User Guide

Spectrum Master

Ultraportable Spectrum Analyzer

MS2760A-0032 - 9 kHz to 32 GHz
MS2760A-0044 - 9 kHz to 44 GHz
MS2760A-0050 - 9 kHz to 50 GHz
MS2760A-0070 - 9 kHz to 70 GHz
MS2760A-0090 - 9 kHz to 90 GHz
MS2760A-0110 - 9 kHz to 110 GHz

/Anritsu

Product Information, Compliance, and Safety

Regulatory Compliance

Following compliance notices and declarations of conformity apply to the products listed on the title page. This equipment is categorized as Class A devices as noted below:

- A device marketed for use in an industrial application and is not intended for use in the home or residential area is classified as Class A. Class A equipment, commonly known as ISM (industrial, scientific, and medical) equipment, are for professional use in engineering and scientific applications commanding specialized training and good understanding of the English language. Products being sold in a commercial market for such applications have significantly less stringent emissions limits than Class B (residential) devices.

- A device that is marketed for use in the home or a residential area by the customer is classified as a Class B device. Class B verification is for devices that are marketed for in-home use, but are not permanently connected to a personal computer.

Note	Depending on the economic region/area that your equipment is marketed for, certain labels may not be applicable. Please refer to the markings affixed to your equipment.

CE Conformity Marking

Anritsu affixes the CE Conformity marking onto its conforming products in accordance with Council Directives of The Council Of The European Communities in order to indicate that these products conform to the EMC and LVD directive of the European Union (EU).

European Parliament and Council Directive 2012/19/EC
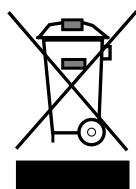
Equipment Marked with the crossed-out Wheelie Bin symbol complies with the European Parliament and Council Directive 2012/19/EC (the "WEEE Directive") in the European Union.

For Products placed on the EU market after August 13, 2012, please contact your local Anritsu representative at the end of the product's useful life to arrange disposal in accordance with your initial contract and the local law.

RCM Conformity Marking

Anritsu affixes the Regulatory Compliance Mark (RCM) onto its conforming products in accordance with the electromagnetic compliance regulations of Australia and New Zealand in order to indicate that these products conform to the EMC regulations of Australia and New Zealand.

KCC Conformity Marking

Anritsu affixes the Korean Communications Commissions (KCC) mark onto its conforming products in accordance with the electromagnetic compliance regulations of Korea

Recycle Marking

Anritsu affixes the universal recycle symbol onto its products to indicate that the marked part is made from recyclable materials and should be recycled. Materials should be recycled in accordance with your local regulatory requirements.

Proposition 65 Notification

Notification for California customers: Chemicals known to the state of California to cause cancer, birth defects, or other reproductive harm may be present in these products or their related accessories. For information, see: https://oag.ca.gov/prop65

Chinese RoHS Compliance Statement

产品中有毒有害物质或元素的名称及含量						NLNB - 201606

部件名称	有毒有害物质或元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 [Cr(VI)]	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
印刷线路板 (PCA)	×	○	×	○	○	○
机壳、支架 (Chassis)	×	○	×	×	○	○
其他（电缆、风扇、 连接器等） (Appended goods)	×	○	×	×	○	○
○：表示该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T 11364-2014 标准规定的限量要求以下。 ×：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 SJ/T 11364-2014 标准规定的限量要求。						

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注）生产日期标于产品序号的前四码（如 S/N 1628XXXX 为16 年第 28 周生产）。

Unauthorized Use or Disclosure

Anritsu Company has prepared the product user documentation for use by Anritsu Company personnel and customers as a guide for the proper installation, operation, and maintenance of Anritsu Company equipment and software programs. The drawings, specifications, and information contained therein are the property of Anritsu Company, and any unauthorized use or disclosure of these drawings, specifications, and information is prohibited; they shall not be reproduced, copied, or used in whole or in part as the basis for manufacture or sale of the equipment or software programs without the prior written consent of Anritsu Company.

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- USB Type-C is a trademark of the USB Implementers Forum, Inc.
- Acrobat and Acrobat Reader are registered trademarks of Adobe Corporation.
- All other trademarks mentioned are the property of their respective companies.

Warranty Information

The Anritsu products listed on the title page are warranted against defects in materials and workmanship for three years from the date of shipment. Anritsu's obligation covers repairing or replacing products which prove to be defective during the warranty period. Buyers shall prepay transportation charges for equipment returned to Anritsu for warranty repairs. Obligation is limited to the original purchaser. Anritsu is not liable for consequential damages.

Limitation of Warranty

The foregoing warranty does not apply to Anritsu connectors that have failed due to normal wear. Also, the warranty does not apply to defects resulting from improper or inadequate maintenance, unauthorized modification or misuse, or operation outside of the environmental specifications of the product. No other warranty is expressed or implied, and the remedies provided herein are the Buyer's sole and exclusive remedies.

Disclaimer of Warranties

To the maximum extent permitted by applicable law, Anritsu Company and its suppliers disclaim all warranties, either expressed or implied, including, but not limited to, implied warranties of merchantability and fitness for a particular purpose, with regard to the product. The user assumes the entire risk of using the product. Any liability of provider or manufacturer will be limited exclusively to product replacement.

No Liability For Consequential Damages

To the maximum extent permitted by applicable law, in no event shall Anritsu Company or its suppliers be liable for any special, incidental, indirect, or consequential damages whatsoever (including, without limitation, damages for loss of business profits, business interruption, loss of business information, or any other pecuniary loss) arising out of the use of or inability to use the product, even if Anritsu Company has been advised of the possibility of such damages. Because some states and jurisdictions do not allow the exclusion or limitation of liability for consequential or incidental damages, the above limitation may not apply to you.

Updates

Updates, if any, can be downloaded from the Library tab on the Anritsu product page:

https://www.anritsu.com/en-us/test-measurement/products/ms2760a

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Chapter 1 — General Information

1-1   Scope of Manual

This manual provides general information, as well as installation and operating information for the Anritsu MS2760A Spectrum Master Ultraportable Spectrum Analyzer and Spectrum Master User Interface Software.

1-2   Introduction

This chapter contains general information about the Anritsu MS2760A Spectrum Analyzer and MS2760A Software. It includes the following information:

- General description of the device and software
- Identification number
- Initial inspection
- Preparation for storage and shipment

1-3   Description

The Anritsu MS2760A is an innovative mmWave spectrum analyzer delivering basic spectrum analysis capabilities well below the price point of traditional spectrum analyzers in an unimaginably small form factor until now that operates from 9 kHz up to 110 GHz.

The MS2760A is a spectrum analyzer that connects and communicates with a PC via USB. It can measure signals at frequencies as low as 9 kHz and up to 110 GHz. It is ideal for the testing of many mmWave applications such as 802.11ad, wireless backhaul, and other future 5G applications.

The MS2760A is a direct conversion spectrum analyzer below 6.15 GHz and a sampler-based spectrum analyzer above 6.15 GHz. The sampler-based portion of the MS2760A exploits Anritsu's patented Non-Linear Transmission Line Technology (NLTL) sampling technology in a customized Radio Frequency Integrated Circuit (RFIC). The MS2760A employs software algorithms to virtually eliminate image responses. Most images are removed, however low level image responses very close to the noise floor may be seen when making multi-tone or modulated signal measurements. These effects can be more noticeable when using trace averaging and can be minimized with narrower VBW filters.

Note	The MS2760A uses a USB 3.0 Type C interface for PC and remote communication and requires USB 3.0 as a power source.

1-4   Software and Documentation

All software and documentation for the MS2760A spectrum analyzer is available online. To go directly to the spectrum analyzer product page https://www.anritsu.com/en-us/test-measurement/products/ms2760a.

Refer to Chapter 2, "Installation" for system requirements and installation instructions.

Note	Anritsu follows a practice of regular improvement to our software; we recommend users check http://www.anritsu.com to ensure you have the latest versions.

Refer to the MS2760A Spectrum Master Technical Data Sheet for the latest options, available accessories, and performance specifications for your instrument model.

1-5   Initial Inspection

Inspect the shipping container for damage. If the shipping container is damaged, retain it until the contents of the shipment have been checked and the instrument has been checked for mechanical and electrical operation. The following items are typically included with every shipment, but should be verified with the packing list:

- MS2760A Spectrum Analyzer
- 2000-1859-R 1.0 m USB A to C Port Cable
- 2000-1605-R BNC(m) to MCX(m) Cable (quantity 2)
- Certificate of Calibration
- 11410-00976 Getting Started Flier

If the shipment is incomplete or if the spectrum analyzer is damaged mechanically or electrically, notify your local sales representative or Anritsu Customer Service. If the shipping container is damaged or shows signs of stress, notify the carrier as well as Anritsu. Keep the shipping materials for the carrier's inspection.

1-6   Spectrum Master Identification

All Anritsu spectrum analyzers are assigned a unique seven digit serial number, such as "0701016". The serial number is printed on a label that is affixed to the unit. When ordering parts or corresponding with Anritsu Customer Service, please use the correct serial number with reference to the specific instrument's model number.

1-7   Preparation for Storage/Shipment

Preparing the spectrum analyzer for storage consists of cleaning the unit, packing the inside with moisture-absorbing desiccant crystals, and storing the unit in the recommended temperature environment. Please refer to the data sheet for storage temperature recommendations.

To provide maximum protection against damage in transit, the spectrum analyzer should be repackaged in the original shipping container. If this container is no longer available and the unit is being returned to Anritsu for repair, please advise Anritsu Customer Service and use the following process to package the Spectrum Master Ultraportable Spectrum Analyzer for shipment:

Note	Disconnect any USB and Trigger cables before packaging the analyzer.

- Use a Suitable Container: Obtain a corrugated cardboard carton. This carton should have inside dimensions of no less than 15 cm larger than the unit dimensions to allow for cushioning.
- Protect the Instrument: Surround the unit with polyethylene sheeting to protect the finish.
- Cushion the Instrument: Cushion the instrument on all sides by tightly packing urethane foam between the carton and the unit. Provide at least three inches of dunnage on all sides.
- Seal the Container: Seal the carton by using either shipping tape or an industrial stapler.
- Address the Container: If the instrument is being returned to Anritsu for service, mark the address of the appropriate Anritsu service center and your return address on the carton in one or more prominent locations.

1-8   Contacting Anritsu

To contact Anritsu, please visit: http://www.anritsu.com/contact-us

From here, you can select the latest sales, service and support contact information in your country or region, provide online feedback, complete a "Talk to Anritsu" form to get your questions answered, or obtain other services offered by Anritsu.

Chapter 2 — Installation

2-1 Introduction

This chapter provides information on installing the Anritsu MS2760A Spectrum Analyzer and the MS2760A Spectrum Master software, including:

- Hardware and software requirements for the Anritsu Spectrum Master application
- Installing the Spectrum Master program procedure

2-2 Hardware and Software Requirements

The following are the recommended minimum PC specifications for installing and using the software:

- Equivalent to Quad Core i7 fourth generation or higher CPU, 16 GB RAM, 128 GB Data Storage
- Microsoft® Windows 7, Windows 8.1, and Windows 10, (64-bit required for all versions)
- 100 MB hard-disk free space
- Display resolution 1024 × 768
- Super speed USB 3.0 (required)

2-3 Installing the MS2760A Software Application and Drivers

Both the Spectrum Master application and drivers must be installed before using the Spectrum Master MS2760A instrument. Follow the steps below as a guide for proper installation.

1. Go to http://www.anritsu.com and type MS2760A into the search. Find the Spectrum Master MS2760A software from the Downloads section and download the MS2760A installer .exe file.

2. Double click the application file and follow the installation instruction.

Note	The following figures are example dialogs that pop up during the installation process. Actual version and time stamp may differ.
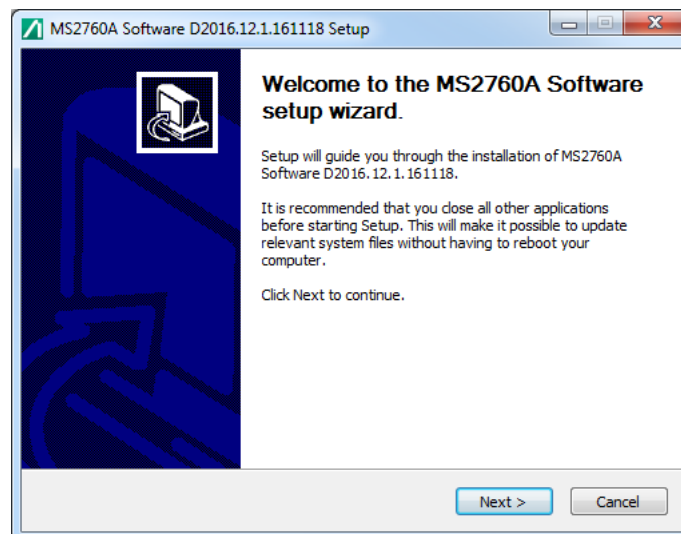
Figure 2-1. Anritsu Welcome Screen

3. Select **Next**.
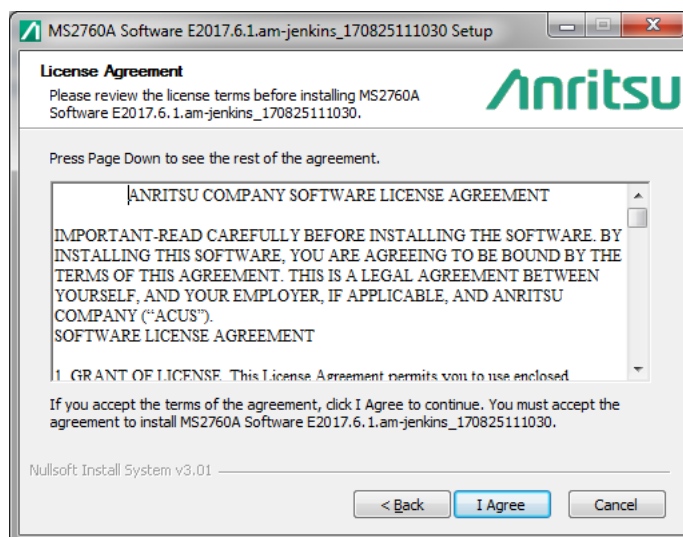
Figure 2-2.   Spectrum Master License Agreement

4. Read the license agreement and select "**I Agree**". The Select shortcut options dialog opens.

5. Select the desired options to be installed.

6. Press **Next**.
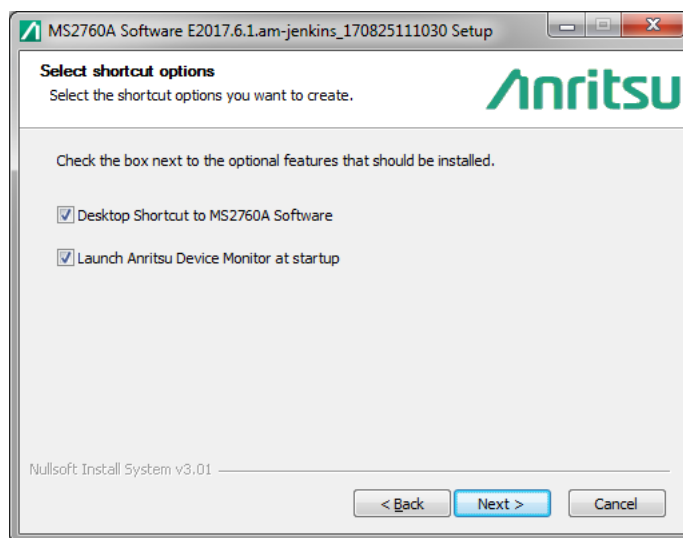
Figure 2-3.   Select Shortcut Options Dialog

7. To use the default directory for the program installation, press **Install.**

Note	If you choose not to have the Device Monitor launch after installation, you will have to launch it manually before the MS2760A will connect to the software.
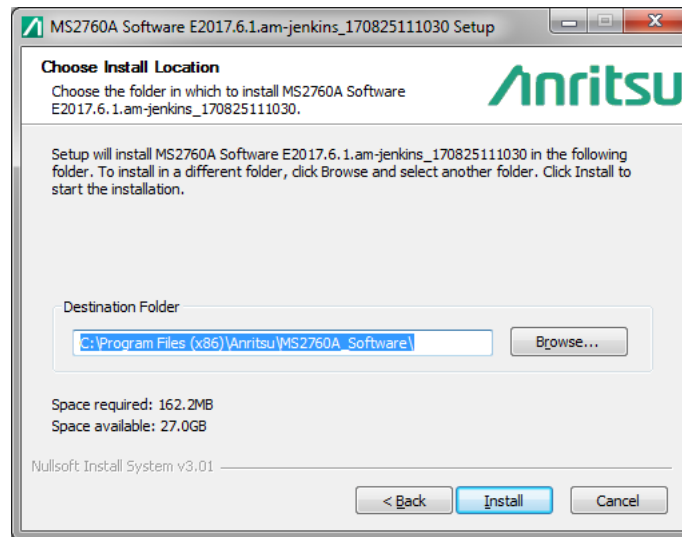
Figure 2-4. Choose Install Location Dialog

The software loads and installs to the selected location.
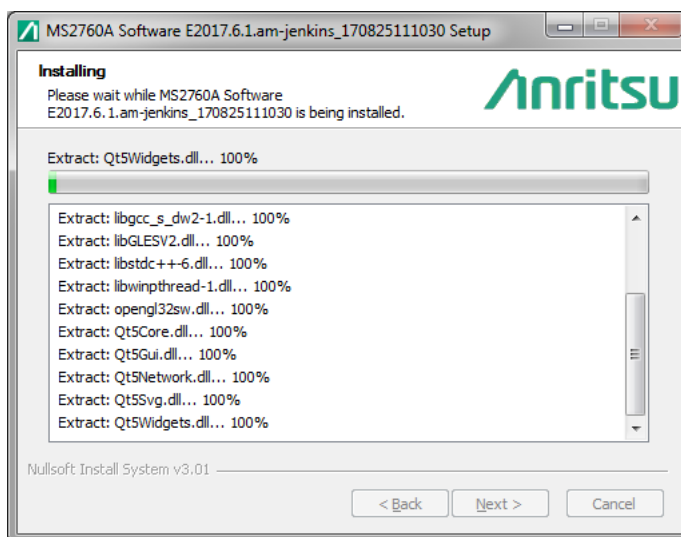
Figure 2-5. Installing Dialog

8. Select **Finish** to complete the installation.
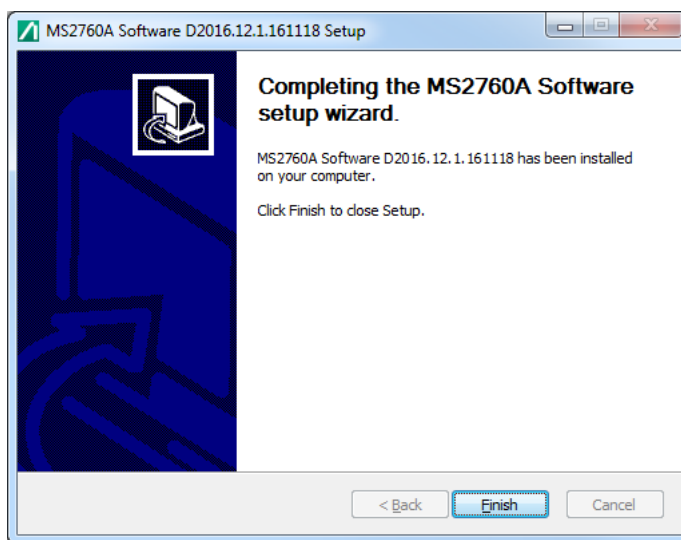
Figure 2-6. Anritsu Spectrum Master Installation Complete

During the first installation, the following dialog may display and can be ignored. It has no bearing on the installation process or functionality of the MS2760A.
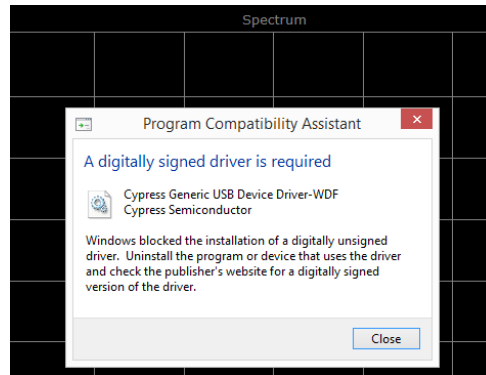
Figure 2-7.   Installation Driver Dialog

2-4 Status Indicator and Connectors

Connectors and status indicator for the Spectrum Master are shown below in Figure 2-8.

