89601 VSA mode will start the 89600-Series VSA software application. 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 the R&D engineer. Reach deeper into signals, gather more data on signal problems, and gain greater insight...

Over 30 general-purpose analog and digital demodulators ranging from 2FSK to 1024QAM

Standards specific modulation analysis including:

- Cell: GSM, cdma2000, WCDMA, TD-SCDMA and more
- Wireless networking: 802.11a/b/g, 802.11n, 802.16 WiMax (fixed/mobile), UWB
- 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

Six 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 Agilent 89600 Series VSA web site at www.agilent.com/find/89600

To learn more about how to use the 89600 VSA running in the MXA, after the 89600 VSA application is running, open the 89600 VSA Help and open the "About Agilent X-Series Signal Analyzers (MXA/EXA) with 89600-Series Software" help topic.

Key Path	Mode
Example	INST:SEL VSA89601 INST:NSEL 101

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

SCPI Command	:INITiate[:IMMEDIATE]
Example	:INIT:IMM
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.
Remote Command Notes	:INITiate:RESTART :INITiate:IMMEDIATE Either of the above commands perform exactly the same function.
SCPI 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.
SCPI Command	:INITiate:RESTART
Example	:INIT:REST
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.
Remote Command Notes	:INITiate:RESTART :INITiate:IMMEDIATE Either of the above commands perform exactly the same function.

Restart

SCPI 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.
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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`.

Certain conditions may cause an implicit restart to be performed. These are detailed in section "Measurement Related Instrument Settings" in the Swept SA measurement PD.

Single (Single Measurement/Sweep)

Single 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.

Example	:INIT:CONT OFF
Remote Command Notes	See Cont key description.
Key Path	Front panel key

See Restart 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). 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.

Single (Single Measurement/Sweep)

Cont (Continuous Measurement/Sweep)

Cont 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.

SCPI Command	:INITiate:CONTinuous OFF ON 0 1 :INITiate:CONTinuous?
Example	: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
Key Path	Front panel key

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 Number** (in **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 Number** 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 Number 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 **Continuous** 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's 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.

Cont (Continuous Measurement/Sweep)

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Vector Analysis

The Vector Analysis measurement is accessed from the Meas hardkey. The Vector Analysis measurement bases its results on a set of periodic time samples of a channel. The channel is defined by a combined bank of hardware and DSP filters whose overall frequency response has a flat top and steep rolloff at the band edges. The time record is operated upon by a number of mathematical functions, including the FFT to produce spectrum results and statistical functions, including complementary cumulative distribution function (CCDF). Any of these results may be displayed in a flexible layout, with the Y data formatted in a variety of ways, and results scaled as desired. Many of these analysis results are also available in optional VSA demodulation measurements.

Mode	VSA
Key Path	Meas

The Vector Analysis measurement is invoked remotely by the following:

```
:CONFigure:VECTor
```

```
:CONFigure:VECTor:NDEFault
```

Remote results may be obtained using the following:

```
:FETCh:VECTor [n] ?
```

Only table results may be obtained using FETCh. The tables available for the Vector Analysis measurement are ACP and OccBW tables, which are available to any VSA measurement.

```
:INITiate:VECTor
```

```
:READ:VECTor [n] ?
```

NOTE: The MEASure? command is not supported by the Vector Analysis measurement.

NOTE: For Trace Data SCPI commands and remote results see Help for the **MEAS** key.

View/Display

The View/Display key provides access to a menu that enable you to select display parameters for the current measurement.

For more information on other View/Display functions (Display and Layout) see Analyzer Setup, View/Display

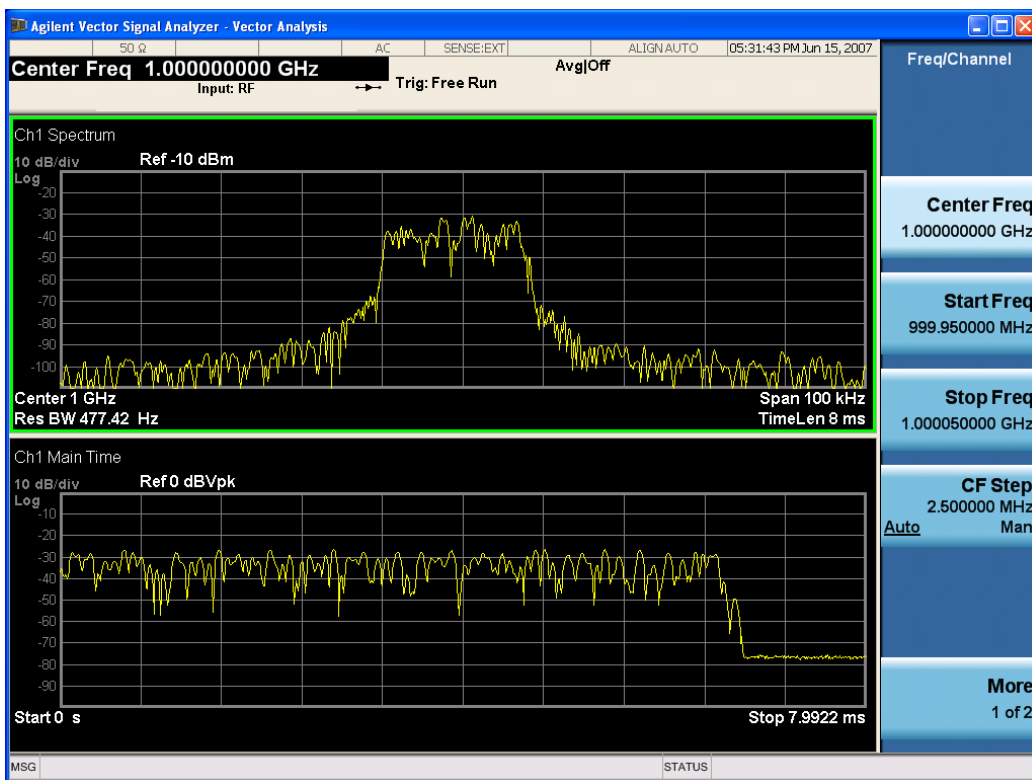
View Presets affect the trace layout, trace data assignment, scaling and formatting but do not affect hardware measurement setup.

Mode	VSA
Remote Command	:DISPlay:VECTor:VIEW:PRESet SPECTrum STATistics
Example	:DISP:VECT:VIEW:PRES SPEC
Key Path	Front Panel

Preset View: Spectrum/Time

This preset uses the Stack 2 layout style (see View/Display, Layout) with Spectrum in trace 1 and Main Time in trace 2

Mode	VSA
Key Path	View/Display



Preset View: Statistics

This preset uses the Stack 2 layout style (see View/Display, Layout) with the CCDF in trace 1 and Main Time in trace 2.

Mode	VSA
Key Path	View/Display

Vector Analysis
View/Display



Meas Setup

This key accesses a menu of keys that select measurement functions for the current VSA Measurement.

Mode	VSA
Key Path	Front Panel

Trigger

Triggering is used to determine when a measurement should start taking data. There are several available trigger sources. For each trigger source, there are associated setup parameters. Typically, a trigger event is generated when a signal (or a characteristic of the signal) crosses a defined trigger level (or threshold) on a rising or falling slope. The measurement begins at a specified time delay from the trigger point. The delay may be negative, allowing pretrigger data to be taken. Each trigger source has associated its own trigger level, slope, and delay settings.

Mode	VSA
Key Path	Front Panel

Sweep/Control

This key accesses a menu that allows you to select Sweep/Control parameters for all VSA measurements.

For more information see Measurement Functions, Sweep/Control

Mode	VSA
Key Path	Front Panel

AMPTD Y Scale

This key accesses a menu that allows you to select amplitude or Y-scale parameters for the current measurement.

For more information see [t Functions, AMPTD Y-Scale](#)

Mode	VSA
Key Path	Front Panel

Auto Couple

The Auto Couple key forces all Auto / Man functions into Auto. These include the following functions. Other measurement specific functions will be listed in their individual PDs. Note that this key does not invoke the Auto tune function, nor does it cause any Y autoscaling or Input Auto ranging.

- Frequency Step
- X Scale
- Y Axis Unit Preference
- Frequency Points

For more information see: Analyzer Setup Functions, Auto Couple

Mode	VSA
Key Path	Front Panel

BW

The BW key provides access to a menu that allows you to set available resolution bandwidth parameters for the spectrum measurement result, as well as the shape of the resolution bandwidth filter (controlled by the FFT windowing function).

For more information see: Analyzer Setup Functions, BW

Mode	VSA
Key Path	Front Panel

FREQ Channel

Frequency parameters for any vector measurement consist of 2 pairs of properties: Center Frequency and Span or Start Frequency and Stop Frequency. These behave much as they do in any other application, but there is the additional constraint that the span is limited to much less than the center frequency range.

If you change center frequency the start and stop frequencies change by the same amount.

If you change span, start frequency and stop frequency are changed by 1/2 the span change.

If you change start frequency, stop frequency remains fixed and span and center frequency are refigured accordingly. Changing stop frequency has similar behavior.

For more information see: Analyzer Setup Functions, FREQ Channel

Mode	VSA
Key Path	Front Panel

Output

This key provides access to a menu that allows you to select input/output parameters for the measurement data.

For more information see: Analyzer Setup Functions, Input/Output

Mode	VSA
Key Path	Front Panel

Source

There are no selectable Source parameters for this measurement.

For more information see: Analyzer Setup Functions, Source

Mode	VSA
Key Path	Front Panel

SPAN X Scale

This key provides access to a menu that allows you to select span or X-scale parameters for the current measurement.

For more information see: Analyzer Setup Functions, SPAN X-Scale

Mode	VSA
Key Path	Front Panel

Trace/Detector

This section details the trace results accessible via the data key and also via SCPI, many of which are available in other measurements as well.

For more information see: Analyzer Setup Functions, [Trace/Detector on page 226](#)

Mode	VSA
Key Path	Front Panel

Data

This key provides a menu of trace data choices for the selected trace. For the SCPI command, and other details, see Analyzer Setup Functions, Trace/Detector, [Data on page 228](#).

The following trace data results are available:

Trace data soft key name	SCPI string form	Description
Spectrum	"Spectrum1"	Averaged result of successive Inst Spectrum results (If RMS or Max averaging is on). Otherwise, FFT of current windowed Main (or Gate) Time
Inst Spectrum	"Inst Spec1"	Instantaneous Spectrum is the FFT of the current windowed Main (or Gate) Time. It is instantaneous in the sense that it isn't rms averaged, but it may included time-averaged data.
Main Time	"Main Time1"	Same as Inst Main Time unless Time averaging is on, in which case it is the averaged result of successive Inst Main Time results. If Time Gating is on, Main Time is the source to which the Gate is applied.
Inst Main Time	"Inst Main Time1"	Instantaneous Main Time is the current corrected, resampled, time record.
Gate Time	"Gate Time1"	Gate Time replaces Main Time as input to results if gating is on.

Raw Main Time	"Raw Main Time1"	Time record as it comes from the hardware, before software resampling or corrections
Power Spectral Density (PSD)	"PSD1"	Power spectrum divided by ResBW
CCDF	"CCDF1"	Complementary Cumulative Distribution Function of all time date since last measurement restart
CDF	"CDF1"	Cumulative Distribution Function of all time date since last measurement restart
PDF	"PDF1"	Probability Distribution Function of all time date since last measurement restart
Auto Correlation	"Auto Correl1"	Autocorrelation function of the current Main (or Gate) Time result
OBW Summary Trace 1	"OBW Summary Trc1"	Table of Occupied Bandwidth results if OccBW is enabled on Trace 1 and Trace 1 has Spectrum or PSD data. Similar summaries are available for all traces.
ACP Summary Trace 1	"ACP Summary Trc1"	Table of Adjacent Channel Power results if ACP is enabled on Trace 1 and Trace 1 has Spectrum or PSD data. Similar summaries are available for all traces.
No Data	"No Data"	An empty trace

The following Trace Data types are available in all measurements:

Soft Key Name	SCPI string form
No Data	"No Data"
Spectrum	"Spectrum1"
Inst Spectrum	"Inst Spectrum1"
Raw Main Time	"Raw Main Time1"
OBW Summary Trace 1	"OBW Summary Trc1"
OBW Summary Trace 2	"OBW Summary Trc2"
OBW Summary Trace 3	"OBW Summary Trc3"
OBW Summary Trace 4	"OBW Summary Trc4"
ACP Summary Trace 1	"ACP Summary Trc1"
ACP Summary Trace 2	" ACP Summary Trc2"
ACP Summary Trace 3	" ACP Summary Trc3"

Soft Key Name

SCPI string form

ACP Summary Trace 4

" ACP Summary Trc4"

Marker

The Marker key accesses the Marker menu. A marker can be placed on a trace to allow the value of the trace data at the marker position to be determined precisely. Markers may also be used in pairs to read the difference (or delta) between two data points. They can also be used to make power calculation over a band of frequencies or a time interval. See Marker Functions below for more details.

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 control mode is described below.

Pressing Marker always makes the selected maker's X position the active function.

If the currently selected marker is Off, pressing Marker sets it to Normal mode and places it at the center of the screen on the currently selected trace.

As a convenience, if there are no markers displayed on the current trace, pressing the marker hardkey (whenever the marker menu is already showing) selects the lowest numbered marker that is currently off and turns it on in normal mode on the selected trace. In other words, pressing the Marker hardkey twice will always turn on a marker on the selected trace if none was turned on before.

For more information see the Analyzer Setup, Marker for a description of this function.

Mode	VSA
Key Path	Front Panel

Marker Function

This key provides access to a menu that allows you to select marker functions for the current measurement.

For more information see: Analyzer Setup Functions, marker Fctn

Mode	VSA
Key Path	Front Panel

Marker To

This key provides access to a menu that allows you to select where to move the marker.

For more information see: Analyzer Setup Functions, Marker To

Mode

VSA

Key Path

Front Panel

Peak Search

This key initiates an immediate search for the peak level signal and places a marker at that data point.

For more information see: Analyzer Setup Functions, Peak Search

Mode	VSA
Key Path	Front Panel

The Analog Demod measurement is accessed from the Meas hardkey. The Analog Demod measurement enhances the capabilities offered by Vector Analysis by adding a demodulation function. AM, FM, and PM signals may be demodulated, and the output of the demodulator may be further analyzed in the same ways as the input signal. For example, you may look simultaneously at the spectra and time records of the input signal and the demodulated signal. Also available are time gating, autocorrelation, and statistical functions such as CCDF.

Mode	VSA
Key Path	Meas

The Analog Demod measurement is invoked remotely by the following:

```
:CONFigure:ADEMod  
:CONFigure:ADEMod:NDEFault  
:INITiate:ADEMod
```

FETCh and READ commands below may be used to obtain ACP and OBW table information when those functions are turned on.

```
:FETCh:ADEMod [n] ?  
:READ:ADEMod [n] ?
```

NOTE: The MEASure? command is not supported by the Analog Demod measurement.

NOTE: Remote results may be obtained using CALCulate:ADEMod:DATA<n> commands. For Trace Data SCPI commands and remote results see **Help** for the **MEAS** key.

View/Display (View Presets)

The View/Display key displays a menu that enables you to select display parameters for the current measurement.

For more information on other View/Display functions (Display and Layout) see Analyzer Setup, View/Display

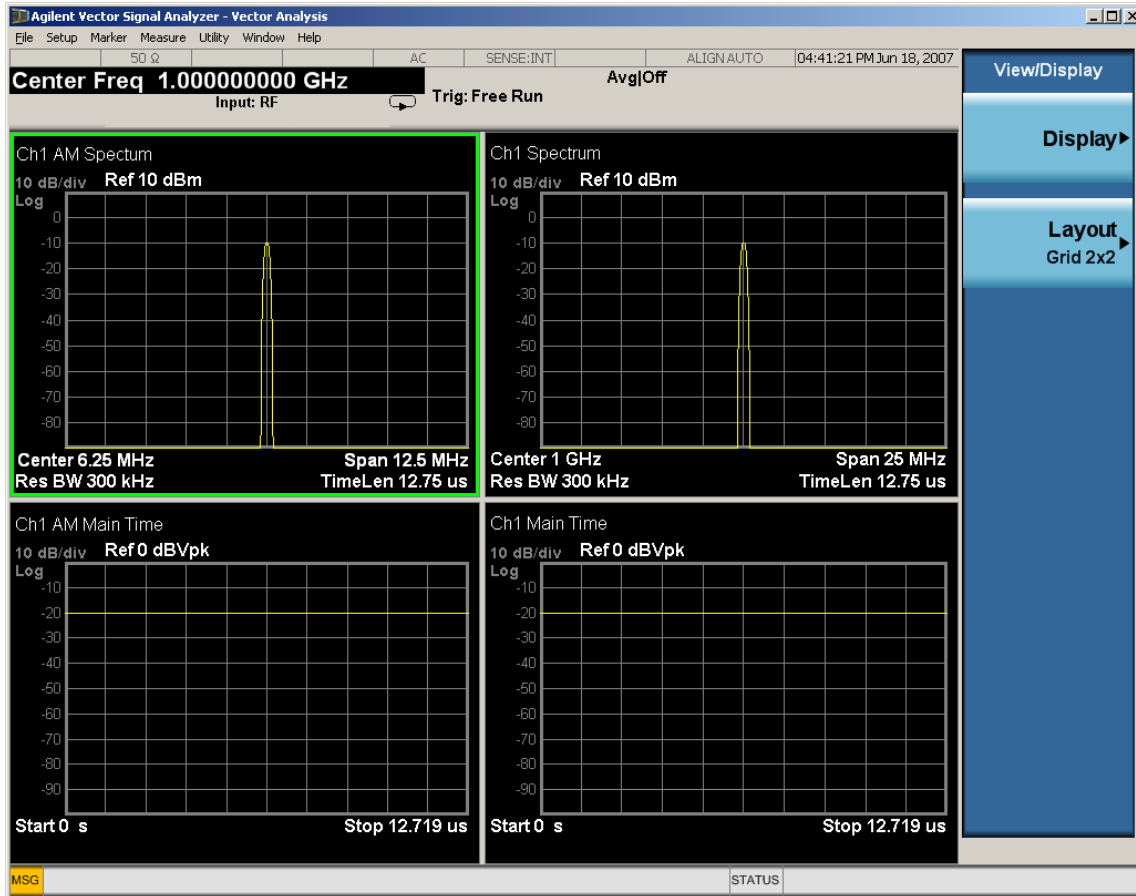
View Presets affect the trace layout, trace data assignment, scaling and formatting but do not affect hardware measurement setup.

Mode	VSA
Remote Command	:DISPlay:ADEMod:VIEW:PRESet DSPectrum STATistics
Example	DISP:ADEM:VIEW:PRES DSP
Key Path	View/Display

Preset View: Demod Spectrum/Time

This preset shows a quad layout with the Demod Spectrum in trace 1, Demod Main Time in trace 2, the input Spectrum in trace 3, and the input Main Time in trace 4.

Mode	VSA
Key Path	View/Trace



Preset View: Statistics

This preset shows a stacked 2 layout with the CCDF of the input in trace 1 and input Main Time in trace 2.

Mode	VSA
Key Path	View/Trace

Analog Demod
View/Display (View Presets)



Meas Setup

Displays a menu of available settings for the current measurement.

Mode	VSA
Key Path	Meas Setup

Avg Number

Allows you to specify how many averages to perform.

Suppose you specify 3 averages. For the first average, the analyzer clears previous trace data and obtains a new trace. The second average consists of averaging the next trace with the first trace. The third average consists of averaging the third trace with the averaged results of the first two traces.

The analyzer updates the display after each average. In this example, the analyzer would update the display after the first average, again after the second average, and finally after the third average. To decrease the number of display updates and possibly speed up the measurement, you can turn on Fast Averaging.

Mode	VSA
Key Path	Meas Setup

Average Mode

Allows you to set the averaging mode used for the current measurement.

For more information see: Measurement Functions, Meas Setup, Average Mode

Mode	VSA
Key Path	Meas Setup

Average Setup

Allows you to set other averaging parameters for the current measurement.

For more information see: Measurement Functions, Meas Setup, Average Setup

Mode	VSA
Key Path	Meas Setup

Demod Setup

Allows you to set Demodulation parameters for the current measurement.

For more information see: Measurement Functions, Meas Setup, Demod Setup

Mode	VSA
Key Path	Meas Setup

Demod Type

Demod Type lets you select the type of analog demodulation to be applied to your signal. You can select AM, PM, or FM demodulation. In addition, you can enable Auto Carrier Phase and/or Auto Carrier Frequency. Auto carrier controls how the analyzer determines your carrier frequency.

Mode	VSA
Remote Command	<code>[[:SENSe]:ADEMod:MODulation AM FM PM</code> <code>[[:SENSe]:ADEMod:MODulation?</code>
Example	<code>ADEM:MOD AM</code> <code>ADEM:MOD?</code>
Preset	AM
State Saved	Saved in instrument state.
Range	AM FM PM

Key Path **Meas Setup, Demod Setup**

AM Units

This allows you to select whether the display units for AM demodulation are in normalized units ("am") or percent ("%").

Mode	VSA
Remote Command	[:SENSe] :ADEMod:AM:UNIT AM PCT [:SENSe] :ADEMod:AM:UNIT?
Example	ADEM:AM:UNIT AM ADEM:AM:UNIT?
Restriction and Notes	Greyed out if Demod Type is FM or PM
Preset	AM
State Saved	Saved in instrument state.
Range	am %
Key Path	Meas Setup, Demod Setup

Auto Carrier Freq

This allows you to turn on or off automatic carrier frequency estimation for FM or PM demodulation. When Auto Carrier Freq is off, the analyzer uses the Center Frequency setting as the carrier. If the actual carrier frequency is different from the center frequency, a ramp is visible in the phase results. Turning on Auto Carrier Freq causes the analyzer to estimate the actual carrier frequency. Proper setting of the carrier frequency is especially important in PM demodulation.

When the VSA is in analog demodulation mode, you can select one of two different types of auto carrier setting. The types of auto carrier setting available depends on the type of demodulation, as shown in the following table.

For this demodulation:	You can use this auto carrier:
AM	None
FM	Auto Carrier Frequency

PM Auto Carrier Frequency and Auto Carrier
Phase

Note that you cannot select auto carrier frequency with AM demodulation. AM demodulation does not require carrier frequency estimation because the AM calculations are based on the carrier envelope. The carrier amplitude estimate is based on data within a single time record and is updated on a record-by-record basis.

Auto Carrier Frequency

Accurate angle demodulation (FM or PM) depends on precisely identifying the carrier frequency. Errors result in phase ramping. The arc tangent of the complex time record is the basis of both PM and FM demodulation. Hence, correcting for the phase ramp is the goal of auto carrier frequency.

Without auto carrier frequency, the analyzer uses its center frequency to determine the carrier frequency of your signal. When auto carrier frequency is selected, the analyzer uses an algorithm to estimate the carrier frequency. If you can lock the analyzer to an external reference which is coherent with your carrier, no carrier frequency estimation is needed, and you do not need to select auto carrier frequency.

When auto carrier frequency is selected, the carrier frequency estimate is calculated independently for each time record, and is used in the demodulation calculation to take out FM offsets, or PM phase ramps due to error between your carrier frequency and the analyzer's LO (center frequency).

Hint

If auto carrier frequency is selected, you can select demod carrier to display the estimated carrier frequency for FM demodulation. Cross channel results show the estimates for both channels. For PM demodulation, you must select both Auto Carrier Frequency and Auto Carrier Phase to display the estimated carrier frequency.

Auto Carrier Frequency and Averaging

The operation of auto carrier frequency is modified if averaging is turned on. For FM measurements, the carrier frequency estimate from the current time record is fed into an exponential average of estimates from prior time records. The resulting, averaged carrier-frequency is used to compensate the current time record for carrier-frequency offsets from the center frequency.

Considerations When Using Auto Carrier Frequency

The following situations can bias the phase ramp estimation:

- Low frequency modulation, such as a periodic signal with fewer than 10 cycles over the time record.
- Phase discontinuities present in digital communication formats.
- Transients, such as carrier turn-on in the middle of the time record.

In cases where biases are unavoidable, auto carrier frequency should be turned off. Where possible, lock the analyzer's external reference to a reference coherent with the carrier to eliminate frequency errors.

Mode	VSA
Remote Command	[:SENSE] :ADEMod:CARRier:FREQuency:AUTO OFF ON 0 1 [:SENSE] :ADEMod:CARRier:FREQuency:AUTO?
Example	ADEM:CARR:FREQ:AUTO ON ADEM:CARR:FREQ:AUTO?
Restriction and Notes	Greyed out if Demod Type is AM
Preset	OFF
State Saved	Saved in instrument state.
Key Path	Meas Setup, Demod Setup

When Auto Carrier Frequency is on (for Demod types FM or PM), the calculated average carrier frequency may be queried for any trace showing a demod result by using the following SCPI command.

Mode	VSA
Remote Command	:DISPlay:ADEMod:TRACe [1] 2 3 4 :CARRier:FREQuency?
Example	DISP:ADEM:TRAC:CARR:FREQ?
Remote Command Notes	This returns the result of the carrier frequency calculation (if Demod Mode is FM or PM and Auto Carrier Freq is on) for the addressed trace (which must be assigned a demod result). Returns NaN otherwise.
Key Path	SCPI only

Auto Carrier Phase

This allows you to turn on or off automatic carrier phase offset estimation for PM demodulation. Even with Auto Carrier Freq turned on, the PM demodulation may have a fixed or slowly varying phase offset. This function estimates the phase offset and takes it

out. A phase offset does not affect FM results, because the offset differentiates to zero.

Mode	VSA
Remote Command	<code>[:SENSe] :ADEMod:CARRier:PHASe:AUTO OFF ON 0 1</code> <code>[:SENSe] :ADEMod:CARRier:PHASe:AUTO?</code>
Example	ADEM:CARR:PHAS:AUTO ON ADEM:CARR:PHAS:AUTO?
Restriction and Notes	This is robust enough that it sometimes works even if Auto Carrier Freq is turned off, but it is recommended that you turn on Auto Carrier Freq along with this. Greyed out if Demod Type is AM or FM
Preset	OFF
State Saved	Saved in instrument state.
Key Path	Meas Setup, Demod Setup

Meas Preset

For more information, see the section under the Preset key in the Utility section.