Index	Description
1	TRIG -External Trigger Connector: MCX(f), 50 Ω
2	Status Indicator Initialization: Will blink red intermittently during the process. Normal operation: Will be solid green, meaning all is well. Normal operation: A red light may indicate an over range condition or lock failure.
3	USB Interface: USB 3.0, Type C Connector
4	REF - External Reference In Connector: MCX(f), 50 Ω, 10 MHz
5	RF In Connectors: 32 GHz and 44 GHz Instruments: K Connector (2.92 mm), male Ω, torque 8 in-lb 50 GHz and 70 GHz Instruments: V Connector (1.85 mm), male 50 Ω, torque 8 in-lb 90 GHz and 110 GHz Instruments: W Connector (1.00 mm), male 50 Ω, torque 4 in-lb Note: For all connector types, max RF input level is +30 dBm (1W) CW.

Figure 2-8. Spectrum Master Connectors and Status Indicator

2-5   Connecting to a Personal Computer, Laptop, or Tablet

1. Confirm that the Anritsu Device Monitor is running before attaching the MS2760 Spectrum Analyzer to a personal computer, laptop or tablet.

2. Click the Show Hidden Icons button on the Taskbar system tray to open the Hidden Icon window. Confirm that the Anritsu Device Monitor is displayed.
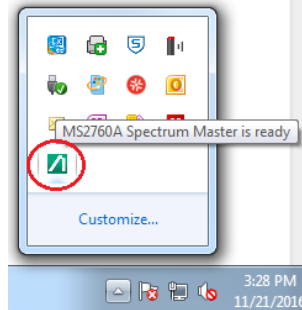
Figure 2-9.   Anritsu Device Monitor Displayed.

3. Attach the mini connector of the USB cable to the MS2760A.

4. Attach the standard connector of the USB cable to the personal computer, laptop, or tablet. The MS2760A will go through an initialization process. Wait for the "MS2760 Spectrum Master is ready" message to display. If the software is run immediately after connecting the spectrum analyzer and before the ready message is displayed, the software will time out.
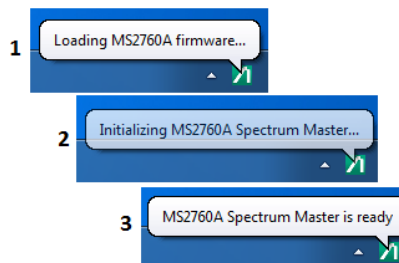
Figure 2-10.   Initialization Process after Connection

5. Run the MS2760A Software.

Figure 2-11. MS2760A Connection to Tablet

Chapter 3 — Graphical User Interface Overview

3-1 Introduction

The MS2760A Spectrum Master software controls the MS2760A spectrum analyzer which can be run from a Windows-based desktop PC, laptop, or tablet via USB 3.0 connectivity. The figure below identifies the main display areas, which are then summarized and finally detailed later within this section.

Index	Description	Index	Description
1	Anritsu Title Bar	**8**	X-axis
2	Display Bar	**9**	Pop-up Menu
3	Measurement Display	**10**	Marker/Setup Table
4	Pop-up Numeric Keypad	**11**	Status & Trace Panel
5	Menu Panel	**12**	Spectrogram with Cursors and Markers
6	Connection Status Line	**13**	Y-axis
7	Control Panel	**14**	Color Setup Bar (Spectrogram View)

Figure 3-1. GUI Overview (sample display elements)

Title Bar

The Title Bar is the top portion of the GUI and it provides a variety of information and actions as described below.
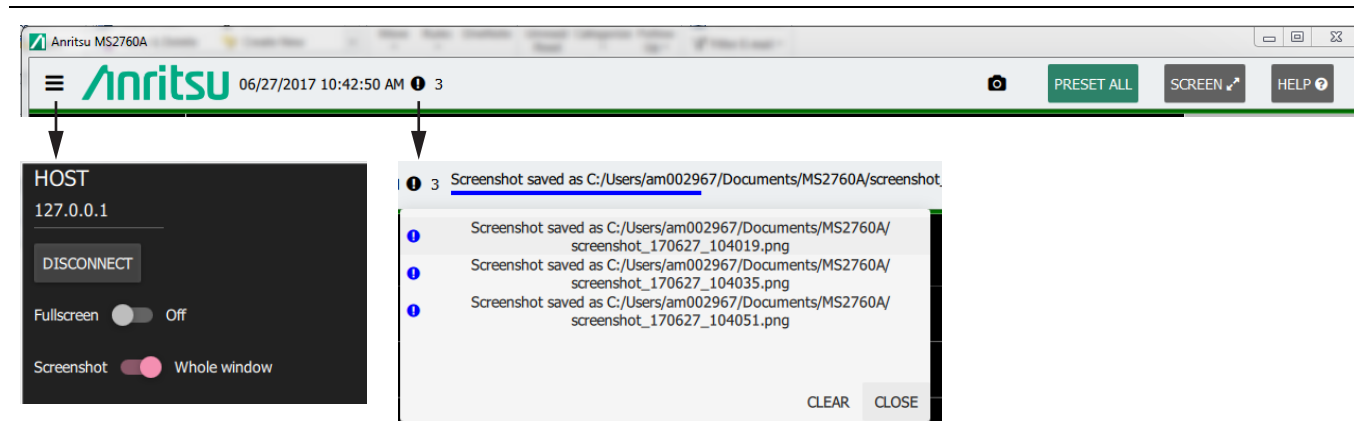
Figure 3-2.   Title Bar

The left side of the instrument title bar displays the system date and time. Clicking the three bars presents device connection information and gives options for setting the default screen size and screen shot action. A notification symbol along with a count of notifications appears adjacent to the time if an error occurs or an activity such as a screen shot has taken place. The notification symbol is a black circle with an exclamation mark. Clicking the symbol shows a message screen listing the notifications.

The camera icon is a button to take an immediate screen shot of the MS2760A software. The file is given a name in the following format: *screenshot_yymmdd_hhmmss.png* (year, month, day, hour, minute, second), and the file is saved in a folder set in the SAVE / RECALL menu.

The PRESET ALL button in the title bar resets all settings to their factory default values. For other preset values, see the options in the PRESET button in the Control Panel.

Next to the PRESET ALL button is the SCREEN<--> button. With the STATUS PANEL set On and STATUS PANEL (full screen) set to Off, pressing SCREEN<--> allows you to view the measurement in the full application window. The arrows right of SCREEN will then point inward (SCREEN-> <-). Pressing SCREEN-> <- will bring back the Status Panel, Control Panel, any menu, or table that was displayed before going into full view.

The Help button launches HTML help for the application.

Connection Status Line

At the bottom of the title bar is a line that will be colored green or red (See Figure 3-1, "GUI Overview (sample display elements)"). Green indicates that the connection and communication to the MS2760A is good. Red indicates no communication or that the PC, laptop, tablet is disconnected from the MS2760A Spectrum Analyzer. If disconnected and attempting to communicate or reconnect with the MS2760A Spectrum Analyzer using the Connect command under the manual command button in the system settings menu, the line will trace across yellow or orange. If the reconnection was successful, the line turns green. If unsuccessful, the line turns red.

Display Bar
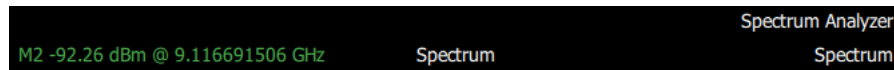
Figure 3-3.   Display Bar

The display bar is shown above the graticule. If a marker or markers are in use, the active marker's amplitude and frequency will be displayed in green on the left edge of the edge of the display bar. At the center of the display bar is the current measurement view. The right side of the display shows labels for the current measurement mode and measurement. Clicking the measurement label activates a pull-down list to conveniently change the current measurement.

Measurement Display
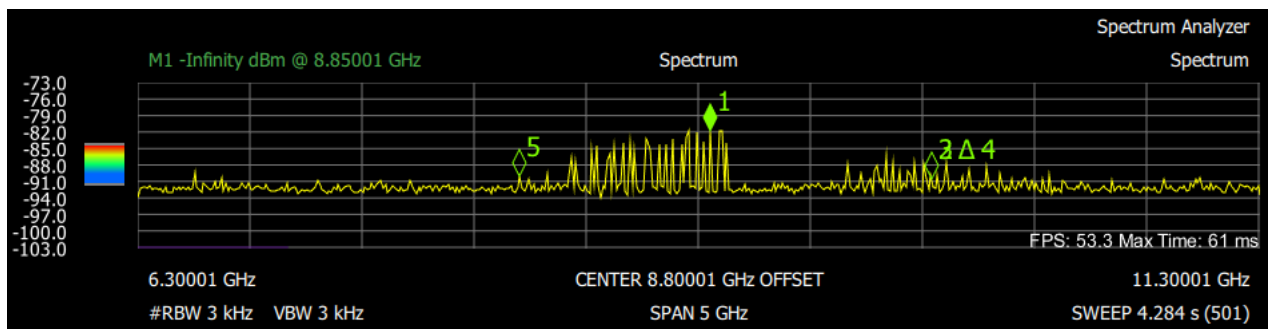
Figure 3-4.   Measurement Display

The main data/trace display in the application window. The x-axis bottom grid line of the display is also used to indicate the position of the trace being drawn across the screen with a progressive purple line.

X-axis

At the left of the X-axis shown above is the start frequency and RBW/VBW settings. If either resolution bandwidth or video bandwidth are set to manual, the "#" symbol will precede their label. At center are the center frequency and span. If an offset frequency is entered, "OFFSET" will display to the right of the center frequency. The right edge of the X-axis shows the stop frequency, sweep time, and number of points swept. Click any of these parameters to open their pop-up menu or use the keyboard to edit the parameter setting directly. The sweep time and number of points is information only and cannot be changed.

Y-axis

Displays the amplitude of the graticule lines. Its settings can be changed by clicking the AMPLITUDE button. The example shown in Figure 3-4 includes the Color Bar when the measurement view is set to Spectrogram.

Color Setup Bar (Spectrogram View)

The Spectrogram is useful for identifying intermittent interference and for providing a lot of historical signal data in a single view. It is a multi-dimensional display representing frequency time, and power. Frequency and time are shown on a typical two dimensional scale, while power level is displayed in the color dimension. The color is set by adjusting the color range of the color setup bar. Spectrogram view is selected from the MODE MEAS button on the control panel and by selecting the Spectrogram view. Click MEAS SETUP in the Control Panel to open the COLOR SETUP menu and enter the top and bottom range to match the upper and lower amplitude of the trace, or you can grab the ends of the Y-axis color setup bar and drag them to the desired upper and lower amplitudes of the trace. Change the color of the Spectrogram by adjusting the reference hue. Grab the black dot on the color palette and drag it across the palette to the desired color in the Spectrogram. Refer to Spectrogram with Cursors and Markers for more information.

Status & Trace Panel

The top portion of the status panel displays the current status of the frequency and amplitude parameters. Clicking any of these parameters opens the associated pop-up menu that allows you to conveniently change that parameter.

The TRACES (or CURSORS in Spectrogram view) summary panel is displayed below the status panel. The current status of up to six traces or cursors are displayed in a quick-view summary. The summary information includes the trace or cursor number, type, mode, and detector type. The active trace or cursor will be highlighted in gray and restated under the table. Clicking on a trace in the summary panel opens the TRACE/DETECTOR pop-up menu. It allows you to select and set up an individual trace as desired. To set up or edit multiple traces, scroll down and click the TRACE SETUP button at the bottom of the TRACE/DETECTOR pop-up menu. The TRACE/DETECTOR SETTINGS table will display below the measurement display.

Below the TRACES summary panel are the status fields for SWEEP/MEASURE, CAPTURE TIME, and FREQ REFERENCE. Clicking on either the SWEEP/MEASURE or FREQ REFERENCE status field toggles between Single and Continuous sweep, or Internal and External frequency reference. The CAPTURE TIME displays the actual capture time based on the sweep and bandwidth settings. The actual capture time will generally be longer, but as close as possible to the MIN CAPTURE TIME setting in the sweep menu.

Figure 3-5.   Status and Trace Panel

Control Panel

The control panel is the primary access point for all instrument controls, measurement selections, and system operations. The main functions for each control panel button are described below.
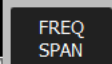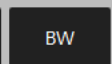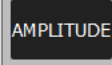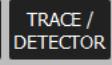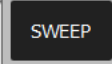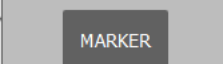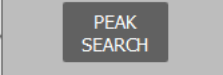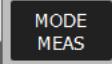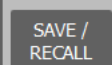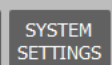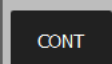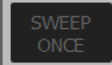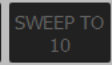
FREQ SPAN: Contains all frequency control settings such as center frequency, start and stop frequency, span, frequency offset and frequency step.

BW: Provides access to resolution and video bandwidth settings and Auto ratios, and sets the bandwidth filter types.

AMPLITUDE: Provides access to all amplitude related settings including reference level, graticule scale, and amplitude measurement units. Also selects the IF gain and image reject settings.

TRACE/DETECTOR: Provides trace and detection related controls to set trace behaviors, presets, and access to the trace/detector settings table. Also, when in spectrogram view, provides spectrogram cursor controls and the spectrogram time display setting.

SWEEP: Provides controls for sweep behaviors, number of measurement points, and the minimum capture time setting.

TRIGGER: Controls the trigger source, delay and holdoff, and trigger slope settings. When in zero span, provides access to video triggering.

MARKER: Used to enable and set all marker related parameters and provides access to the marker table.

PEAK SEARCH: Controls for marker to peak search functions and provides access to the peak setup table where you can set peak threshold and excursion.

MODE MEAS: Used to select the measurements such as spectrum, channel power, occupied bandwidth, and adjacent channel power, and sets the spectrogram viewing options.

MEAS SETUP: Measurement controls for setting average/hold, pass/fail display, and access to the limit setup table. When in spectrogram view, provides access to the spectrogram color setup menu.

SAVE/RECALL: Used to save and recall instrument setups and measurements, limit limes, and screen images. Also provides access to save on event controls.

SYSTEM SETTINGS: Provides access to instrument connection controls and status, and the frequency reference source setting.

DISPLAY: Used to set all display attributes such as the graticule, labeling, and screen annotations. Also provides access to the backend SCPI command history and setting frequency scroll lock.

PRESET: Opens the preset menu with selective trace, marker, limits, and measurement preset commands, or an all inclusive preset command.

CONT/SINGLE: Toggles the sweep mode between single sweep and continuous sweep.

RESTART: Restarts the current sweep, measurement, or set of averaged/held sweeps or measurements. If the measurement is currently paused, pressing restart resumes the action.

SWEEP ONCE: When set to single, triggers a single measurement sweep. This button has no function when the instrument is in continuous sweep mode.

SWEEP TO 10: When set to single and trace type is set to average, rolling average, rolling max hold, or rolling min hold, triggers ten consecutive measurement sweeps. This button has no function when the instrument is in continuous sweep mode.

Figure 3-6. Control Panel

Pop-up Numeric Keypad

Clicking on a parameter value in a menu pops up the numeric keypad with the parameter's current value. You can enter numbers on the physical keyboard or use the pop-up keypad. Also, the "+" and "-" buttons on the physical keyboard corresponds to the +/- toggle button on the pop-up keypad. The number field on the pop-up numeric keypad gets updated while typing. When there is one termination value, the keyboard will not allow you to enter a value that is beyond the range. The value in the menu is not updated until after the Enter key is pressed or a terminator is selected (for example, dBm).

The up arrow and down arrow increment or decrement the value based on offset settings, if settable, or by one unit of measure for other presets. For span, the up/down arrows increment/decrement by the frequency step setting. For RBW/VBW the arrows increment/decrement in a 1:3:10 sequence. You can also use the "up" and "down" arrow keys on the PC/laptop keyboard.

At the right edge of the pop-up keypad are the backspace key and unit keys. The backspace key erases the right most number. The unit buttons (for example GHz, MHz, etc…) set the unit for the parameter, terminates the entry, and updates the menu panel to the new value. Pressing the keyboard Enter key enters the new value with the current units in use.

The pop-up keyboard can be dragged to any location that is convenient. It will close after entry or by clicking anywhere outside of the pop-up keyboard, or by clicking a new command.

Pop-up Menu

Clicking on status data, a parameter field, or label in the display bar, status panel, x-axis, or setup table opens a pop-up menu that allows you to directly edit that parameter setting. Pop-up menus will open close to the item that was clicked. They can be dragged to any convenient location. They will close after entry or by clicking on the application outside of the menu, or by hitting the Esc keyboard key.

Menu Panel

When a button in the control panel is clicked, the associated menu opens. The name of the button pressed in the control panel is reflected in the title bar of the menu. Instrument setup, control, and measurement functions are performed through the use of the menu. The buttons within the menu may change for various measurement settings and instrument setup parameters. Clicking the control panel button after a menu has been opened will close the menu. The majority of this chapter documents the individual menus provided through the GUI.

Marker/Setup Table

Some setups are more conveniently entered or viewed through the use of a table. These setups include limits, Markers, Traces, and several other measurement setups. The setup fields could be entry fields, select fields, or drop-down list fields. These tables are described in the context of their access controls.

Device Monitor

When the MS2760A software is installed on a PC, the Anritsu Device Monitor runs as a background application to provide instrument details and the option to set the restore settings from the previous power down. The device monitor can be accessed via the Windows system tray near the clock. Click to expand the hidden icons from the system tray, then right click the device monitor icon as shown below for a list of options.

Figure 3-7.   Anritsu Device Monitor and Instrument Details

3-2   FREQ / SPAN Menu

FREQ / SPAN
CENTER FREQ
19.784541075 GHz
SPAN
39.102877943 GHz
FULL SPAN
LAST SPAN
ZERO SPAN
START FREQ
233.102103 MHz
STOP FREQ
39.335980047 GHz
FREQUENCY STEP
1 Hz
FREQ OFFSET
0 Hz

CENTER FREQ: Press the CENTER FREQ button to enter the desired frequency using the pop-up keypad or the PC/laptop keyboard. If entering a frequency using the keypad, the button labels change to GHz, MHz, kHz, and Hz. Press the appropriate units key. Pressing the **Enter** key has the same affect as pressing the terminator for the current units.

When using the up and down arrows, the frequency moves in steps defined by the value entered using the FREQUENCY STEP parameter. When using the left or right arrow keys, the frequency of the active parameter moves by 0.1 MHz. The center frequency can also be changed by dragging the trace left or right by holding down the left mouse button. The span will stay constant.

SPAN: This menu button displays the current value for span in units of GHz, MHz, kHz, or Hz. When SPAN is pressed, span becomes the active parameter and may be changed. Use the pop-up keypad, the PC/laptop keyboard, or the directional arrow keys to increase or decrease the span frequency. If the span is changed using the up/down arrow keys, the span changes by the value currently set on the FREQUENCY STEP button for each key press.

FULL SPAN: Pressing this button sets the span to cover the entire tunable spectrum of the instrument.

LAST SPAN: Pressing this button returns the span to the previously set span value.

ZERO SPAN: Sets zero span mode. In this mode, the display shows amplitude changes at a single frequency vs. time on the X-axis. This function is frequently used to allow easy monitoring of power variations over time. In zero span, the low side sweep will be automatically selected, unless IMAGE REJECT is set to Upper Only (refer to "IMAGE REJECT" on page 3-10 for more information).

(continued...)

Figure 3-8.   FREQ / SPAN Menu (1 of 2)

FREQ / SPAN
CENTER FREQ 19.784541075 GHz
SPAN 39.102877943 GHz
FULL SPAN
LAST SPAN
ZERO SPAN
START FREQ 233.102103 MHz
STOP FREQ 39.335980047 GHz
FREQUENCY STEP 1 Hz
FREQ OFFSET 0 Hz

(...continued)

START FREQ: Press to enter the desired frequency using the pop-up keypad or the PC/laptop keyboard. If entering a frequency using the keypad, the button labels change to GHz, MHz, kHz, and Hz. Press the appropriate units key. Pressing the **Enter** key has the same affect as the pressing the terminator for the current units. If the start frequency is higher than the stop frequency, the new stop frequency will be the value of the new start frequency plus the span. If this values exceeds the maximum range of the spectrum analyzer, then the stop frequency will be the maximum value and the span will be the difference between the start and stop frequency.

STOP FREQ: Press the STOP FREQ button and enter the desired frequency using the pop-up keypad or the PC/laptop keyboard. If entering a frequency using the pop-up numeric keypad, select from the list of buttons (GHz, MHz, kHz, and Hz) to set the units. Press the appropriate unit key. Pressing the **Enter** key on the keyboard has the same affect as the clicking the terminator for the current units. If the stop frequency is less than the start frequency the new start frequency will be the stop frequency minus the span. If the new start frequency would be less than zero, the new start frequency will be set to zero, and the span will be the difference between the stop and start frequencies.

FREQUENCY STEP: Press the FREQUENCY STEP button and enter the desired frequency step size using the pop-up keypad or the PC/laptop keyboard. This is the value that the center/start/stop frequency values will increment up or down when using the up and down arrow keys. The minimum setting is zero (0) up to the maximum frequency range of the instrument.

FREQ OFFSET: The FREQ OFFSET value accounts for frequency conversions outside of the analyzer. This value is added to the display readout of the marker frequency, center frequency, start frequency, stop frequency, and all other absolute frequency settings in the analyzer. When a frequency offset is entered, the CENTER FREQ readout on the X-axis will indicate OFFSET. The offset frequency is added to the start, stop, center, fixed marker, and normal marker frequencies.

Press to enter the desired frequency using the pop-up keypad or the PC/laptop keyboard. If entering a frequency using the pop-up numeric keypad, select from the list of buttons (GHz, MHz, kHz, and Hz) to set the units. Press the appropriate unit key. Pressing the **Enter** key on the keyboard has the same affect as clicking the MHz button. The range is from –500 GHz to +500 GHz.

Figure 3-8.   FREQ / SPAN Menu (2 of 2)

3-3   AMPLITUDE Menu

AMPLITUDE

REF LEVEL
-50 dBm

AUTO REF LEVEL

SCALE / DIV
3 dB

Y AXIS UNITS

dBm

REF LEVEL OFFSET
0 dB

IF GAIN

On   Off

IMAGE REJECT

Normal

REF LEVEL: The reference level is the top graticule line on the measurement display and can be set from +30 dBm to –150 dBm. A value may be entered from the keypad and a negative value can be entered by using the plus/minus (+/-) button for a negative value. After entering the value, press the dBm button or the Enter key. The default value is 0.0 dBm. The maximum is +30.0 dBm plus the reference level offset and the minimum is –150.0 dBm plus the reference level offset. The up or down arrow keys change the reference level in +10 dB or –10 dB steps and the left or right arrow keys change the value by –1 dB or +1 dB steps. **Note:** If the reference level offset is given a value other than zero, the reference level changes to the offset reference level.

AUTO REF LEVEL: Auto reference level will change the reference value such that the maximum signal is about two graticule lines from the top.

SCALE/DIV: The scale can be set in 0.1 dB steps from 1 dB per division to 15 dB per division. The value can be changed using the keypad or the arrow keys. The default setting is 10.0 dB. Up and down arrow keys increment the values by +1.0 dB or –1.0 dB. The left and right arrow keys increment the value by –0.1 dB or +0.1 dB.

Y AXIS UNITS: Press this button to select the amplitude units based on the DISPLAY SCALE selection. Log unit is in dBm.

REF LEVEL OFFSET: Reference level offset compensates for the presence of external input attenuation or gain. Enter a value to compensate for gain or loss, then press Enter. The new reference level offset value will be displayed on the button.

The reference level on the Y-axis should reflect the new value. For example, if the reference level is 0 dBm and a reference level offset of –10 dB is applied, then the new reference level becomes 10 dBm. The default offset value is 0.0 dB. The min/max value is ±99 dB. The up or down arrow keys change the reference level in +1 dB or –1 dB steps, respectively; the left or right arrow keys change the value by –0.1 dB or +0.1 dB steps, respectively.

IF GAIN: Turns the IF gain On or Off. Default is Off. The analyzer has an IF amplifier with approximately 20 dB of gain. When you can turn on the IF Gain without overloading the analyzer (reference levels of –10 dBm or less), it allows full use of the dynamic range of the analyzer. If the reference level is changed to be more than –10 dBm and IF gain was on, it will be turned off for any reference level over –10 dBm. Likewise, the IF gain cannot be turned on for a reference level over –10 dBm.

IMAGE REJECT: The MS2760A employs special image rejection algorithms to eliminate spurs and images created in the receiver. Under normal operation, the analyzer will take two samples (a high side and a low side) and compare the two to find images. This setting selects an image reject algorithm of Normal, Upper Only, or Lower Only. Normal is the combination of both the high- and the low-side mixing products, which provides the benefit of spur/image rejection. The high and low settings offer no image rejection and only show one of the results from the mixer (either high or low). In zero span, the low side sweep will be automatically selected unless IMAGE REJECT is set to Upper Only.

Figure 3-9.   AMPLITUDE Menu

3-4   BANDWIDTH Menu

RES BW: The current resolution bandwidth value is displayed under the RES BW button. The RBW can be changed using the keypad or the arrow keys. When using the arrows, bandwidth values increment in a 1 to 3 sequence, from 1 Hz to 3 Hz to 10 Hz, or from 10 Hz to 30 Hz to 100 Hz, for example. Refer to your instrument technical data sheet for the resolution bandwidth range.

Auto/Manual: When RES BW is Auto, the instrument selects the resolution bandwidth based on the current span width. The ratio of span width to RBW can be specified using the SPAN/RBW button. When RES BW is Manual, the RBW label, at the left edge of the X-axis, will be preceded by the "#" symbol.

VIDEO BW: The current video bandwidth value is displayed under the VIDEO BW button. The VBW can be changed using the keypad or the arrow keys. When using the arrows, bandwidth values increment in a 1:3:10 sequence, from 1 Hz to 3 Hz to 10 Hz, or from 10 Hz to 30 Hz to 100 Hz, for example. Refer to your instrument technical data sheet for the video bandwidth range.

Auto/Manual: When VIDEO BW is Auto, the instrument selects the video bandwidth based on the resolution bandwidth. The ratio of video bandwidth to resolution bandwidth can be set using the RBW:VBW button. When VIDEO BW is Manual, the VBW label, at the left edge of the X-axis, will be preceded by the "#" symbol.

VBW/AVERAGE TYPE Linear/Log: Toggles between linear averaging (arithmetic mean) and logarithmic averaging (geometric mean).

RBW:VBW: This parameter displays the ratio between resolution bandwidth and video bandwidth. To change the ratio, press this button and use the keypad or the arrow keys to select a new ratio. When using the arrows, ratio values increment in a 1:3:10 sequence, from 1 Hz to 3 Hz to 10 Hz, or from 10 Hz to 30 Hz to 100 Hz, for example. The default ratio is 1. The range is from 1 to 10,000.

SPAN:RBW: Displays the ratio between the span width and the resolution bandwidth. The default value is 100, meaning that the span width will be 100 times the resolution bandwidth. To change the ratio, press this button and use the keypad or the arrow keys to select a new ratio. When using the arrows, ratio values increment in a 1:3:10 sequence, from 1 Hz to 3 Hz to 10 Hz, or from 10 Hz to 30 Hz to 100 Hz, for example.

RBW FILTER: Allows you to select between the Flat Top window and the Nutall RBW filter type.

Figure 3-10. BANDWIDTH Menu

3-5   SWEEP Menu

SWEEP

SWEEP/MEAS
Single   Continuous

RESTART

SWEEP ONCE

SWEEP TO 10

POINTS
501

MIN CAPTURE TIME
0.000 ms

Or

SWEEP TIME
0.020 ms

SWEEP/MEAS Single/Continuous: This button toggles between continuous sweep and single sweep. In single sweep mode, the results of a sweep are displayed on the screen while the instrument awaits a trigger event to start a new sweep. Pressing the SINGLE/CONT button on the control panel performs the same function. The current state of the instrument is displayed in the status panel.

With average/hold number (in MEAS SETUP menu) set to 1, or averaging is 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. To take one more sweep without resetting the average count, press the SWEEP ONCE button.

RESTART: The restart function restarts the current sweep or measurement.

SWEEP ONCE: When sweep is set to SINGLE, SWEEP ONCE triggers a single measurement sweep. This key has no function when the instrument is in continuous sweep mode.

SWEEP TO 10: When sweep is set to SINGLE and trace type is set to AVERAGE, ROLLING AVERAGE, ROLLING MAX HOLD, or ROLLING MIN HOLD, SWEEP TO 10 triggers 10 consecutive measurement sweeps, SWEEP TO 10 triggers 10 consecutive measurement sweeps. This button has no function when the instrument is in continuous sweep mode.

POINTS: Sets the number of data points per sweep and displayed in each trace. The current value of points is displayed parenthetically, next to the sweep time in the lower-right corner of the display. Using more points provides greater resolution. Using fewer points compacts the data and decreases the time required to access a trace over the remote interface. The minimum setting is 10 and the maximum setting is 10001. Points is fixed to 501 in zero span mode and the button is not available.

MIN CAPTURE TIME: The minimum capture time feature allows you to control the capture time by forcing the analyzer to take more data at each sampling point. Increasing the minimum capture time may increase the overall sweep time. Note that the actual capture time of the instrument is dependent on several variables and will not exactly match the MIN CAPTURE TIME user entry. The actual capture time is displayed in the status panel on the left side of the user interface. The capture time will always snap to the next highest possible value greater than the user entered minimum capture time. Therefore, setting the minimum capture time to 0 (zero) is the easiest way to set the actual capture time to the minimum allowable by the instrument. The maximum allowed capture time is based on the selected span and RBW. Generally, narrower RBW and span settings will increase the maximum possible capture time.

This feature is useful for measuring fast signals such as periodic pulsed or other modulated signals. In many cases, the capture time can be set long enough for the analyzer to capture the characteristics of the input signal that change over time without missing these events.

SWEEP TIME: Sweep time is available in zero span mode only and is similar to minimum capture time. Sweep time is displayed in the lower right of the trace display and can be set from 20 microseconds up to 60 seconds.

Figure 3-11. SWEEP Menu

3-6   TRACE / DETECTOR Menu (Spectrum View)

SELECT TRACE: Selects traces 1 through 6. Selecting a trace that is off turns the trace on. TRACE TYPE will be Clear / Write, TRACE MODE will be Active, and DETECTOR TYPE will be Peak. Selecting a trace will draw the trace on top of all other traces. This feature is not available in Spectrogram mode.

TRACE TYPE: Selects one of the following types of traces:

- **Clear/Write:** Clears the trace after each sweep is complete and writes a new trace.
- **Average:** The average of all previous "k" sweeps until k = N. Once k = N or is greater, the trace/average is the average of the last "N" sweeps. N is the hold number set by the AVERAGE/HOLD button found in the MEAS SETUP menu.
- **Max Hold:** Represents the maximum value since sweeping began. The number of sweeps is displayed in the status panel if the selected trace is set to Max Hold.
- **Min Hold:** Represents the minimum value since sweeping began. The number of sweeps is displayed in the status panel if the selected trace is set to Min Hold.
- **Rolling Average:** Is the average of the last N traces. N is the hold number set by the AVERAGE/HOLD button found in the MEAS SETUP menu.
- **Rolling Max Hold:** Is the maximum value of the last N traces. N is the hold number set by the AVERAGE/HOLD button found in the MEAS SETUP menu.
- **Rolling Min Hold:** Is the minimum value of the last N traces. N is the hold number set by the AVERAGE/HOLD button found in the MEAS SETUP menu.

CLEAR TRACE: Stops the current trace and restarts the currently set trace type.

TRACE MODE: Selects one of the following trace mode types:

- **Active:** Displays the selected trace as it is updating.
- **Hold/View:** Displays the trace and it is not updating. It displays the last sweep from when the trace mode was set to Hold/View.
- **Blank**: Does not display the trace and is not updating. It is the same as if the trace was off.

(continued)...

Figure 3-12. TRACE / DETECTOR Menu (1 of 2)

...(continued)

DETECTOR TYPE: Selects one of three DETECTOR TYPES. Several detection methods tailor the function of the instrument to meet specific measurement requirements. There are often more measurement points across the screen than display points. The various detection methods are different ways of dealing with how measurement points will be shown at each display point.

- **Peak:** This method causes the largest measurement point to be shown for each display point, assuring that a narrow peak is not missed.
- **RMS/Avg:** In the Preset case, when the VBW/AVERAGE type is set to Linear, this method detects the average power of measurement points that go into the display point. When VBW/AVERAGE type is set to Log, the traditional average of log (power), such as dBm, is displayed for the detector, as well as for VBW and trace average.
- **Negative:** This method causes the smallest measurement point to be shown for each display point. This method is also useful when looking at modulated signals, to see if some frequencies are not being used.

ALL DETECTORS PEAK: Sets the detector for each trace to a Peak detector.

PRESET ALL TRACES: Turns off traces 2 through 6 and Trace 1 is set to Clear/Write, Active, with Peak Detector.

TRACE SETUP: Selecting the TRACE SETUP button brings up the TRACE/DETECTOR SETTINGS panel. It has six tabs allowing you to set up all six traces at once or view all trace settings at once.

Click on a trace or its parameters in the TRACE/DETECTOR SETTINGS panel to change or select a new trace parameter value. The selected trace will be highlighted with a white border. Selection lists will pop up to change the trace type, trace mode, and detector type.

Figure 3-12. TRACE / DETECTOR Menu (2 of 2)

3-7   TRACE / DETECTOR Menu (Spectrogram View)

When the Spectrogram view is selected via the MODE MEAS button on the control panel, Spectrogram related buttons are added to the TRACE / DETECTOR menu allowing you to select Spectrogram features and set up parameters. Because there is only one reference trace in Spectrogram view the SELECT TRACE, TRACE MODE, and TRACE SETUP buttons are removed.

TRACE TYPE: Selects one of the following types of traces:

- **Clear/Write:** Clears the trace after each sweep is complete and writes a new trace.
- **Average:** The average of all previous "k" sweeps until k = N. Once k = N or is greater, the trace/average is the average of the last "N" sweeps. N is the hold number set by the AVERAGE/HOLD button found in the MEAS SETUP menu.
- **Max Hold:** Represents the maximum value since sweeping began. The number of sweeps is displayed in the status panel if the selected trace is set to Max Hold.
- **Min Hold:** Represents the minimum value since sweeping began. The number of sweeps is displayed in the status panel if the selected trace is set to Min Hold.
- **Rolling Average:** Is the average of the last N traces. N is the hold number set by the AVERAGE/HOLD button found in the MEAS SETUP menu.
- **Rolling Max Hold:** Is the maximum value of the last N traces. N is the hold number set by the AVERAGE/HOLD button found in the MEAS SETUP menu.
- **Rolling Min Hold:** Is the minimum value of the last N traces. N is the hold number set by the AVERAGE/HOLD button found in the MEAS SETUP menu.

CLEAR TRACE: Stops the current trace and restarts the currently set trace type.

DETECTOR TYPE: Selects one of three DETECTOR TYPES. Several detection methods tailor the function of the instrument to meet specific measurement requirements. There are often more measurement points across the screen than display points. The various detection methods are different ways of dealing with how measurement points will be shown at each display point.

- **Peak:** This method causes the largest measurement point to be shown for each display point, assuring that a narrow peak is not missed.
- **RMS/Avg:** In the Preset case, when the VBW/AVERAGE type on the BANDWIDTH menu is set to Linear, this method detects the average power of measurement points that go into the display point. When VBW/AVERAGE type is set to Log, the traditional average of log (power), such as dBm, is displayed for the detector, as well as for VBW and trace average.
- **Negative:** This method causes the smallest measurement point to be shown for each display point. This method is also useful when looking at modulated signals to see if some frequencies are not being used.

PRESET: Presets Trace 1 to Clear/Write, Active, with Peak Detector.

Figure 3-13. TRACE / DETECTOR Menu (Spectrogram View)

CURSOR Menu

CURSOR

MODE

Position　Time

SELECT CURSOR

Cursor 2　▼

STATE

Active　▼

POSITION
15

TIME
10.000 s

MODE Position/Time: Every trace captured in the spectrogram has a Time and a Position index. The MS2760A software allows you to set the position of the spectrogram cursor based on either the Time index or the Position index. When Position is selected, you can change the position index of the cursor from the POSITION button. If Time is selected, you can set the time index of the cursor from the TIME button.

SELECT CURSOR: Used to add additional cursors or select an active cursor on the Spectrogram Waterfall. The selected cursor also displays the associated trace in the Spectrum display. For more information, refer to "Spectrogram with Cursors and Markers" on page 3-17.

STATE: Selects one of the following cursor states:

- **Active:** Displays the selected trace as it is updating.
- **Blank**: Does not display the trace and is not updating. It is the same as if the trace was off.

Spectrogram Position: Available when a Position cursor is selected. This opens the Position number keypad, allowing you to change the sweep position index of the selected Spectrogram cursor in relation to the number of total sweeps in the Spectrogram. The number of sweeps in the Spectrogram is based on the size of the Spectrogram window, so the sweep index changes when changing the Spectrogram cursor position index. The Spectrum view also displays the currently selected trace. A position of 0 (zero) represents the most recent (or live) trace. Entry into this field is disabled when the Spectrogram cursor mode is set to Time.

Spectrogram Time: Available when a Time cursor is selected. This opens the Time number keypad, allowing you to change the time index of the selected Spectrogram cursor in relation to the Start and Stop time displayed in the Spectrogram. The time in the Spectrogram is based on the size of the Spectrogram window, so the time changes when changing the Spectrogram cursor time index. The Spectrum view also displays the currently selected trace. A time of 0 (zero) represents the most recent (or live) trace. Entry into this field is disabled when the Spectrogram cursor mode is set to Position.

Figure 3-14. TRACE / DETECTOR Menu (Spectrogram View)

Spectrogram with Cursors and Markers

Figure 3-15. Spectrogram Waterfall Display with Cursors

Time/Position Cursors: Displayed as C1, C2, C3, etc. with the currently selected cursor as a solid white line along the Spectrogram.

Start Time: This is the most recent completed sweep and the beginning of the waterfall.

Stop Time: The total time length of the Spectrogram. It is essentially the amount of time it takes for a sweep to get from the bottom to the top of the waterfall diagram with the current settings.

Selected Marker Data: The information in green at the top of the Spectrum and Spectrogram displays the currently selected marker's information. The Spectrum displays the marker's frequency and amplitude values while the Spectrogram displays the marker's time and position values. In this example, the selected Marker 2 shows the historical delta frequency and amplitude of a signal with respect to fixed Marker 4. Marker 3 shows the same delta values for the signal relative to the same fixed marker in real time.

3-8   TRIGGER Menu

SOURCE: The SOURCE button offers several triggering options depending on which view mode the instrument is set:

- **Free Run:** A new sweep is started immediately upon completion of the current sweep. No trigger event is required to initiate a sweep.

- **Video:** Available only in zero span. A new sweep is started when the input video level meets the value set via the LEVEL button. Video triggering is useful for monitoring a known frequency and its time transients, such as pulsed signal rise or fall times.

- **External:** A TTL signal applied to the External Trigger MCX input connector causes a single sweep. After the sweep is complete, the resultant trace is continuously displayed until the next trigger signal is received.

LEVEL: Used in zero span mode when the trigger source is set to Video. Sets the video trigger level threshold that initiates a sweep. The level crossing applies to rising, falling, or both edges. Use the hysteresis setting below to adjust the sensitivity of the trigger level.

DELAY: Used when the trigger source is set to External or Video. When set to On, the delay value sets the amount of time that the analyzer waits to begin a measurement after a trigger signal is received. For non-zero span, trigger delay can be set from 0 to 1670 ms. For zero span, trigger delay can be set from –(sweep time) to 1670 ms. Negative trigger delay effectively moves the trace to the right so you can observe the activity before the trigger event.

HOLDOFF: Used when the trigger source is set to External or Video. When set to On, the analyzer waits the user defined amount of time to re-arm the trigger between trigger events. If a trigger event is received after the previous trigger, but before the holdoff time has elapsed, that trigger event will be ignored.

AUTO: Used when the trigger source is set to External or Video. When set to On, the instrument waits the set time for a trigger condition to be met to start a sweep. If the trigger conditions are not met after the specified time, the instrument will trigger a new sweep.