Mode	VSA
Key Path	Meas Setup

Trigger

Allows you to set trigger parameters for the current measurement.

For more information see Measurement Functions, Trigger

Mode	VSA
Key Path	Front Panel

Sweep/Control

Allows you to set sweep parameters for the current measurement.

For more information see Measurement Functions, Sweep/Control

Mode	VSA
Key Path	Front Panel

AMPTD Y Scale

Allows you to set Amplitude parameters for the current measurement.

For more information see Analyzer Setup Functions, AMPTD Y-Scale

Mode	VSA
Key Path	Front Panel

Attenuation

Mode	VSA
Key Path	AMPTD Y Scale

Internal Preamp

The internal preamplifier function is not available for this measurement.

Mode	VSA
Key Path	AMPTD Y Scale

BW

Allows you to set bandwidth parameters for the current measurement.

For more information see Analyzer Setup Functions, BW

Mode	VSA
Key Path	Front Panel

FREQ Channel

Allows you to set frequency or channel number parameters for the current measurement.

For more information see Analyzer Setup Functions, FREQ Channel

Mode	VSA
Key Path	Front Panel

Input/Output

This is described in the Meas Common PD.

Allows you to set Source parameters for the current measurement.

For more information see Analyzer Setup Functions, Source

Mode	VSA
Key Path	Front Panel

SPAN X Scale

Allows you to set span or X-scale parameters for the current measurement.

For more information see Analyzer Setup Functions, SPAN X-Scale

Mode	VSA
Key Path	Front Panel

Trace/Detector

This section details the trace results accessible via the data key and also via SCPI, many of which are available in other measurements as well.

For more information see: Analyzer Setup Functions, Trace Detector

Mode	VSA
Key Path	Front Panel

Select Trace

Allows you to select a data trace for the current measurement.

For more information see Analyzer Setup Functions, Trace/Detector, [Select Trace on page 255](#)

Data

This softkey brings up a menu of trace data choices for the selected trace. For more details and SCPI, see Analyzer Setup, Trace/Detector, [Data on page 257](#).

The following trace data results are available under the Pre Demod submenu. They are identical to the results available in the Vector Analysis measurement.

Trace data	SCPI string form	Description
Spectrum	"Spectrum1"	Averaged result of successive Inst Spectrum results (If RMS or Max averaging is on). Otherwise, FFT of current windowed Main (or Gate) Time
Inst Spectrum	"Inst Spec1"	Instantaneous Spectrum is the FFT of the current windowed Main (or Gate) Time. It is instantaneous in the sense that it isn't rms averaged, but it may include time-averaged data.
Main Time	"Main Time1"	Same as Inst Main Time unless Time averaging is on, in which case it is the averaged result of successive Inst Main Time results. If Time Gating is on, Main Time is the source to which the Gate is applied.

Inst Main Time	"Inst Main Time1"	Instantaneous Main Time is the current corrected, resampled, time record.
Gate Time	"Gate Time1"	Gate Time replaces Main Time as input to results if gating is on.
Raw Main Time	"Raw Main Time1"	Time record as it comes from the hardware, before software resampling or corrections
Power Spectral Density (PSD)	"PSD1"	Power spectrum divided by ResBW
CCDF	"CCDF1"	Complementary Cumulative Distribution Function of all time date since last measurement restart
CDF	"CDF1"	Cumulative Distribution Function of all time date since last measurement restart
PDF	"PDF1"	Probability Distribution Function of all time date since last measurement restart
Auto Correlation	"Auto Correl1"	Autocorrelation function of the current Main (or Gate) Time result

These Demodulation results are available under the Demod submenu. The name of the demod result and the trace title annotation are prefixed with the name of the demodulation type. For example, if you select AM demodulation, then under Trace/Detector, Demod you will be able to select "AM Spectrum" and the trace will be labeled "Ch1 AM Spectrum".

Trace data	SCPI string form	Description
Spectrum	"AnDemod Spectrum1"	Same as calculation for input Spectrum, but using demod time data
Inst Spectrum	"AnDemod Inst Spec1"	Same as calculation for input Inst Spectrum, but using demod time data
Main Time	"AnDemod Main Time1"	Main demodulated time record. Averaging and gating applied in the same manner as input Main Time.
Inst Main Time	"AnDemod Inst Main Time1"	Demodulated Inst Main Time
Gate Time	"AnDemod Gate Time1"	Gated version of Demod Main Time, used as input to all other demod results if gating is on.
Power Spectral Density (PSD)	"AnDemod PSD1"	Power spectrum of demodulated signal divided by ResBW
CCDF	"AnDemod CCDF1"	Complementary Cumulative Distribution Function of all demodulated time date since last measurement restart

Analog Demod
Trace/Detector

CDF	"AnDemod CDF1"	Cumulative Distribution Function of all demodulated time data since last measurement restart
PDF	"AnDemod PDF1"	Probability Distribution Function of all demodulated time data since last measurement restart
Auto Correlation	"AnDemod Auto Correl1"	Autocorrelation function of the current demodulated Main (or Gate) Time result

These following data types are also available for all measurements:

OBW Summary Trace 1	"OBW Summary Trc1"	Table of Occupied Bandwidth results if OccBW is enabled on Trace 1 and Trace 1 has Spectrum or PSD data. Similar summaries are available for all traces.
ACP Summary Trace 1	"ACP Summary Trc1"	Table of Adjacent Channel Power results if ACP is enabled on Trace 1 and Trace 1 has Spectrum or PSD data. Similar summaries are available for all traces.
No Data	"No Data"	An empty trace

Marker

This key displays a menu that allows you to select marker parameters for the current measurement.

For more information see: Analyzer Setup Functions, Marker

Mode	VSA
Key Path	Front Panel

Marker Fctn

This key displays a menu that allows you to select marker functions for the current measurement.

For more information see: Analyzer Setup Functions, marker Fctn

Mode	VSA
Key Path	Front Panel

Marker To

This key displays a menu that allows you to select where to move the marker.

For more information see: Analyzer Setup Functions, Marker To

Mode	VSA
Key Path	Front Panel

Peak Search

This key initiates an immediate search for the peak level signal and places a marker at that data point.

For more information see: Analyzer Setup Functions, Peak Search

Mode	VSA
Key Path	Front Panel

The Digital Demod measurement is accessed from the Meas hardkey. The Digital Demod measurement builds upon basic Vector analysis (89601X Option 205) by including flexible demodulation of a wide variety of standard and custom single-carrier digital modulation formats. You may simultaneously view pre-demod time and spectrum displays, demodulated signal, reconstructed reference signal, recovered symbols and various error traces and summaries.

Measurements are possible on continuous or pulsed (burst) carriers (such as TDMA). In addition, you can specify a sync pattern and an offset to look at selected segments of demodulated data.

The digital demodulator uses your signal to generate an ideal signal (called I/Q reference or FSK reference). You can compare the measured signal to the reference signal to quantify and locate errors in your signal.

Digital demodulation has built-in filters which may be applied to the measured signal as well as to the reference signal. This allows you maximum flexibility in comparing your signal to an ideal signal. Additionally, this allows complete flexibility to probe any analog point in a communication system.

Mode	VSA
Key Path	Front Panel

The Digital Demod measurement is invoked remotely by the following:

```
:CONFigure:DDEMod
:CONFigure:DDEMod:NDEFault
:INITiate:DDEMod
```

Symbol/Error Table results may also be obtained using the FETCh or READ commands. The Sym/Err table must be assigned to a trace in order to obtain valid results.

```
:FETCh:DDEMod [n] ?
:READ:DDEMod [n] ?
```

NOTE: The MEASure:DDEMod? command is not supported by the Digital Demod measurement.

NOTE: For Trace Data SCPI commands and remote results see Help for the **MEAS** key. All trace and tabular data results are available using CALCulate:DDEMod:DATA commands. These commands also enable you to get names and units of results.

Condition	N	Results Returned
All Mod Formats	Not specified, or n=1	<p data-bbox="570 373 846 405">Error Summary Table</p> <p data-bbox="570 422 1386 548">Returns 30 comma-separated scalar results, corresponding to the items in the table portion of the Syms/Err trace. Note some values are not available (n/a) for some formats. NaN (9.91 E 37) is returned for results that are not available.</p> <ol data-bbox="570 569 1386 1843" style="list-style-type: none"> 1. EVM rms (% rms) (n/a for FSK) 2. EVM peak (% pk) (n/a for FSK) 3. symbol position of EVM peak (n/a for FSK) 4. offset EVM rms (% rms) (OQPSK only, n/a otherwise) 5. offset EVM peak (% pk) (OQPSK only, n/a otherwise) 6. symbol position of Offset EVM peak (OQPSK only, n/a otherwise) 7. FSK err rms (% rms) (FSK only, n/a otherwise) 8. FSK err peak (% pk) (FSK only, n/a otherwise) 9. symbol position of FSK err peak (FSK only, n/a otherwise) 10. magnitude error rms (% rms). 11. magnitude error peak (% pk) 12. symbol position of magnitude error peak 13. phase error rms (deg) (n/a for FSK) 14. phase error peak (deg pk) (n/a for FSK) 15. symbol position of phase error peak (n/a for FSK) 16. frequency error (Hz) (n/a for FSK) 17. carrier offset (Hz) (FSK only, n/a otherwise) 18. SNR(MER) (dB) (QPSK, QAM, APSK and VSB only, n/a otherwise) 19. FSK deviation (Hz) (FSK only, n/a otherwise) 20. Pilot Level (dB) (8 VSB only, n/a otherwise) 21. time offset (s) (triggered APSK only, n/a otherwise) 22. IQ offset (dB) (n/a for FSK, VSB) 23. amplitude droop (dB/sym) (n/a for QPSK, OQPSK, MSK Type 1, QAM, APSK, VSB and FSK) 24. rho (QPSK and OQPSK only, n/a otherwise) 25. quadrature error (deg) (n/a for BPSK, VSB and FSK) <p data-bbox="610 1856 894 1887">(Continued Next Page)</p>

All Mod Formats (Cont'd)	Not specified, or n=1	26. gain imbalance (dB) (n/a for BPSK, VSB and FSK) 27. R2/R1 ratio (dimensionless) (APSK only, n/a otherwise) 28. R3/R1 ratio (dimensionless) (APSK 32 only, n/a otherwise) 29. peak EVM mean (%) (EDGE only, n/a otherwise) 30. 95% EVM (%) (EDGE only, n/a otherwise)
-----------------------------	-----------------------	--

Also available are the standard ACP and OBW tables.

See Measurement Functions, Trace/Detector,

View/Display

The View/Display key provides access to a menu that enable you to select display parameters for the current measurement.

For more information on other View/Display functions (Display and Layout) see Analyzer Setup, View/Display

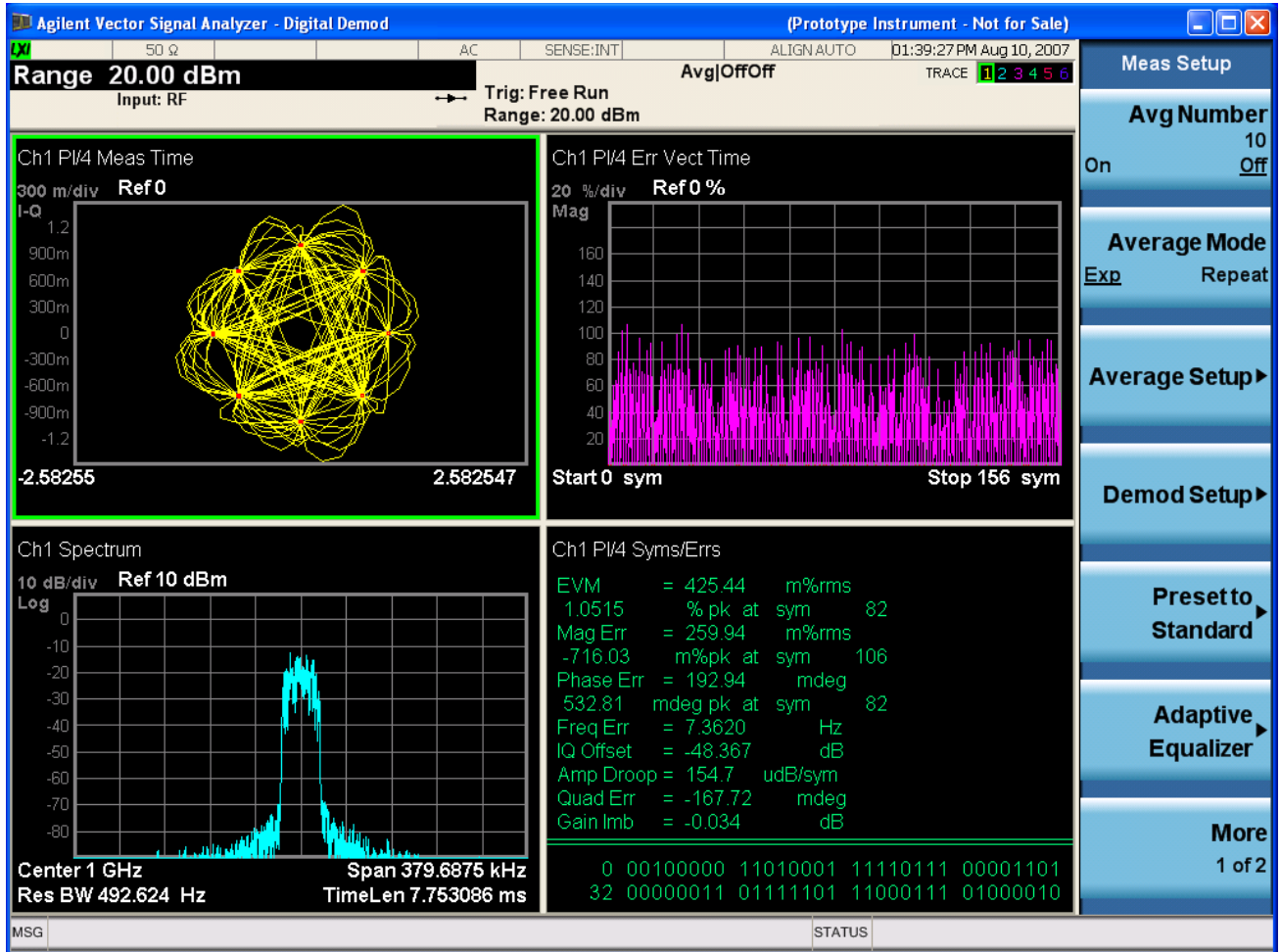
View Presets affect the trace layout, trace data assignment, scaling and formatting but do not affect hardware measurement setup.

Mode	VSA
Remote Command	:DISPlay:DDEMod:VIEW:PRESet QUAD
Example	DISP:DDEM:VIEW:PRES QUAD
Key Path	View/Display

Preset View: Demod Quad

This preset displays a quad layout with the IQ Meas Time in trace 1, Spectrum in trace 2, Error Vector Time in trace 3, and the Symbol/Error table in trace 4.

Mode	VSA
Key Path	View/Display



Meas Setup

This key displays a menu allowing you to select measurement parameters for the current measurement.

Mode	VSA
Key Path	Front Panel

Averaging

Averaging applies to a limited set of measurement results in digital demod. RMS and Max average types apply to Spectrum, Error Vector Spectrum, IQ Meas Spectrum, and IQ Reference Spectrum traces. The behavior for these types is the same as in the Vector Analysis Measurement. Averaging of numeric error data in the symbol table is described below:

Average Type	Average Mode	Effects of averaging
RMS, Time	any (single sweep)	After each scan, the Syms/Err table shows a running (linear) average over past scans for each parameter in the table. Peak or position parameters are not averaged. Parameters that appear in the table in dB are converted to linear units in order to average them. The measurement stops after the specified Avg Number of scans.
RMS, Time	repeat (continuous sweep)	Same as above, except that averages are reset after the specified Avg Number of scans, and the measurement continues.
RMS, Time	exponential (continuous sweep)	Same as the single sweep case until the specified Avg Number of scans is complete. After that, averaging continues using exponential weighting.
Max	any	After each scan, compares each parameter in the table with the current scan's value and keeps the maximum. Symbol positions relate to the maximum peak value seen.

For more information see: Measurement Functions, Meas Setup, Averaging

Mode	VSA
Key Path	Meas Setup

Avg Number

Avg Number controls averaging for those results that can be averaged. For more information see: Measurement Functions, Meas Setup, Averaging

Mode	VSA
Key Path	Meas Setup, Averaging

Average Mode

Average Mode controls averaging for those results that can be averaged-. For more information see: Measurement Functions, Meas Setup, Averaging

Mode	VSA
Key Path	Meas Setup, Averaging

Average Setup

Average Setup controls averaging for those results that can be averaged-. For more information see: Measurement Functions, Meas Setup, Averaging

Mode	VSA
Key Path	Meas Setup, Averaging

Demod Setup

This key displays a menu that allows you to adjust digital demodulation parameters.

Mode	VSA
Key Path	Meas Setup

Modulation Format

This allows you to select the digital communication format that is used by the demodulator. The selection includes:

- QAM formats: QAM 16, QAM 32, QAM 64, QAM 128, QAM 256, QAM 512, and QAM 1024
- PSK formats: BPSK, QPSK, Offset QPSK, /4 DQPSK, DQPSK, 8PSK, /8 D8PSK, and D8PSK
- MSK type 1 and type 2
- FSK formats: FSK 2, FSK 4, FSK 8, and FSK 16
- DVB QAM formats: DVB QAM 16, DVB QAM 32, DVB QAM 64, DVB QAM 128, and DVB QAM 256
- VSB formats: VSB 8 and VSB 16
- APSK (amplitude/phase shift keying) formats: APSK 16, APSK 16 w/DVB, APSK 32, APSK 32 w/DVB
- EDGE

Mode	VSA
------	-----

Remote Command

```
[ :SENSe ] :DDEMod:MODulation  
BPSK | QPSK | OQPSK | PI4DQPSK | DQPSK | PSK8 | PI8DPSK8 | DPSK8 | QAM1  
6 | QAM32 | QAM64 | QAM128 | QAM256 | QAM512 | QAM1024 | FSK2 | FSK4 | FS  
K8 | FSK16 | MSK1 | MSK2 | EDGE | APSK16 | APSK32 | DVBAPSK16 | DVBAPSK  
32 | DVBQAM16 | DVBQAM32 | DVBQAM64 | DVBQAM128 | DVBQAM256 | VSB8 |  
VSB16
```

```
[ :SENSe ] :DDEMod:MODulation?
```

Example	DDEM:MOD QPSK
---------	---------------

```
DDEM:MOD?
```

Preset	QPSK
--------	------

State Saved	Saved in instrument state.
Range	BPSK QPSK Offset QPSK /4DQPSK DQPSK 8PSK /8 DPSK8 D8PSK QAM 16 QAM 32 QAM 64 QAM 128 QAM 256 QAM 512 QAM 1024 FSK 2 FSK 4 FSK 8 FSK 16 MSK Type 1 MSK Type 2 EDGE APSK 16 APSK 32 APSK 16 w/DVB APSK 32 w/DVB DVB QAM 16 DVB QAM 32 DVB QAM 64 DVB QAM 128 DVB QAM 256 VSB 8 VSB 16
Key Path	Meas Setup, Demod Setup

Symbol Rate

The Symbol Rate key allows you to set the symbol rate (symbols per second) for the analyzer's digital demodulator. Set this parameter to match the symbol rate of your system.

In digital modulation, the symbol rate determines the rate (frequency) at which symbols occur. A symbol may consist of one or more bits as determined by the modulation format. For example, in a BPSK system, each symbol represents 1 bit; in a QPSK system, each symbol represents 2 bits.

Symbols are valid only at the timing instant when the receiver interprets the signal. This timing instant is called the detection-decision point.

The analyzer's demodulator uses the symbol rate to determine the frequency of your detection-decision points. It is important that you set the symbol rate to match exactly the symbol rate of your system, because the symbol clock frequency is not estimated.

Note that the more complex your modulation format, the more critical it is that the symbol rate be exact. Specifying an incorrect symbol rate introduces errors into the demodulation process.

The analyzer can accurately measure symbol rates that are less than the maximum span of the analyzer. There may be instances where you want to set the symbol rate beyond what can be measured. The analyzer lets you do this, but accuracy is not specified.

If you enter a symbol rate that is slightly different than the symbol rate of your signal, the EVM (error vector magnitude) is typically small at the center of the result length and increases linearly towards the ends of the result length.

The symbol rate determines the maximum frequency span (information bandwidth) that you can measure. For QAM and PSK signals, the symbol rate also determines the minimum frequency span that meets published specifications.

Mode	VSA
------	-----

Remote Command	<code>[:SENSe] :DDEMod:SRATe <frequency></code> <code>[:SENSe] :DDEMod:SRATe?</code>
Example	<code>DDEM:SRAT 1 MHZ</code> <code>DDEM:SRAT?</code>
Dependencies/Couplings	Span is forced to be $< 15.625 * (\text{Symbol rate})$
Preset	3840000 HZ
State Saved	Saved in instrument state.
Min	1
Max	9.9E+37
Key Path	Meas Setup, Demod Setup

Meas Interval

This key sets the number of symbols that the demodulation will analyze. This and the symbol rate set the overall time record length (in seconds) that is used by the demodulator. It also sets indirectly sets the resolution bandwidth for the various spectrum results. (The ResBW cannot be set independently.)

The resolution bandwidth and Time length are related by the following equation:

$$\text{Res BW} = \text{ENBW} / T$$

where:

ENBW is the normalized effective noise bandwidth of the Window (see the FFT Window topic for more details).

For the pre-demod Spectrum result, $T = 1.2 * (\text{Meas Interval}) / \text{Symbol Rate}$.

For the all other Spectrum results, $T = (\text{Meas Interval}) / \text{Symbol Rate}$.

The resolution bandwidth is annotated below any spectrum trace. To programmatically query the resolution bandwidth, use the following (with the trace number for <n>)

`CALC:DDEM:DATA<n>:HEAD? "ResBW"`

Mode	VSA
Remote Command	<code>[:SENSe] :DDEMod:SWEep:POINts <integer></code> <code>[:SENSe] :DDEMod:SWEep:POINts?</code>
Example	<code>DDEM:SWE:POIN 137</code> <code>DDEM:SWE:POIN?</code>

Preset	200
State Saved	Saved in instrument state.
Min	10
Max	4096
Key Path	Meas Setup, Demod Setup

Points / Symbol

Allows you to set how many points are displayed per symbol in time displays of demodulated data. The allowed values are 1, 2, 4, 5, 10 and 20.

Points/Symbol do not apply to W-CDMA(3GPP) or cdma2000 demodulation.

Minimum (except OQPSK):	1 point per symbol
Minimum (OQPSK):	2 points per symbol
Maximum:	20 points per symbol
EDGE default (see below):	1 point per symbol

For example, if the value of Points/Symbol is 1, each display point corresponds to a symbol. If the value is 5, the 5th display point corresponds to a symbol in this case, an IQ diagram would show 4 display points between each symbol.

Saving Points/Symbol: When you save a digitally demodulated trace, the Points/Symbol value used to create the trace is saved with the trace. When you recall the trace, the analyzer displays the trace with the Points/Symbol value used to create the trace the analyzer DOES NOT use the current value of Points/Symbol.

MSK Demodulation: For the MSK demodulation format, changing Points/Symbol affects the error data displayed in the Alphabetical Listing of Error Summary Data. This occurs because the analyzer uses all points to compute Error data results for MSK, whereas the analyzer uses only the points that occur at the symbol times to compute error data results for other demodulation formats.

OQPSK Demodulation: For OQPSK, an even number of Points/Symbol are required due to the offset between I and Q. If you specify an odd value for Points/Symbol, the analyzer chooses the next, lower, even value.

EDGE demodulation: For `EDGE` demodulation format and the Points/Symbol is set to 1 (default), the IQ Meas Time, IQ Magnitude Error, IQ Phase Error and Error Summary Table trace data results are the ISI (inter-symbol interference) compensated values. That is, when the points/symbol is set to 1 (default), the analyzer removes the effects of ISI

(inter-symbol interference), which provides a "clean" IQ Meas Time constellation diagram. For points/symbol greater than one, the trace data results are not compensated for the effects of ISI. For values greater than 1 point/symbol, the symbols in EDGE constellation diagrams may appear randomly placed due to the effects of ISI.

Couple to Gain Imb./Quad Skew: This measurement parameter selection controls the number of points per symbol used to calculate the IQ Gain Imbalance and Quadrature Skew symbol error data results. For further information, see Couple to Gain Imb./Quad Skew, IQ Gain Imbalance, and Quadrature Skew.

Mode	VSA
Remote Command	<code>[:SENSE] :DDEMod:PPSYmbol <integer></code> <code>[:SENSE] :DDEMod:PPSYmbol?</code>
Example	DDEM:PPSY 2 DDEM:PPSY?
Notes	The only supported values are 1, 2, 4, 5, 10 and 20. Numeric entries are rounded to the nearest valid value.
Preset	5
State Saved	Saved in instrument state.
Min	1
Max	20
Key Path	Meas Setup, Demod Setup

Gain Imb / Quad Skew Coupling

Controls what measurement data is included in the Quadrature Skew Error and IQ Gain Imbalance error data calculations.

- Off: Calculations use one Point per Symbol.
- On: Calculations use the value shown in the Points per Symbol parameter box.

Mode	VSA
Remote Command	<code>:CALCulate:DDEMod:PPSYmbol:COUple OFF ON 0 1</code> <code>:CALCulate:DDEMod:PPSYmbol:COUple?</code>

Example	CALC:DDEM:PPSY:COUP OFF CALC:DDEM:PPSY:COUP?
Dependencies/Couplings	No
Preset	OFF
State Saved	Saved in instrument state.
Key Path	Meas Setup, Demod Setup

Meas Filter

Allows you to select the Meas Filter used by the receiver.

Data filtering is used in digital demodulation to limit bandwidth and reduce intersymbol interference. This analyzer includes several commonly used filter types and has the ability to apply user-defined filters. All filters are computed to 20 symbols in length. If the filter alpha is < 0.2 , the analyzer uses 40 symbols to compute filter length (for most formats).

The shape and width of a filter is defined by the alpha (for cosine filters) or the BT (for Gaussian filters). The alpha or BT indicates the filter roll-off (or excess bandwidth) of the selected filter which occurs due to the practical inability of filter technology to build a perfectly square (brick-wall) filter which would have an alpha of 0 (no excess bandwidth). For example, a typical filter with an alpha of 0.3 has a bandwidth 30% greater than the theoretical minimum.

The analyzer's digital demodulator produces two signals: a measured and a reference signal. These signals are called I/Q Measured and I/Q Reference or, for FSK measurements, FSK Measured and FSK Reference.

You can select different filters for the measured and reference signals, as shown in the following, generic block diagram.

Note that for FSK signals, filtering is baseband and occurs after the FM demodulator.

The measured signal is the signal that results after demodulating your waveform. The reference signal is the signal that would result after demodulating your signal if your signal were ideal (contained no errors).

Notice that there are separate filters for the measured and reference signals. You **MUST** select the correct filter for both signals.

Filtering for various communication systems may occur either at the transmitter or the receiver; or the filtering may be distributed between the transmitter and the receiver. This is an important concept which affects your filter selection for the measured and reference signals. The analyzer's measured filter represents filtering in the system's receiver while the reference filter represents filtering in the entire system. Both filters share the same alpha/BT. The following table shows some examples of filter selection:

If the transmitter filter is:	The measure filter should be:	The reference filter should be:
root raised cosine	root raised cosine	raised cosine
raised cosine	none	raised cosine
Gaussian	none	Gaussian
any type	user defined	any type

You can modify the shape and width of Gaussian and Nyquist (cosine) filters. The shape and width is defined by the alpha (for cosine filters) or the BT (for Gaussian filters). All filters are computed to 20 symbols in length. If the filter alpha is < 0.2, the analyzer uses 40 symbols to compute filter length (for most formats).

Mode	VSA
Remote Command	[:SENSe] :DDEMod:FILTer:MEASurement NONE RRCosine GAUSSian EDGE IS95EQ RECTangle LPASs USER [:SENSe] :DDEMod:FILTer:MEASurement?
Example	DDEM:FILT:MEAS RRC DDEM:FILT:MEAS?
Notes	USER defined requires you to specify a register (see Meas User Defined).
Preset	RRC
State Saved	Saved in instrument state.
Range	No Filter Root Raised Cosine Gaussian EDGE CDMA (IS-95A Base EQ) Rectangular Low Pass User Defined
Key Path	Meas Setup, Demod Setup

Meas User Defined Pressing this key sets the Meas Filter to User Defined. Pressing it a second time allows you to select a data register which contains data that defines the filter.

The analyzer lets you use a filter of your design for the I/Q measured filter or the I/Q reference filter. Typical applications for user-defined filters include:

- Custom filters other than those provided. In this case both measured and reference

filters are user defined.

- Modified filters that are based on the raised cosine filter but add channel equalization. In this case, the measure filter is a user-defined filter and the reference filter is standard.

To define a filter, create a trace file containing the time-domain impulse response of the filter. (The easiest way to start is to export a time domain trace into a file in text or csv format and modify it. See Utility (System Functions), Save, Export Trace Data .) Then recall the trace file into the desired register. (See Utility (System Functions), Recall, Import Trace Data.) The data must satisfy these criteria:

- Only be real data, not complex
- Only be time-domain data. If the data domain type cannot be determined from the trace file (unknown domain), the analyzer will default to time-domain data. If any other domain is used, for example the frequency-domain, the analyzer will reject the user-defined trace file and use a root raised cosine filter as the Measurement filter and a raised cosine filter as the Reference filter.
- Contain > 0 and ≤ 20 symbols (401 samples) in overall length. However, if the filter alpha is < 0.2 , the trace length must be ≤ 40 symbols (801 samples) in overall length.
- Contain 20 samples-per-symbol. For example, 401 samples = 20 symbols at 20 points-per-symbol.
- Use an odd number of points so that the center of the impulse is positioned on a symbol, this would be the 201st point in a 401 point trace. The middle sample is assumed to be at $t = 0$.

If the trace file does not satisfy all of previously mentioned criterion, the analyzer rejects the user-defined trace file and defaults to using the root raised cosine filter as the Measurement filter and the raised cosine filter as the Reference filter.

Accuracy of user-defined filters is undefined. In addition, the value of Alpha/BT has no effect on user-defined filters.

Mode	VSA
Remote Command	[:SENSe] :DDEMod:FILTer:MEASurement:REGister D1 D2 D3 D4 D5 D6 [:SENSe] :DDEMod:FILTer:MEASurement:REGister?
Example	DDEM:FILT:MEAS:REG D1 DDEM:FILT:MEAS:REG?
Notes	Individual Data register selections are greyed out if they do not contain appropriate data for use as filter coefficients.
Dependencies/Couplings	Filter Alpha influences length constraint (see above) but has no other effect.
Preset	D1

State Saved	Saved in instrument state.
Range	Data 1 Data 2 Data 3 Data 4 Data 5 Data 6
Key Path	Meas Setup, Demod Setup, Meas Filter

Ref Filter

Pressing this key selects the Ref Filter that represents the cascaded transmit and receive filter.

This analyzer includes several commonly used filter types and has the ability to apply user-defined filters. All filters are computed to 20 symbols in length. If the filter alpha is < 0.2, the analyzer uses 40 symbols to compute filter length (for most formats).

The shape and width of a filter is defined by the alpha (for cosine filters) or the BT (for Gaussian filters). The alpha or BT indicates the filter roll-off (or excess bandwidth) of the selected filter which occurs due to the practical inability of filter technology to build a perfectly square (brick-wall) filter which would have an alpha of 0 (no excess bandwidth). For example, a typical filter with an alpha of 0.3 has a bandwidth 30% greater than the theoretical minimum.

The analyzer's digital demodulator produces two signals: a measured and a reference signal. These signals are called I/Q Measured and I/Q Reference or, for FSK measurements, FSK Measured and FSK Reference. The following table shows some examples of filter selection:

If the transmitter filter is:	The measure filter should be:	The reference filter should be:
root raised cosine	root raised cosine	raised cosine
raised cosine	none	raised cosine
Gaussian	none	Gaussian
any type	user defined	any type

You can modify the shape and width of Gaussian and Nyquist (cosine) filters. The shape and width is defined by the alpha (for cosine filters) or the BT (for Gaussian filters). All filters are computed to 20 symbols in length. If the filter alpha is < 0.2, the analyzer uses 40 symbols to compute filter length (for most formats).

Matched filtering of a demodulated signal is not available with the MSK demodulators. The measured filter is normally off. A user defined filter can be selected. Its primary use is

for additional band-limiting and channel equalization.

Mode	VSA
Remote Command	[:SENSe] :DDEMod:FILTer:REFeRence RCOSine RRCosine GAUSSian EDGE IS95BB RECTangle HSINe U SER [:SENSe] :DDEMod:FILTer:REFeRence?
Example	DDEM:FILT:REF RCOS DDEM:FILT:REF?
Notes	Individual Data register selections are greyed out if they do not contain appropriate data for use as filter coefficients. USER defined requires you to specify a register (see Ref User Defined).
Preset	RCOS
State Saved	Saved in instrument state.
Range	Raised Cosine Root Raised Cosine Gaussian EDGE CDMA (IS-95 Base) Rectangular Half Sine User Defined
Key Path	Meas Setup, Demod Setup

Ref User Defined Pressing this key causes the Ref Filter to become User Defined. Pressing it a second time displays a menu that allows you to select the data register which containing the data that defines the filter.

To define a filter, create a trace file containing the impulse response of the filter. (The easiest way to start is to export a time domain trace into a file in text or CSV format and modify it Then recall the file into the desired register. The data must satisfy these criteria:

- Only be real data, not complex
- Only be time-domain data. If the data domain type cannot be determined from the trace file (unknown domain), the analyzer will default to time-domain data. If any other domain is used, for example the frequency-domain, the analyzer will reject the user-defined trace file and use a root raised cosine filter as the Measurement filter and a raised cosine filter as the Reference filter.
- Contain > 0 and <= 20 symbols (401 samples) in overall length. However, if the filter alpha is < 0.2, the trace length must be <= 40 symbols (801 samples) in overall length.
- Contain 20 samples-per-symbol. For example, 401 samples = 20 symbols at 20 points-per-symbol.
- Use an odd number of points so that the center of the impulse is positioned on a symbol, this would be the 201st point in a 401 point trace. The middle sample is assumed to be

at $t = 0$.

Mode	VSA
Remote Command	[:SENSe] :DDEMod:FILTer:REFeRence:REGister D1 D2 D3 D4 D5 D6 [:SENSe] :DDEMod:FILTer:REFeRence:REGister?
Example	DDEM:FILT:REF:REG D1 DDEM:FILT:REF:REG?
Dependencies/Couplings	Filter Alpha influences length constraint (see above) but has no other effect.
Preset	D1
State Saved	Saved in instrument state.
Range	Data 1 Data 2 Data 3 Data 4 Data 5 Data 6
Key Path	Meas Setup, Demod Setup, Ref Filter

Alpha / BT

Determines the filter characteristics of the Raised cosine, Root-raised cosine and Gaussian filters used by the analyzer's digital demodulator. These characteristics apply to both the Meas and Ref filters.

Allowable values,

Raised cosine, root-raised cosine filters: .05 to 1

Gaussian filters: .05 to 100

Mode	VSA
Remote Command	[:SENSe] :DDEMod:ALPHa <real> [:SENSe] :DDEMod:ALPHa?
Example	DDEM:ALPH 0.22 DDEM:ALPH?
Dependencies/Couplings	Alpha also determines length criteria for user defined meas and ref filters
Preset	0.22
State Saved	Saved in instrument state.

Min	0.05
Max	100
Key Path	Meas Setup, Demod Setup

Burst/Sync Search

This key displays a menu that allows you to select Burst and Sync searches, and to select search parameters for the current measurement..

Mode	VSA
Key Path	Meas Setup, Demod Setup

Search Length This defines the time length over which the analyzer will search for a burst and/or sync word. . You can specify search length in number of symbols or units of time.

Mode	VSA
Remote Command	[:SENSE] :DDEMod:SYNC:SLENgth <time> [:SENSE] :DDEMod:SYNC:SLENgth?
Example	DDEM:SYNC:SLEN 200 US DDEM:SYNC:SLEN?
Dependencies/Couplings	Minimum: Meas Interval / Symbol Rate Maximum: Depends on span
Preset	666.666667E-6
State Saved	Saved in instrument state.
Min	0
Max	9.9E+37
Key Path	Meas Setup, Demod Setup, Burst/Sync Search

Burst Search This key turns on or off burst search

Mode	VSA
Remote Command	[:SENSE] :DDEMod:SYNC:BURSt:STATe OFF ON 0 1 [:SENSE] :DDEMod:SYNC:BURSt:STATe?
Example	DDEM:SYNC:BURS:STAT OFF DDEM:SYNC:BURS:STAT?
Preset	OFF
State Saved	Saved in instrument state.
Key Path	Meas Setup, Demod Setup, Burst/Sync Search

Sync Search This key turns on or off Sync Word search. Sync search lets you use a synchronization pattern to isolate a segment of your signal for display and analysis. The analyzer searches through demodulated data to find your sync pattern, and then uses the Result Length to determine how much data to display and the Search Offset to display data relative to the sync pattern.

Note that the sync pattern must be a multiple of the number of bits-per-symbol. For example, if the number of bits-per-symbol is 4 (as with 16 QAM), then the number of bits in the sync pattern must be a multiple of four. Sync search lets you specify any number of bits for the sync pattern; however, bits that are not a multiple of the bits-per-symbol are truncated.

Mode	VSA
Remote Command	[:SENSE] :DDEMod:SYNC:SWORd:STATe OFF ON 0 1 [:SENSE] :DDEMod:SYNC:SWORd:STATe?
Example	DDEM:SYNC:SWOR:STAT OFF DDEM:SYNC:SWOR:STAT?
Preset	OFF
State Saved	Saved in instrument state.
Key Path	Meas Setup, Demod Setup, Burst/Sync Search

Sync Pattern This allows you to define a bit pattern for the sync word search. The maximum length of the pattern is 32 symbols. When you press this key, an editor dialog appears that allows you to define the pattern in binary or hexadecimal.

The analyzer can only search for search patterns that are a multiple of the number of bits-per-symbol. The analyzer assembles the bits in the search pattern into an integer number of symbols, ignoring any trailing bits that cannot complete a full symbol.

For example, if the number of bits-per-symbol is 4 (as with 16 QAM), and your search pattern contains 18 bits, the analyzer only uses the first 16 bits during sync search and ignores the last two bits.

Although the underlying sync pattern is binary, the editor allows you to enter bit patterns in either binary or hexadecimal.

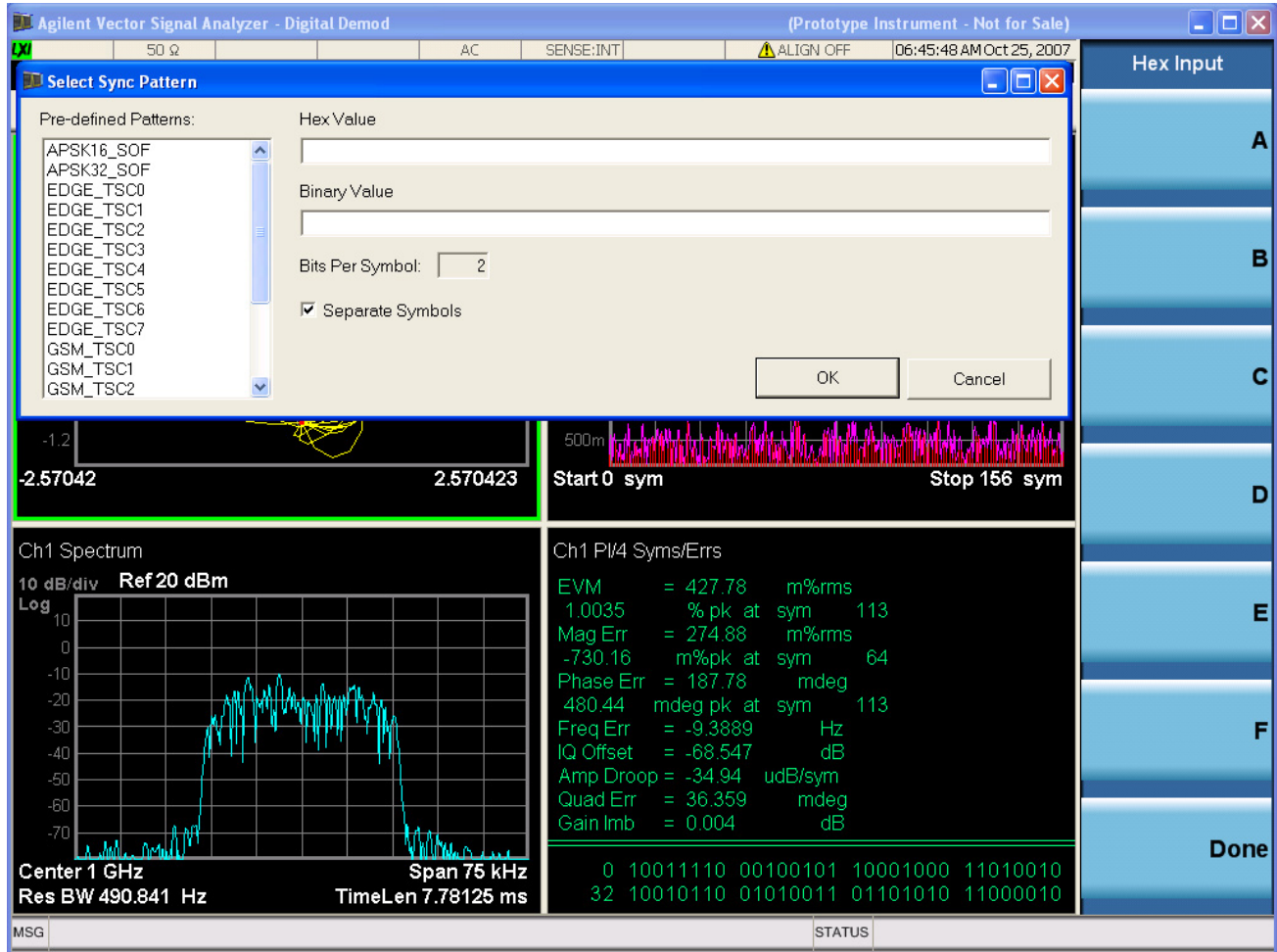
Hexadecimal entries are in symbol table hex format. In this format, each symbol is represented by 1 to 3 hex digits. The least significant bits are used to make up the symbol and any extra bits are ignored. Thus, for 6 bits per symbol, the binary value of 101101 is encoded in hex as 2D. If you entered AD as the symbol value, it would be converted to the same binary value as 2D would, because the upper 2 bits would be ignored. 3-bit-wide symbols are represented by 1 hex digit with the most significant bit ignored.

Predefined sync patterns are available for GSM/EDGE and APSK. If you choose one of these formats from the list, it populates the sync pattern hex and binary text boxes with their predefined value.

When Separate Symbols is turned on, spaces appear between symbols in the binary representation.

You can navigate around the dialog without needing a mouse. Pressing tab right and tab left move you from one control to the next. Arrow keys and the knob can be used to navigate within a list or editing box. The space key will toggle the Separate Symbols check box on and off. Softkeys and the numeric entry keys are used to enter patterns. Press Select or Done to complete the entry. Cancel or Return returns exits the dialog without changing the pattern.

Digital Demod (Option AYA)
Meas Setup



Mode	VSA
Remote Command	<code>[:SENSE] :DDEMod:SYNC:SWOR:PATtern <string></code> <code>[:SENSE] :DDEMod:SYNC:SWOR:PATtern?</code>
Example	<code>DDEM:SYNC:SWOR:PATT '1011010'</code> <code>DDEM:SYNC:SWOR:PATT?</code>
Notes	<string> must be a string of 1s and 0s only. The maximum string length is 320 bits.
Preset	<code>=""</code>
State Saved	Saved in instrument state.
Key Path	Meas Setup, Demod Setup, Burst/Sync Search

Sync Offset This key specifies the time (in symbols) between the start of the measurement

data and the start of the sync word. If positive, the sync word starts after the start of the measurement data. If negative, the sync word starts before the start of the measurement data.

The minimum and maximum offsets you can enter depend on these parameters:

- Search Length
- Result Length
- Sync Pattern

Basically, you can enter any offset such that the result length falls within the search length. Increasing any of these parameters affects the maximum positive or negative offset that you can enter as follows:

Increasing search length increases the maximum positive or negative offset that you can enter.

Increasing result length decreases the maximum negative offset that you can enter but has no effect on the maximum positive offset.

Increasing the length of the sync pattern decreases the maximum positive offset that you can enter but has no effect on the maximum negative offset.

Mode	VSA
Remote Command	[:SENSe] :DDEMod:SYNC:SWOR:OFFSet <integer> [:SENSe] :DDEMod:SYNC:SWOR:OFFSet?
Example	DDEM:SYNC:SWOR:OFFS -3 DDEM:SYNC:SWOR:OFFS?
Dependencies/Couplings	Max and min constrained by Search Length, Sync Pattern length
Preset	0
State Saved	Saved in instrument state.
Min	see coupling
Max	see coupling
Key Path	Meas Setup, Demod Setup, Burst/Sync Search

Advanced Dig Demod

This key displays a menu that allows you to select advanced demodulation parameters for the current measurement. These settings are for advanced users and do not normally

require adjustment for most common measurements.

Mode	VSA
Key Path	Meas Setup, Demod Setup

Clock Adjust This key allows you to adjust symbol clock timing in fractions of a symbol. The adjustment is relative to the symbol clock time that is computed by the demodulation algorithm. Some digital communications systems contain nonlinearities that can bias the digital demodulator's estimation of the symbol clock position. You can use clock adjust to compensate for this offset and obtain a lower EVM (Error Vector Magnitude).

Specifying a clock adjust only affects the I/Q measured trace. It does not affect the I/Q reference trace.

Use the eye diagram with an eye length of one (1) to observe the accuracy of the symbol clock timing. You may also want to monitor the EVM (Error Vector Magnitude) in the symbol table summary while adjusting clock adjust to obtain the optimum symbol timing.

Clock adjust is reset to 0.0 on power-up or when you select Preset.

Mode	VSA
Remote Command	<code>[[:SENSE]:DDEMod:CADJust <real></code> <code>[[:SENSE]:DDEMod:CADJust?</code>
Example	<code>DDEM:CADJ 0.14</code> <code>DDEM:CADJ?</code>
Notes	The parameter is interpreted as a fraction of a sample
Preset	0
State Saved	Saved in instrument state.
Min	-0.5
Max	0.5
Key Path	Meas Setup, Advanced Dig Demod

IQ Rotation This rotates the Meas/Ref Time data and corresponding ideal state positions

by a user defined amount ranging from –360 degrees to 360 degrees. The Rotation parameter affects the IQ Gain Imbalance and Quadrature Skew error data results.

Mode	VSA
Remote Command	:CALCulate:DDEMod:IQRotation <real> :CALCulate:DDEMod:IQRotation?
Example	CALC:DDEM:IQR 45 CALC:DDEM:IQR?
Notes	The numeric parameter is interpreted as degrees.
Preset	0
State Saved	Saved in instrument state.
Min	–360
Max	360
Key Path	Meas Setup, Advanced Dig Demod

IQ Normalize Turns IQ Normalize on and off. When IQ Normalize is on, the Meas Time and Ref Time data is normalized so the extreme points have a value of 1. For quadrature modulation types, the outermost points of the constellation are normalized to 1. (Note, for non-square QAM constellation, the points that appear at the corners of the containing square are normalized to 1.) For FSK constellations, the deviation is normalized to 1.

When IQ Normalize is turned off, the actual data values based on the input signal level are plotted on the constellation.

When normalization is ON, the analyzer normalizes or scales the demodulated trace data results to a nominal value of 1. Normalization is performed on these traces:

IQ measured time for Digital, WLAN-OFDM, WLAN-DSSS/CCK/PBSS, WCDMA, cdma2000, TD-SCDMA and 1xEV-DO demodulation.

IQ reference time for Digital, WLAN-OFDM, WLAN-DSSS/CCK/PBSS, WCDMA, cdma2000, TD-SCDMA and 1xEV-DO demodulation.

Error vector time

FSK measured time (FSK measurements)

FSK measured reference (FSK measurements)

Carrier error magnitude (FSK measurements)

FSK error (FSK measurements)

CDP and CDE measurements for W-CDMA, cdma2000 1xEV-DO and TD-SCDMA demodulation)

Mode	VSA
Remote Command	:CALCulate:DDEMod:NORMalize OFF ON 0 1 :CALCulate:DDEMod:NORMalize:?
Example	CALC:DDEM:NORM ON CALC:DDEM:NORM?
Preset	ON
State Saved	Saved in instrument state.
Key Path	Meas Setup, Advanced Dig Demod

APSK R2 / R1 This allows you to specify the expected ratio between the two inner rings for APSK modulation formats.

APSK R2 / R1 determines the Ring 2 to Ring 1 ratio for APSK format measurements.

The ring ratio is the ratio of the magnitude of symbol states on a ring (R2) to the magnitude of symbol states on the inner ring (R1). R2 / R1 is a valid parameter for both 16 APSK and 32 APSK format measurements.

Mode	VSA
Remote Command	[:SENSe]:DDEMod:APSK:R2Ratio <real> [:SENSe]:DDEMod:APSK:R2Ratio?
Example	DDEM:APSK:R2R 3 DDEM:APSK:R2R?
Notes	Affects the position of the ideal state indicators on constellation diagrams
Preset	2.84
State Saved	Saved in instrument state.
Min	1.25
Max	8

Key Path **Meas Setup, Advanced Dig Demod**

APSK R3 / R1 This allows you to specify the expected ratio between the outer and inner rings for APSK32 modulation formats.

APSK R3 / R1 determines the Ring 3 to Ring 1 ratio for APSK format measurements.

The ring ratio is the ratio of the magnitude of symbol states on a ring (R3) to the magnitude of symbol states on the inner ring (R1). R3 / R1 is a valid parameter only for 32 APSK format measurements.

Mode	VSA
Remote Command	[:SENSe] :DDEMod:APSK:R3Ratio <real> [:SENSe] :DDEMod:APSK:R3Ratio?
Example	DDEM:APSK:R3R 5 DDEM:APSK:R3R?
Notes	Affects the position of the ideal state indicators on constellation diagrams
Preset	5.27
State Saved	Saved in instrument state.
Min	1.5625
Max	10
Key Path	Meas Setup, Advanced Dig Demod

Low SNR Enhancement Enhances the ability of the demodulator to lock on to signals with low SNR. This process reduces the frequency lock range and enables additional filtering. This filtering allows the demodulator to lock in the presence of more. To compensate for the smaller frequency lock range, the frequency estimate is tracked from measurement to measurement. An exponential average is used and the output of this average becomes the starting point for the next frequency estimate for the next measurement.

This enhancement is only available for the following modulation formats:

- All QAM and DVB QAM formats
- BPSK, QPSK, and 8PSK

- All APSK (amplitude/phase shift keying) and DVB APSK formats
- EDGE

Mode	VSA
Remote Command	<code>[:SENSe] :DDEMod:LSNR OFF ON 0 1</code> <code>[:SENSe] :DDEMod:LSNR?</code>
Example	DDEM:LSNR OFF DDEM:LSNR?
Notes	Softkey is greyed out for formats not supported.
Preset	OFF
State Saved	Saved in instrument state.
Key Path	Meas Setup, Advanced Dig Demod

Adaptive Equalizer Setup

This key displays a menu that allows you to select Adaptive Equalizer parameters for the current measurement. Adaptive equalization removes linear errors from modulated signals by dynamically creating and applying a FIR (feed-forward) compensating filter. Linear errors can come from filters in a transmitter or receiver's IF, or from the presence of multiple paths in the transmission path, such as reflections in a cable system. These types of problems appear as group-delay distortion, frequency-response errors (tilt, ripple), and reflections or multipath distortion.