SLOPE Rising/Falling/Both: Used when the trigger source is set to External or Video. Sets the trigger slope to rising, falling, or both. When slope is set to Both, the analyzer triggers on both the rising and falling edges. Triggering on both rising and falling edges is not available in zero span.

HYSTERESIS: Hysteresis is used to address noisy trigger signals. The hysteresis setting adjusts the sensitivity of the trigger system (the difference between the firing level and the arming level as shown below). A low hysteresis value sets the arming and firing levels close to each other, meaning a small signal change will cause a trigger. A large hysteresis value sets the arming and firing levels far apart, meaning a large signal will be required to cause a trigger.
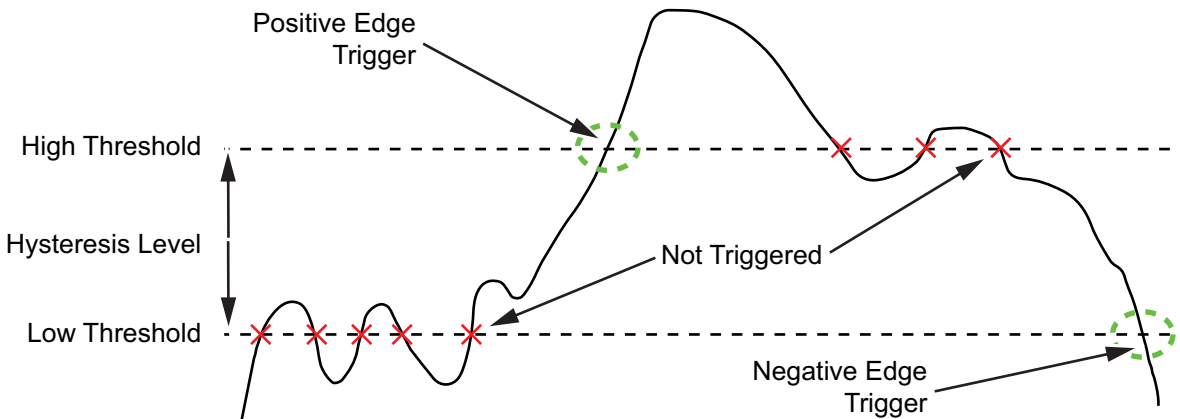
Figure 3-16. TRIGGER Menu

Figure 3-17. Trigger Levels and Hysteresis

3-9 MARKER Menu

MARKER

SELECT MARKER
Marker 4 ▼

MARKER FREQUENCY
5.220644297 GHz

MARKER AMPLITUDE
-74.7798 dBm/Hz

MARKER MODE
Normal ▼

MARKER FUNC
Noise ▼

DELTA RELATIVE TO
Marker 5 ▼

MARKER TRACE
Trace 1 ▼

▦ MARKER TABLE

ALL MARKERS OFF

▦ MARKER SETUP

SELECT MARKER: Turns on the selected marker if it is off or makes it the active marker if it is already turned on. Pressing the MARKER button on the control panel the first time will turn on Marker 1 as a normal marker at the center frequency and open the MARKER menu. Pressing the MARKER button on the control panel thereafter opens the MARKER menu to the current active marker, which is displayed in the upper left-hand corner of the screen. When a marker is turned on, it is a normal marker positioned at the center frequency of the selected trace.

MARKER FREQUENCY: Displays the marker frequency. For delta markers, the frequency is relative to the reference marker. Change the marker frequency by clicking on the marker and dragging it to the desired location. You can also change the marker frequency by clicking on the value to open the pop-up numeric keyboard.

MARKER AMPLITUDE: Displays the current marker amplitude. If the marker is a fixed marker, the amplitude value can be changed by clicking on the marker and dragging it to the desired location or by clicking the value and entering a new value from the pop-up numeric keypad.

MARKER MODE: Select marker preference:

- **Normal:** A Normal marker is also known as a tracking marker. The frequency is fixed but the amplitude value varies from sweep to sweep.
- **Delta (Δ):** A Delta (Δ) marker displays the delta frequency and amplitude between itself and a reference marker. If Marker 1 is selected to be a Delta marker (Δ), then Marker 2 is turned on as a Reference marker for Marker 1 and it becomes a Fixed marker at the same location. The Reference marker can then be switched to a Normal marker if desired.
- **Fixed:** A Fixed marker has a fixed amplitude and fixed frequency.
- **Off:** The default state of a marker and turns off an active marker.

MARKER FUNC: Sets the function of the currently selected marker to Noise or Off. For more information about using Noise markers, refer to "Noise Markers" below.

DELTA RELATIVE TO: Shows the Reference marker for a Delta marker. Select a new DELTA RELATIVE TO marker if desired. A Delta marker cannot be its own reference. Only Fixed and Normal markers may be used as a reference for Delta markers.

MARKER TRACE: Selects the trace number to which the marker is currently attached.

MARKER TABLE: Toggle On and Off the MARKER TABLE displayed below the screen.

ALL MARKERS OFF: Turns all markers Off.

MARKER SETUP: Launches the MARKER SETTINGS panel below the screen.

Figure 3-18. MARKER Menu

Noise Markers

Noise Markers use an averaging routine applied to multiple data-point groups to calculate the readout, which is typically comparable to using 1 Hz bandwidth filtering. Because the noise marker routine uses groups of data points for the calculation, the noise marker should not be placed in close proximity to measurable signals. You can observe this effect by moving the marker further away from a signal until the marker readout stabilizes to a more consistent value. Noise markers should be used with an RMS/Avg detector type for proper measurement. When a noise marker function is selected, the marker amplitude value is displayed in dBm/Hz, which is the noise level within the resolution bandwidth filter. Delta markers can also be put into a noise function, but the reference marker must also be a noise marker. If they are different functions, one will be updated to match the other. Fixed markers are not allowed to be set to a noise function, so if a noise marker is changed to fixed mode, the function will automatically be set to Off.

Marker Table and Marker Settings

For the Marker Settings panel, refer to figure below for definitions of the table components.

Figure 3-19. Marker Table and Marker Settings Panels

1. You can select and change a marker's component by selecting the marker from the MARKER menu, or either the MARKER SETTINGS or MARKER TABLE. Clicking a marker's component brings up a menu or entry panel for selecting the new value from a list or for numerical entry. If all of the available markers are not displayed, use the scroll indicator on the right hand border to scroll to the desired view or expand the window to see all of the markers.

2. The currently selected marker's value is shown at the top left of the Display Bar with its current amplitude and frequency values.

3. The selected marker is highlighted. If LINES are enabled, they cross through the center of the marker's current value and will track the marker.

3-10   PEAK SEARCH Menu

PEAK SEARCH

SELECT MARKER

Marker 1 ▼

MARKER FREQUENCY
55 GHz

MARKER AMPLITUDE
-64.09 dBm

PEAK SEARCH
NEXT PEAK
NEXT PEAK LEFT
NEXT PEAK RIGHT
NEXT POINT LEFT
NEXT POINT RIGHT
MKR → CENTER
MKR → REF LEVEL

⊞ PEAK SETUP

SELECT MARKER: If the selected marker is Off it will be turned on and the selected marker is positioned at the peak of Trace 1. If the selected marker is On, then it becomes the active marker and any subsequent actions in the PEAK SEARCH menu will apply to the selected marker. If no markers are On, pressing the PEAK SEARCH button on the control panel will turn on Marker 1 at the peak of Trace 1. Pressing the PEAK SEARCH button also launches the PEAK SEARCH menu.

MARKER FREQUENCY: Sets the marker frequency. For delta markers, the frequency is relative to the reference marker.

MARKER AMPLITUDE: Opens the number pad to enter a numerical value.

PEAK SEARCH: Moves the selected marker to the highest peak.

NEXT PEAK: Moves the selected marker to the next highest peak regardless of location.

NEXT PEAK LEFT: Moves the selected marker to the next peak left of its current position.

NEXT PEAK RIGHT: Moves the selected marker to the next peak right of its current position.

NEXT POINT LEFT: Moves the selected marker one display point to the left of its current position. Useful for fine tuning the position of a marker. The left arrow key on the PC/Laptop performs the same function.

NEXT POINT RIGHT: Moves the selected marker one display point to the right of its current position. Useful for fine tuning the position of a marker. The right arrow key on the PC/Laptop performs the same function.

MKR > CENTER: Changes the center frequency to the frequency of the selected marker.

MKR > REF LEVEL: Changes the reference level to the amplitude of the selected marker.

PEAK SETUP: Launches the PEAK SETUP panel below the screen.

PEAK SETUP	
PEAK THRESHOLD	PEAK EXCURSION
-80	0
On	On

- **PEAK THRESHOLD:** If turned On, sets the threshold that a peak has to achieve to be considered a peak.
- **PEAK EXCURSION:** If turned On, sets the excursion value that a peak amplitude must rise and fall over the peak threshold to qualify as peak.

Figure 3-20. PEAK SEARCH Menu

3-11   MODE MEAS Menu

MODE: This button currently lists only Spectrum Analyzer. New measurement modes will be listed as they become available.

MEASUREMENT: Selects the desired measurement type from the following list:

- Spectrum
- Channel Power: The CHANNEL POWER MEASUREMENT table displays.
- Occupied BW: The OCCUPIED BW table displays.
- ACP: The ACP MEASUREMENT table displays.

VIEW: Selects the desired measurement view from the following list:

- Spectrum
- Spectrogram: When selected, a spectrogram view is added to the display. Spectrogram is only available when the MEASUREMENT is set to Spectrum.

SPECTOGRAM POSITION: Available only when Spectrogram view is selected. Select the desired position of the spectrogram:

- Bottom (default)
- Top
- Full Screen (no Spectrum display)

Figure 3-21. MODE MEAS Menu

3-12   MEAS SETUP Menu (Spectrum)

MODE MEAS > MEASUREMENT (Spectrum) > MEAS SETUP

Refer to "Making Spectrum Analyzer Measurements" on page 4-1 for details on setting up a measurement.

AVERAGE/HOLD: Specifies the number of measurement averages used to calculate the measurement result. The default is 10 with a range from 2 to 1000.

MEAS PRESET: Sets all measurement limit settings to their default state.

LIMIT SETUP: Opens the LIMIT table to set up, edit, move, and create limit line envelopes. For more information, refer to Section 4-9 "Setting Up Limit Lines" on page 4-6.

PASS/FAIL: Displays the PASS/FAIL STATUS panel at the bottom of the screen.

PASS / FAIL STATUS	
Trace 1	PASS

Figure 3-22. MEAS SETUP Menu (Spectrum)

3-13   MEAS SETUP Menu (Channel Power)

MODE MEAS > MEASUREMENT (Channel Power) > MEAS SETUP

Refer to "Channel Power Measurement" on page 4-9 for details on setting up a measurement.

MEAS SETUP AVERAGE/HOLD 10 AVERAGING On Off INTEGRATION BW 9 MHz PSD UNITS dBm/Hz ▼ MEAS METHOD Integration BW ▼ POWER LIMIT -10 dBm On Off PSD LIMIT 0 dBm/Hz On Off MEAS PRESET	**AVERAGE/HOLD:** Specifies the number of measurement averages used to calculate the measurement result. The default is 10 with a range from 2 to 1000. **AVERAGING:** Turns averaging On or Off for the Channel Power measurement. Measurements are made on the selected trace. **INTEGRATION BW:** Specifies the range of integration used in calculating the power in the channel. The integration bandwidth (IBW) is displayed on the trace as two markers connected by an arrow. **PSD UNITS dBm/Hz:** Sets the unit bandwidth for Power Spectral Density. The available units are dBm/Hz and dBm/MHz. **MEAS METHOD:** Integration BW is the only choice at this release. Additional methods are planned for a later release. **POWER LIMIT:** If Power Limit is on, the Power Limit is used as the threshold that can judge whether the real measured channel power can be passed or not. If the real measured channel power exceeds the Power Limit, the channel power test fails; otherwise, channel power passes. If Power Limit is off, the channel power test always passes. **PSD LIMIT:** If the Power Spectral Density LIMIT is On, the PSD LIMIT is used as the threshold that can judge whether the real measured PSD can be passed or not. If the real measured PSD exceeds the PSD LIMIT, the PSD test fails, otherwise it passes. If PSD is Off, the PSD test is always passed. **MEAS PRESET:** Sets all values to PRESET. Turns off limits.

Figure 3-23. MEAS SETUP Menu (Channel Power)

3-14   MEAS SETUP Menu (Occupied BW)

MODE MEAS > MEASUREMENT (Occupied BW) > MEAS SETUP

Refer to "Occupied BW Measurement" on page 4-11 for details on setting up a measurement.

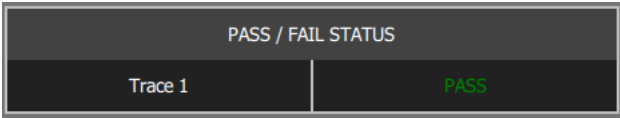|	
MEAS SETUP AVERAGE/HOLD 10 AVERAGING On Off % OBW POWER 99 % X dB 26 dB OBW LIMIT 10 MHz On Off MEAS PRESET	**AVERAGE/HOLD:** Specifies the number of measurement averages used to calculate the measurement result. The average is displayed at the end of each sweep. After the specified number of average counts, the averaging mode (terminal control) setting determines the averaging action. The default is 10 with a range from 2 to 1000. **AVERAGING:** Turns averaging On or Off for the Occupied Bandwidth measurement. Measurements are made on the Selected Trace. **% OBW POWER:** Assigns the percentage of the total power that is measured within the Occupied Bandwidth for the current measurement. The resulting Occupied Bandwidth limits are displayed by markers placed on the frequencies of the specified percentage. **X dB:** Sets the x dB value used for the "x dB bandwidth" result that measures the bandwidth between two points on the signal which is x dB down from the highest signal point within the OBW Span. **OBW LIMIT:** Enables you to turn on or off limit checking at the specified frequency. For results that fail the limit test, a red FAIL appears in the Measurement Bar. **MEAS PRESET:** Sets all values to PRESET. Turns off limits.

Figure 3-24. MEAS SETUP Menu (Occupied BW)

3-15 MEAS SETUP Menu (ACP)

MODE MEAS > MEASUREMENT (ACP) > MEAS SETUP

Refer to "Adjacent Channel Power (ACP) Measurement" on page 4-13 for details on setting up a measurement.

MEAS SETUP AVERAGE/HOLD 10 AVERAGING On Off MAIN INTEGRATION BW 9 MHz MEAS METHOD Integration BW ▼ LIMIT TYPE Absolute Relative LIMITS On Off MEAS PRESET ⊞ LIMIT SETUP	**AVERAGE/HOLD:** Specifies the number of measurement averages used to calculate the measurement result. The average is displayed at the end of each sweep. After the specified number of average counts, the averaging mode (terminal control) setting determines the averaging action. The default is 10 with a range from 2 to 1000. **AVERAGING:** Turns averaging On or Off for the Adjacent Channel Power measurement. Measurements are made on the Selected Trace. **MAIN INTEGRATION BW:** Specifies the range of integration used in calculating the power in the channel. The integration bandwidth (IBW) is displayed on the trace as two markers connected by an arrow. **MEAS METHOD:** Integration BW is the only choice at this release. Other methods will be added later. **LIMIT TYPE:** Absolute or Relative. **LIMITS On/Off:** Select to turn On/Off the use of ACP limits in the ACP LIMIT SETUP table. **MEAS PRESET:** Sets all measurement and limit settings to the preset state. **LIMIT SETUP:** Displays the ACP LIMIT SETUP table for ACP limit configuration.

Figure 3-25. MEAS SETUP Menu (ACP)

3-16   MEAS SETUP Menu (Spectrogram View)

MODE MEAS > MEASUREMENT (Spectrum) > View (Spectrogram) > MEAS SETUP

Refer to "Spectrogram" on page 4-15 for details on setting up a measurement.

AVERAGE/HOLD: Specifies the number of measurement averages used to calculate the measurement result and can be set from 2 to 1000 averages. In this case, each trace on the spectrogram represents X number of traces averaged together.

MEAS PRESET: Presets the Color Setup settings.

LIMIT SETUP: Opens the LIMIT line table to set up, edit, move, and create limit line envelopes. For more information, refer to Section 4-9 "Setting Up Limit Lines" on page 4-6.

COLOR SETUP: Allows you to customize the Spectrogram color range (Color Setup Bar) and Hue values. The color limits and the reference hue are based on a 360 degree color wheel where default 0 is red (255 0 0).

TOP RANGE: Defines the amplitudes where the top color on the color setup bar are applied. Any measurement above this amplitude will appear black on the waterfall diagram.

BOTTOM RANGE: Defines the amplitudes where the bottom setting colors on the color setup bar are applied. Any measurement below this amplitude will appear black on the waterfall diagram.

REFERENCE HUE: Allows you to change the color range of the spectrogram. Drag the black dot from 0 to 359 degrees on a hue color wheel or click to manually enter a number.

Figure 3-26. MEAS SETUP (Spectrogram View) Menu

3-17 SAVE / RECALL Menu

Refer to Chapter 5, "File Management" for more details on working with files.

SAVE AS: saves a setup file immediately with the name under the SAVE AS button. The number in the name is incremented automatically so that the new name is ready for the next setup file to be saved.

SAVE: Opens the SAVE panel to manually enter a file location, enter a file name, sand to set the file type to be saved. You can save the following:

- Setup (.stp): saves the current instrument setup.
- Measurement (.rsm): saves the measurement point (trace) data and the current instrument setup.
- Image (.png): saves the measurement screen data as PNG.
- Trace data (.csv): saves the visible trace point data in comma separated value format. This format is useful for further analysis using 3rd party software tools.
- Limit line (.lim): saves the current limit line point data.

RECALL: Opens the RECALL panel to retrieve a file from a desired location.

SAVE ON EVENT Functions

CROSSING LIMIT On/Off: When set to On, measurement data is automatically saved when the trace crosses a limit line that has been specified in Limit Setup.

SWEEP COMPLETE On/Off: When set to On, measurement data is automatically saved after the current sweep is completed.

SAVE THEN STOP On/Off: Set this key to On to stop the sweep after a measurement is saved. If this setting is Off and SWEEP COMPLETE is On, a measurement is saved after every sweep. The following will occur when both SWEEP COMPLETE and CROSSING LIMIT are both On. If SWEEP COMPLETE event happens first, the event is saved and SWEEP COMPLETE is turned Off. Both event switches are now turned off.

SAVE AT INTERVAL On/Off: A save will occur periodically. Set the period by pressing the time below On/Off. The SAVE EVENT INTERVAL pop-up is displayed. Set the desired time. Pressing any of the unit buttons will automatically close the pop-up.

CLEAR ALL EVENTS: Press this button to turn Off all save on event keys:

- CROSSING LIMIT
- SWEEP COMPLETE
- SAVE THEN STOP
- SAVE AT INTERVAL

Figure 3-27. SAVE / RECALL Menu

3-18   SYSTEM SETTINGS Menu

AUTO-CONNECT: Determines whether or not the GUI will attempt to automatically connect to the backend software on startup.

MANUAL CONTROL Connect/Disconnect: Allows the ability to manually connect or disconnect from the backend software.

STATUS: Opens the CONNECTION DETAILS table. This information can also be accessed via the Device Monitor as described in "Device Monitor" on page 3-7.

FREQ REFERENCE: This determines which frequency reference the device should use. It has an internal reference that is used by default, but if connecting to an external reference, this setting must be changed for it to switch to using the external reference.

HOST: Specifies the IP address of the computer where the backend software is running. An IP address of 127.0.0.1 specifies the local PC.

Figure 3-28. SYSTEM SETTINGS Menu

3-19   DISPLAY Menu

DISPLAY

DISPLAY LINE
-100 dBm
On   Off

STATUS PANEL
On   Off

STATUS PANEL
(FULL SCREEN)
On   Off

X-AXIS
On   Off

Y-AXIS
On   Off

DISPLAY BAR
On   Off

GRID
On   Off

SCREEN ANNOTATIONS
On   Off

⊞ CMD HISTORY

FREQ SCROLL LOCK
On   Off

DISPLAY LINE: Turns on and off a display line at the specified value.

STATUS PANEL: Turns the status panel on or off. The status panel at the left edge of the Spectrum Master program is removed from the window. This allows for a larger measurement display area.

STATUS PANEL (FULL SCREEN): Setting the status panel off allows the display window to make use of the graphical user interface for displaying a measurement when the <<SCREEN>> button is pressed.