Equalization allows measurement of some impaired channels and can be used to isolate linear from nonlinear error mechanisms. Equalization does not require symbol lock or prior knowledge of the signal (such as a training sequence) and is compatible with recorded data.

By default, the equalization filter has a unit impulse response which yields a flat frequency response (only one tap in the filter has a non-zero value and data simply passes through the filter). The position of the unit impulse is a function of the filter length and is positioned to provide the most optimum efficiency for most situations. The position cannot be adjusted.

The equalization filter has a unit impulse response when you:

- first run the application
- reset the equalizer filter
- change points/symbol.

- change the measured or reference filter
- change the symbol rate
- change the clock delay adjustment
- change the equalizer filter length
- preset the application

Aside from the above conditions, the application uses the last computed coefficients when you enable equalization. For example, if you used equalization in a previous measurement, the application uses the coefficients from the previous measurement unless you select reset the equalization filter or change [points/symbol]. Therefore, it is good practice to reset the equalization filter to initialize the filter coefficients before you start a measurement.

Mode	VSA
Key Path	Meas Setup

Filter

Turns adaptive equalization filter on or off. Adaptive equalization uses the measured signal to determine the coefficients of the equalization filter.

When equalization is on, the equalization filter has a unit impulse response. The length of the filter determines the position of the unit impulse response in the filter. The impulse is located in the center of the filter for short filter lengths. As the filter length increases, the impulse moves, proportionally, towards the start of the filter to handle channels with large delay-spread.

If Adaptive is set to run, the analyzer uses the results of the current measurement to update the filter coefficients for the next measurement. The analyzer chooses coefficients that produce a modulation quality metric that is less impacted by the presence of linear distortion.

If Adaptive is set to hold, the analyzer does not update the filter coefficients. Instead, the analyzer uses the last updated coefficients before selecting hold.

You can select run or hold at any time to continue or stop updating filter coefficients.

Note that the analyzer does not redefine the equalization filter to have a unit impulse response when you select run or when you turn the equalization filter off and then on instead, the analyzer uses the last updated filter coefficients.

Equalization is applied to time-domain data. To see where equalization is applied, see the block diagram for [Digital Demodulation] in this block diagram, equalization is applied in

the time-domain corrections block.

For best results, make sure you select a frequency span that contains all energy of your signal. If significant energy from your signal falls outside of the displayed frequency span, equalization will not work on your signal.

You can define the length of the equalization filter (in symbols) and set the convergence (convergence determines the size of the steps used to reshape the equalization filter). For additional details about these parameters, see online help for convergence and filter length.

You can use equalization with pulse search and sync search. Note, however, that the adaptive equalizer does not update the filter coefficients when a "Pulse Not Found" condition exists. In other words, if pulse search is on and the measurement results in a "pulse not found" message, the results of that measurement will not affect the equalization filter coefficients. The same is true if sync search is on and the measurement results in a "SYNC NOT FOUND" message.

The following parameters affect measurement speed when using adaptive equalization:

- result length
- filter length (for the equalization filter)
- points/symbol

Mode	VSA
Remote Command	<code>[[:SENSe]:DDEMod:EQUalization:STATe OFF ON 0 1</code> <code>[[:SENSe]:DDEMod:EQUalization:STATe?</code>
Example	<code>DDEM:EQU:STAT ON</code> <code>DDEM:EQU:STAT?</code>
Preset	OFF
State Saved	Saved in instrument state.
Key Path	Meas Setup, Adaptive Equalizer Setup

Filter Length

Sets the length (in symbols) of the for the analyzer's equalization filter.

In general, the best filter length is the smallest that meets your measurement requirements. For measurements at the transmitter, the filter length may only need to be a few symbols in length. Longer filter lengths may be needed to measure multi-path environments.

The filter length also determines the placement of the impulse response in the equalization filter. For longer filter lengths, the analyzer puts the initial, unit impulse response closer to the beginning of the time record to accommodate multi-path measurements, as follows:

Filter Length (symbol)	Unit Impulse Response Position (symbol)
3 to 31	$(\text{length} - 1)/2$
31 to 75	15
75 to 99	$(\text{length})/5$

For example, if the filter length is 11, the unit impulse response is positioned at symbol 5. If the filter length is 35, the unit impulse response is positioned at symbol 15.

Mode	VSA
Remote Command	<code>[:SENSe] :DDEMod :EQUalization :FLENgth <integer></code> <code>[:SENSe] :DDEMod :EQUalization :FLENgth?</code>
Example	<code>DDEM:EQU:FLEN 31</code> <code>DDEM:EQU:FLEN?</code>
Notes	Must be an odd number. If an even number is entered, it is rounded up to the next odd.
Preset	21
State Saved	Saved in instrument state.
Min	3
Max	99
Key Path	Meas Setup, Adaptive Equalizer Setup

Convergence

Sets the adaptive filter convergence factor higher to converge faster. Note that too high a

value can cause the filter to not converge. Set convergence factor smaller for better accuracy.

Mode	VSA
Remote Command	<code>[[:SENSe]:DDEMod:EQUalization:CONVergence <real></code> <code>[[:SENSe]:DDEMod:EQUalization:CONVergence?</code>
Example	DDEM:EQU:CONV 2 DDEM:EQU:CONV?
Preset	1
State Saved	Saved in instrument state.
Min	0
Max	10000000
Key Path	Meas Setup, Adaptive Equalizer Setup

Hold

Turns the filter coefficient updates on or off. Normally the adaptation algorithm updates the filter coefficients after each scan. When Hold is on, the coefficients of the equalization filter are frozen, that is., the adaptive filter becomes fixed. When you turn Hold off again, the coefficients are again allowed to adapt, starting from where they currently are.

Mode	VSA
Remote Command	<code>[[:SENSe]:DDEMod:EQUalization:HOLD OFF ON 0 1</code> <code>[[:SENSe]:DDEMod:EQUalization:HOLD?</code>
Example	DDEM:EQU:HOLD ON DDEM:EQU:HOLD?
Preset	OFF
State Saved	Saved in instrument state.
Key Path	Meas Setup, Adaptive Equalizer Setup

Reset Filter Coefficients

This function resets the adaptive filter coefficients to 1.

Mode	VSA
Remote Command	[:SENSe] :DDEMod:EQUalization:RESet
Example	DDEM:EQU:RES
Key Path	Meas Setup, Adaptive Equalizer Setup

Preset to Standard

This key allows you to preset Digital Demod Setup parameters and Span to measure a wide variety of standard digital communications formats. Preset to Standard does not constrain you from afterward making any possible adjustment to measurement parameters. The following standard presets are available:

- Cellular: IS-95 Base and Mobile, GSM, EDGE, CDPD, NADC, PDC, PHP, 3GPP (W-CDMA)
- Wireless Networking: 802.11b, HIPERLAN/1 (HBR and LBR), Bluetooth, ZigBee 868, 915, and 2450
- Digital Video: DTV8, DTV16, DVB16, DVB32, DVB64, DVB128, DVB256, DVB 16APSK with code rates 2/3 to 9/10, DVB 32 APSK with code rates 3/4 to 9/10.
- Other: APCO 25, DECT, TETRA, VDL Mode 3

Mode	VSA
Remote Command	[:SENSe] :DDEMod:STANdard:PRESet CDMABTS CDMAMS CDPD EDGE GSM NADC PDC PHS WCDMA BLUETOOTH HIPERLANHBR HIPERLANLBR WLAN11B ZIGBEE2450 ZIGBEE868 ZIGBEE915 DTV8 DTV16 DVB16 DVB32 DVB64 DVB128 DVB256 DVB16APSK23 DVB16APSK34 DVB16APSK45 DVB16APSK56 DVB16APSK89 DVB16APSK910 DVB32APSK34 DVB32APSK45 DVB32APSK56 DVB32APSK89 DVB32APSK910 APCO DECT TETRA VDL3
Example	DDEM:STAN:PRES CDMABTS
Key Path	Meas Setup

Meas Preset

This key performs the same function as Meas Setup, Preset to Standard, W-CDMA. For more information, see the section under the Preset key in the Utility section.

Mode	VSA
Key Path	Meas Setup

Sweep/Control

This key provides a menu that allows you to select Sweep/Control parameters for the current measurement.

For more information see: Measurement Functions, Sweep/Control

Mode	VSA
Key Path	Meas Setup

AMPTD Y Scale

This key displays a menu that allows you to select amplitude or Y-scale parameters for the current measurement.

For more information see: Analyzer Setup Functions, AMPTD Y-Scale

Mode	VSA
Key Path	Front Panel

Attenuation

Attenuation functionality is not available for this measurement.

Key Path	AMPTD Y Scale
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Internal Preamp

Internal Preamplifier functionality is not available for this measurement.

Key Path	AMPTD Y Scale
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Auto Couple

The Auto Couple key forces all Auto / Man functions into Auto. These include the following functions. Other measurement specific functions will be listed in their individual PDs. Note that this key does not invoke the Auto tune function, nor does it cause any Y autoscaling or Input Auto ranging.

- Frequency Step
- X Scale
- Y Axis Unit Preference
- Frequency Points
- Playback Start/Stop

For more information see: Analyzer Setup Functions, Auto Couple

Mode	VSA
Key Path	Front Panel

BW

The BW key displays a menu that allows you to set the FFT Window for the spectrum measurement result. All other softkeys are unavailable (greyed out) for this measurement.

For more information see: Analyzer Setup Functions, BW

Mode	VSA
Key Path	Front Panel

FFT Window

This key allows you to choose the Window function that is applied to the time data prior to the FFT calculation used for Spectrum, Error Vector Spectrum, IQ Meas Spectrum, and IQ Ref Spectrum results.

For more information see: Analyzer Setup Functions, BW, FFT Window

Mode	VSA
Key Path	BW

FREQ Channel

This key displays a menu that allows control over the Center, Start, or Stop Frequency settings.

The maximum allowed span (Stop Freq – Start Freq) is coupled to symbol rate. See Symbol rate for more information.

For more information see: Analyzer Setup Functions, FREQ Channel

Mode	VSA
Key Path	Front Panel

Input/Output

This key displays a menu that allows you to select input/output parameters for the measurement data.

For more information see: Analyzer Setup Functions, Input/Output

Mode	VSA
Key Path	Front Panel

Source

This key displays a menu that allows you to select source parameters for the current measurement.

For more information see: Analyzer Setup Functions, Source

Mode	VSA
Key Path	Front Panel

SPAN X Scale

This key displays a menu that allows you to select span or X-scale parameters for the current measurement.

Maximum span is coupled to symbol rate. See Symbol rate for more information.

For more information see: Analyzer Setup Functions, SPAN X-Scale

Mode	VSA
Key Path	Front Panel

Trace/Detector

This section details the trace results accessible via the Data softkey and also via SCPI. Note that when the modulation format is one of the FSK types, the available trace data results are different.

For more information, see Analyzer Setup, [Trace/Detector on page 226](#).

Mode	VSA
Key Path	Front Panel

Select Trace

This key provides access to a menu that allows you to select a trace for the current measurement.

For more information, see Analyzer Setup, Trace/detector, [Select Trace on page 226](#).

Mode	VSA
Key Path	Trace/Detector

Data

This key displays a menu of trace data choices for the selected trace.

For more information, see Analyzer Setup, Trace/detector, [Data on page 228](#).

The following trace data results are available for all modulation formats but FSK:

Table 8-1

Trace data soft key name	SCPI string form	Description
Spectrum	"Spectrum1"	Averaged result of successive Inst Spectrum results (If RMS or Max averaging is on). Otherwise, FFT of current windowed Main (or Gate) Time

Table 8-1

Trace data soft key name	SCPI string form	Description
Inst Spectrum	"Inst Spectrum1"	Instantaneous Spectrum is the FFT of the current windowed Main (or Gate) Time. It is instantaneous in the sense that it isn't rms averaged, but it may include time-averaged data.
Search Time	"Search Time1"	Entire time data (after corrections) that will be searched (when Burst search or Sync search is on).
Time	"Time1"	Time data used as input to demodulation. If Burst or Sync search is on, this is the time data that fulfills the search criteria.
Raw Main Time	"Raw Main Time1"	Time record as it comes from the hardware, before software resampling or corrections
IQ Meas Time	"IQ Meas Time1"	Demodulated Time Trace
IQ Meas Spectrum	"IQ Meas Spec1"	Averaged result of successive Inst IQ Meas Spectrum if RMS or Max averaging is on. Otherwise, same as Inst IQ Meas Spectrum
Inst IQ Meas Spectrum	"Inst IQ Meas Spec1"	Instantaneous (not averaged) FFT of current IQ Meas Time
IQ Ref Time	"IQ Ref Time1"	Reconstructed ideal time waveform to compare IQ Meas Time against
IQ Ref Spectrum	"IQ Ref Spec1"	Averaged result of successive Inst IQ Ref Spectrum if RMS or Max averaging is on. Otherwise, same as Inst IQ Ref Spectrum
Inst IQ Ref Spectrum	"Inst IQ Ref Spec1"	Instantaneous (not averaged) FFT of IQ Ref Time
Error Vector Time	"Error Vector Time1"	Vector difference between IQ Meas Time and IQ Ref Time at each point in time.
Error Vector Spectrum	"Error Vector Spec1"	Averaged result of Inst Error Vector Spectrum if RMS or Max averaging is on. Otherwise, same as Inst Error Vector Spectrum.
Inst Error Vector Spectrum	"Inst Err Vect Spec1"	FFT of Error Vector Time
IQ Mag Error	"IQ Mag Error1"	Difference in length of the IQ Meas Time vector and IQ Ref Time vector at each point in time. Expressed as a % of Ref Time length.
IQ Phase Error	"IQ Phase Error1"	Difference in phase of the IQ Meas Time vector and IQ Ref Time vector at each point in time.

Table 8-1

Trace data soft key name	SCPI string form	Description
Equalizer Impulse Response	"Eq Impulse Response1"	Impulse response of the adaptive equalizer (no data is available if equalizer is off)
Channel Frequency Response	"Ch Frequency Response1"	FFT of Equalizer Freq Response
Symbols/Errors	"Syms/Errs1"	Shows table of error statistics and a listing of symbol data. Only symbol results can be obtained using CALC:DDEM:DATA (see Table Data for how to retrieve tabular results).
No Data	"No Data"	Blank Trace

If the modulation format is FSK, then the following replace the IQ measurement and reference time and spectrum data, and error vector magnitude data:

Table 8-2

Trace data soft key name	SCPI string form	Description
FSK Meas Time	"FSK Meas Time1"	Demodulated Time Trace
FSK Meas Spectrum	"FSK Meas Spec1"	Averaged result of successive Inst FSK Meas Spectrum if RMS or Max averaging is on. Otherwise, same as Inst FSK Meas Spectrum
Inst FSK Meas Spectrum	"Inst FSK Meas Spec1"	Instantaneous (not averaged) FFT of FSK Meas Time
FSK Ref Time	"FSK Ref Time1"	Reconstructed ideal time waveform to compare FSK Meas Time against
FSK Ref Spectrum	"FSK Ref Spec1"	Averaged result of successive Inst FSK Ref Spectrum if RMS or Max averaging is on. Otherwise, same as Inst FSK Ref Spectrum
Inst FSK Ref Spectrum	"Inst FSK Ref Spec1"	Instantaneous (not averaged) FFT of FSK Ref Time
FSK Error Time	"FSK Error Time1"	Difference between FSK Meas Time and FSK Ref Time at each point in time.
FSK Error Spectrum	"FSK Error Spec1"	Averaged result of successive Inst FSK Error Spectrum if RMS or Max averaging is on. Otherwise, same as Inst FSK Error Spectrum.

Table 8-2

Trace data soft key name	SCPI string form	Description
Inst FSK Error Spectrum	"Inst FSK Err Spec1"	Instantaneous (not averaged) FFT of FSK Error Spectrum
Carrier Mag Error	"Carrier Mag Error1"	Amplitude error of carrier, relative to average amplitude.

The following Trace Data types are available in all measurements:

Table 8-3

Soft Key Name	SCPI string form
No Data	"No Data"
Spectrum	"Spectrum1"
Inst Spectrum	"Inst Spectrum1"
Raw Main Time	"Raw Main Time1"
OBW Summary Trace 1	"OBW Summary Trc1"
OBW Summary Trace 2	"OBW Summary Trc2"
OBW Summary Trace 3	"OBW Summary Trc3"
OBW Summary Trace 4	"OBW Summary Trc4"
ACP Summary Trace 1	"ACP Summary Trc1"
ACP Summary Trace 2	" ACP Summary Trc2"
ACP Summary Trace 3	" ACP Summary Trc3"
ACP Summary Trace 4	" ACP Summary Trc4"

For more information see: Analyzer Setup Functions, Trace/Detector, Data

Mode VSA
Key Path Trace/Detector

Table 8-4

Result name	Available in Demod Format:	Displayed Unit	Remote Name	Remote Unit
Phase error (peak)	All but FSK	deg	PhaseErrPeak	deg
Phase error (peak) symbol number	All but FSK		PhaseErrPeak Sym	
Frequency Error	All but FSK	Hz	FreqErr	Hz
Carrier Offset	FSK	Hz	FskCarrOffs	Hz
SNR(MER)	QPSK, QAM, APSK, VSB	dB	SigToNoise	dB
FSK Deviation	FSK	Hz	FskDev	Hz
Pilot Level	8VSB	dB	PilotLevel	dB
TimeOffset	APSK (triggered)	s	TimeOffset	s
IQ Offset	All but FSK or VSB	dB	IqOffset	dB
Amplitude Droop	MSK2, PSK (except QPSK, OQPSK)	dB/sym	AmpDroop	dB/sym
Rho	QPSK, OQPSK		Rho	
Quadrature Error	All but BPSK, VSB, FSK	deg	QuadErr	deg
IQ Gain Imbalance	All but BPSK, VSB, FSK	dB	IqGainImbalance	dB
Ring2 to Ring1 Ratio	APSK		R2Ratio	
Ring3 to Ring1 Ratio	APSK32		R3Ratio	
Peak EVM (rms)	EDGE	%	PeakEvmRms	%
95% EVM	EDGE	%	NinetyFivePercentEvm	%

Mode

VSA

Key Path

Trace/Detector

Marker

The Marker key displays the Marker menu. A marker can be placed on a trace to allow the value of the trace data at the marker position to be determined precisely. Markers may also be used in pairs to read the difference (or delta) between two data points. They can also be used to make power calculation over a band of frequencies or a time interval. See Marker Functions below for more details.

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 control mode is described below.

Pressing Marker always makes the selected maker's X position the active function.

If the currently selected marker is Off, pressing Marker sets it to Normal mode and places it at the center of the screen on the currently selected trace.

As a convenience, if there are no markers displayed on the current trace, pressing the marker hardkey (whenever the marker menu is already showing) selects the lowest numbered marker that is currently off and turns it on in normal mode on the selected trace. In other words, pressing the Marker hardkey twice will always turn on a marker on the selected trace if none was turned on before.

For more information see the Analyzer Setup, Marker for a description of this function.

Mode	VSA
Key Path	Front Panel

Marker Fctn (Function)

This key provides access to a menu that allows you to select marker functions for the current measurement.

For more information see: Analyzer Setup Functions, marker Fctn

Mode	VSA
Key Path	Front Panel

Marker To

The Marker -> hardkey provides access to some convenient functions for copying the marker position to a number of frequency and Y-axis scaling parameters. These functions are available from the front panel only. No SCPI is provided, because you can already read the marker position via SCPI and then set any frequency or scaling parameter accordingly, with full accuracy.

Pressing the Marker -> hardkey always makes the selected marker's X position the active function.

If the selected marker is off, pressing the Marker -> hardkey turns on the selected marker in normal mode on the currently selected trace. For more information see: Analyzer Setup Functions, Marker To

Mode	VSA
Key Path	Front Panel

Peak Search

The Peak Search hardkey displays a menu that allows markers to be easily moved among peaks on a trace. It also is used to perform the Peak Search function, as described below. Pressing Peak Search also makes the selected marker's X position the active function. For more information see: Analyzer Setup Functions, Peak Search

Mode	VSA
Key Path	Front Panel

This key selects the VSA WLAN OFDM measurement.

Mode	VSA
Key Path	Meas

```
:CONFigure:W11A
:CONFigure:W11A:NDEFault
:FETCh:W11A[n]?
:INITiate:W11A
:MEASure:W11A[n]?
:READ:W11A[n]?
```

This standard remote result is also available thru the CALC:DATA<n> set of queries, where <n> is a reference to the trace number. The results assigned to each trace vary depending on which tests are enabled. As an example, with the default trace layout, these results in the Error Summary results are returned by CALC:W11A:DATA4:TABLE? See Common Functions, Data Queries, CALCulate:DATA for more details.

The following table denotes the VSA WLAN OFDM specific results returned from the (FETCh | MEASure | READ):W11A commands, and their corresponding CALC:DATA queries, indexed by subopcode.

Note that valid results are only returned if the Symbols/Errors trace is being computed. It must be selected though it is not necessary for it to be shown in the current Layout.

NOTE: For Trace Data SCPI commands and remote results see **Help** for the **MEAS** key.

Results table (with subopcodes):

Table 9-1

N	Results Returned
---	------------------

Table 9-1

Not specified or n=1	<p>Returns 22 comma-separated scalar results, corresponding exactly to the items returned in the Error Summary:</p> <ol style="list-style-type: none"> 1. EVM (dB) 2. EVM (% rms) 3. Pilot EVM (dB) 4. CPE (%) 5. Frequency Error (Hz) 6. IQ Offset (dB) 7. IQ Quadrature Error (deg) 8. IQ Gain Imbalance (dB) 9. Sync Correlation (1.0 = ideal) 10. Symbol Clock Error (ppm) 11. Modulation Format 12. Octets (bytes) 13. Symbols 14. Code Rate (ratio) 15. Bit Rate (bps) <p>If the results are not available, NaN (9.91e37) is returned.</p>
-------------------------	---

NOTE: For Trace Data SCPI commands and remote results see Help for the MEAS key.

Modulation Format enumerations:

Table 9-2

Enumeration	Meaning
0	Unknown
1	BPSK
2	QPSK
4	16QAM
6	64QAM

View/Display

The view setup can be changed by selections from the View/Display menu, including by pressing View Preset: Basic.

Mode	VSA
Key Path	Front-panel key

Preset View

Mode	VSA
Remote Command	:DISPlay:W11A:VIEW:PRESet BASic EVM POWer DIAGnostic
Example	DISP:W11A:VIEW:PRES BAS
Key Path	(SCPI only)

Preset View: Basic

This preset view consists of the following traces in a Grid 2x2 layout:

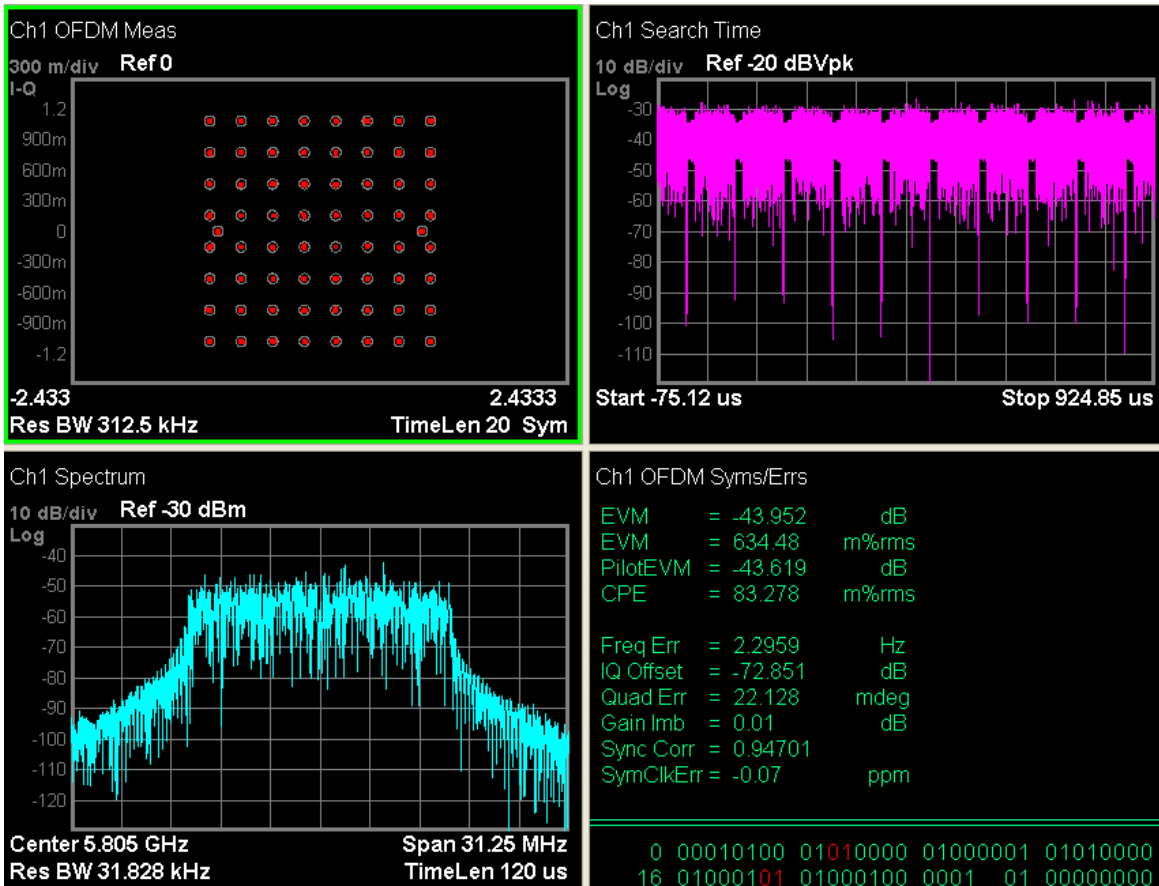
1. IQ Meas Time in I-Q format
2. Spectrum in Log Mag (dB) format
3. Search Time in Log Mag (dB) format
4. Symbols/Errors

The Preset View: Basic softkey does an immediate action of changing the layout and view to this state. This Preset View is an action, not a state.