X-AXIS: Turns the X-axis on and off.

Y-AXIS: Turns the Y-axis on and off.

DISPLAY BAR: Turns the display bar on and off.

GRID: Turns the grid lines in the measurement display on and off.

SCREEN ANNOTATIONS: Turns any markings on the measurement on and off.

CMD HISTORY: Displays the current SCPI commands used to create the measurement screen.

FREQ SCROLL LOCK: Selecting **Off** allows you to grab the measurement trace and move it horizontally. Selecting **On** locks the current position.

Figure 3-29. DISPLAY Menu

3-20   PRESET Menu

PRESET

PRESET TRACES

PRESET MARKERS

PRESET LIMIT LINES

PRESET MEAS SETUP

PRESET ALL

PRESET TRACES: Turns Traces 2 through 6 off and sets Trace 1 to Clear/Write, Active, Peak Detector.

PRESET MARKERS: Turns all markers off.

PRESET LIMIT LINES: Turns off limit lines and clears all limit data back to factory default.

PRESET MEAS SETUP: Sets all measurement and limit settings to their default state.

PRESET ALL: Resets instrument to factory default.

Figure 3-30. PRESET Menu

Note	A feature to set the restore settings is described in "Device Monitor" on page 3-7. Enabling this feature returns the software settings from when previously closed. Disabling this feature could be useful in resolving problems encountered when launching the program or if a default turn-on state is desired.

Chapter 4 — Measurement Functions

4-1   Introduction

Spectrum analyzer measurements include the use of additional functions beyond frequency, span, amplitude, and marker functions. "Making Spectrum Analyzer Measurements" explains setup procedures and settings for making spectrum analyzer measurements. The remainder of this section discusses the following topics and related content:

- Resolution Bandwidth
- Video Bandwidth
- Detection
- Setting Up Limit Lines
- Channel Power Measurement
- Occupied BW Measurement
- Adjacent Channel Power (ACP) Measurement
- Spectrogram

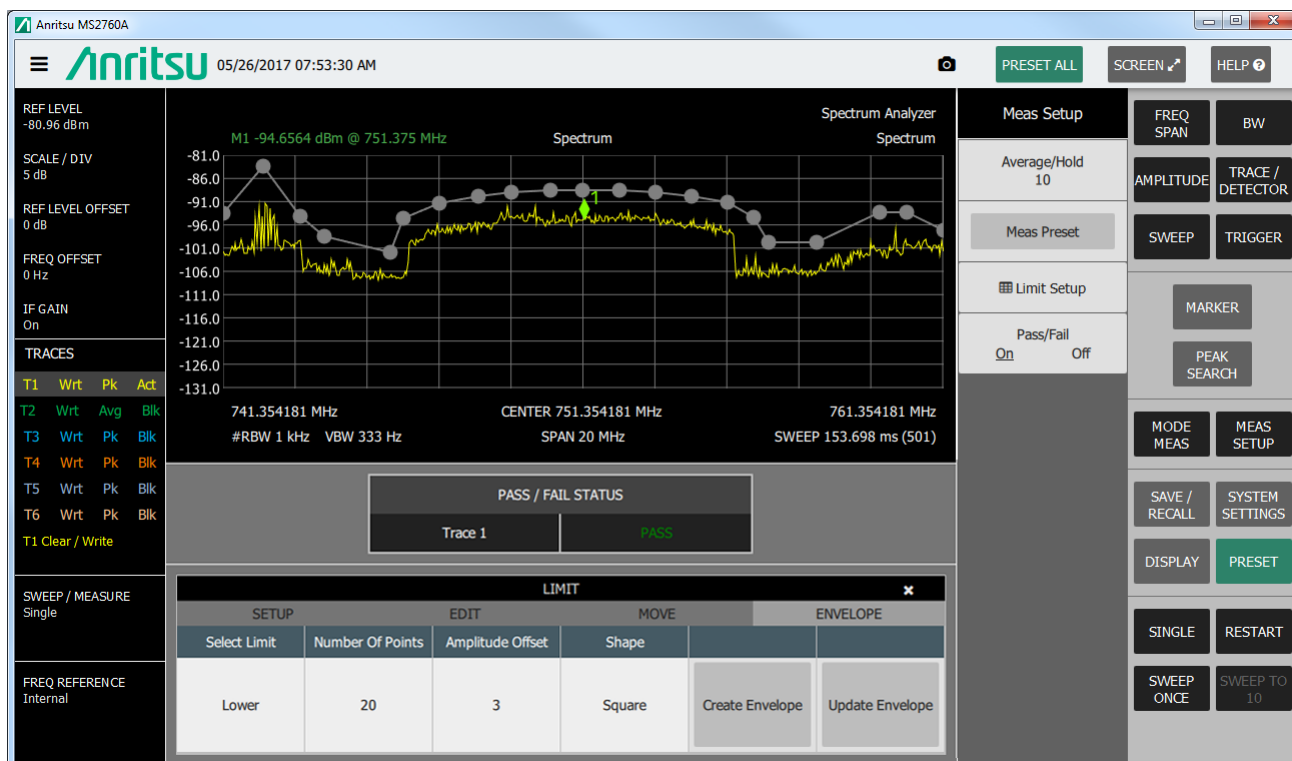## 4-2   Making Spectrum Analyzer Measurements

Figure 4-1.   Spectrum Measurement with Limit Line Example

Required Equipment

An antenna that is appropriate for the frequency range to be measured.

Required Setup

Connect the input signal or antenna to the RF In test port.

Setting the Spectrum Measurement Mode

1. Press the **MODE MEAS** button on the control panel.

2. Click the pull-down list for MEASUREMENT.

3. Select **Spectrum**.

Setting Frequency

The tuning frequency range can be entered in several different ways depending upon what makes the most sense, either for the user or for the application. The frequency parameters - stop, start, center, offset, and span can be viewed all at once and then edited by clicking the **FREQ SPAN** button in the control panel. These parameters can be directly accessed for editing by clicking on them in the Status Panel or X-axis. In either case, a corresponding pop-up numeric key will display to edit the parameter.

Offset Frequency

In addition, a user-defined frequency offset can be entered to adjust the frequency that is displayed on the instrument from the actual swept frequency. For example, if the DUT is an antenna system receiving signals in the 10 GHz range and offsetting the signals to the 1 GHz range, you can set a frequency offset in the spectrum analyzer in order to display the actual received antenna frequency in the sweep window.

Both positive and negative offset values are allowed. Negative offsets can be useful for seeing differences from expected values. Enter a negative offset of the expected value, and the received antenna frequency should display in the 0 Hz range.

Frequency Offset is displayed as the forth parameter in the Status Panel and "OFFSET" will display right of the center frequency in the X-axis.

To remove a frequency offset, set the Freq Offset to 0 Hz.

Setting Bandwidth Parameters

Both resolution bandwidth (RBW) and video bandwidth (VBW) can be coupled to the frequency span automatically or manually set. When set to Auto RES BW, RES BW adjusts automatically in proportion to the frequency span. The default ratio of the span width to the resolution bandwidth is 100:1, and can be changed as follows:

1. Press the **BW** in the Control Panel.

2. Press the **SPAN:RBW** menu key. The current **SPAN:RBW** ratio is shown as part of the menu key label. Change the value for SPAN:RBW using the pop-up number keypad or the directional arrows, and then press **OK**.

When auto-coupling between the span and RBW is selected (the RES BW button is set to "Auto"), this is indicated on the left side of the X-axis display with the RBW label and one to three digits followed by the frequency units; this represents the resolution bandwidth value. If Manual RES BW is selected (the RES RBW button is set to "Manual"), the "**#**" symbol is shown in front of the RBW label. Adjust resolution bandwidth independently of the span. If an unavailable resolution bandwidth is entered, then the instrument selects the next higher resolution bandwidth. If a value greater than the widest RBW is entered, then the widest RBW will be selected.

VIDEOBW can be set two ways – manually or by auto coupling. Auto coupling of the VIDEO BW links the video bandwidth to the resolution bandwidth, so that VBW varies in proportion to RBW. Auto-coupling is indicated on the left side of the X-axis display with the VBW label and followed by one to three digits and the frequency units; this represents the video bandwidth value. If Manual VIDEO BW coupling is selected, the "**#**" symbol is shown in front of VBW label. Adjust video bandwidth independently of the RBW. If a non-existent video bandwidth is entered, then the instrument will select the next higher video bandwidth. If a value greater than the widest VIDEO BW is entered, then the widest VIDEO BW will be selected.

The ratio of the resolution bandwidth to the video bandwidth can be changed by pressing the BW main menu key, the RBW:VBW menu key, and then using the keypad or the directional arrows to set the ratio. By default, the RBW:VBW ratio is set to 1.

The current value of the ratio is shown as part of the menu key label.

1. Press **BW** in the Control Panel.

2. Press the **RBW:VBW** button. The current RBW:VBW ratio is shown as part of the button label. Enter the desired value.

The RES BW range varies with instrument features. Refer to the RES BW button description in Section 3-4 "BANDWIDTH Menu" on page 3-11. Check your Technical Data Sheet for the RBW range of your instrument.

Setting Sweep Parameters

To set the sweep parameters, press **SWEEP** in the Control Panel.

SWEEP/MEAS

When this menu key is pressed, the instrument toggles between Single sweep and Continuous sweep. In Single Sweep mode, the instrument waits until the Sweep Once button or the Sweep to 10 button is pressed or another triggering mode is selected.

The spectrum analyzer has several mixer bands. Depending on the operating frequency, the local oscillator may be above or below the input frequency. When the local oscillator frequency is below the input frequency, an increase in the input frequency results in an increase in the IF output frequency. When the local oscillator is above the input frequency, an increase in the input frequency moves it closer to the local oscillator frequency and the If output frequency consequently decreases.

Setting External Trigger Parameters

To set the external trigger parameters, press **TRIGGER** in the Control Panel.

External Trigger

Click the **SOURCE** button and select External. A TTL signal that is applied to the External Trigger female MCX input connector causes a single sweep to occur. In the Spectrum Analyzer mode, triggering normally occurs on the rising edge of the signal, but the MS2760A can trigger on rising, falling, or both edges. After the sweep is complete, the resultant trace is displayed until the next trigger signal arrives. Set the DELAY, HOLDOFF, AUTO, and SLOPE parameters as desired.

Video Trigger

Video triggering is only available in Spectrum view with Zero Span.

1. Click **FREQ/SPAN** and select ZERO SPAN, or set the SPAN to 0 Hz.

2. Click **TRIGGER** and select Video as the trigger **SOURCE**. Video triggering will cause a sweep to occur when the RF input crosses the LEVEL threshold. In the Spectrum Analyzer mode, triggering normally occurs on the rising edge of the signal, but the MS2760A can trigger on rising, falling, or both edges. After the sweep is complete, the resultant trace is displayed until the next trigger signal arrives. Set the DELAY, HOLDOFF, AUTO, and SLOPE parameters as desired.

4-3 Resolution Bandwidth

Resolution Bandwidth (RES BW) determines frequency selectivity. The spectrum analyzer traces the shape of the RBW filter as it tunes past a signal. The choice of resolution bandwidth depends on several factors. Filters take time to settle. The output of the filter will take sometime to settle to the correct value, so that it can be measured. The narrower the filter bandwidth (resolution bandwidth), the longer the settling time needs to be, and therefore, the slower the sweep speed.

The choice of resolution bandwidth will depend upon the signal being measured. If two closely-spaced signals are to be measured individually, then a narrow bandwidth is required.If a wider bandwidth is used, then the energy of both signals will be included in the measurement. Thus, the wider bandwidth does not have the ability to look at frequencies selectively, but instead simultaneously measures all signals falling within the resolution bandwidth. Therefore, a broadband measurement would include all signals and noise within the measurement bandwidth into a single measurement.

On the other hand, a narrow-band measurement will separate the frequency components, resulting in a measurement that includes separate peaks for each signal. There are advantages to each. The ultimate decision will depend upon the type of measurement required.

There is always some amount of noise present in a measurement. Noise is often broadband in nature; that is, it exists at a broad range of frequencies. If the noise is included in the measurement, the measured value could be in error (too large) depending upon the noise level. With a wide bandwidth, more noise is included in the measurement. With a narrow bandwidth, less noise enters the resolution bandwidth filter, and the measurement is more accurate. If the resolution bandwidth is narrower, the noise floor will drop on the spectrum analyzer display. As the measured noise level drops, smaller signals that were previously obscured by the noise can now be measured.

4-4 Video Bandwidth

Spectrum analyzers typically use another type of filtering after the detector called video filtering. This filter also affects the noise on the display but in a different manner than the resolution bandwidth. In video filtering, the average level of the noise remains the same, but the variation in the noise is reduced. Hence, the effect of video filtering is a "smoothing" of the signal noise. The resultant effect on the analyzer's display is that the noise floor compresses into a thinner trace, while the average position of the trace remains the same.

Changing the video bandwidth (VIDEO BW) does not improve sensitivity, but it does improve discernibility and repeatability when making low-level measurements. As a general rule, most field spectrum analyzer measurements are made at a video bandwidth that is a factor of 10 to 100 less than the resolution bandwidth. This ratio can be specified in the BW main menu. Using this ratio, with a resolution bandwidth of 30 kHz, typically, the video bandwidth is set between 300 Hz and 3 kHz, although it can be set anywhere from 1 Hz to 10 MHz.

4-5 Sweep Limitations

Anritsu products are designed to relieve the user from having to calculate the sweep speed or experiment to discover a sweep speed that yields accurate results. When changing the RES BW and VIDEO BW, the sweep speed automatically changes to the fastest sweep speed that will yield accurate results. The sweep speed will be faster for a wide RES BW or VIDEO BW and slower for a narrow RES BW or VIDEO BW. Regardless of the minimum sweep time setting, the instrument will never sweep faster than the RES BW and VIDEO BW settings will allow. The instrument is designed to ensure that no uncalibrated measurement conditions will occur.

4-6   Low-Level CW Signal Notes

The following actions, listed in decreasing order of effectiveness, can facilitate the detection of low-level CW signals:

1. Decrease the reference level and attenuation. Refer to "AMPLITUDE Menu" on page 3-10.

2. Press the **AMPLITUDE** button in the Control Panel.

3. Set **REF LEVEL** -10dBm or lower.

4. For IF GAIN, select **On**.

5. Press **BW** in the Control Panel and reduce RES BW. Refer to "BANDWIDTH Menu" on page 3-11.

6. Decrease VIDEO BW (RBW/VBW = 10 is often optimal for this purpose).

7. If VIDEO BW is already set to 1 Hz, use trace averaging

8. Press **TRACE/DETECTOR** in the Control Panel.

9. Press the **TRACE TYPE** button pull-down list arrow.

10. Select **Average**.

4-7   Detection

Several detection methods tailor the performance of the instrument to meet specific measurement requirements. In general, several measurement points are calculated for each display point. The various detection methods are different ways of dealing with how measurement point data is shown at each display point. Refer to "TRACE / DETECTOR Menu (Spectrum View)" on page 3-13.

- **Peak:** This method causes the largest measurement point to be shown for each display point, and ensures that a narrow peak is not missed.

- **RMS/Avg:** This method performs a root-mean-square calculation of all the measurement points in each display point. This is particularly useful in displaying the average value of noise or noise-like signals.

- **Negative:** This method causes the smallest measurement point to be shown for each display point. It is especially useful in zero span, to see if the signal amplitude drops briefly. The method is also useful when looking at modulated signals, to see if some frequencies are not being used.

4-8   Indications of Excessive Signal Level

The Spectrum Analyzer has built-in features to indicate when a received signal is too high for the current setup. Before proceeding with the measurements, adjust the reference level as instructed. Adjusting the resolution bandwidth and frequency range may also help.

4-9   Setting Up Limit Lines

Two types of limit lines can be specified, lower limit lines and upper limit lines. Limit lines can be used for visual reference only, or for pass/fail criteria using the limit alarm. Limit alarm failures are reported whenever a signal is above the upper limit line or below the lower limit line. By using save-on-event, a signal that causes a limit alarm can be automatically saved.

Each limit line can consist of a single segment, or as many as 40 segments. These limit segments are retained regardless of the current frequency span of the instrument, which allows the configuring of specific limit envelopes at various frequencies of interest without having to re-configure them each time the frequency is changed.

1. Click the **MEAS SETUP** button in the Control Panel to display the MEAS SETUP menu.

2. Press the **Limit Setup** button to open the Limit setup table.

Note	Once limit lines are in the measurement display, you can grab an individual point and move it to a desired location. Place the cursor on a point, the cursor will turn into a hand. Press the left mouse button and the hand with grab the point. Grabbing the point will place a horizontal and vertical blue line through the point. These lines will aid you in moving the point. Move the point to the desired location. This process works with a simple single limit line with two end points or a multi-segment limit line with multiple points.

Setup

Click **SETUP** and set the following parameters as desired.

- **Select Limit Upper/Lower:** Selects which limit line will be active for editing - Upper or Lower Limit line.

- **Limit On/Off:** Displays the selected limit when On.

- **Alarm On/Off:** This setting is for toggling the alarm function ON and OFF for the currently active limit line. When ON, an alarm beep will occur when a data point exceeds the limit.

- **Set Default:** Pressing this button deletes all limit points for the currently active limit line and sets the default limit line value, which is a single limit whose position is 2.5 grid lines from the top of the screen (for the upper limit line) or 2.5 grid lines from the bottom of the screen (for the lower limit line), depending upon which limit is active. The inactive limit line is not altered.

- **Limit Line Type Absolute/Relative:** Use to set the selected limit line be absolute or be relative. This selection may be used at any time while working with limit lines. Absolute limit lines set the limit inflection points based upon the entered frequencies for each point. Relative limit lines set the limit inflection points relative to the current center frequency. Regardless of how a limit line is set up, saved, or recalled, it can be changed between absolute and relative by pressing the desired state.

- **Mirror On/Off:** Many emission masks are symmetrical. The low frequency side is identical to the upper side. The Limit Mirror feature allows you to create half of the limit line and get the other half built automatically. This feature can work in either of two ways:

    - Turn Mirror on before beginning to build a limit line. As you add a point on either side of the center frequency, another point is automatically added on the opposite side of the center frequency.

    - Leave Mirror off until half of the limit line is built, then turn **On** Mirror. the other half of the limit line is built automatically.

Edit

When EDIT is selected the (Upper/Lower) Limit Points table opens adjacent to the Control panel or to the MEAS SETUP menu if still open. The Upper Limit Points or Lower Limit Points table is determined by the setting Select Limit in SETUP. EDIT allows for creating or editing of single or multi-segment limit lines. The currently active limit point is designated by an empty circle on the display.

- **Select Point (Point # on List):** Displays the Point highlighted in light gray in the Upper/Lower Limit Points List.

- **Frequency:** Sets the frequency of a limit line inflection point. The frequency of each inflection point in a limit line can be individually set. When a new point is added, it takes on a value halfway between two existing points, or it takes on the stop frequency of the current sweep if no point is higher in frequency than the one being added. See the Add Point button description for more details. Use the keypad, the left or right arrow keys, to change the frequency of an inflection point. The left or right arrows move the inflection point by ±0.1. Up or down arrows move the inflection point ±1.

- **Amplitude:** Sets the amplitude of a limit line inflection point. The amplitude of each inflection point can also be individually set. By default, when a new point is added it takes on the amplitude that is on the limit line at the frequency where the point was added. Use the keypad (using the ± key to set a negative value) or the up or down arrow keys to move the point to the desired value. The unit of the amplitude limit is the same as the current vertical amplitude unit. See the Add Point button description for details. Use the keypad or the left or right arrow keys to change the amplitude of an inflection point. The left or right arrows move the inflection point by ±1. The up or down arrows move the inflection point by ±10.

- **Add Point:** Press this button to add a limit line inflection point. The precise behavior of this button depends upon which inflection point is active at the time that the key is pressed. If the active limit point is somewhere in the middle of a multi-segment limit line, then a new limit point is added that is halfway between the currently active point and the point immediately to its right. The amplitude of the inflection point will be such that it falls on the limit line. For example, if a limit point exists at 2.0 GHz with an amplitude of −30 dBm, and if the next point is 3.0 GHz with an amplitude of −50 dBm, then the added point will be at 2.5 GHz with an amplitude of −40 dBm. The frequency and amplitude values of the new point can be adjusted as needed with POINT FREQUENCY and POINT AMPLITUDE. If the last limit point is active (assuming it is not at the right edge of the display), then the new limit point will be placed at the right edge of the display at the same amplitude as the point immediately to its left. Points may not be added beyond the current sweep limits of the instrument.