This layout is the layout set by Meas Preset and is good for insuring that the signal is being demodulated correctly, as well as giving visibility to many basic demodulation setup problems.

Mode	VSA
Remote Command	:DISPlay:W11A:VIEW:PRESet BASic

Example DISP:W11A:VIEW:PRES BAS
Key Path View/Display



Preset View: EVM

This preset view consists of the following traces in a Stacked layout:

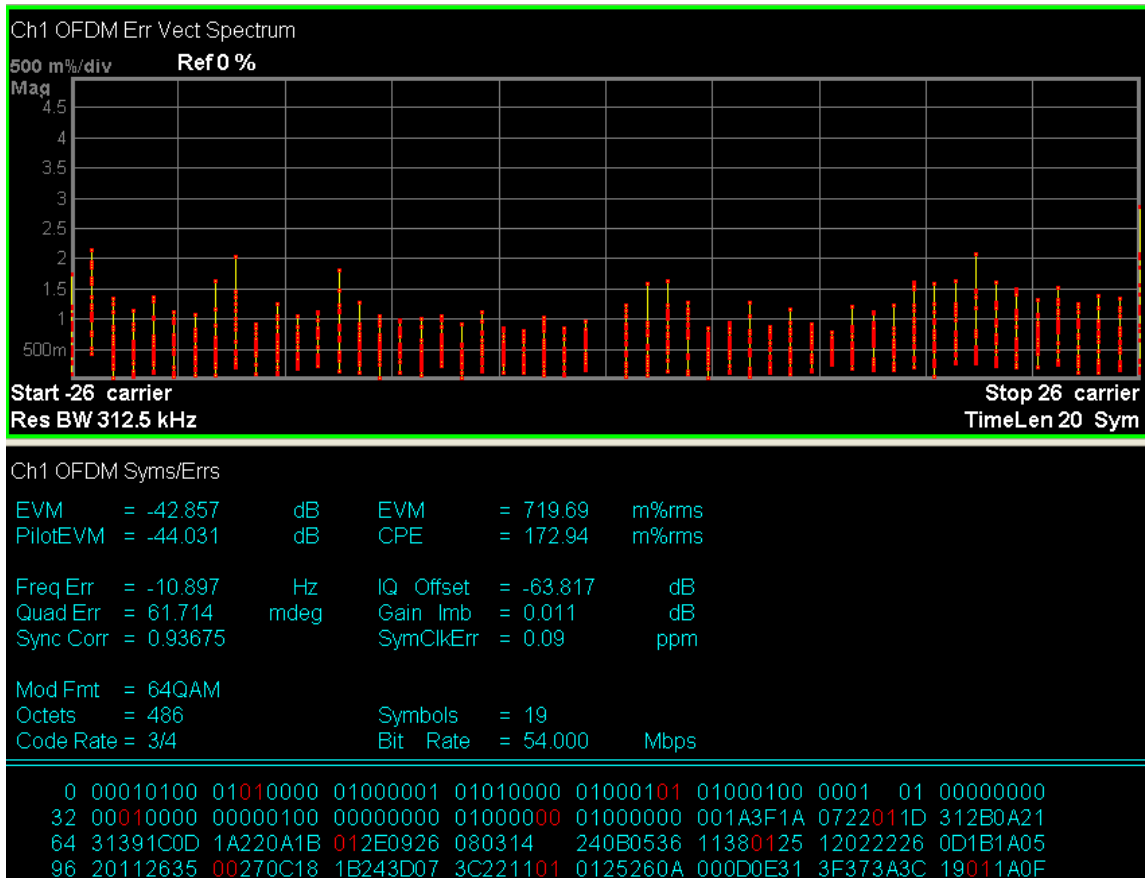
1. Error Vector Spectrum in Linear Mag format
2. Symbols/Errors

This layout is for more detailed EVM analysis.

The Preset View: EVM softkey does an immediate action of changing the layout and view to this state. This Preset View is an action, not a state.

Mode VSA
Remote Command :DISPlay:W11A:VIEW:PRESet EVM

Example DISP:W11A:VIEW:PRES EVM
Key Path View/Display



Preset View: Power

This preset view consists of the following traces in a Grid 2x2 layout:

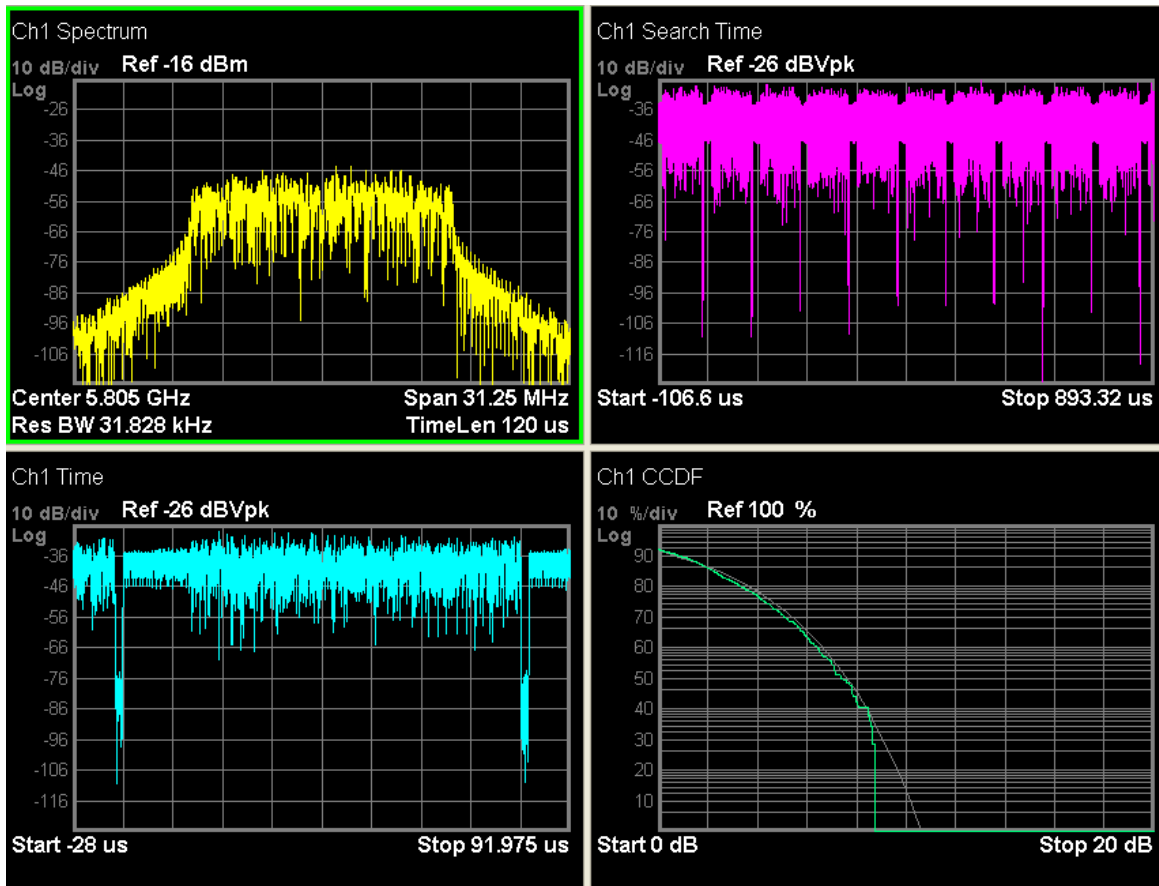
1. Spectrum in Log Mag (dB) format
2. Time in Log Mag (dB) format
3. Search Time in Log Mag (dB) format
4. CCDF in Log Mag (Linear Unit) format

This layout is oriented towards examining the signal in the Time and Power domain.

The Preset View: Basic softkey does an immediate action of changing the layout and view

to this state. This Preset View is an action, not a state.

Mode	VSA
Remote Command	:DISPlay:W11A:VIEW:PRESet POWer
Example	DISP:W11A:VIEW:PRES POW
Key Path	View/Display



Preset View: Diagnostic

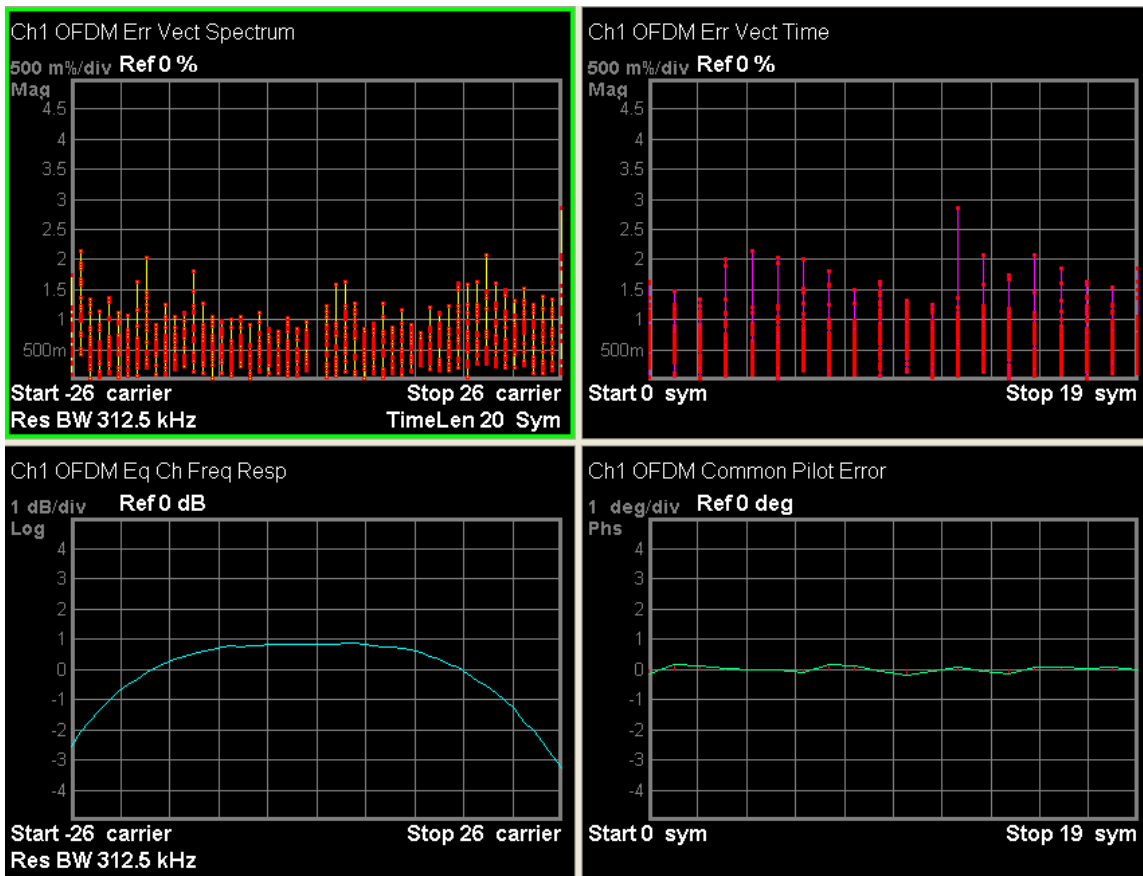
This preset view consists of the following traces in a Grid 2x2 layout:

1. Error Vector Spectrum in Linear Mag format
2. Ch Frequency Response in Log Mag (dB) format
3. Error Vector Time in Linear Mag format
4. Common Pilot Error in Wrap Phase format

This layout is useful for diagnosing modulation impairments and errors.

The Preset View: Basic softkey does an immediate action of changing the layout and view to this state. This Preset View is an action, not a state.

Mode	VSA
Remote Command	:DISPlay:W11A:VIEW:PRESet DIAGnostic
Example	DISP:W11A:VIEW:PRES DIAGnostic
Key Path	View/Display



Meas Setup

This key provides a menu allowing you to select measurement parameters for the current measurement.

Mode	VSA
Key Path	Front Panel

Avg Number

This key turns averaging on or off and sets the number of time records whose measurement results will be averaged. For more information see Measurement Functions, Meas Setup, Avg Numbe.

Mode	VSA
Key Path	Meas Setup

Averaging applies to a limited set of measurement results in VSA WLAN OFDM. RMS and Max average types apply to the Spectrum and Ch Frequency Response traces. The behavior for these types is the same as in the Vector Analysis Measurement. Averaging of numeric error data in the symbol table is described below:

Average Type	Average Mode	Effects of averaging
RMS, Time	any (single sweep)	After each scan, the Syms/Err table shows a running (linear) average over past scans for each parameter in the table. Peak or position parameters are not averaged. Parameters that appear in the table in dB are converted to linear units in order to average them. The measurement stops after the specified Avg Number of scans.
RMS, Time	repeat (continuous sweep)	Same as above, except that averages are reset after the specified Avg Number of scans, and the measurement continues.
RMS, Time	exponential (continuous sweep)	Same as the single sweep case until the specified Avg Number of scans is complete. After that, averaging continues using exponential weighting.

Max	any	After each scan, compares each parameter in the table with the current scan's value and keeps the maximum. Symbol positions relate to the maximum peak value seen.
-----	-----	--

Average Mode

Average Mode determines what happens if the Sweep Control is in Continuous mode and the number of time records processed exceeds the Average Number (see above). If the Sweep Control is in Single mode, this setting has no effect. For more information see Measurement Functions, Meas Setup, Average Mode.

Mode	VSA
Key Path	Meas Setup

Demod Setup

This key brings up a menu of commonly used demodulation setup parameters.

Mode	VSA
Key Path	Meas Setup

Data Modulation Detect

This key allows you to select whether the data subcarrier modulation format is automatically detected or manually set to the particular modulation format selected by Modulation Format.

Mode	VSA
Remote Command	[:SENSE] :W11A[:SUBCarrier] :DEMod:AUTO OFF ON 0 1 [:SENSE] :W11A[:SUBCarrier] :DEMod:AUTO?
Example	W11A:DEM:AUTO ON
Dependencies/Couplings	Set to Default by Preset to Standard.
Preset	ON

State Saved	Saved in instrument state.
Range	Auto Man
Key Path	Meas Setup, Demod Setup

Modulation Format

This selects the Modulation format used when Data Modulation Detect is set to Manual.

Mode	VSA
Remote Command	<code>[:SENSe] :W11A [:SUBCarrier] :DEMod BPSK QPSK QAM16 QAM64</code> <code>[:SENSe] :W11A [:SUBCarrier] :DEMod?</code>
Example	W11A:DEM BPSK
Dependencies/Couplings	Set to Default by Preset to Standard.
Preset	BPSK
State Saved	Saved in instrument state.
Range	BPSK QPSK 16QAM 64QAM
Key Path	Meas Setup, Demod Setup

BPSK Selects BPSK Data subcarrier Modulation format.

Mode	VSA
Key Path	Meas Setup, Demod Setup, Data Modulation

QAM Selects QAM Data subcarrier Modulation format.

Mode	VSA
Key Path	Meas Setup, Demod Setup, Data Modulation

16QAM Selects 16QAM Data subcarrier Modulation format.

Mode	VSA
Key Path	Meas Setup, Demod Setup, Data Modulation

64QAM Selects 64QAM Data subcarrier Modulation format.

Mode	VSA
Key Path	Meas Setup, Demod Setup, Data Modulation

Guard Interval

The Guard Interval is the ratio of the Cyclic Prefix "CP" time to the inverse FFT time "T(IFFT)."

Mode	VSA
Remote Command	[:SENSe] :W11A:GINTerval <real> [:SENSe] :W11A:GINTerval?
Example	W11A:GINT 0.25
Restriction and Notes	Entries are rounded to the nearest 1/128.
Dependencies/Couplings	Set to Default by Preset to Standard.
Preset	0.25
State Saved	Saved in instrument state.
Min	0.0
Max	1.0
Key Path	Meas Setup, Demod Setup

Preset to Standard

When one of the presets from the menu below this is selected, this immediately sets all measurement parameters to the appropriate values.

When "IEEE 802.11a/g OFDM" is chosen, this is the same as Meas Preset except that the display state is left alone.

In general, this sets all parameters to their Preset values. For the " IEEE 802.11a/g Turbo Mode" and " IEEE 802.11p DSRC" presets choices, these parameters may be different: Span, Sync Training Sequence, Subcarrier Spacing, and Search Length. For all presets, Standard is set. See the descriptions of these individual parameters for details.

About IEEE 802.11g modulation:

The IEEE 802.11g standard defines both single-carrier and OFDM modulation formats. The single-carrier modulation formats are compatible with 802.11b and can be demodulated using the VSA WLAN DSSS measurement.

IEEE 802.11g defines two different OFDM modulation formats. One, which is mandatory in 802.11g, is an exact copy of the 802.11a format except that the carrier frequencies are in the 2.4 GHz band. We refer to this as "IEEE 802.11g OFDM". The other OFDM format is an optional format called DSSS-OFDM that combines an 802.11b-style single-carrier preamble with an 802.11a-style OFDM data payload. We refer to this as "IEEE 802.11g DSSS-OFDM". This measurement can demodulate and analyze either of these OFDM formats.

Mode	VSA
Remote Command	[:SENSe] :W11A:STANdard:PRESet I11AGOFDM HIPERLAN2 I11GDSSSOFDm I11AGTURBO I11PDSRC I11J10MHZ
Example	W11A:STAN:PRES I11AGOFDM
Preset	I11AGOFDM
Range	IEEE 802.11a/g OFDM HIPERLAN/2 IEEE 802.11g DSSS-OFDM IEEE 802.11a/g Turbo Mode IEEE 802.11p DSRC IEEE 802.11j 10 MHz
Key Path	Meas Setup

This table shows the mapping between the names of the selections on the softkey menu and their corresponding SCPI forms.

Preset soft key name	Preset SCPI form
IEEE 802.11a/g OFDM	I11AGOFDM
HIPERLAN/2	HIPERLAN2

IEEE 802.1g DSSS-OFDM	I11GDSSSOFD
IEEE 802.11a/g Turbo Mode	I11AGTURBO
IEEE 802.11p DSRC	I11PDSRC
IEEE 802.11j 10 MHz	I11J10MHZ

IEEE 802.11a/g OFDM

Sets the demodulation preset to IEEE std 802.11a–1999 specification.

Mode	VSA
Key Path	Meas Setup, Preset to Standard

HIPERLAN/2

Sets the demodulation preset to ETSI TS 101 475 V1.2.2 (2001–02) - Broadband Radio Access Networks (BRAN); HIPERLAN Type 2; Physical (PHY) Layer specification.

Mode	VSA
Key Path	Meas Setup, Preset to Standard

IEEE 802.1g DSSS-OFDM

Sets the demodulation preset to IEEE std 802.11g – 2003 specification

Mode	VSA
Key Path	Meas Setup, Preset to Standard

IEEE 802.11a/g Turbo Mode

Sets the demodulation preset to a nonstandard double rate 802.11a.

Mode	VSA
Key Path	Meas Setup, Preset to Standard

IEEE 802.11p DSRC

Sets the demodulation preset to ASTM E2213 – 02 DSRC specification

Mode	VSA
Key Path	Meas Setup, Preset to Standard

IEEE 802.11j 10 MHz

Sets the demodulation preset to IEEE std 802.11j – 2004 specification

Mode	VSA
Key Path	Meas Setup, Preset to Standard

Meas Time

This key brings up a menu consisting of the time length and positioning demodulation setup parameters.

Mode	VSA
Key Path	Meas Setup

Search Length

Allows you to specify the length of time allowed to acquire the input signal (in seconds). This defines the length of time that the pulse search is performed.

The analyzer searches within the specified search length and demodulates the first complete pulse (burst). The pulse can occur anywhere within the search length. Pulses beyond the first complete pulse are disregarded and are not demodulated. In order for the pulse search algorithm to detect a pulse edge, the pulse must be at least 15 dB above the noise floor. The resultant pulse is then demodulated.

Mode	VSA
Remote Command	[:SENSe] :W11A:SYNC:SLENgth <time> [:SENSe] :W11A:SYNC:SLENgth?
Example	W11A:SYNC:SLEN 0.001
Dependencies/Couplings	The minimum is constrained to meet the number of symbols of Result Length or Max Auto Result Length, whichever is active. See the table below for the Preset to Standard values.
Preset	1.0 ms
State Saved	Saved in instrument state.
Min	264 us
Max	26.952 ms
Key Path	Meas Setup, Meas Time

The Search Length is set to the following by Preset to Standard:

Standard	Search Length
IEEE 802.11a/g OFDM	1.0 ms
HIPERLAN/2	1.0 ms
IEEE 802.1g DSSS-OFDM	1.0 ms
IEEE 802.11a/g Turbo Mode	0.5 ms
IEEE 802.11p DSRC	2.0 ms
IEEE 802.11j 10 MHz	2.0 ms

Result Length

This key allows you to either manually set the Result Length or to have it automatically

detected.

The result length is the total number of symbols included in the acquired and demodulated data. The Measurement Interval and Measurement Offset parameters are used to specify the measurement length within the Result Length.

When Result Length is Automatic, the result length is the number of symbols in the current burst, up to the limit of Max Auto Result Length.

Note that when Result Length is Manual, the demodulation is not limited to the number of symbols transmitted within the burst as is done when the Result Length is Auto. The analyzer will demodulate the total number of symbols specified by Result Length, which if longer than the burst, could lead to unexpected and incorrect data results.

Mode	VSA
Remote Command	[:SENSE]:W11A:TIME:RESult:LENGth <integer> [:SENSE]:W11A:TIME:RESult:LENGth? [:SENSE]:W11A:TIME:RESult:AUTO OFF ON 0 1 [:SENSE]:W11A:TIME:RESult:AUTO?
Example	W11A:TIME:RES:LENG 60 W11A:TIME:RES:AUTO ON
Dependencies/Couplings	Search Length is increased to include the Result Length, if Result Length is in Manual mode. Set to Preset by Preset to Standard.
Preset	60 symbols ON
State Saved	Saved in instrument state.
Min	1 symbol
Max	1367 symbols
Key Path	Meas Setup, Meas Time

Max Auto Result Length

When Result Length is set to Auto this key causes the effective result length, the total number of symbols included in the demodulated data, to be automatically determined by comparing the input signal's length to the Max Auto Result Length value and using the smaller number.

Mode	VSA
------	-----

Remote Command	<code>[:SENSe] :W11A:TIME:RESult:MAX <integer></code> <code>[:SENSe] :W11A:TIME:RESult:MAX ?</code>
Example	W11A:TIME:RESult:MAX 60
Dependencies/Couplings	Search Length is increased to include the Max Auto Result Length, if Result Length is in Auto mode. Set to Default by Preset to Standard.
Preset	60 symbols
State Saved	Saved in instrument state.
Min	1 symbol
Max	1367 symbols
Key Path	Meas Setup, Meas Time

Meas Offset

Measurement Offset determines the start position, in symbols, of the Meas Interval with respect to the first symbol of the PLCP Preamble. The value must be less than the Result Length or Maximum Result Length parameter (depending on which option is selected for Result Length). This parameter combined with Measurement Interval specifies the portion of the result length to analyze and display to the user.

Mode	VSA
Remote Command	<code>[:SENSe] :W11A:TIME:OFFSet <integer></code> <code>[:SENSe] :W11A:TIME:OFFSet?</code>
Example	W11A:TIME:OFFS 0
Dependencies/Couplings	The maximum is limited to Result Length or Max Auto Result Length, whichever is active, minus Meas Interval. Set to Default by Preset to Standard.
Preset	0 symbols
State Saved	Saved in instrument state.
Min	0 symbols
Max	See coupling
Key Path	Meas Setup, Meas Time

Meas Interval

Measurement Interval, in conjunction with Meas Offset, lets you specify an interval (segment) of the result length data to be demodulated and analyzed. Measurement Interval is entered as an integer number of Symbol-times.

The measurement interval value must be less than or equal to the Result Length or Maximum Result Length parameter (depending on which option is selected for Result Length Select). This parameter combined with Measurement Offset specifies the portion of the result length to analyze and display to the user.

Mode	VSA
Remote Command	<code>[:SENSe] :W11A:TIME:INTerval <integer></code> <code>[:SENSe] :W11A:TIME:INTerval?</code>
Example	W11A:TIME:INT 60
Dependencies/Couplings	The maximum is limited to Result Length or Max Auto Result Length, whichever is active. If necessary, Meas Offset is reduced to keep Meas Interval plus Meas Offset within Result Length or Max Result Length, whichever is active. Set to Default by Preset to Standard.
Preset	60 symbols
State Saved	Saved in instrument state.
Min	1 symbol
Max	See coupling
Key Path	Meas Setup, Meas Time

Subcarriers

Allows you to specify what Subcarrier data are analyzed and data results displayed.

Mode	VSA
Remote Command	<code>[:SENSe] :W11A:SUBCarrier:SElect ALL PIlot SINGLE</code> <code>[:SENSe] :W11A:SUBCarrier:SElect?</code>
Example	W11A:SUBC:SEL ALL
Dependencies/Couplings	Set to Default by Preset to Standard.
Preset	ALL

State Saved	Saved in instrument state.
Range	All Pilots Single
Key Path	Meas Setup, More

All

Displays data results for all subcarriers. (-26 Through 26)

Mode	VSA
Key Path	Meas Setup, More, Subcarriers

Pilots

Displays data results for all Pilot subcarriers. Pilots subcarriers include subcarrier -21, -7, 7, and 21.

Mode	VSA
Key Path	Meas Setup, More, Subcarriers

Single

Displays data results for the selected Subcarrier.

Mode	VSA
Key Path	Meas Setup, More, Subcarriers

Subcarrier Selects the single subcarrier that is used when Single is chosen.

Mode	VSA
Remote Command	[:SENSE] :W11A:SUBCarrier:NUMBER <integer> [:SENSE] :W11A:SUBCarrier:NUMBER?

Example	W11A:SUBC:NUMB 1
Restriction and Notes	Subcarrier 0 is unused and so may not be selected.
Dependencies/Couplings	Set to Default by Preset to Standard.
Preset	1
State Saved	Saved in instrument state.
Min	-26
Max	26
Key Path	Meas Setup, More, Subcarriers, Single

Advanced

This key displays a menu that allows you to select lesser used demodulation parameters for the current measurement. These settings are for advanced users and do not normally require adjustment for most common measurements.

Mode	VSA
Key Path	Meas Setup, More

Subcarrier Spacing

Set the Subcarrier spacing.

Mode	VSA
Remote Command	<code>[:SENSe] :W11A:SUBCarrier:SPACing <freq></code> <code>[:SENSe] :W11A:SUBCarrier:SPACing?</code>
Example	W11A:SUBC:SPAC 312.5E3
Dependencies/Couplings	Span is forced to be at least 5.3 times the Subcarrier Spacing. So the maximum Span sets the maximum Subcarrier Spacing. Likewise, the Span will be forced to be within 530 times the Subcarrier Spacing and so the minimum Span sets the minimum Subcarrier Spacing. See the table below for the Preset to Standard values.
Preset	312.5 kHz
State Saved	Saved in instrument state.

Min	See Coupling
Max	See Coupling
Key Path	Meas Setup, More, Advanced

The Subcarrier Spacing is set to the following by Preset to Standard:

Standard	Subcarrier Spacing
IEEE 802.11a/g OFDM	312.5 kHz
HIPERLAN/2	312.5 kHz
IEEE 802.1g DSSS-OFDM	312.5 kHz
IEEE 802.11a/g Turbo Mode	625 kHz
IEEE 802.11p DSRC	156.25 kHz
IEEE 802.11j 10 MHz	156.25 kHz

Symbol Timing Adjust

Shifts the start of the TFFT period earlier in the symbol. You specify the amount of TFFT shift as a percentage of the TFFT length.

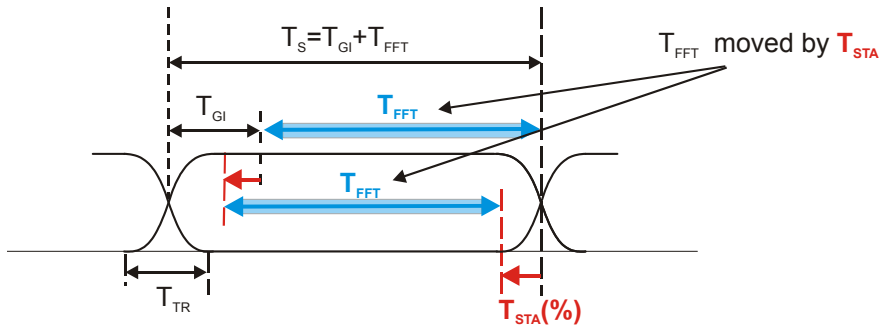
Moving the TFFT period away from the ending transition time (TTR) into the guard interval (TGI) may help avoid inter-symbol interference. Make sure that the TFFT period is not shifted so much that it includes corrupt data from the transition time at the beginning of the symbol.

Symbol Timing Adjust allows you to adjust the "useful symbol time period" (TFFT) within the "OFDM extended symbol time period" (TS). Symbol Timing Adjust shifts the start of the TFFT period earlier in the TS time period. You specify the amount of TFFT shift as a percentage of the TFFT length.

The extended OFDM symbol time period (TS) consists of a guard interval (TGI) plus a "useful symbol time period" (TFFT). Within the TS, the analyzer performs the demodulation and data analysis on only one TFFT time period. The Symbol Time Adjust parameter allows you to move the TFFT within the TS. This value is expressed as a percentage of the TFFT length.

Typically, the TGI time period is ignored and only the TFFT time period is used. The Symbol Time Adjust parameter causes the demodulation start time to begin earlier within

each extended symbol time. The minimum Symbol Time Adjust value is equal to "guard interval*100", the maximum value is "0" (full guard interval).



- T_S = Extended Symbol Time
- T_{GI} = Guard Interval
- T_{FFT} = Useful Symbol Time Period and also the FFT Time Period
- T_{TR} = Symbol Transition Time
- T_{STA} = **Symbol Timing Adjust (%)**

OFDM Frame with cyclic extension for a single symbol time

Mode	VSA
Remote Command	<code>[:SENSE] :W11A:TADJust <real></code> <code>[:SENSE] :W11A:TADJust?</code>
Example	W11A:TADJ -3.125
Dependencies/Couplings	Set to Default value for all Standards by Preset to Standard.
Preset	-3.125 %
State Saved	Saved in instrument state.
Min	-25 %
Max	0.0 %
Key Path	Meas Setup, More, Advanced

Pilot Tracking

This key displays a menu of several Pilot Tracking setup parameters.

Mode	VSA
Key Path	Meas Setup, More, Advanced

Track Amplitude When Track Amplitude is selected, the analyzer applies pilot subcarrier amplitude error correction to the pilot and data subcarriers. This is in addition to Track Phase and Track Timing error correction if selected.

This parameter specifies whether the analyzer tracks amplitude changes in the pilot subcarriers. When true, the Common Pilot Error trace will show the amplitude tracking in the magnitude portion of the trace

Mode	VSA
Remote Command	[:SENSe] :W11A:TRACk:AMPLitude OFF ON 0 1 [:SENSe] :W11A:TRACk:AMPLitude?
Example	W11A:TRAC:AMPL OFF
Dependencies/Couplings	Set to Default by Preset to Standard.
Preset	OFF
State Saved	Saved in instrument state.
Key Path	Meas Setup, More, Advanced, Pilot Tracking

Track Phase .When Track Phase is selected, the analyzer applies pilot subcarrier phase error correction to the pilot and data subcarriers. This is in addition to Track Amplitude and Track Timing error correction if selected.

Mode	VSA
Remote Command	[:SENSe] :W11A:TRACk:PHASe OFF ON 0 1 [:SENSe] :W11A:TRACk:PHASe?
Example	W11A:TRAC:PHASe ON
Dependencies/Couplings	Set to Default by Preset to Standard.
Preset	ON
State Saved	Saved in instrument state.
Key Path	Meas Setup, More, Advanced, Pilot Tracking

Track Timing When Track Timing is selected the analyzer applies pilot subcarrier timing

error correction (frequency offset correction) to the pilot and data subcarriers. This is in addition to Track Amplitude and Track Phase error correction if selected.

Mode	VSA
Remote Command	[[:SENSE]:W11A:TRACk:TIMing OFF ON 0 1 [:SENSE]:W11A:TRACk:TIMing?
Example	W11A:TRAC:TIM OFF
Dependencies/Couplings	Set to Default by Preset to Standard.
Preset	OFF
State Saved	Saved in instrument state.
Key Path	Meas Setup, More, Advanced, Pilot Tracking

EQ Training

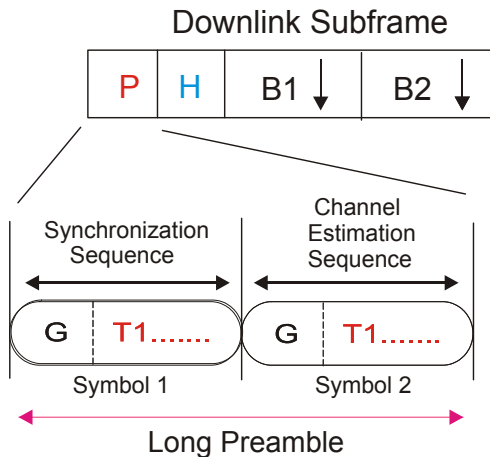
When demodulating an OFDM signal, the analyzer uses an equalizer to correct for linear impairments in the signal path, such as multi-path. The 89600 analyzer supports two different ways to initialize, or "train," the equalizer.

The valid values are Channel Estimation Seq Only and Channel Estimation Seq & Data. The value Channel Estimation Seq Only, which is the default, specifies that the equalizer is trained using only the channel estimation sequence (also called the "long sync") portion of the burst preamble.

The value and Channel Estimation Seq & Data specifies that the equalizer should be trained using both the channel estimation sequence and the entire data portion of the burst. This usually gives a more accurate estimate of the equalizer response. It also typically lowers the EVM by one or two dB.

Mode	VSA
Remote Command	[[:SENSE]:W11A:EQUalizer:TRAIning CHANnel CDATa [:SENSE]:W11A:EQUalizer:TRAIning?
Example	W11A:EQU:TRA CHAN
Dependencies/Couplings	Set to Default by Preset to Standard.
Preset	Channel Est Seq Only
Range	Channel Est Seq Only Channel Est Seq & Data
Key Path	Meas Setup, More, Advanced

Channel Est Seq Only The equalizer is trained by looking at the Channel Estimation Sequence in the preamble of the OFDM burst. After this initialization, the equalizer coefficients are held constant while demodulating the rest of the burst.



Mode VSA
Key Path **Meas Setup, More, Advanced, EQ Training**

Channel Est Seq & Data The equalizer is trained by analyzing the entire OFDM burst, including the Channel Estimation Sequence (contained in the preamble) and the Data symbols. This type of training generally gives a more accurate estimate of the true response of the transmission channel.

Mode VSA
Key Path **Meas Setup, More, Advanced, EQ Training**

Sync Training Sequence

The Sync parameters control the type of synchronization used to synchronize to the start of an OFDM burst. The two available choices are "Short Training Sequence" (also called Short Sync or Short Training Symbols) and "Chan Estimation Seq" (also called Long Sync or Long Training Symbols).

Mode VSA

Remote Command	<code>[:SENSe] :W11A:SYNC:SEQuence LONG SHORT</code> <code>[:SENSe] :W11A:SYNC:SEQuence?</code>
Example	W11A:SYNC:SEQ SHOR
Dependencies/Couplings	See the table below for the Preset to Standard values.
Preset	SHOR
Range	Long Short
Key Path	Meas Setup, More, Advanced

The Sync Training Seq is set to the following by Preset to Standard:

Standard	Sync Training Seq
IEEE 802.11a/g OFDM	Short
HIPERLAN/2	Long (Channel Estimation)
IEEE 802.1g DSSS-OFDM	Long (Channel Estimation)
IEEE 802.11a/g Turbo Mode	Long (Channel Estimation)
IEEE 802.11p DSRC	Short
IEEE 802.11j 10 MHz	Short

IQ Normalize

When set to On, the IQ trace data results (including IQ Meas, IQ Ref, Error Vector Time and corresponding Spectrum results) are normalized.

When set to Off, the trace data results are not normalized.

When normalization is On, the analyzer normalizes or scales the demodulated trace data results, in magnitude, to a nominal value of 1, relative to the outermost states of the ideal (IQ Reference) constellation diagram.

Note that regardless of this setting, the Error Summary trace data results are always normalized.

Mode	VSA
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Remote Command	:CALCulate:W11A:NORMalize OFF ON 0 1 :CALCulate:W11A:NORMalize?
Example	CALC:W11A:NORM ON
Dependencies/Couplings	Set to Default by Preset to Standard.
Preset	ON
State Saved	Saved in instrument state.
Key Path	Meas Setup, More, Advanced

Standard

This single parameter takes care of setting a number of internal, standard specific details of the demodulation. The valid values are the same as that of Preset to Standard and are set to the same by Preset to Standard.

Mode	VSA
Remote Command	[:SENSe] :W11A:STANdard I11AGOFDM HIPERLAN2 I11GDSSSOFDm I11AGTURBO I11PDSRC I11J10MHZ [:SENSe] :W11A:STANdard?
Example	W11A:STAN I11J10MHZ
Dependencies/Couplings	Set to matching Standard by Preset to Standard.
Preset	IEEE 802.11a/g OFDM
Range	IEEE 802.11a/g OFDM HIPERLAN/2 IEEE 802.1g DSSS-OFDM IEEE 802.11a/g Turbo Mode IEEE 802.11p DSRC IEEE 802.11j 10 MHz
Key Path	Meas Setup, More, Advanced

This table shows the mapping between the names of the selections on the softkey menu and their corresponding SCPI forms.

Preset soft key name	Preset SCPI form
IEEE 802.11a/g OFDM	I11AGOFDM

WLAN OFDM (Option B7R)
Meas Setup

HIPERLAN/2	HIPERLAN2
IEEE 802.1g DSSS-OFDM	I11GDSSSOFD
IEEE 802.11a/g Turbo Mode	I11AGTURBO
IEEE 802.11p DSRC	I11PDSRC
IEEE 802.11j 10 MHz	I11J10MHZ

IEEE 802.11a/g OFDM Per the IEEE std 802.11a–1999 specification.

Mode	VSA
Key Path	Meas Setup, Preset to Standard

HIPERLAN/2 Per the ETSI TS 101 475 V1.2.2 (2001–02) - Broadband Radio Access Networks (BRAN); HIPERLAN Type 2; Physical (PHY) Layer specification.

Mode	VSA
Key Path	Meas Setup, Preset to Standard

IEEE 802.1g DSSS-OFDM Per the IEEE std 802.11g – 2003 specification

Mode	VSA
Key Path	Meas Setup, Preset to Standard

IEEE 802.11a/g Turbo Mode This is a nonstandard double rate 802.11a.

Mode	VSA
Key Path	Meas Setup, Preset to Standard

IEEE 802.11p DSRC Per the ASTM E2213 – 02 DSRC specification

Mode VSA
Key Path **Meas Setup, Preset to Standard**

IEEE 802.11j 10 MHz Per the IEEE std 802.11j – 2004 specification

Mode VSA
Key Path **Meas Setup, Preset to Standard**

Meas Preset

This immediately sets all measurement parameters to their 802.11a/g OFDM Preset values. This presets the display state in the same way as Preset View: Basic.

For more information, see the section under the Preset key in the Utility section.

Mode VSA
Key Path **Meas Setup, More**

Amplitude (AMPTD) Y Scale

This menu has controls for the input signal conditioning as well as the Y-scaling of trace data. For more information, see Analyzer Setup Functions, AMPTD Y Scale.

Mode	VSA
Key Path	Front-panel key

Auto Couple

The Auto Couple key forces all Auto / Man functions into Auto. This applies to Data Modulation Detect and Result Length. For more information, see Analyzer Setup Functions, Auto Couple.

Mode	VSA
Key Path	Front-panel key

BW

The BW key provides access to a menu that allows you to set the FFT Window for the Spectrum and Inst Spectrum measurement results.

For more information see: Analyzer Setup Functions, BW.

Mode	VSA
Key Path	Front Panel

FFT Window

This key allows you to choose the Window function that is applied to the time data prior to the FFT calculation used for Spectrum and Inst Spectrum measurement results.

For more information, see Analyzer Setup Functions, BW, FFT Window.

Mode	VSA
Preset	Flat Top
Key Path	BW

FREQ Channel

This key provides access to a menu that allows control over the Center, Start, or Stop Frequency settings. For more information, see Analyzer Setup Functions, FREQ Channel.

Mode	VSA
Key Path	Front Panel

Input/Output

This key provides access to a menu that allows you to select input/output parameters for the measurement data. For more information, see *Analyzer Setup Functions, Input/Output*.

Mode	VSA
Key Path	Front-panel key

SPAN X Scale

This menu has softkeys for selecting measurement span and also for scaling of the X axis. There are no measurement unique SCPI/features, other than Span dependence on Subcarrier Spacing and Preset to Standard. For more information, see Analyzer Setup Functions, SPAN X Scale.

Mode	VSA
Key Path	Front-panel key

Span

This controls the frequency span of the measurement. See the **FREQ Channel** section for details on how this interacts with Start, Stop, and Center frequencies.

Mode	VSA
Dependencies/Couplings	Limited to be within a factor of 5.3 to 530 of the Subcarrier Spacing. When Subcarrier Spacing is changed, Span may be changed to meet this requirement. See the table below for the Preset to Standard values.
Preset	31.25 MHz (limited by hardware to 10 MHz or 25 MHz with Option B25)
Key Path	SPAN X Scale

Standard	Span
IEEE 802.11a/g OFDM	31.25 MHz
HIPERLAN/2	31.25 MHz
IEEE 802.1g DSSS-OFDM	31.25 MHz
IEEE 802.11a/g Turbo Mode	62.5 MHz
IEEE 802.11p DSRC	15.625 MHz

WLAN OFDM (Option B7R)
SPAN X Scale

IEEE 802.11j 10 MHz	15.625 MHz
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Trace/Detector

This key allows you to select the results shown in the trace windows. .

Mode	VSA
Key Path	Front-panel key

For more information, see Analyzer Setup, [Trace/Detector on page 226](#).

Data

This key accesses a menu of Trace data choices for the selected trace.

Mode	VSA
Key Path	Trace/Detector

For more information, see Analyzer Setup, Trace'Detector, [Data on page 228](#).

The following are the SCPI string forms for the Data types that are specific to this measurement, in alphabetical order:

Table 9-3

Trace data soft key name	SCPI string form
CCDF	"CCDF1"
CDF	"CDF1"
Ch Frequency Response	"Ch Frequency Response1"
Common Pilot Error	"Common Pilot Error1"
Eq Impulse Response	"Eq Impulse Response1"
Error Vector Spectrum	"Error Vector Specrum1"
Error Vector Time	"Error Vector Time1"
IQ Meas	"IQ Meas1"
IQ Ref	"IQ Ref1"
Inst Ch Frequency Response	"Inst Ch Frequency Response1"
Inst Spectrum	"Inst Spectrum1"

Table 9-3

PDF	"PDF1"
Preamble Error	"Preamble Error1"
Preamble Freq Error	Preamble Freq Error1
RMS Error Vector Spectrum	RMS Error Vector Spectrum1
RMS Error Vector Time	RMS Error Vector Time1
Raw Main Time	"Raw Main Time1"
Search Time	"Search Time1"
Spectrum	"Spectrum1"
Symbols/Errors	"Syms/Errs1"
Time	"Time1"

The following Trace Data types are available in all measurements:

Table 9-4

Soft Key Name	SCPI string form
No Data	"No Data"
Spectrum	"Spectrum1"
Inst Spectrum	"Inst Spectrum1"
Raw Main Time	"Raw Main Time1"
OBW Summary Trace 1	"OBW Summary Trc1"
OBW Summary Trace 2	"OBW Summary Trc2"
OBW Summary Trace 3	"OBW Summary Trc3"
OBW Summary Trace 4	"OBW Summary Trc4"
ACP Summary Trace 1	"ACP Summary Trc1"
ACP Summary Trace 2	" ACP Summary Trc2"
ACP Summary Trace 3	" ACP Summary Trc3"
ACP Summary Trace 4	" ACP Summary Trc4"

Pre Demod

This key accesses the Trace Data choices which show pre-demodulation results.

Mode	VSA
Key Path	Trace/Detector, Data

Spectrum Averaged FFT of the Time waveform.

Mode	VSA
Key Path	Trace/Detector, Data, Pre Demod

Inst Spectrum The FFT of the time waveform for the current measurement. “Inst” or Instantaneous refers to this result not being averaged like the Spectrum Trace Data result.

Mode	VSA
Key Path	Trace/Detector, Data, Pre Demod

Search Time The Search Length long time record acquired for the current measurement.

Mode	VSA
Key Path	Trace/Detector, Data, Pre Demod

Time The time record before digital demodulation and after the pulse/burst search.

The starting point is the beginning of the burst, offset by the Meas Offset and its length is the Meas Interval.

The exception to this is that 10% more additional data on both sides is shown when the Measurement Offset is set to zero and the Measurement Interval is set the same as the Result Length in Manual Result Length mode. In automatic Result Length mode, this will occur when the Measurement Offset to zero and the Measurement Interval is set to the

Max Auto Result Length, but will not go more than 10% beyond the end of the burst.

Mode	VSA
Key Path	Trace/Detector, Data, Pre Demod

Raw Main Time The raw time record acquired for the current measurement. This data is unprocessed and includes additional points acquired for settling of the filters involved in subsequent processing, such as the demodulation filtering.

Mode	VSA
Key Path	Trace/Detector, Data, Pre Demod

Statistical

This key accesses the Trace Data choices which show statistical results.

Mode	VSA
Key Path	Trace/Detector, Data

CCDF The Complementary, Cumulative Density function (CCDF) for the selected input channel.

The analyzer plots CCDF using units of percent (%) for the y-axis and power (dB) for the x-axis. Power on the x-axis is relative to the signal average power.

Mode	VSA
Key Path	Trace/Detector, Data, Statistical

CDF The Cumulative Density Function (CDF) for the selected input channel. CDF is computed by integrating the CCDF (Probability Density Function).

Mode	VSA
------	-----

Key Path **Trace/Detector, Data, Statistical**

PDF The Probability Density Function (PDF) for the selected input channel. PDF indicates the probability that a given level has occurred.

Mode VSA
Key Path **Trace/Detector, Data, Statistical**

Demod

This key accesses the Trace Data choices which show general demodulation results.

Mode VSA
Key Path **Trace/Detector, Data**

IQ Meas IQ Meas is the measured IQ symbol values of the subcarriers. There is one complex value for each subcarrier for each symbol in the burst.

Normally this trace data is displayed as a constellation. The constellation display shows both data and pilot subcarriers, the pilots and data values are shown with different colors.

With most other display formats, the data is plotted vs. subcarrier, with the points for each symbol all plotted separately. This is the same kind of display as Error Vector Spectrum.

Mode VSA
Key Path **Trace/Detector, Data, Demod**

IQ Ref IQ Ref is the reference (ideal) IQ values of the subcarriers. There is one complex value for each subcarrier for each symbol in the burst.

Normally this trace data is displayed as a constellation. The constellation shows both data and pilot subcarrier symbols, the pilots and data values are shown with different colors.

With most other display formats, the data is plotted vs. subcarrier, with the points for each

symbol all plotted separately. This is the same kind of display as Error Vector Spectrum.

Mode	VSA
Key Path	Trace/Detector, Data, Demod

Demod Error

This key accesses the Trace Data choices which show demodulation error related results.

Mode	VSA
Key Path	Trace/Detector, Data

Error Vector Time This trace, like Error Vector Spectrum shows each of the individual signal error vectors for each subcarrier and symbol vs. Time (symbol) and frequency (subcarrier). Each error vector is the vector difference, for that subcarrier at that symbol-time, between the corresponding IQ Meas value and the IQ Ref value.

On this trace, the individual error vectors are plotted vs Time (symbol). So at each valid symbol, there is a point plotted for each valid subcarrier (52 total, since subcarrier 0 is not used.) In addition, a white trace is drawn, where each point is the RMS average over the valid subcarriers, which is the same result as is plotted separately as RMS Error Vector Time.

Mode	VSA
Key Path	Trace/Detector, Data, Demod Error

RMS Error Vector Time RMS Error Vector Time is the difference between IQ Meas and IQ Ref is the error vector (which would have a complex value) at each subcarrier at each symbol-time. This trace is the RMS average of the error vector for each valid subcarrier at the plotted symbol, the same data shown as a white trace shown in Error Vector Time.

Mode	VSA
Key Path	Trace/Detector, Data, Demod Error

Error Vector Spectrum This trace, like Error Vector Time shows each of the individual signal error vectors for each subcarrier and symbol vs. Time (symbol) and frequency (subcarrier). Each error vector is the vector difference, for that subcarrier at that symbol-time, between the corresponding IQ Meas value and the IQ Ref value.

On this trace, the individual error vectors are plotted vs frequency (subcarrier). So at each valid subcarrier, there is a point plotted for each valid symbol. Note that subcarrier 0 is not plotted since it is not used. In addition, a white trace is drawn, where each point is the RMS average over the valid symbols, which is the same result as is plotted separately as RMS Error Vector Spectrum.

Mode	VSA
Key Path	Trace/Detector, Data, Demod Error

RMS Error Vector Spectrum This trace is the RMS average of the error vector for each valid symbol at the plotted subcarrier, the same data shown as a white trace shown in Error Vector Time. Note that subcarrier 0 is not plotted since it is not used.

Mode	VSA
Key Path	Trace/Detector, Data, Demod Error

Common Pilot Error This trace shows the difference between the measured and ideal pilot subcarrier symbols.

At each symbol in the burst, the measured symbol values of the four pilot subcarriers are compared with the ideal values. The differences are averaged together, producing a single complex value for each symbol. Normally the phase of this trace is displayed, showing how the pilot phase changes over the burst. You can also look at the magnitude of this trace to see signal magnitude changes over the burst.

To display in frequency units, select the Group Delay Trace Format. See Analyzer Setup Functions, Trace/Detector, Format.

Mode	VSA
Key Path	Trace/Detector, Data, Demod Error

Preamble Error Preamble Error shows the correlation between segments of the measured preamble signal with the ideal preamble signal. You can select the desired preamble sequence to be compared to with the EQ Training and Sync Training Sequence parameters.

Mode	VSA
Key Path	Trace/Detector, Data, Demod Error

Preamble Freq Error Preamble Frequency error is the difference between the measured center frequency of the transmitted signal and the measurement center frequency. The Preamble Frequency Error trace shows the total frequency error during the preamble portion of the OFDM burst. This includes the constant frequency error as displayed in the Symbols/Errors trace in addition to any time-varying frequency error.

When Sync Training Sequence is set to Short (the default for 802.11a), Preamble Frequency Error covers both the short training sequence and the channel estimation sequence. When the Sync type parameter is set to Chan Est, Preamble Frequency Error covers only the channel estimation sequence.

Mode	VSA
Key Path	Trace/Detector, Data, Demod Error

Tables

This key accesses the Trace Data choices which are in tabular form, including demodulated symbols tables.

Mode	VSA
Key Path	Trace/Detector, Data

Symbols/Errors This display contains an error summary in the upper part, and a listing of demodulated symbols in the lower part. The error summary consists of:

Response

This key accesses the Trace Data choices which show equalizer response results.