- **Delete Point:** Press this button to delete the currently active point. The active point becomes the point that is immediately to the left of the point that was deleted.

- **Add Vertical:** In many measurement masks, step changes occur in the value of the limit line. Press this button to add two inflection points. The two inflection points share the same frequency and are centered midpoint between adjacent measured points. The magnitudes of the points are set by using a visually intuitive algorithm that is based upon the adjacent inflection points.

  You can adjust the magnitudes independently, but the frequencies of the two points remain linked and are adjusted as a vertical pair. Setting a discrete frequency, a limit inflection point will keep that exact frequency and place the limit point appropriately regardless of the frequency span. This is especially useful for emission mask verification.

- **Next Point Left:** Press this button to select the inflection point that is immediately to the left of the active point, making this newly selected point active for editing or deletion. With each key press, the active point becomes that point to the left of the previously active point, until the newly selected active point becomes the left-most point on the screen.

- **Next Point Right:** Press this button to select the limit point immediately to the right of the active point, making this newly selected point active for editing or deletion. With each key press, the active point becomes that point to the right of the previously active point, until the newly selected active point becomes the right-most point on the screen.

Move

- **Center:** Pressing this button moves the center of the existing limit line to the center frequency of the measurement. The span of the existing limit line is not changed by doing this. Use this button as an easy way to get an existing limit line on screen. If no limit line is turned on, then a new, flat default limit line is turned on and is located 2.5 grid lines from the top of the screen for the upper limit line or 2.5 grid lines from the bottom of the screen for the lower limit line.

- **X-Offset:** Allows you to adjust the frequencies of the limit line. All inflection points are moved by the value entered. Click the current value under X-Offset to display the OFFSET FREQUENCY keypad. Enter a value. Pressing the Enter key has the same affect as pressing the terminator for the current units.

  Left: Pressing this button moves all inflection points to the left by the value entered.

  Right: Pressing this button moves all inflection points to the right by the value entered.

- **Y-Offset:** Use Y-Offset to move the limit line up or down by the selected number of dB. Click the current value under Y-Offset to display the OFFSET AMPLITUDE keypad. Enter a value. Pressing the Enter key has the same affect as pressing the terminator for the current units.

  Up: Pressing this button moves all inflection points up by the value entered.

  Down: Pressing this button moves all inflection points down by the value entered.

- **MARKER 1 OFFSET:** Sets a limit line offset value from Marker 1 amplitude. This feature moves the limit line amplitude and frequency as needed to place the center of the limit line the user-specified number of dB from the position of Marker 1. Positive values place the limit line above Marker 1, and negative values place the limit line below Marker 1.

  Marker 1: Move the frequency and amplitude of the center frequency of the limit line to the frequency and amplitude of Marker 1 (assuming that the Offset from Marker 1 value is set to 0 dB).

Envelope

A limit envelope is very useful when you want to easily detect new signals in the presence of other preexisting signals. Use the limit envelope function to automatically create upper or lower limit lines that are based upon the on-screen measured spectrum analysis values SELECT LIMIT Upper or Lower:

- **Select Limit:** Press this button to select Upper Points or Lower Points for envelope design.

- **Number of Points:** Opens the ENVELOPE POINTS MAX SIZE keypad. Enter the desired number of points to create an envelope.

- **Amplitude Offset:** Upper Offset (Select Limit is set to Upper), Lower Offset (Select Limit is set to Lower):

  Use to define how far away from the measured signal the upper or lower envelope will be placed. The limits are ± 100 dB. For an upper envelope, usually the value will be positive in order to place the envelope above the signal. For a lower envelope, the value will usually be negative in order to place the envelope below the signal.

- **Shape:** Upper Shape Square/Slope (Select Limit is set to Upper), Lower Shape Square/Slope (Select Limit is set to Lower):

  Use to choose whether the default for the upper or lower envelope will be with flat tops (Square setting) and reasonably vertical lines to change level or whether the envelope will have sloped lines (Slope setting) between adjacent inflection points. When the square envelope type is selected, two inflection points are used for each horizontal segment.

- **Create Envelope:** Press this button to generate the envelope using the Limit Envelope characteristics. If the default results are not satisfactory, then you can make adjustments to the amplitude and frequency of each inflection point, and you can add or delete inflection points.

- **Update Envelope:** While working on your envelope (or if your signal amplitude changes), you may want to adjust the amplitude of the current limit without changing the frequencies of the inflection points. Pressing this button makes those amplitude adjustments without frequency adjustments.

At the completion of setting up Limit Lines, close the Limit setup panel by clicking the **X** in upper right box of the panel or **Limit Setup** in the MEAS SETUP menu.

4-10   Channel Power Measurement

Channel power measurement is one of most common measurements for a radio transmitter. This test measures the output power, or channel power, of a transmitter over the frequency range. Out-of-specification power measurements indicate system faults, which can be in the power amplifiers or in filter circuits. Channel Power measurements can be used to validate transmitter performance, comply with government regulations, or to keep overall system interference at a minimum.
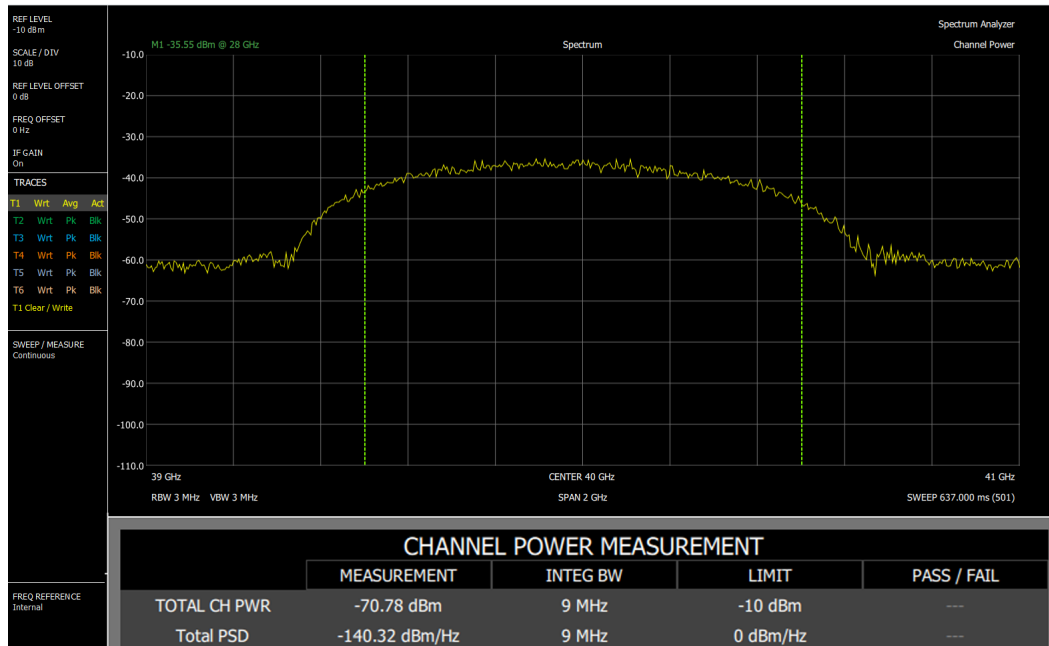

Figure 4-2.   Channel Power Measurement Example

Set the Channel Power Measurement Mode

1. Press the **MODE MEAS** button.

2. Click the pull-down list for Measurement.

3. Select **Channel Power**. The CHANNEL POWER MEASUREMENT table displays under the measurement display.

Procedure

1. Click the **FREQ SPAN** button in the Control Panel. The FREQ/SPAN menu displays.

2. Set the desired values for CENTER FREQ, SPAN, START FREQ, STOP FREQ, FREQUENCY STEP, and FREQ OFFSET. The associated pop-up keypad will display when clicked.

3. Click the **AMPLITUDE** button in the Control Panel. The AMPLITUDE menu displays.

4. Set the desired values for REF LEVEL, Auto Ref Level, SCALE/DIV, Y AXIS UNITS, REF LEVEL OFFSET, and IF GAIN. The associated pop-up keypad will display when clicked.

5. Click the **BW** button in the Control Panel. The BANDWIDTH menu displays.

6. Set the desired values for RES BW, VIDEO BW, VBW/AVERAGE TYPE, RBW:VBW, SPAN:RBW, and RBW FILTER. The associated pop-up keypad will display when clicked.

7. Click the **MEAS SETUP** button in the Control Panel. The MEAS SETUP menu displays.

8. Set the desired values for Average/Hold, Averaging, Integration BW, PSD Units, Meas Method, Power Limit, and PSD Limit. The associated pop-up keypad will display when clicked.

9. Press the **SINGLE CONT** button on the Control Panel to take either a single measurement or continually take channel power measurements.

10. The PASS/FAIL results can be viewed in the CHANNEL POWER MEASUREMENT table when the POWER LIMIT or the PSD LIMIT is turned on from the MEAS SETUP menu.

4-11 Occupied BW Measurement

Occupied Bandwidth (OBW) is a common measurement performed on radio transmitters. This measurement calculates the bandwidth containing the total integrated power occupied in a given signal bandwidth. There are two different methods of calculation depending upon the technique used to modulate the carrier.

- % Integrated Power Method: The occupied frequency bandwidth is calculated as the bandwidth containing the specified percentage of the transmitted power.
- >dBc Method: The occupied frequency bandwidth is defined as the bandwidth between the upper and lower frequency points at which the signal level is a desired number of dB below the peak carrier level.
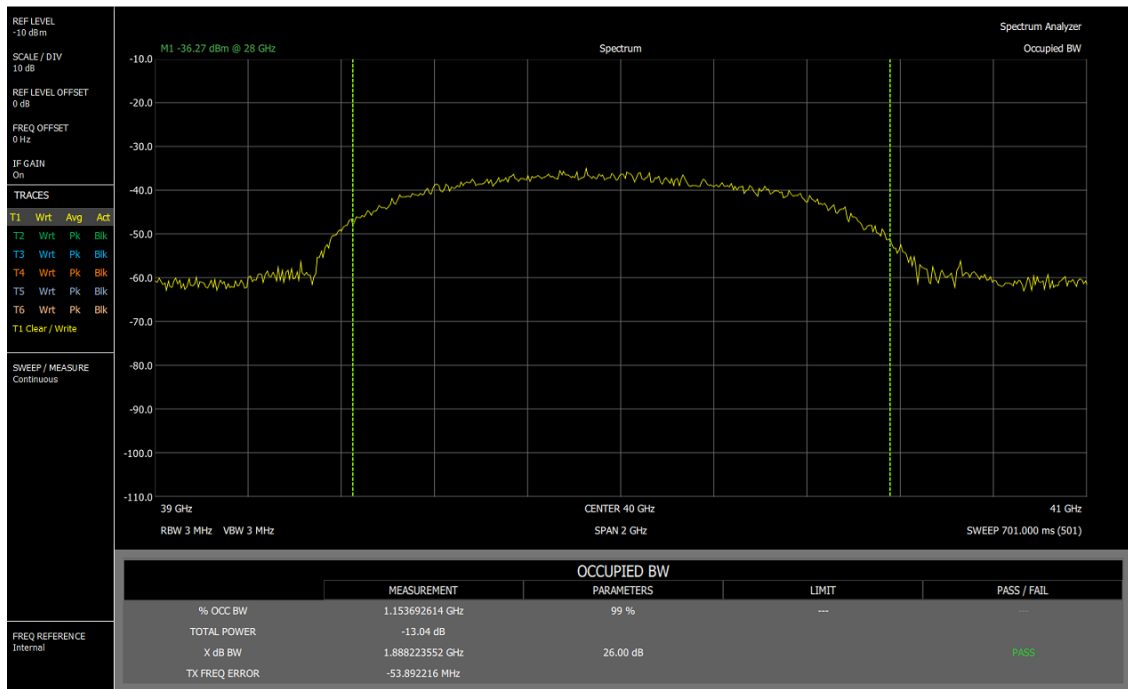

Figure 4-3. Occupied BW Measurement Example

Required Equipment

- The appropriate antenna for the frequency bands being measured.

Set the Occupied BW Measurement Mode

1. Press the **MODE MEAS** button in the Control Panel.
2. Click the pull-down list for Measurement.
3. Select **Occupied BW**. The OCCUPIED BW table opens.

Procedure

1. Click the **FREQ SPAN** button in the Control Panel. The FREQ/SPAN menu displays.

2. Set the desired values for CENTER FREQ, SPAN, START FREQ, STOP FREQ, FREQUENCY STEP, and FREQ OFFSET. The associated pop-up keypad will display when clicked.

3. Click the **AMPLITUDE** button in the Control Panel. The AMPLITUDE menu displays.

4. Set the desired values for REF LEVEL, Auto Ref Level, SCALE/DIV, Y AXIS UNITS, REF LEVEL OFFSET, and IF GAIN. The associated pop-up keypad will display when clicked.

5. Click the **BW** button in the Control Panel. The BANDWIDTH menu displays.

6. Set the desired values for RES BW, VIDEO BW, VBW/AVERAGE TYPE, RBW:VBW, SPAN:RBW, and RBW FILTER TYPE. The associated pop-up keypad will display when clicked.

7. Press the **MEAS SETUP** button in the Control Panel. The MEAS SETUP menu opens. Set up Average/Hold, Averaging, %OBW Power, X dB, OBW Limit as desired.

8. Press the **SINGLE CONT** button on the Control Panel to take either a single measurement or continually take Occupied BW measurements.

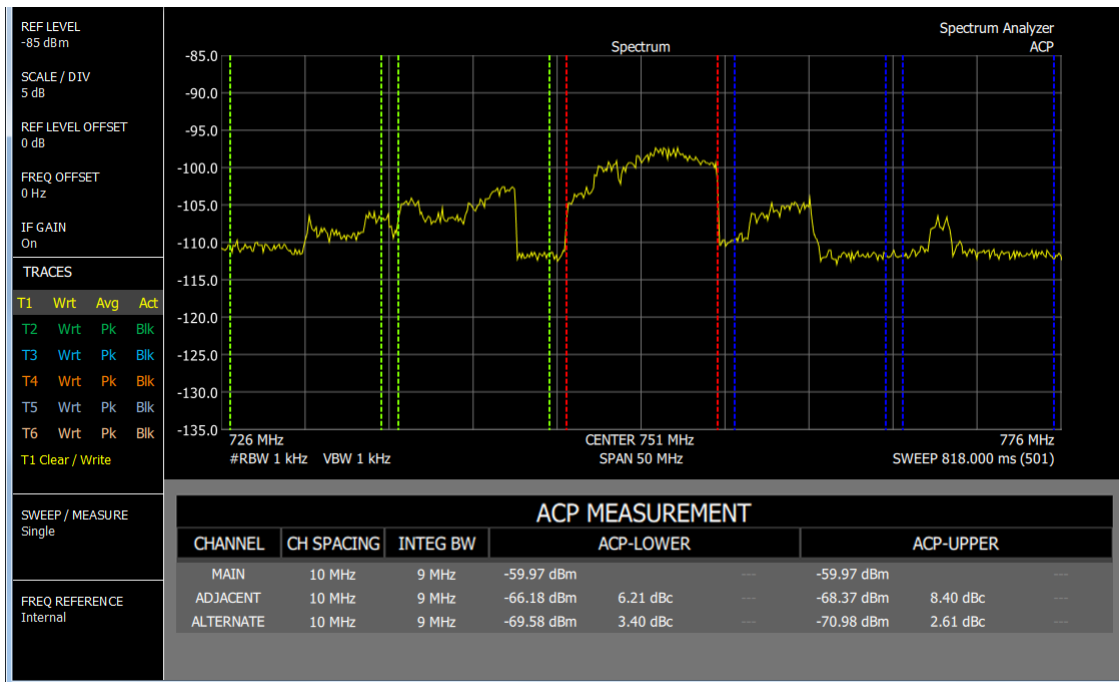# 4-12 Adjacent Channel Power (ACP) Measurement

Figure 4-4.   ACP Measurement Example

Required Equipment

- The appropriate antenna for the frequency bands being measured.

Set the Adjacent Channel Power Mode

1. Press the **MODE MEAS** button.
2. Click the pull-down list for Measurement.
3. Select **ACP**. The ACP MEASURMENT table is displayed.

Setting Up Limit Lines

1. Click the **MEAS SETUP** button in the Control Panel. The MEAS SETUP menu displays.
2. Press the LIMIT SETUP button. an the LIMIT setup table opens.

Procedure

1. Click the **FREQ SPAN** button in the Control Panel. The FREQ/SPAN menu displays.
2. Set the desired values for CENTER FREQ, SPAN, START FREQ, STOP FREQ, FREQUENCY STEP, and FREQ OFFSET. The associated pop-up keypad will display when clicked.
3. Click the **AMPLITUDE** button in the Control Panel. The AMPLITUDE menu displays.
4. Set the desired values for REF LEVEL, Auto Ref Level, SCALE/DIVISION, Y AXIS UNITS, REFLEVEL OFFSET, and IF GAIN. The associated pop-up keypad will display when clicked.
5. Click the **BW** button in the Control Panel. The BANDWIDTH menu displays.
6. Set the desired values for RES BW, VIDEO BW, VBW/AVERAGE TYPE, RBW:VBW, SPAN:RBW, and RBW FILTER TYPE. The associated pop-up keypad will display when clicked.

7. Press the **MEAS SETUP** button. The MEAS SETUP menu for ACP is displayed.

8. Set the desired values for AVERAGE/HOLD, AVERAGING, INTEGRATION BW, MEAS METHOD, LIMIT TYPE, and LIMITS.

9. Press the **SINGLE CONT** button on the Control Panel to take either a single measurement or continually take Adjacent Channel Power measurements.

4-13   Spectrogram

A Spectrogram is a multi-dimensional representation of frequency, time, and power useful for identifying intermittent interference. Color is used to represent power levels.
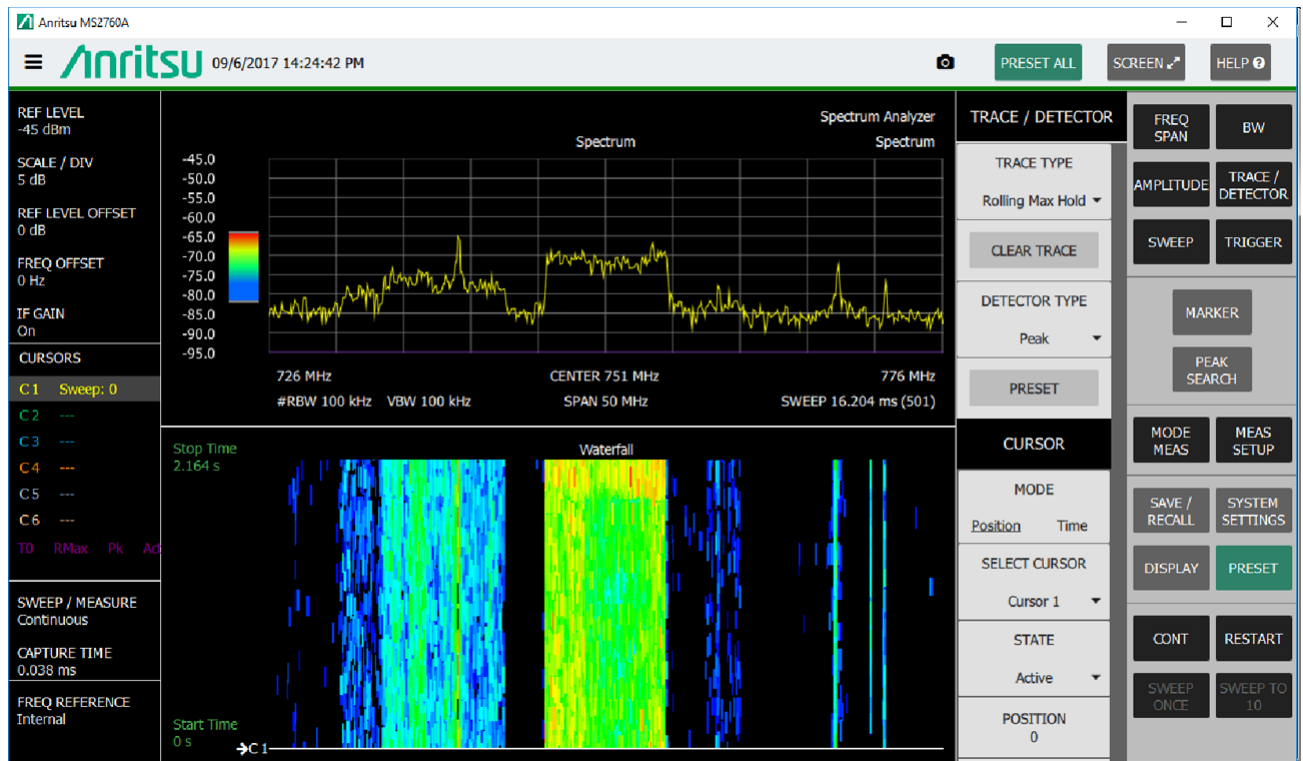

Figure 4-5.   Spectrogram Display Example

Required Equipment

- The appropriate antenna for the frequency bands being measured.