Mode	VSA
Key Path	Trace/Detector, Data

Ch Frequency Response Ch Frequency Response shows the equalizer channel frequency response, which is the reciprocal of the equalizer frequency response. This is the measured equalizer frequency response for the burst, based on analyzing the preamble of the burst. It contains one complex value for each subcarrier, plus an interpolated value at the middle unused subcarrier (a total of 53 values).

This trace is averaged when Averaging is turned on.

Mode	VSA
Key Path	Trace/Detector, Data, Response

Inst Ch Frequency Resp This is the instantaneous (non-averaged) Ch Frequency Response. If averaging is on, the Inst Ch Frequency Response does not show the effects of averaging.

Mode	VSA
Key Path	Trace/Detector, Data, Response

EQ Impulse Response This shows the impulse response of the equalization filter. The equalizer impulse response is computed by taking the reciprocal of the channel equalizer frequency response, performing data filtering and computations that produce a result length of 4x the FFT length, and then converting to the time domain. The Eq Impulse Response is the computed channel impulse response used to compensate for signal channel response degradation.

Mode	VSA
Key Path	Trace/Detector, Data, Response

This key selects the VSA WLAN DSSS measurement.

Mode	VSA
Key Path	Meas

```
:CONFigure:W11B
:CONFigure:W11B:NDEFault
:FETCh:W11B [n] ?
:INITiate:W11B
:MEASure:W11B [n] ?
:READ:W11B [n] ?
```

This standard remote result is also available thru the CALC:DATA<n> set of queries, where <n> is a reference to the trace number. The results assigned to each trace vary depending on which tests are enabled. As an example, with the default trace layout, these results in the Error Summary results are returned by CALC:W11B:DATA4:TABLE? See Common Functions, Data Queries, CALCulate:DATA for more details.

The following table denotes the VSA WLAN DSSS specific results returned from the (FETCh | MEASure | READ):W11B commands, and their corresponding CALC:DATA queries, indexed by subopcode.

Note that valid results are only returned if the Symbols/Errors trace is being computed. It must be selected though it is not necessary for it to be shown in the current Layout.

NOTE: For Trace Data SCPI commands and remote results see **Help** for the **MEAS** key.

Results table (with subopcodes):

Table 10-1

N	Results Returned
Not specified or n=1	Returns 22 comma-separated scalar results, corresponding exactly to the items returned in the Error Summary: <ol style="list-style-type: none"> 1. EVM (% rms) 2. EVM Peak (% peak) 3. EVM Peak Location (chip) 4. Magnitude Error (%rms) 5. Magnitude Error Peak (%) 6. Magnitude Error Peak Location (chip) 7. Phase Error (deg) 8. Phase Error Peak (deg) 9. Phase Error Peak Location (chip) 10. Frequency Error (Hz) 11. IQ Offset (ratio) 12. IQ Quadrature Error (deg) 13. IQ Gain Imbalance (ratio) 14. Sync Correlation (1.0 = ideal) 15. 802.11b EVM Peak (%) 16. Header Status (see below) 17. Mac Status (see below) 18. Burst Type (see below) 19. Bit Rate (bps) 20. Octets 21. Data Time Length (sec) 22. Symbol Clock Error (ratio) If the results are not available, NaN (9.91e37) is returned.

Header Status enumerations:

Table 10-2

Enumeration	Meaning
0	No SFD found - the Preamble Start Frame Delimiter was not found.

Table 10-2

Enumeration	Meaning
1	Invalid header bits - some of the bits in the PLCP Header were incorrect, but the analyzer was able to determine the data length and data modulation format.
2	Header CRC failed - the header looked correct except for the CRC, which did not match the rest of the header data.
3	Invalid header phase shift - an extra (incorrect) 90 degree phase shift was detected at the start of the header.
4	Invalid Barker1/short - the detected burst type is 1MB/sec Barker with a short preamble, which is an invalid format.
5	Unknown - the result length was not long enough to capture all of the header data, so the status can not be determined.
6	OK - the header appears correct and the CRC passed.

Mac Status enumerations:

Table 10-3

Enumeration	Meaning
0	Unknown - the result length was not long enough to capture all of the data, so the MAC status can not be determined.
1	MAC FCS failed - the MAC frame checksum failed.
2	OK - the MAC frame checksum passed.

Burst Type enumerations:

Note: The Burst Type value encodes whether the preamble is the "long format" or "short format", which affects the output value. If the long preamble format is detected, the values are the first number shown. If a short preamble format is detected, 4096 is added to the "long format" value and shown in (parentheses).

Table 10-4

Enumeration	Meaning
0 (4096)	1 Mbit/sec Barker spreading (BPSK chips)
1 (4097)	2 Mbit/sec Barker spreading (QPSK chips)

Table 10-4

Enumeration	Meaning
2 (4098)	5.5 Mbit/sec CCK modulation (QPSK chips)
3 (4099)	11 Mbit/sec CCK modulation (QPSK chips)
4 (4100)	5.5 Mbit/sec PBCC modulation (QPSK chips)
5 (4101)	11 Mbit/sec PBCC modulation (QPSK chips)
6 (4102)	22 Mbit/sec PBCC modulation (8PSK chips)
7 (4103)	33 Mbit/sec PBCC modulation (8PSK chips at 16.5 MHz)
8 (4104)	DSSS-OFDM modulation (OFDM symbols)
9 (4105)	Unknown modulation format

View/Display

The view setup can be changed by selections from the View/Display menu, including by pressing View Preset: Basic.

Mode	VSA
Key Path	Front-panel key

Preset View

Mode	VSA
Remote Command	:DISPlay:W11B:VIEW:PRESet BASic EVM POWer DIAGnostic
Example	DISP:W11B:VIEW:PRES BAS
Key Path	(SCPI only)

Preset View: Basic

This preset view consists of the following traces in a Grid 2x2 layout:

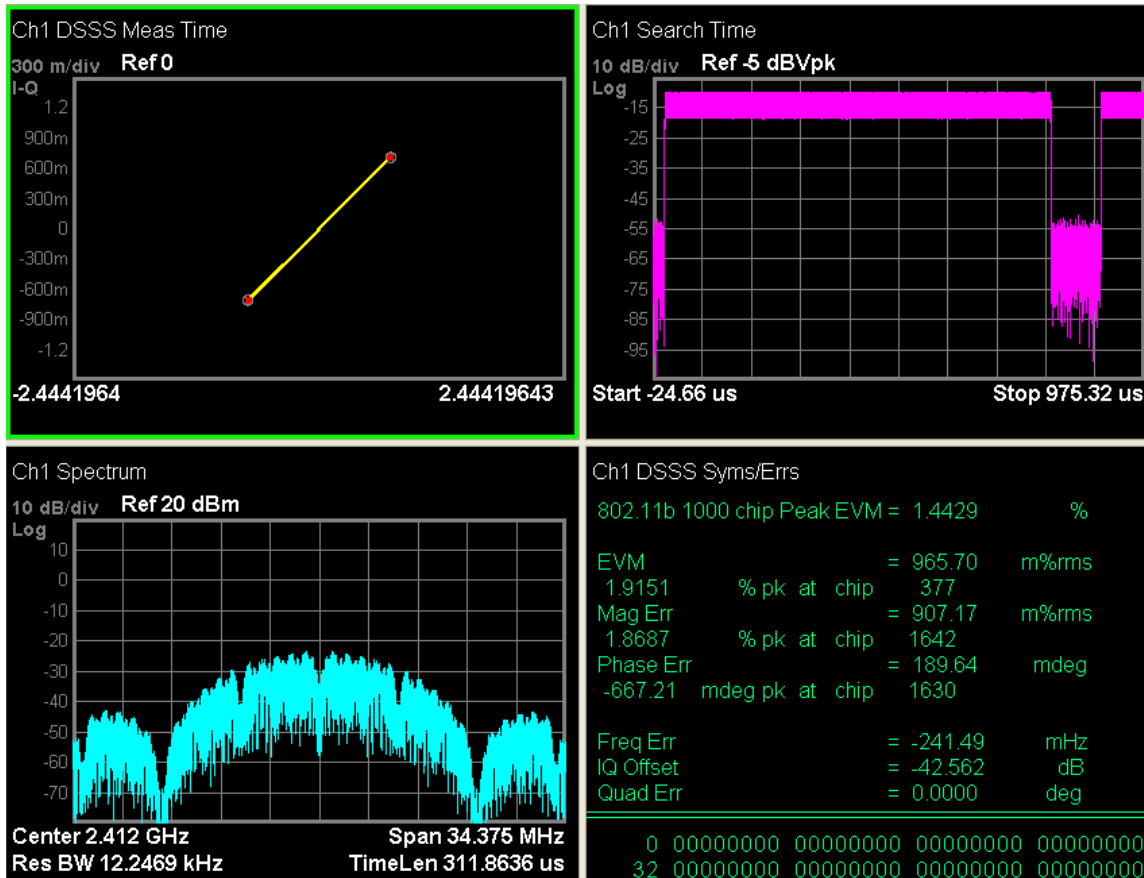
1. IQ Meas Time in I-Q format
2. Spectrum in Log Mag (dB) format
3. Search Time in Log Mag (dB) format
4. Symbols/Errors

The Preset View: Basic softkey does an immediate action of changing the layout and view to this state. This Preset View is an action, not a state.

This layout is the layout set by Meas Preset and is good for insuring that the signal is being demodulated correctly, as well as giving visibility to many basic demodulation setup problems.

Mode	VSA
Remote Command	:DISPlay:W11B:VIEW:PRESet BASic

Example DISP:W11B:VIEW:PRES BAS
Key Path View/Display



Preset View: EVM

This preset view consists of the following traces in a Stacked layout:

1. Error Vector Time in Linear Mag format
2. Symbols/Errors

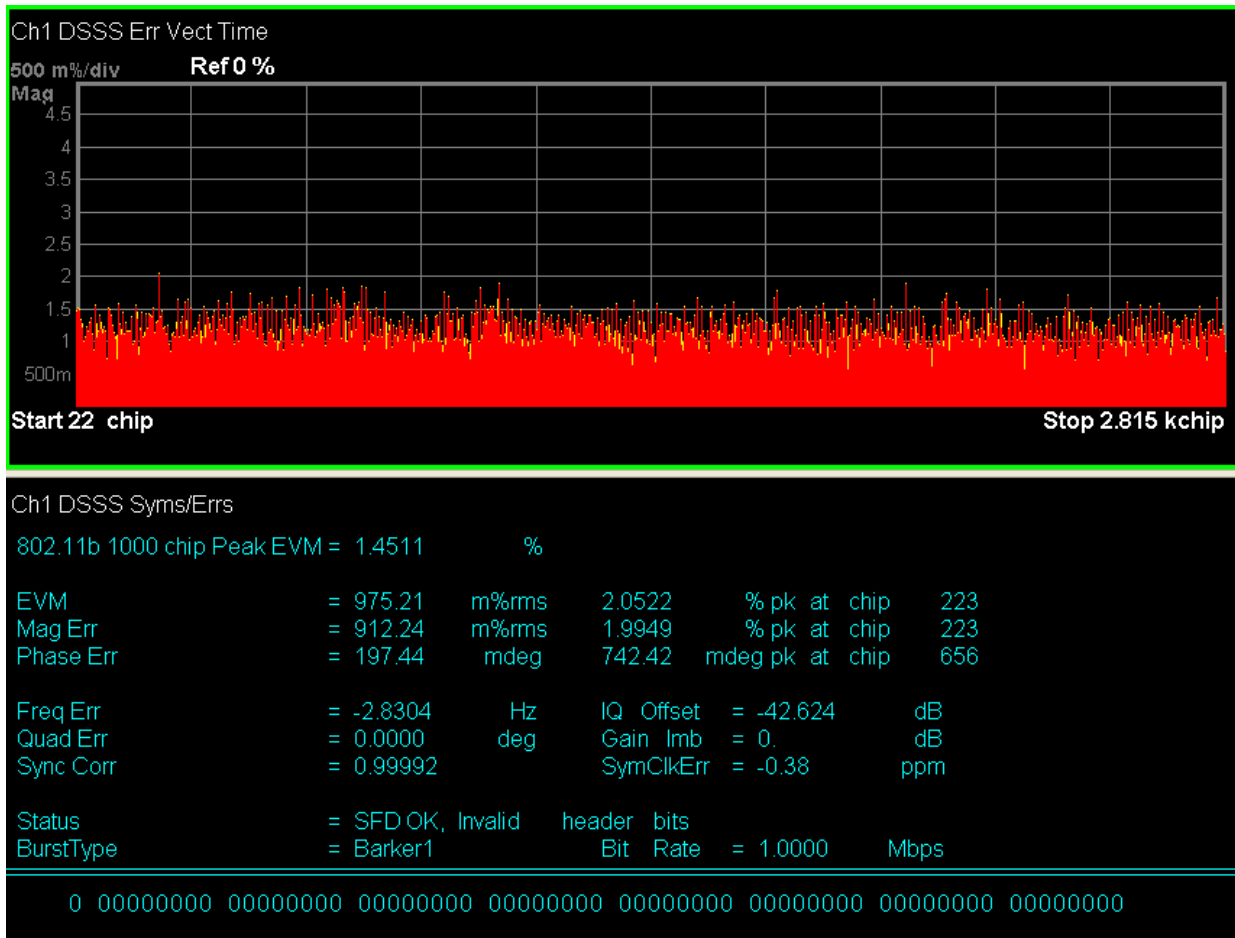
This layout is for more detailed EVM analysis.

The Preset View: EVM softkey does an immediate action of changing the layout and view to this state. This Preset View is an action, not a state.

Mode VSA
Remote Command :DISPlay:W11B:VIEW:PRESet EVM
Example DISP:W11B:VIEW:PRES EVM

Key Path

View/Display



Preset View: Power

This preset view consists of the following traces in a Grid 2x2 layout:

1. Spectrum in Log Mag (dB) format
2. Time in Log Mag (dB) format
3. Search Time in Log Mag (dB) format
4. CCDF in Log Mag (Linear Unit) format

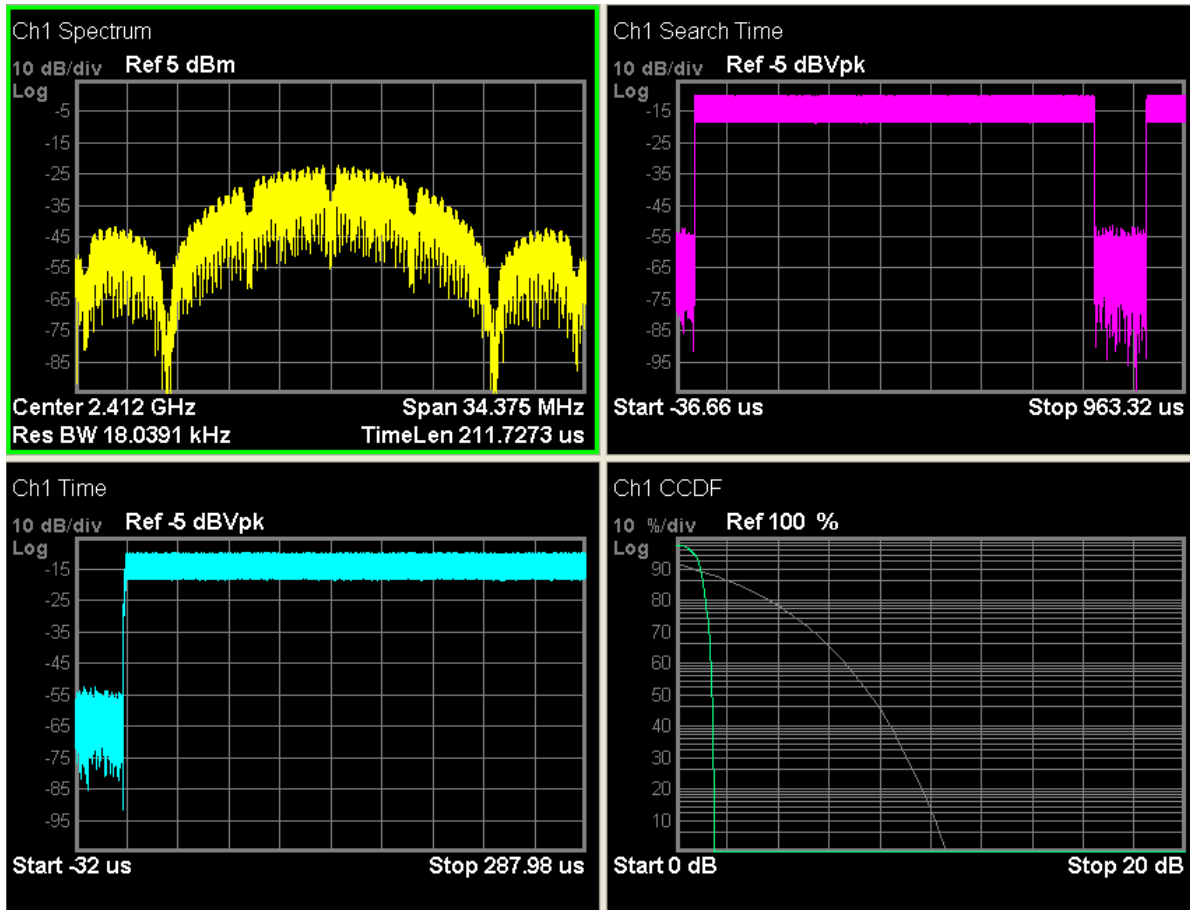
This layout is oriented towards examining the signal in the Time and Power domain.

The Preset View: Basic softkey does an immediate action of changing the layout and view to this state. This Preset View is an action, not a state.

Mode

VSA

Remote Command :DISPlay:W11B:VIEW:PRESet POWer
Example DISP:W11B:VIEW:PRES POW
Key Path View/Display



Preset View: Diagnostic

This preset view consists of the following traces in a Grid 2x2 layout:

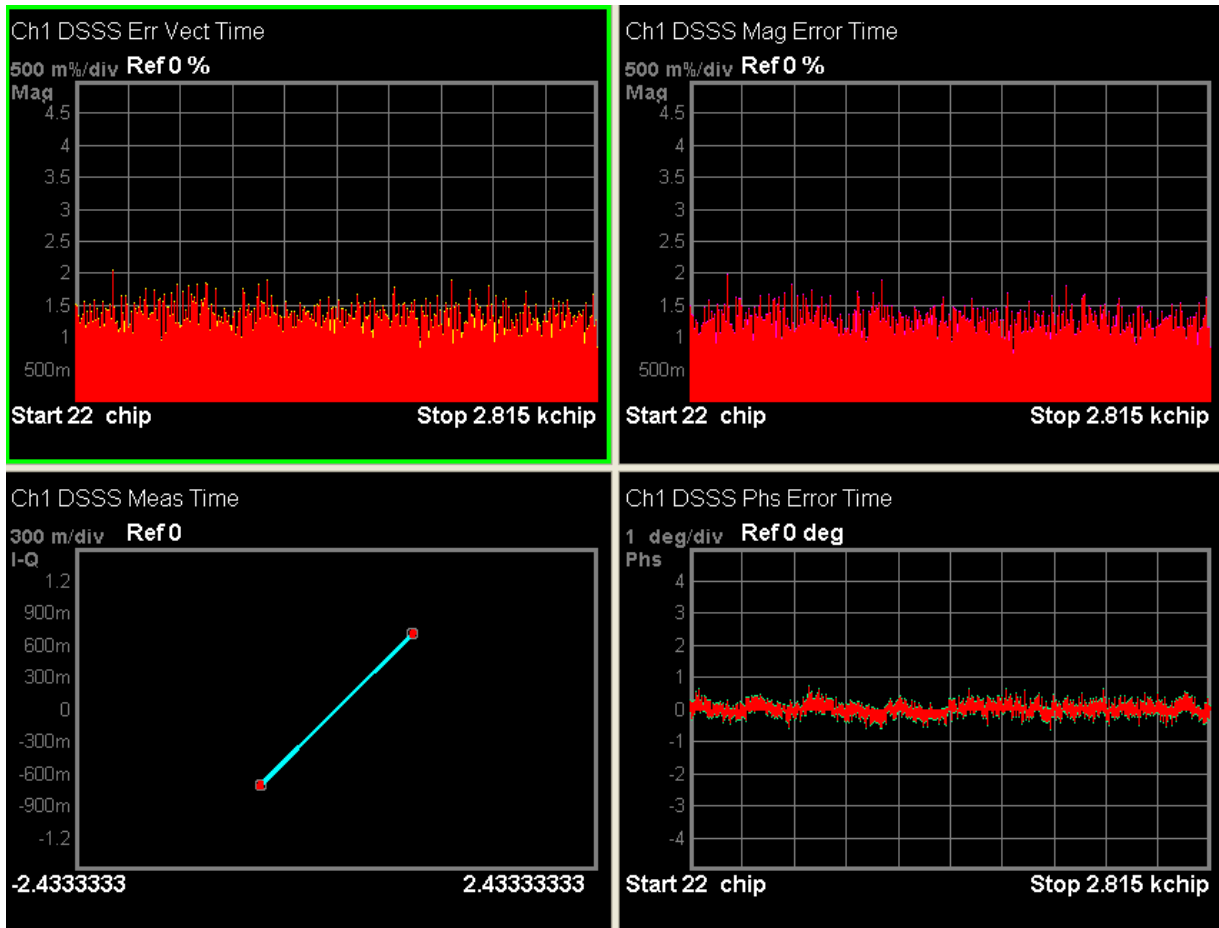
1. Error Vector Time in Linear Mag format
2. IQ Meas Time in I-Q format
3. IQ Mag Error in Linear Mag format
4. IQ Phase Error in Wrap Phase format

This layout is useful for diagnosing modulation impairments and errors.

The Preset View: Basic softkey does an immediate action of changing the layout and view

to this state. This Preset View is an action, not a state.

Mode	VSA
Remote Command	:DISPlay:W11B:VIEW:PRESet DIAGnostic
Example	DISP:W11B:VIEW:PRES DIAGnostic
Key Path	View/Display



Meas Setup

This key provides a menu allowing you to select measurement parameters for the current measurement.

Mode	VSA
Key Path	Front Panel

Demod Setup

This key brings up a menu of commonly used demodulation setup parameters.

Mode	VSA
Key Path	Meas Setup

Data Modulation Detect

This key allows you to select whether the data modulation format is automatically detected or manually set to a particular data modulation format.

When set to Auto, the SIGNAL and SERVICE field data within the PLCP Header are used to determine the data modulation format. When set to Manual, it is forced to be the value set by Mod Format.

Mode	VSA
Remote Command	<code>[:SENSe] :W11B:DEMod:AUTO OFF ON 0 1</code> <code>[:SENSe] :W11B:DEMod:AUTO?</code>
Example	W11B:DEM:AUTO ON
Dependencies/Couplings	Set to Default by Preset to Standard.
Preset	ON
State Saved	Saved in instrument state.
Key Path	Meas Setup, Demod Setup

Mod Format

This key sets the modulation format that is forced to be used when Data Modulation Detect is set to Manual.

Mode	VSA
Remote Command	[:SENSe] :W11B:DEMod DSSS1M DSSS2M CCK5M5 CCK11M PBCC5M5 PBCC11M PBCC22M PBC C33M [:SENSe] :W11B:DEMod?
Example	W11B:DEM DSSS1M
Dependencies/Couplings	Set to Default by Preset to Standard.
Preset	DSSS1M
State Saved	Saved in instrument state.
Range	1 Mbps DSSS 2 Mbps DSSS 5.5 Mbps CCK 11 Mbps CCK 5.5 Mbps PBCC 11 Mbps PBCC 22 Mbps PBCC 33 Mbps PBCC
Key Path	Meas Setup, Demod Setup

DSSS Formats This key brings up a selection of the available DSSS Modulation Formats.

Mode	VSA
Key Path	Meas Setup, Demod Setup, Mod Format

1 Mbps DSSS Selects 1 Mbps 11 Chip DSSS Barker DBPSK Data Modulation Format.

Mode	VSA
Key Path	Meas Setup, Demod Setup, Mod Format, DSSS Formats

2 Mbps DSSS Selects 2 Mbps 11 Chip DSSS Barker DQPSK Data Modulation Format.

Mode VSA
Key Path **Meas Setup, Demod Setup, Mod Format, DSSS Formats**

CCK Formats This key brings up a selection of the available CCK Modulation Formats.

Mode VSA
Key Path **Meas Setup, Demod Setup, Mod Format**

5.5 Mbps CCK Selects 5.5 Mbps 8 Chip CCK DQPSK Data Modulation Format.

Mode VSA
Key Path **Meas Setup, Demod Setup, Mod Format, CCK Formats**

11 Mbps CCK Selects 11 Mbps 8 Chip CCK DQPSK Data Modulation Format.

Mode VSA
Key Path **Meas Setup, Demod Setup, Mod Format, CCK Formats**

PBCC Formats This key brings up a selection of the available PBCC Modulation Formats.

Mode VSA
Key Path **Meas Setup, Demod Setup, Mod Format**

5.5 Mbps PBCC Selects 5.5 Mbps PBCC QPSK Data Modulation Format.

Mode VSA

Key Path **Meas Setup, Demod Setup, Mod Format, PBCC Formats**

11 Mbps PBCC Selects 11 Mbps PBCC QPSK Data Modulation Format.

Mode VSA

Key Path **Meas Setup, Demod Setup, Mod Format, PBCC Formats**

22 Mbps PBCC Selects 22 Mbps PBCC 8PSK Data Modulation Format.

Mode VSA

Key Path **Meas Setup, Demod Setup, Mod Format, PBCC Formats**

33 Mbps PBCC Selects 33 Mbps PBCC 8PSK Data Modulation Format.

Mode VSA

Key Path **Meas Setup, Demod Setup, Mod Format, PBCC Formats**

Reference Filter

Selects the Reference Filter, as well as the companion Measurement Filter.

The following table shows what Measurement filter is used for each selected Reference Filter.