Set the Spectrogram View

1. Press the **MODE MEAS** button.

2. Click the pull-down list for Measurement and select **Spectrum**.

3. Click the pull-down list for View and select **Spectrogram**.

   The Spectrogram Position button is displayed. By default the Spectrogram is displayed below the trace display. Move it above the trace display by selecting Top.

Procedure

1. Click the **FREQ SPAN** button in the Control Panel. The FREQ/SPAN menu displays.

2. Set the desired values for CENTER FREQ, SPAN, START FREQ, STOP FREQ, FREQUENCY STEP, and FREQ OFFSET. The associated pop-up keypad will display when clicked.

3. Click the **AMPLITUDE** button in the Control Panel. The AMPLITUDE menu displays.

4. Set the desired values for REF LEVEL, Auto Ref Level, SCALE/DIV, Y AXIS UNITS, REF LEVEL OFFSET, and IF GAIN. The associated pop-up keypad will display when clicked.

5. Click the **BW** button in the Control Panel. The BANDWIDTH menu displays.

6. Set the desired values for RES BW, VIDEO BW, VBW/AVERAGE TYPE, RBW:VBW, SPAN:RBW, and RBW FILTER. The associated pop-up keypad will display when clicked.

7. Press the **MEAS SETUP** button. The MEAS SETUP menu and COLOR SETUP menu for Spectrogram are displayed.

8. For MEAS SETUP, set the desired values for Average/Hold, Meas Preset, and Limit Setup.

9. For Color Setup, set the desired values for Top Range, Bottom Range, and Reference Hue. For Reference Hue, grab the dot with the cursor and drag it across the color panel to the desired Spectrogram color.

10. Adjust the **Color Setup Bar** to the peaks and valleys of the measurement trace. Click **Top Range** and enter an upper limit value. Click **Bottom Range** and enter a lower limit value. You can also adjust the Top Range and Bottom Range directly on the Color Setup Bar. Place the mouse cursor at the top or bottom edge of the Color Setup Bar. When the cursor changes to an arrow pointing up and down, grab that edge and move it to the desired location.

11. **TRACE/DETECTOR** menu setup. Select the function of the Time Cursor by pressing the **Spectrogram Select** button, **Position**, or **Time**. Position will allow you to move Time Cursor to a specific trace using the Spectrogram Position button. Press the **Spectrogram Position** button to open the number keypad and enter the desired trace. Selecting **Time** will place the Time Cursor at the time displayed on the Spectrogram Time button. Press the **Spectrogram Time** button and the number keyboard opens. Enter a new time. Note that the Time Cursor can be selected with the mouse and dragged to the desired position as well.

12. Press the **SINGLE CONT** button on the Control Panel to take either a single measurement or continually take measurements.

Chapter 5 — File Management

5-1   Introduction

This chapter describes the file management features of the MS2760A software and its screen menus. The SAVE/RECALL menu and its buttons allow you to save and recall files to the local drive or to an external USB flash drive. Below the Save and Recall buttons are On/Off switches to enable or disable Save On Event functions.

The SAVE/RECALL button on the Control Panel displays the SAVE/RECALL menu. See Figure 3-1, "GUI Overview (sample display elements)".

5-2   Saving Files

Save As

You can immediately save a file with this button. Pressing this key will save setup parameters, trace data, image files, limit lines, or measurement results to the file that is named on the button. Upon completion, the file name numerical suffix increments by 1 and will be applied the next time SAVE AS is pressed. The file extension is determined by the current file mode, such as .stp for a SETUP file. You can change the current file type in the Save or Recall menu.

Note	The file type may need to be set using the Save or Recall menus the first time this feature is used.

Save

Save a file manually by pressing the SAVE button to open the SAVE panel.

A list of entry fields are displayed. Fill the entry fields accordingly.
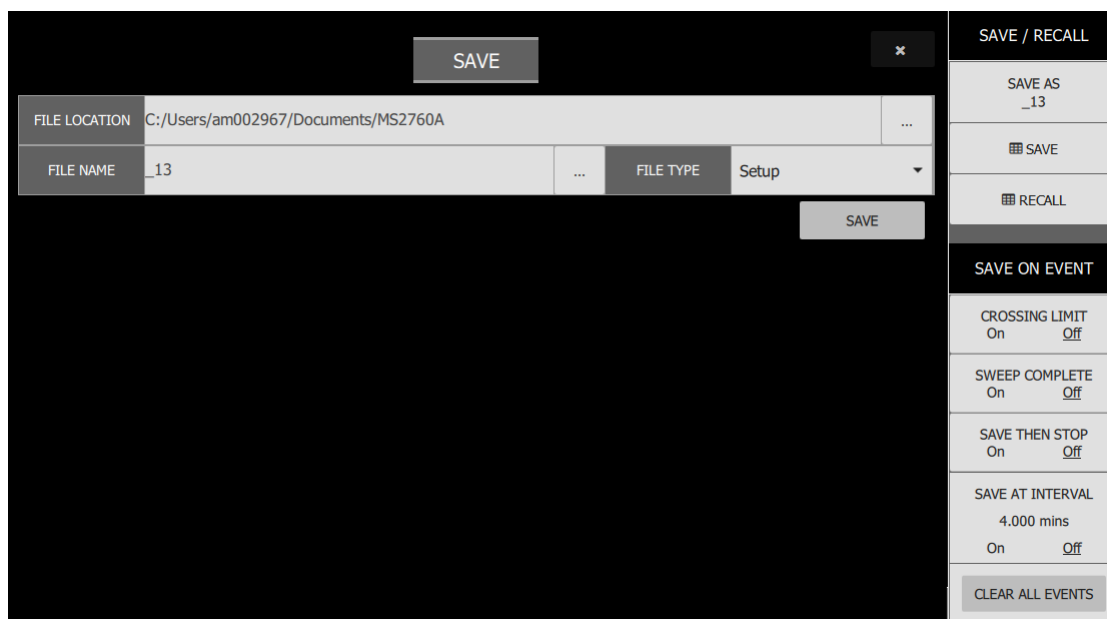

Figure 5-1.   Save Panel

- **FILE LOCATION:** Enter the location manually or click on the box with three dots to navigate to the desired folder.
- **FILE NAME:** You can use the current name listed in the entry window or manually type in a different name.
- **FILE TYPE:** Click on the pull down list button and select the file type to be saved. File types supported by the MS2760A software are:
    - Setup (.stp): saves the current instrument setup.
    - Measurement (.rsm): saves the measurement point (trace) data and the current instrument setup.
    - Image (.png): saves the measurement screen data as PNG.
    - Trace data (.csv): saves the visible trace point data in comma separated value format. This format is useful for further analysis using 3rd party software tools.
    - Limit line (.lim): saves the current limit line point data.

When completed, press the SAVE button. A notification will pop up at the top of the measurement display during the saving process. It states the information set for saving the file and will clear at the completion of the saving process. Press the cancel **(X)** button to close the panel.

Save On Event

The buttons are used to automatically save measurement data to the current save location or to save, then stop the measurement after a selected event type. Set the switches as desired. This menu is not available in all modes of operation.

- **Crossing Limit On/Off:** When this button is set to On, measurement data is automatically saved when the selected trace crosses a limit line.
- **Sweep Complete On/Off:** When button is set to On, measurement data is automatically saved after the current sweep is completed.
- **Save then Stop On/Off:** Set this button to ON to stop saving after an event has occurred. This will save the event (Crossing Limit and Sweep Complete) and then stop saving.
- **Save at Interval On/Off, <time>:** A save will occur periodically. Set the period by pressing the time below On/Off. The SAVE EVENTS INTERVAL pop-up is displayed. Set the desired time. Pressing the any of the units button will automatically close the pop-up.
- **Clear All Events:** Press this button to turn Off all Save On Event keys:
  - Crossing Limit
  - Sweep Complete
  - Save then Stop
  - Save at Interval

5-3   Recalling Files

Press the RECALL button to open the RECALL panel. A list of entry fields are displayed. Fill in the entry fields accordingly.
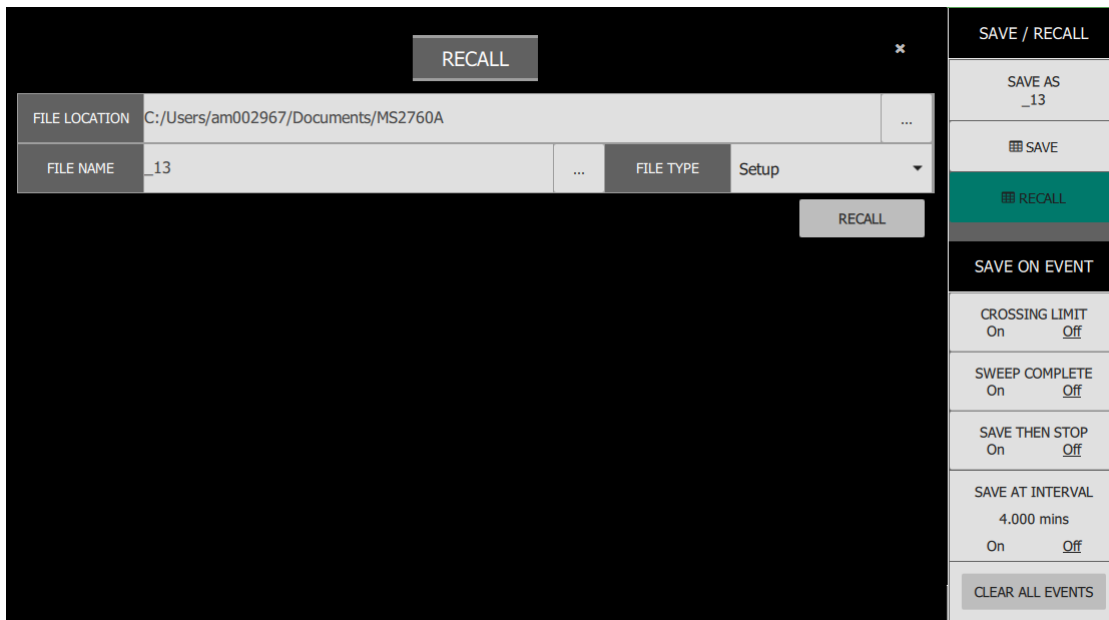

Figure 5-2.   Recall Panel

- **FILE LOCATION:** Enter the location manually or click on the box with three dots to navigate to the desired folder.

- **FILE TYPE:** File types supported by the MS2760 Software are setup (.stp), measurement (.rsm), and limit line (.lim). Click on the pull down list button and select the file type to be recalled. PNG image files are not listed because they cannot be recalled.

- **FILENAME:** You can use the current name listed in the entry window, manually type in the name of the desired file, or press the three dot button at the right to navigate to the desired file.

Press the **RECALL** button. A notification will pop up at the top of the measurement display during the recall process. It states the information set for recalling the file and will clear at the completion of the recalling process. Press the cancel **(X)** button to close the panel.

Chapter 6 — Programming with SCPI

6-1   Introduction

This chapter provides an introduction to Standard Commands for Programming Instruments (SCPI). The SCPI standard defines a set of programming commands and standards for use by all SCPI compatible instruments. SCPI is intended to provide a consistent environment for program development. It does so by defining standardized controller messages, instrument responses, and message formats for all SCPI compatible instruments. The following sections include descriptions of the command types, hierarchical command structure, command subsystems, data parameters, and notational conventions with examples.

6-2   Remote Programming Setup and Interface

Remote programming and operation between the instrument and PC is accomplished via USB 3.0. The MS2760A Software communicates to the backend software of the instrument. The backend software handles USB communication between the PC and the MS2760A with SCPI commands through a network socket. SCPI commands are sent to port 9001 of the local PC.

6-3   SCPI Command Overview

SCPI commands, which are also referred to as SCPI instructions, are messages to the instrument to perform specific tasks and to return data. The following sections provide descriptions of the command syntax and notational conventions, command types and the hierarchical command structure, and command subsystems and data parameter format. For further information about SCPI, refer to the Standard Commands for Programmable Instruments (SCPI) 1999.0 document hosted by the IVI Foundation. A subset of the standard conventions defined in that document as they apply to the MS2760A are covered in this manual.

Command Names

Typical SCPI commands consist of one or more keywords, parameters, and punctuation. SCPI command keywords can be a mixture of upper and lower case characters. As with any programming language, the exact command keywords and command syntax must be used. The syntax of the individual commands is described in detail in the programming command chapters. Unrecognized versions of long form or short form commands or improper syntax will generate an error.

Long Format vs. Short Format

Except for common commands, each keyword has a long and a short form. The short form is a subset of the long form of the command. In this manual, the long form is presented with the short form in upper case and the remainder in lower case. For example, the long form of the command keyword to control the instrument display is `:DISPlay`.

The short form keyword is usually the first four characters of the long form (`:DISP` for `:DISPlay`). The exception to this rule is when the long form is longer than four characters *and* the fourth character is a vowel. In such cases, the vowel is dropped and the short form becomes the first three characters of the keyword. For example, the short form of the keyword `:POWer` is `:POW`.

A mixture of short form keywords with the entire long form keyword of each command is acceptable. For example, `:SENS:FREQuency:STAR` is an acceptable form of the command. However, `:SENS:FREQuen:STAR` is not an acceptable form of the command because `:FREQuen` is not the entire short nor long form of the command keyword.

Command Syntax

The command statement usually starts with a colon ":" and includes a number of keywords and parameters. The leading colon is optional, but each subsequent keyword must be separated by a colon ":" and may be followed by a parameter setting when they are available. The end of the command string and the first command parameter must be separated by a space. For example:

```
:DISPlay:POINtcount 201
```

A comma "," is generally used for separating multiple command parameters, for example:

```
:CALCulate:LIMit1:LOWer 1DBM,2DBM,3DBM
```

Complete command strings may be combined on a single line and separated by a semicolon ";" as follows:

```
:SENSe:FREQuency:STARt 100; SENSe:FREQuency:STOP 500
```

Some command keywords may have a keyword parameter suffix to differentiate between multiple instrument features such as multiple trace options. When these features are available, the keyword parameter is identified and enclosed by curly braces. For example, `:TRACe{1|2|3}` is entered as `:TRACe1` or `:TRACe3`.

Note	If a keyword parameter is not included in a command, the first option is implied. In the previous paragraph, `:TRACe` is identical to `:TRACe1`. Curly braces { } designate optional keyword parameters. Square brackets [ ] designate optional command keywords.

Notational Conventions

The SCPI interface standardizes command syntax and style that simplifies the task of programming across a wide range of instrumentation. As with any programming language, the exact command syntax, and command keywords, must be used. Unrecognized commands or improper syntax will not function and most often produce an error condition. The table below lists the standard notational conventions used in this document.

Table 6-1.   Notational Conventions

:	A colon links command keywords together to form commands. The colon is not an actual part of the keyword, but is a signal to the SCPI interface parser. A colon must precede a root keyword immediately following a semicolon (see "Notational Examples" on page 6-7).
;	A semicolon separates commands if multiple commands are placed on a single program line.
[ ]	Square brackets enclose one or more optional keywords.
{ }	Curly braces enclose one or more keyword or command parameters that may be included one or more times.
|	A vertical bar indicates "or" and is used to separate alternative parameter options. For example: `ON|OFF` is the same as `ON` or `OFF`.
< >	Angle brackets enclose command parameter descriptions (see "Data Parameters" on page 6-3).

Command Terminators

The new line character (ASCII 10) in the last data byte of a command string is used as a command terminator. Use of a command terminator will reset the command path to the root of the tree.

Data Parameters

Data parameters, referred to simply as "parameters," are the quantitative values used as arguments for the SCPI commands. The parameter type associated with a particular SCPI command is determined by the type of information required to control the particular instrument function. For example, Boolean (ON|OFF) type parameters are used with commands that control switch functions. Some command descriptions specify the type of data parameter to be used with each command. The most commonly used parameter types are numeric, extended numeric, discrete, and Boolean.

Numeric:	Numeric parameters comprise integer numbers or any number in decimal or scientific notation, and may include polarity signs. This includes specific extended values as defined in "Data Parameter Notations" below.
Extended Numeric:	Extended numeric parameters include values such as NAN|INFinity|NINFinity (not a number|infinity|negative infinity).
Discrete:	Discrete parameters, such as INTernal and EXTernal, are used to control program settings to a predetermined finite value or condition.
Boolean:	Boolean parameters represent binary conditions and may be expressed as ON, OFF or 1, 0.

Data Parameter Notations

The following conventions are used to note data parameter descriptions:

Table 6-2.   Parameter Notations

<integer>	an unsigned integer without a decimal point (implied radix point)
<numeric_value>	SCPI numeric value: <NRf>|NAN|INFinity|NINFinity or other types <NRf> is any of <NR1>|<NR2>|<NR3> <NR1> is a signed integer without a decimal point (implied radix point) <NR2> is a signed number with an explicit radix point <NR3> is a scaled explicit decimal point numeric with an exponent (floating point number) +/- infinity (INFinity|NINFinity) and Not-A-Number (NAN) values can be specified for parameters of type NR3 with the values of +/- 9.9e37 and 9.91e37, respectively.
<char>	<CHARACTER PROGRAM DATA> Examples: CW, FIXed, UP, and DOWN
<string>	<STRING PROGRAM DATA> ASCII characters enclosed by double quotes, such as "OFF"
<block>	IEEE-488.2 block data format (see "Spectrum Trace Data Format")

Spectrum Trace Data Format

Trace data uses SCPI standard (IEEE 488.2) block data format. The data format is '#AXD', where D is a comma separated list of amplitudes (in ASCII), X is one or more ASCII digits specifying the number of bytes in D, and A is a single ASCII digit specifying the number of digits in X.

Trace data only contains amplitude. The frequency information for each point is

```
Frequency = start_frequency + (span/(display_points-1))*N
where N = 0, 1, 2, … display_points
```

Unit Suffixes

Unit suffixes are not required for data parameters, provided the values are scaled for the global default units, they do not require a space, and they are not case sensitive. The instrument SCPI default units are:

- HZ (hertz) for frequency related parameters
- DB for power related parameters
- MS (milliseconds) for time related parameters
- M (meters) for distance related parameters

Query Commands

All commands, unless specifically noted in the commands syntax descriptions, have a query form. As defined in IEEE-488.2, a query is a command with a question mark "?" appended to the command. For example:

    :OPTions?

When a query form of a command is received, the current setting associated with the command is placed in the output buffer. Query commands always return the short form of the parameter unless otherwise specified. Boolean values are returned as 1 or 0, even when they can be set as on or off.