Reference Filter	Companion Measurement Filter
Rect (none)	Rect (none)
Gaussian	Rect (none)
Raised Cosine	Root Raised Cosine (RRC)

The 802.11b standard specifies that no reference filter should be used when computing EVM. However, a transmitter must use a transmit filter in order to meet the 802.11b spectral mask requirement, so it may be useful to specify a reference filter when computing EVM.

Mode	VSA
Remote Command	[:SENSe] :W11B:FILTer:REFerence RECTangular GAUSSian RCOSine [:SENSe] :W11B:FILTer:REFerence?
Example	W11B:FILT:REF RECT
Dependencies/Couplings	Set to Default by Preset to Standard.
Preset	RECT
State Saved	Saved in instrument state.
Range	Rectangular Gaussian Raised Cosine
Key Path	Meas Setup, Demod Setup

Rectangular Selects the Rectangular (no) Reference Filter and the Rectangular (no) Measurement Filter

Mode	VSA
Key Path	Meas Setup, Demod Setup, Data Modulation, Reference Filter

Gaussian Selects the Gaussian Reference Filter and the Rectangular (no) Measurement Filter

Mode	VSA
Key Path	Meas Setup, Demod Setup, Data Modulation, Reference Filter

Raised Cosine Selects the Raised Cosine Reference Filter and the Root Raised Cosine

(RRC) Measurement Filter

Mode	VSA
Key Path	Meas Setup, Demod Setup, Data Modulation, Reference Filter

Alpha / BT

If you specify a Gaussian Reference Filter, you can set the BT (Bandwidth Time Product) for the filter. If you specify a raised Cos Reference Filter, you can set the Alpha for the filter.

BT describes the shape of a Gaussian filter. BT indicates the filter roll-off (or excess bandwidth) of the Gaussian filter.

Alpha describes the shape of a Nyquist (raised cosine) filter. Alpha is also called the roll-off or the excess bandwidth factor. A higher value for alpha increases the bandwidth that is used in excess of the theoretical minimum.

Mode	VSA
Remote Command	<code>[:SENSe] :W11B:ALPHa <real></code> <code>[:SENSe] :W11B:ALPHa?</code>
Example	W11B:ALPH 0.5
Dependencies/Couplings	Set to Default by Preset to Standard.
Preset	0.5
State Saved	Saved in instrument state.
Min	.05
Max	100.0 (Gaussian Reference Filter), 1.0 (Raised Cos Reference Filter)
Key Path	Meas Setup, Demod Setup

Preset to Standard

This immediately sets all measurement parameters to their Preset values. This is the same as Meas Preset except that the display state is left alone.

Mode	VSA
Remote Command	<code>[:SENSe] :W11B:STANdard:PRESet I11BGDSSS</code>

Example	W11B:STAN:PRES I11BGDSSS
Notes	The parameter is required although there is only one choice.
Key Path	Meas Setup

Meas Time

This key brings up a menu consisting of the time length and positioning demodulation setup parameters.

Mode	VSA
Key Path	Meas Setup

Search Length

Lets you specify the length of time to acquire the input signal (in seconds). This defines the length of time that the pulse search is performed.

The analyzer searches within the specified search length and demodulates the first complete pulse (burst). The pulse can occur anywhere within the search length. Pulses beyond the first complete pulse are disregarded and are not demodulated. In order for the pulse search algorithm to detect a pulse edge, the pulse must be at least 15 dB above the noise floor. The resultant pulse is then demodulated.

Even if no pulse is found, the analyzer will attempt to demodulate starting at the beginning of the Search Length. If a PLCP Preamble Sync pattern is found near the start of the search length, the demodulation will be correct.

Mode	VSA
Remote Command	<code>[[:SENSE]:W11B:SYNC:SLENgth <time></code> <code>[[:SENSE]:W11B:SYNC:SLENgth?</code>
Example	W11B:SYNC:SLEN 0.001
Dependencies/Couplings	The minimum is constrained to meet the number of chip requirements of Result Length or Max Auto Result Length, whichever is active, at the current Chip Rate. Set to Default by Preset to Standard.
Preset	1.0 ms
State Saved	Saved in instrument state.

Min	.001 ms
Max	33.70373 ms
Key Path	Meas Setup, Meas Time

Result Length

This key allows you to manually set the Result Length or to have it automatically detected.

The result length is the total number of chips included in the acquired and demodulated data and includes the PLCP Preamble and Header.

When Result Length is Automatic, the result length is the number of chips in the current burst, up to the limit of Max Auto Result Length

Note that when Result Length is Manual, the demodulation is not limited to the number of chips transmitted within the burst as is done when the Result Length is Auto. The analyzer will demodulate the total number of chips specified by Result Length, which if longer than the burst, could lead to unexpected and incorrect data results.

Mode	VSA
Remote Command	[:SENSe]:W11B:TIME:RESult:LENGth <integer> [:SENSe]:W11B:TIME:RESult:LENGth? [:SENSe]:W11B:TIME:RESult:AUTO OFF ON 0 1 [:SENSe]:W11B:TIME:RESult:AUTO?
Example	W11B:TIME:RES:LENG 2816 W11B:TIME:RES:AUTO ON
Dependencies/Couplings	Search Length is increased to include the Result Length, if Result Length is in Manual mode. Set to Default by Preset to Standard.
Preset	2816 chips ON
State Saved	Saved in instrument state.
Min	1 chip
Max	65941 chips
Key Path	Meas Setup, Meas Time

Max Auto Result Length.

Note that when Result Length is Manual, the demodulation is not limited to the number of chips transmitted within the burst as is done when the Result Length is Auto. The analyzer will demodulate the total number of chips specified by Result Length, which if longer than the burst, could lead to unexpected and incorrect data results.

Mode	VSA
Remote Command	[:SENSe]:W11B:TIME:RESult:LENGth <integer> [:SENSe]:W11B:TIME:RESult:LENGth? [:SENSe]:W11B:TIME:RESult:AUTO OFF ON 0 1 [:SENSe]:W11B:TIME:RESult:AUTO?
Example	W11B:TIME:RES:LENG 2816 W11B:TIME:RES:AUTO ON
Dependencies/Couplings	Search Length is increased to include the Result Length, if Result Length is in Manual mode. Set to Default by Preset to Standard.
Preset	2816 chips ON
State Saved	Saved in instrument state.
Min	1 chip
Max	65941 chips
Key Path	Meas Setup, Meas Time

Max Auto Result Length

This key has an effect only when Result Length is set to Auto. In this case, the effective result length, the total number of chips included in the demodulated data, is automatically determined by comparing the input signal's chip length to the Max Auto Result Length value and using the smaller number.

Mode	VSA
Remote Command	[:SENSe]:W11B:TIME:RESult:MAX <integer> [:SENSe]:W11B:TIME:RESult:MAX ?
Example	W11B:TIME:RESult:MAX 2816

Dependencies/Couplings	Search Length is increased to include the Max Result Length, if Result Length is in Auto mode. Set to Default by Preset to Standard.
Preset	2816 chips
State Saved	Saved in instrument state.
Min	1 chip
Max	370741 chips
Key Path	Meas Setup, Meas Time

Meas Offset

Measurement Offset determines the start position, in chips, of the Meas Interval with respect to the first Chip of the PLCP Preamble. Measurement Interval is entered in chips, which is rounded to the nearest whole number of data symbols, as determined from the input signal's data modulation format.

Mode	VSA
Remote Command	[:SENSe] :W11B:TIME:OFFSet <integer> [:SENSe] :W11B:TIME:OFFSet?
Example	W11B:TIME:OFFS 22
Dependencies/Couplings	The maximum is limited to Result Length or Max Auto Result Length, whichever is active, minus Meas Interval. Set to Default by Preset to Standard.
Preset	22 chips
State Saved	Saved in instrument state.
Min	0 chips
Max	See coupling
Key Path	Meas Setup, Meas Time

Meas Interval

Measurement Interval, in conjunction with Meas Offset, lets you specify an interval (segment) of the result length data to be demodulated and analyzed. Measurement Interval is entered in chips, which is rounded to the nearest whole number of data

symbols, as determined from the input signal's data modulation format.

Mode	VSA
Remote Command	[:SENSe] :W11B:TIME:INTerval <integer> [:SENSe] :W11B:TIME:INTerval?
Example	W11B:TIME:INT 2794
Dependencies/Couplings	The maximum is limited to Result Length or Max Auto Result Length, whichever is active. If necessary, Meas Offset is reduced to keep Meas Interval plus Meas Offset within Result Length or Max Result Length, whichever is active. Set to Default by Preset to Standard.
Preset	2794 chips
State Saved	Saved in instrument state.
Min	1
Max	See coupling
Key Path	Meas Setup, Meas Time

Advanced

This key accesses a menu that allows you to select lesser used demodulation parameters for the current measurement. These settings are for advanced users and do not normally require adjustment for most common measurements.

Mode	VSA
Key Path	Meas Setup, More

Chip Rate

This key lets you set the Chip Rate for the analyzer's demodulator. This allows you the freedom to enter nonstandard chip rates for test and analysis purposes.

Mode	VSA
Remote Command	[:SENSe] :W11B:CRATe <freq> [:SENSe] :W11B:CRATe?

Example	W11B:CRAT 11.0E6
Dependencies/Couplings	Span is forced to be at least one tenth of the Chip Rate. So the maximum Chip Rate is one tenth of the maximum Span. Likewise, the Span will be forced to be within ten times the Chip Rate and so the minimum Span sets the minimum Chip Rate. Set to Default by Preset to Standard.
Preset	11 MHz
State Saved	Saved in instrument state.
Min	See Coupling
Max	See Coupling
Key Path	Meas Setup, More, Advanced

Clock Adjust

Clock Adjust determines when the analyzer's digital demodulator samples the I/Q trajectory.

The demodulator used in this measurement does not require symbol-clock timing signals to determine the location of chip detection-decision points. Instead, the demodulator uses an algorithm to determine chip locations.

Some digital communications systems contain non-linearities that can bias the digital demodulator's estimation of the chip clock position. You can use clock adjust to compensate for this "offset" and obtain a lower EVM (Error Vector Magnitude).

Mode	VSA
Remote Command	[:SENSe] :W11B:CADJust <real> [:SENSe] :W11B:CADJust?
Example	W11B:CADJ 0.0
Dependencies/Couplings	Set to Default by Preset to Standard.
Preset	0 chips
State Saved	Saved in instrument state.
Min	-0.5 chips
Max	0.5 chips
Key Path	Meas Setup, More, Advanced

Track Phase

The Track Phase parameter enables tracking of phase drift within the WLAN burst. This may be useful if the carrier frequency drifts significantly during a burst. Circular arcs in the constellation of the IQ Meas Time trace display is an indicator of phase drift. The Track Phase parameter can be used to remove the phase drift, which will improve the IQ constellation trace and reduce the EVM data results. Frequency drift can also cause poor equalizer performance, so selecting Track Phase may improve equalizer results.

Mode	VSA
Remote Command	[:SENSe] :W11B:TRACk:PHASe OFF ON 0 1 [:SENSe] :W11B:TRACk:PHASe?
Example	W11B:TRAC:PHAS OFF
Dependencies/Couplings	Set to Default by Preset to Standard.
Preset	OFF
State Saved	Saved in instrument state.
Key Path	Meas Setup, More, Advanced

Equalizer

Equalizer State turns the Equalizer on or off.

The Equalizer numeric entry sets the length of the equalization filter.

In general, the best Equalizer filter length is the smallest that meets your measurement requirements. For measurements at the transmitter, the filter length may only need to be a few chips in length. Longer filter lengths may be needed to measure multi-path environments.

The 802.11b specification does not allow for equalization prior to computing EVM. This means that any linear distortion, such as group delay distortion in the IF, will increase EVM. When EVM is high the equalizer can be used as a diagnostic tool. If use of the equalizer significantly improves the EVM result, then the channel frequency response should be examined for flatness problems (i.e. group delay distortion). If it does not, then the problem is more likely related to noise, non-linear distortion, or spurious error.

Mode	VSA
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Remote Command	[:SENSE]:W11B:EQUalization:FLENgth <integer> [:SENSE]:W11B:EQUalization:FLENgth? [:SENSE]:W11B:EQUalization[:STATe] OFF ON 0 1 [:SENSE]:W11B:EQUalization[:STATe]?
Example	W11B:EQU:FLEN 21 W11B:EQU OFF
Restriction and Notes	Only odd values are valid. Even value entries are rounded down.
Dependencies/Couplings	The maximum Equalizer length is also limited to 2 chips less than the result length. Set to Default by Preset to Standard.
Preset	21 OFF
State Saved	Saved in instrument state.
Min	3
Max	99
Key Path	Meas Setup, More, Advanced

Descramble

Descramble Mode lets you enable/disable the WLAN 802.11b/g descrambler. With this feature you can separately view the descrambled or raw data bits for the preamble, header or payload data fields.

Mode	VSA
Remote Command	[:SENSE]:W11B:DESCramble ALL NONE PREamble PHEader [:SENSE]:W11B:DESCramble?
Example	W11B:DESC ALL
Dependencies/Couplings	Set to Default by Preset to Standard.
Preset	ALL
Range	All None Preamble Only Preamble & Header Only
Key Path	Meas Setup, More, Advanced

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Meas Setup

All The WLAN Descrambler is ON, the Preamble, Header, and Payload data bits are descrambled.

Mode VSA
Key Path **Meas Setup, More, Advanced, Descramble**

None The WLAN Descrambler is OFF, the Preamble, Header, and Payload data bits are not descrambled.

Mode VSA
Key Path **Meas Setup, More, Advanced, Descramble**

Preamble Only Only the Preamble data bits are descrambled. The Header data bits and Payload data bits are not descrambled.

Mode VSA
Key Path **Meas Setup, More, Advanced, Descramble**

Preamble & Header Only Only the Preamble and Header data bits are descrambled. The Payload data bits are not descrambled.

Mode VSA
Key Path **Meas Setup, More, Advanced, Descramble**

IQ Normalize

When set to On, the IQ trace data results (including IQ Meas Time, IQ Ref Time, IQ Mag Err, IQ Phase Err, and Error Vector Time and corresponding Spectrum results) are normalized.

When set to Off, the trace data results are not normalized.

When normalization is On, the analyzer normalizes or scales the demodulated trace data

results, in magnitude, to a nominal value of 1, relative to the outermost states of the ideal (IQ Reference) constellation diagram.

Note that regardless of this setting, the Error Summary trace data results are always normalized.

Mode	VSA
Remote Command	:CALCulate:W11B:NORMALize OFF ON 0 1 :CALCulate:W11B:NORMALize?
Example	CALC:W11B:NORM ON
Dependencies/Couplings	Set to Default by Preset to Standard.
Preset	ON
State Saved	Saved in instrument state.
Key Path	Meas Setup, More, Advanced

Meas Preset

This immediately sets all measurement parameters to their Preset values. This presets the display state in the same way as Preset View: Basic.

For more information, see the section under the Preset key in the Utility section.

Mode	VSA
Key Path	Meas Setup, More

Amplitude (AMPTD) Y Scale

This menu has controls for the input signal conditioning as well as the Y-scaling of trace data. For more information, see Analyzer Setup Functions, AMPTD Y Scale.

Mode	VSA
Key Path	Front-panel key

Auto Couple

The Auto Couple key forces all Auto / Man functions into Auto. This applies to Data Modulation Detect and Result Length. For more information, see Analyzer Setup Functions, Auto Couple.

Mode	VSA
Key Path	Front-panel key

BW

The BW key provides access to a menu that allows you to set the FFT Window for the spectrum measurement results.

For more information see: Analyzer Setup Functions, BW.

Mode	VSA
Key Path	Front Panel

FFT Window

This key allows you to choose the Window function that is applied to the time data prior to the FFT calculation used for Spectrum, Error Vector Spectrum, IQ Meas Spectrum, and IQ Ref Spectrum results as well as the non-averaged (Inst) versions of these results.

For more information, see Analyzer Setup Functions, BW, FFT Window.

Mode	VSA
Preset	Flat Top
Key Path	BW

FREQ Channel

This key provides access to a menu that allows control over the Center, Start, or Stop Frequency settings. For more information, see Analyzer Setup Functions, FREQ Channel.

Mode	VSA
Key Path	Front Panel

Input/Output

This key provides access to a menu that allows you to select input/output parameters for the measurement data. For more information, see Analyzer Setup Functions, Input/Output.

Mode	VSA
Key Path	Front-panel key

SPAN X Scale

This menu has softkeys for selecting measurement span and also for scaling of the X axis. For more information, see Analyzer Setup Functions, SPAN X Scale.

Mode	VSA
Key Path	Front-panel key

Span

This controls the frequency span of the measurement. See the **FREQ Channel** section for details on how this interacts with **Start**, **Stop**, and **Center** frequencies.

Mode	VSA
Dependencies/Couplings	Limited to a factor of 10 higher and lower than Chip Rate. When Chip Rate is changed, Span may be changed to meet this requirement.
Preset	34.375 MHz (limited by hardware to 10 MHz or 25 MHz with Option B25)
Key Path	SPAN X Scale

Trace/Detector

This key allows you to select the results shown in the trace windows. For more information, see Analyzer Setup, [Trace/Detector on page 226](#).

Mode	VSA
Key Path	Front-panel key

Data

This accesses a menu of Trace data choices for the selected trace.

Mode	VSA
Key Path	Trace/Detector

For more information, see Analyzer Setup, Trace/Detector, [Data on page 228](#).

The following are the SCPI string forms for the Data types that are specific to this measurement, in alphabetical order:

Table 10-5

Trace data soft key name	SCPI string form
CCDF	"CCDF1"
CDF	"CDF1"
Ch Frequency Response	"Ch Frequency Response1"
Eq Impulse Response	"Eq Impulse Response1"
Error Vector Spectrum	"Error Vector Spec1"
Error Vector Time	"Error Vector Time1"
Header Symbols	"Header Syms1"
IQ Mag Error	"IQ Mag Error1"
IQ Meas Spectrum	"IQ Meas Spec1"

Table 10-5

Trace data soft key name	SCPI string form
IQ Meas Time	"IQ Meas Time1"
IQ Phase Error	"IQ Phase Error1"
IQ Ref Spectrum	"IQ Ref Spec1"
IQ Ref Time	"IQ Ref Time1"
Inst Error Vector Spectrum	"Inst Error Vect Spec1"
Inst IQ Meas Spectrum	"Inst IQ Meas Spec1"
Inst IQ Ref Spectrum	"Inst IQ Ref Spec1"
Inst Spectrum	"Inst Spectrum1"
PDF	"PDF1"
Preamble Symbols	"Preamble Syms1"
Raw Main Time	"Raw Main Time1"
Search Time	"Search Time1"
Spectrum	"Spectrum1"
Symbols/Errors	"Syms/Errs1"
Time	"Time1"

The following Trace Data types are available in all measurements:

Table 10-6

Soft Key Name	SCPI string form
No Data	"No Data"
Spectrum	"Spectrum1"
Inst Spectrum	"Inst Spectrum1"
Raw Main Time	"Raw Main Time1"
OBW Summary Trace 1	"OBW Summary Trc1"
OBW Summary Trace 2	"OBW Summary Trc2"
OBW Summary Trace 3	"OBW Summary Trc3"
OBW Summary Trace 4	"OBW Summary Trc4"
ACP Summary Trace 1	"ACP Summary Trc1"

Time The time record before digital demodulation and after the pulse/burst search.

The starting point is the beginning of the burst, offset by the Meas Offset and its length is the Meas Interval.

The exception to this is that 10% more additional data on both sides is shown when the Measurement Offset is set to zero and the Measurement Interval is set the same as the Result Length in Manual Result Length mode. In automatic Result Length mode, this will occur when the Measurement Offset to zero and the Measurement Interval is set to the Max Result Length, but will not go more than 10% beyond the end of the burst.

Mode	VSA
Key Path	Trace/Detector, Data, Pre Demod

Raw Main Time The raw time record acquired for the current measurement. This data is unprocessed and includes additional points acquired for settling of the filters involved in subsequent processing, such as the demodulation filtering.

Mode	VSA
Key Path	Trace/Detector, Data, Pre Demod

Statistical

This key accesses the Trace Data choices which show statistical results.

Mode	VSA
Key Path	Trace/Detector, Data

CCDF The Complementary, Cumulative Density function (CCDF) for the selected input channel.

The analyzer plots CCDF using units of percent (%) for the y-axis and power (dB) for the x-axis. Power on the x-axis is relative to the signal average power.

Mode	VSA
Key Path	Trace/Detector, Data, Statistical

CDF The Cumulative Density Function (CDF) for the selected input channel. CDF is computed by integrating the CCDF (Probability Density Function).

Mode VSA
Key Path Trace/Detector, Data, Statistical

PDF The Probability Density Function (PDF) for the selected input channel. PDF indicates the probability that a given level has occurred.

Mode VSA
Key Path Trace/Detector, Data, Statistical

Demod

This key accesses the Trace Data choices which show general demodulation results.

Mode VSA
Key Path Trace/Detector, Data

IQ Meas Time The measured time data sampled at exactly the chip times with IQ origin offset, system gain normalization and carrier locking applied to the input signal.

Mode VSA
Key Path Trace/Detector, Data, Demod

IQ Meas Spectrum The averaged frequency spectrum of IQ Meas Time. The selected FFT Window is applied and the FFT performed on the result. This is then averaged, if

averaging is turned on.

Mode	VSA
Key Path	Trace/Detector, Data, Demod

Inst IQ Meas Spectrum The instantaneous (non-averaged) frequency spectrum of IQ Meas Time. The selected FFT Window is applied and the FFT performed on the result.

Mode	VSA
Key Path	Trace/Detector, Data, Demod

IQ Ref Time The ideal representation of the measured input signal (IQ Meas Time).

Mode	VSA
Key Path	Trace/Detector, Data, Demod

IQ Ref Spectrum The averaged frequency spectrum of IQ Ref Time. The selected FFT Window is applied and the FFT performed on the result. This is then averaged, if averaging is turned on.

Mode	VSA
Key Path	Trace/Detector, Data, Demod

Inst IQ Ref Spectrum The instantaneous (non-averaged) frequency spectrum of IQ Ref Time. The selected FFT Window is applied and the FFT performed on the result.

Mode	VSA
Key Path	Trace/Detector, Data, Demod

Demod Error

This key accesses the Trace Data choices which show demodulation error related results.

Mode	VSA
Key Path	Trace/Detector, Data

Error Vector Time The vector (IQ) difference between the IQ Meas Time and IQ Ref Time signals.

Mode	VSA
Key Path	Trace/Detector, Data, Demod Error

Error Vector Spectrum The averaged frequency spectrum of Error Vector Time. The selected FFT Window is applied and the FFT performed on the result. This is then averaged, if averaging is turned on.

Mode	VSA
Key Path	Trace/Detector, Data, Demod Error

Inst Error Vector Spectrum The instantaneous (non-averaged) frequency spectrum of Error Vector Time. The selected FFT Window is applied and the FFT performed on the result.

Mode	VSA
Key Path	Trace/Detector, Data, Demod Error

IQ Mag Error The difference, in magnitude, between the IQ Meas Time and IQ Ref Time signals.

Mode	VSA
Key Path	Trace/Detector, Data, Demod Error

IQ Phase Error The phase difference between the IQ Meas Time and IQ Ref Time signals.

Mode VSA
Key Path Trace/Detector, Data, Demod Error

Tables

This key accesses the Trace Data choices which are in tabular form, including demodulated symbols tables.

Mode VSA
Key Path Trace/Detector, Data

Symbols/Errors This display contains an error summary in the upper part, and a listing of demodulated symbols in the lower part. The error summary consists of:

Result name	Displayed Unit	Remote Name	Remote Unit
EVM (rms)	%rms	EVM	%rms
EVM (peak)	%pk	EVMPeak	%
EVM (peak) location	chip	EVMPeakLoc	chip
Mag error (rms)	%rms	MagErr	%rms
Mag error (peak)	%pk	MagErrPeak	%
Mag error (peak) location	chip	MagErrPeakLoc	chip
Phase error (rms)	deg	PhaseErr	deg
Phase error (peak)	deg	PhaseErrPeak	deg
Phase error (peak) location	chip	PhaseErrPeakLoc	chip

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Trace/Detector

Result name	Displayed Unit	Remote Name	Remote Unit
Frequency Error	Hz	FreqErr	Hz
IQ Offset	dB	IQOffset	(none)
Quadrature Error	deg	IQQuadErr	deg
Gain Imbalance	dB	IQGainImb	(none)
Sync Correlation		SyncCorr	(none)
802.11b 1000 chip Peak EVM	%	80211bEvmPeak	%
Status		HdrStat	(none)
(included in Status above)		MacStat	(none)
Burst Type		BurstType	(none)
Bit Rate	bps	BitRate	bps
Octets		Octets	(none)
Data Len	sec	DataTimeLen	sec
Symbol Clock Err	ppm	SymClkErr	(none)

The error summary values may be obtained using the CALC:W11B:DATA:TABLE commands.

The demodulated symbols are available as the data values for this trace and so may be accessed using the CALCulate:W11B:DATA command. See Common Functions, Data Queries, CALCulate:DATA for more details.

Mode VSA
Key Path Trace/Detector, Data, Tables

Preamble Symbols This trace shows the 802.11b PLCP Preamble data bits.

Mode VSA
Key Path Trace/Detector, Data, Tables

Header Symbols This trace shows the 802.11b PLCP Header data bits.

Mode VSA
Key Path Trace/Detector, Data, Tables

Response

This key accesses the Trace Data choices which show equalizer response results.

Mode VSA
Key Path Trace/Detector, Data

Ch Frequency Response When the Equalizer is On, this trace shows the frequency response of the channel for which the equalizer is correcting. Ch Frequency Response is computed as the inverse of the equalization filter's frequency response.

Mode VSA
Key Path Trace/Detector, Data, Response

EQ Impulse Response When the Equalizer is On, the EQ Impulse Response trace shows the impulse response computed from the 802.11b or 802.11g preamble.

Mode VSA
Key Path Trace/Detector, Data, Response