Hierarchical Command Structure

All SCPI commands, except the common commands, are organized in a hierarchical structure similar to the inverted tree file structure used in most computers. The SCPI standard refers to this structure as "the Command Tree." The command keywords that correspond to the major instrument control functions are located at the top of the command tree. The root command keywords for the SCPI command set are shown in Figure 6-1.
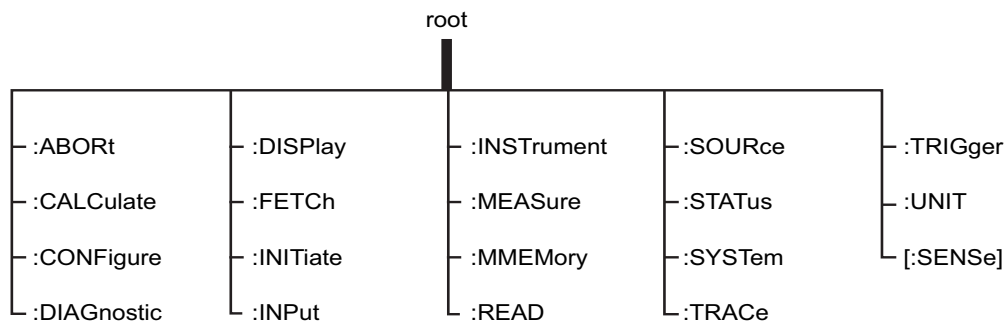
Figure 6-1. SCPI Command Tree

All instrument SCPI commands, except the :ABORt command, have one or more subcommands (keywords) associated with them to further define the instrument function to be controlled. The subcommand keywords may also have one or more associated subcommands (keywords). Each subcommand level adds another layer to the command tree. The command keyword and its associated subcommand keywords form a portion of the command tree called a command subsystem. A sample of the :UNIT command subsystem is shown in Figure 6-2.
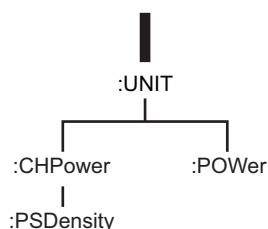
Figure 6-2. SCPI :Sample :UNIT Subsystem

6-4   SCPI Command Types

The MS2760A command set includes the following command types:

- SCPI "common" commands (IEE488.2 mandated commands)
- SCPI required commands (per SCPI 1999.0)
- SCPI optional commands

SCPI Common Commands

Some common commands are defined in the IEEE-488.2 standard and must be implemented by all SCPI compatible instruments. These commands are identified by an asterisk (*) at the beginning of the command. These commands are defined to control instrument status registers, status reporting, synchronization, and other common functions. Examples of common commands supported by the instrument are shown below. See also Section 7-1 "System Common Commands".

*CLS

Title : Clear Status Command

Description: This command clears all status data structures in the device (registers and error queue) and forces the Operation Complete state to Idle.

Parameter(s): none

*IDN?

Title: Identification Query

Description: This command returns the following information in <string> format separated by commas: manufacturer name ("Anritsu"), model number/options, serial number, firmware package number. The model number and options are separated by a "-".

For example, the return string might look like:
`Anritsu,MS2760A-0070,62011032,1.23`

*RST

Title: Reset

Description: This command clears any pending operations on the instrument.

SCPI Required Commands

The required SCPI commands supported by the instrument are listed below. These commands work in all measurement modes.

Table 6-3.   SCPI Required Commands

:STATus
:SYSTem

SCPI Optional Commands

Optional SCPI commands comprise the majority of the MS2760A command set. These commands control most of the programmable functions of the instrument. The top level command subsystems are listed in the table below.

Table 6-4.   SCPI Optional Commands

:ABORt	:DISPlay	:MEASure	:SYSTem
:CALCulate	:FETCh	:MMEMory	:TRACe
:CONFigure	:INITiate	:READ	:TRIGger
:DIAGnostic	:INSTrument	:STATus	:UNIT
			:SENSe

The SCPI optional commands are sorted by measurement modes and the commands may be repeated in more than one mode.

6-5   SCPI Command Programming Examples

Command statements read from left to right and from top to bottom. In the command statement below, the
`:FREQuency` keyword immediately follows the `:SENSe` keyword with no separating space. A space is used
between the command string and its argument.

Notational Examples

`[:SENSe]:FREQuency:STARt <numeric_value>{HZ|KHZ|MHZ|GHZ}`

The following command syntax all produce the same result:

    :SENSe:FREQuency:STARt 1 MHZ

    :SENS:FREQ:STAR 1 MHZ

    :sense:frequency:start 1000000

    :FREQ:STAR 1000 KHZ

Note	Note that the first keyword in the command string does not require a leading colon; however, it is good practice to always use a leading colon for all keywords. Note also that the :SENSe keyword is optional. This is a SCPI convention for all voltage or signal source type instruments that allows shorter command statements to be used.

`:CALCulate:MARKer{[1]|2|3|4|5|6|7|8|9|10|11|12}:X <numeric_value>{HZ|KHZ|MHZ|GHZ}`

The first two commands below set the location of marker 1, the third command sets the location of marker 2:

    :CALC:MARK:X 1 GHZ

    :CALC:MARK1:X 1 GHZ

    :CALC:MARK2:X 2ghz

`:UNIT:POWer <DBM|DBUV>`

The following command syntax is identical:

    :UNIT:POWer DBM

    :unit:pow dbm

`:INITiate:CONTinuous <0|1|ON|OFF>`

The following commands are identical:

    :INITiate:CONTinuous OFF

    :init:cont 0

The following is an example of a multiple command statement that uses two separate commands in a single
program line:

    :FREQuency:STARt 10E6;:FREQuency:STOP 20E9

Note	A semicolon is used to join the commands and a leading colon used immediately after the semicolon to start the second command.

Spectrum Trace Data via SCPI

This section provides an abbreviated example of setting up and capturing spectrum trace data via SCPI commands. SCPI commands are sent to port 9001 of the local PC.

```
//Set the Start and Stop Frequencies

SENS:FREQ:START 88 MHz
SENS:FREQ:STOP 108 MHz


//Set the RBW to 30 kHz

BAND:RES 30 KHz


//Set the Reference Level to -30 dBm

DISP:WIND:TRAC:Y:SCAL:RLEV -30


//Set to single sweep

INIT:CONT OFF


//Get trace amplitude data

TRACE:DATA? 1


//Get number of display points to calculate frequency array

DISP:POIN?
```

6-6 SCPI Commands

Command subsystems control specific instrument functions and some general purpose functions as described earlier in this text. All command subsystems are identified by the leading keyword in a command statement, as in :INITiate:CONTinuous.

The following information is provided for each command described in this:

- The command name, see "Command Names" on page 6-1
- The path from the subsystem root command, see "Hierarchical Command Structure" on page 6-4
- The query form of the command (if applicable), see "Query Commands" on page 6-4
- The command title
- A description of the command function and purpose
- The data parameters used as arguments for the command, see "Data Parameters" on page 6-3
  This may include the parameter type and the available parameter choices.

Refer to the following for the programming commands:

- Chapter 7, "SCPI System Commands"
- Chapter 8, "SCPI SPA Commands"

Refer to the following for SCPI error definitions:

- Appendix A, "SCPI Error Table"

Refer to the following for an alphabetical list of all supported SCPI commands:

- Appendix B, "Alphabetical SCPI Command List"

Chapter 7 — SCPI System Commands

7-1   System Common Commands

The set of system common commands are primarily used to control the state of the instrument for system diagnostics, hardware calibration, and troubleshooting.

*CLS

Title: Clear Status Command

Description: This command clears all status data structures in the device (registers and error queue) and forces the Operation Complete state to Idle.

Parameter(s): none

*ESE <numeric_value>
*ESE?

Title: Standard Event Status Enable

Description: This command provides access the Standard Event Status Enable Register. Refer to IEEE 488.2 for more information on the contents of this register. Value ranges from 0 to 255.

Parameter(s): <numeric_value>

*ESR?

Title: Standard Event Status

Description: This command queries the Standard Event Status Register. Refer to IEEE 488.2 for more information on the contents of this register.

Parameter(s): none

*IDN?

Title: Identify

Description: This command returns the following information in <string> format separated by commas: manufacturer name ("Anritsu"), model number/options, serial number, firmware package number. The model number and options are separated by a "/" and each option is separated by a "/".

Parameter(s): none

*OPC
*OPC?

Title: Operation Complete

Description: The *OPC command causes the device to set the OPC bit of the Standard Event Status Register on the next transition of the No Operation Pending flag from false to true. The *OPC? command returns 1 in the response whenever the No Operation Pending Flag is true.

Parameter(s): none

*RST

Title: Reset

Description: This command clears any pending operations on the instrument.

Parameter(s): none

*SRE <numeric_value>
*SRE?

Title: Service Request Enable

Description: This command provides access to the Service Request Enable Register. Refer to IEEE 488.2 for more information on the contents of this register.

Parameter(s): <numeric_value>

*STB?

Title: Status Byte Query

Description: This command queries the Status Byte Register. Refer to IEEE 488.2 for more information on the contents of this register.

Parameter(s): none

*WAI

Title: Wait-to-Continue Command

Description: This command causes the device to execute no further commands or queries until the No Operation Pending flag is TRUE.

Parameter(s): none

7-2   System Mode Commands

System mode commands control all instrument functions and some general purpose functions. All system mode commands are grouped into the following functional subsystems:

7-3   INSTrument Subsystem

One instrument may contain many logical instruments ("modes"). This subsystem controls the selection of the current instrument mode.

:INSTrument:CATalog:FULL?

Title: Query Available Modes

Description: This query returns a list of string - number pairs. The string contains the name of the available mode. The immediately following NR1-formatted number is its associated mode number. All response data elements are comma separated. If no mode is available, a null string followed by a zero is returned.

Parameter(s): none

:INSTrument:NSELect <numeric_value>
:INSTrument:NSELect?

Title: Select Mode by Number

Description: Sets the instrument mode based on the value of <integer>. The query version returns the number associated with the current mode.

Parameter(s): <numeric_value>

:INSTrument[:SELect] <string>
:INSTrument[:SELect]?

Title: Select Mode by Name

Description: Sets the instrument mode based on the mode name specified by <string>. The query version returns the name of the current mode. Currently, only the Spectrum Analyzer mode is available at this time.

Parameter(s): <string>

7-4   MMEMory Subsystem

The Mass MEMory subsystem contains functions that provide access to the instrument's setup and data storage. For commands involving the directory, the default directory used is located at C:\Users\<this user>\Documents\Anritsu.

:MMEMory:CATalog:DIRectory? <string>,<string>

Title: Memory Catalog Directory

Description: Returns the non-recursive contents of the memory specified by the MSUS and DIRECTORY parameters. Both parameters are case sensitive.

If the intermediate directories in the path don't exist, the command will automatically create them. Common causes of the command failure are:

- The MSUS device is not present (Use `:MMEMory:CATalog:MSUSs` query command to retrieve the list of available storage devices)

- The total space available on MSUS device is not big enough (Use `:MMEMory:CATalog:DIRectory` query command to retrieve the total space available on MSUS)

where <file entry> is: `<file or directory name>,<file type>,<file size>`

Parameter(s): <string>,<string>

:MMEMory:CATalog:MSUSs?

Title: Memory Catalog Msuss

Description: Returns a list of all available mass storage devices present, formated as follows: <Device Name 1>,<Device Name 2>,...<Device Name N>

Parameter(s): none

:MMEMory:CDIRectory <string>
:MMEMory:CDIRectory?

Title: Default Mass Storage Directory

Description: This command selects the default directory on the default mass storage device (see `:MMEMory:MSIS`) for use with MMEMory commands. The parameter is case sensitive. Use "/" as a directory separator. The set command will fail and an error is reported if the requested directory does not exist. Note that the query command returns the name of the default directory that was previously set and the device does not check whether the directory is still present.

Parameter(s): <string>

:MMEMory:COPY <string>,<string>,<string>,<string>

Title: Copy File

Description: This command copies the specified source file into a new file located at the specified destination location. Four parameters are required for this command: 1. Source File Location: The file path to the file to be copied. 2. Source MSUS: The mass storage device the file is located in (i.e. Internal). 3. Destination File Location: The destination file path that the file should be copied to. 4. Destination MSUS: The mass storage device that the destination file should be written to (i.e. Internal). Please note that if a file already exists at the destination location or if the source file does not exist, the command will fail to execute and add an execution error into the SCPI error queue. This command will only copy files. If a directory path is passed in as a parameter, the command will fail to execute.

Parameter(s): <string>,<string>,<string>,<string>

:MMEMory:CREate:DIRectory <string>,<string>

Title: Create Directory

Description: Creates a directory at the specified mass storage device. Both parameters are case sensitive.

Parameter 1: Directory. Use "/" as a directory separator. Parameter 2: MSUS (Use :MMEMory:CATalog:MSUSs query command to retrieve the list of available storage devices)

If the intermediate directories in the path don't exist, the command will automatically create them. Common causes of the command failure are: - The MSUS device is not present (Use :MMEMory:CATalog:MSUSs query command to retrieve the list of available storage devices) - The total space available on MSUS device is not big enough (Use :MMEMory:CATalog:DIRectory query command to retrieve the total space available on MSUS)

Parameter(s): <string>,<string>

:MMEMory:DATA <string>,<string>,<block data>
:MMEMory:DATA? <string>,<string>

Title: File Transfer

Description: This command imports/exports a file to/from the instrument. Data is transferred to/from the instrument as an IEEE definite length arbitrary block response, which has the form <header><block>.

This set command takes three parameters. 1. File Path: The path of the file to be written 2. Msus: The mass storage device to write the file to 3. Block Data: The data to be written to the instrument in block data format

If any directories in the file path do not exist, the instrument will automatically create the required directories. Please note that the maximum file transfer size to the instrument is 25 MB.

The ASCII header specifies the number of data bytes of the file. It looks like #AX, where A is the number of digits in X and X is the number of bytes in the <block>. The first character is the literal ascii hash '#' 043. The second character (A) is a single ASCII digit '1' to '9' describing the number of bytes in the length section (X). This number is called nlength. The next nlength bytes make up an ASCII string of digits '1' to '9' describing the length of the <block> data.

For example, if the first 6 bytes are #49999, then the nlength is 4. The 4 bytes of length are 9999. After that follows the <block>, which would be 9999 bytes in size.

The query command takes two parameters. 1. File Path: The path to the file to be retrieved. 2. Msus: The mass storage device to retrieve the file from.

The file is returned in block data format with an ASCII header The query command will return a #10 if the file cannot be found.

Set Command
Parameter(s): <string>,<string>,<block data>

Query Command
Parameter(s): <string>,<string>

:MMEMory:DELete:DIRectory <string>,<string>

Title: Delete Directory

Description: Deletes the specified directory and all its content at the specified mass storage device. The two parameters for this command are directory name and mass storage device. Both parameters are case sensitive. Use "/" as a directory separator. To delete the root folder in a specified mass storage device, enter "/" for directory name parameter. The available mass storage devices can be retrieved by using the :MMEMory:CATalog:MSUSs command. The command will fail if the directory doesn't exist or the mass storage device is not present.

Parameter(s): <string>,<string>

:MMEMory:DELete:FILe <string>,<string>

Title: Delete File

Description: Deletes the specified file at the specified mass storage device. The two parameters for this command are file name with relative path and mass storage device. Both parameters are case sensitive. Use "/" as a directory separator. The available mass storage devices can be retrieved by the :MMEMory:CATalog:MSUSs command. The command will fail if the file doesn't exist or the mass storage device is not present.

Parameter(s): <string>,<string>

:MMEMory:LOAD:STATe <numeric_value>,<string>,<string>

Title: Load State

Description: This command recalls the specified setup. The file location is resolved using the MSUS and file path parameters. These parameters are case sensitive. Parameters: 1. Numeric Value: currently unused. Send a 0. 2. File path: The file path (including file name) relative to the MSUS root directory. File extension is optional. 3. MSUS: Device to recall the file from. See MMEMory:MSUSs? for information on obtaining the list of available devices. The model of the device that the setup was created in must match the model of the device to recall in; otherwise, the recall will be rejected. The options of the device that the setup was created in must be enabled in the device to recall in; otherwise, the recall will be rejected.

Parameter(s): <numeric_value>,<string>,<string>

`:MMEMory:LOAD:TRACe <string>,<string>,<string>`

Title: Load Trace

Description: This command recalls the specified measurement. The file location is resolved using the MSUS and file path parameters. These parameters are case sensitive. Parameters: 1. Label: Used to specify which trace to recall. Currently, the label only supports recalling all traces. Send an empty string or "ALL" to load all traces. 2. File path: The file path (including file name) relative to the MSUS root directory. File extension is optional. 3. MSUS: Device to recall the file from. See `MMEMory:MSUSs?` for information on obtaining the list of available devices. The model of the device that the measurement was saved in must match the model of the device to recall in; otherwise, the recall will be rejected. The options of the device that the measurement was saved in must be enabled in the device to recall in; otherwise, the recall will be rejected.

Parameter(s): <string>,<string>,<string>

`:MMEMory:LOAD:TRACe:EXIT <LOADprevious|KEEPcurrent>`

Title: Exit Recall State

Description: This command exits recall state if the instrument currently has a measurement file recalled. An enumerable parameter is accepted to determine whether to revert back to the setup prior to recalling a measurement (LOADprevious) or to keep the setup from the measurement file (KEEPcurrent).

Parameter(s): <LOADprevious|KEEPcurrent>

`:MMEMory:LOAD:TRACe:STATus?`

Title: Get Recall State Status

Description: This command retrieves the status of whether or not the instrument is in a state where a measurement file has been recalled. A return value of 0 means that the instrument is not in a state where a measurement file has been recalled. A return value of 1 means that the instrument has recalled a measurement file and is in a state where SCPI commands are restricted. To exit this state, use the :MMEMory:LOAD:TRACe:EXIT SCPI command.

Parameter(s): none

`:MMEMory:MSIS <string>`
`:MMEMory:MSIS?`

Title: Default Mass Storage Device

Description: This command selects the default device for use with MMEMory commands. The mass storage device parameter is case sensitive and must match a device returned from the `:MMEMory:CATalog:MSUSs?` command

Parameter(s): <string>

`:MMEMory:STORe:STATe <numeric_value>,<string>,<string>`

Title: Store State

Description: This command saves the current setup to the specified file location. The file location is resolved using the MSUS and file path parameters. These parameters are case sensitive.If a file with the resolved name already exists, it will be overwritten. Parameters: 1. Numeric Value: currently unused.Send a 0. 2. File path: The file path (including file name) relative to the MSUS root directory. File extension should not be specified. 3. MSUS: Device to save the file on.See `MMEMory:MSUSs?` for information on obtaining the list of available devices.

A common cause of the command failure is not having enough space available on MSUS to save the setup. Use `:MMEMory:CATalog:DIRectory` query command to retrieve the total space available on MSUS.

Parameter(s): <numeric_value>,<string>,<string>

:MMEMory:STORe:TRACe <string>,<string>,<string>

Title: Store Trace

Description: This command saves the current trace to the specified file location. The file location is resolved using the MSUS and file path parameters. These parameters are case sensitive. Parameters: 1. Label: Used to specify which trace to save. Currently, the label only supports saving all traces. Send an empty string or "ALL" to store all traces. 2. File path: The file path (including file name) relative to the MSUS root directory. File extension should not be specified. 3. MSUS: Device to save the file on. See `MMEMory:MSUSs?` for information on obtaining the list of available devices.

A common cause of the command failure is not having enough space available on MSUS to save trace. Use `:MMEMory:CATalog:DIRectory` query command to retrieve the total space available on MSUS.

Parameter(s): <string>,<string>,<string>

7-5   SYSTem Subsystem

This subsystem contains commands that affect instrument functionality that does not directly relate to data collection, display or transfer.

:SYSTem:DEFault:RESet:FACTory

Title: Factory Default Reset

Description: This command presets parameters in all applications as well as system settings with the exception of Ethernet settings (DHCP On/Off, static IP, Static Gateway, Static Subnet) to their factory default values. Last saved settings will be deleted.

Parameter(s): none

:SYSTem:DEFault:RESet:MASTer

Title: Master Default Reset

Description: This command presets parameters in all applications as well as system settings with the exception of Ethernet settings (DHCP On/Off, static IP, Static Gateway, Static Subnet) to default values. Last saved settings, log files, and User Files in the default Folder will be deleted.

Parameter(s): none

:SYSTem:ERRor[:NEXT]?

Title: System Error Queue

Description: If an error occurs, the error number and message are placed in the error queue, which can be read by this query command. Errors are cleared by reading them. Error code 0, is "No error". Error codes from -100 to -199 belongs to the Command error category and sets bit 5 of the standard ESR register. Error codes from -200 to -299 belongs to the Command error category and sets bit 4 of the standard ESR register. Error codes from -400 to -499 belongs to the Query error category and sets bit 2 of the standard ESR register. Error codes from -300 to -399 and 1 to 32767 belongs to the Device-specific error and sets bit 3 of the standard ESR register.

Negative error numbers (command error, execution error, device-dependent error, query error) are standard SCPI errors. Positive error numbers are device specific errors, not standard SCPI errors. The error queue is also cleared by *CLS, *RST, and when power is turned on.

If more errors have occurred than can fit in the buffer, the last error stored in the queue (the most recent error) is replaced with -350, Queue overflow. No additional errors are stored until removing errors from the queue. If no errors have occurred when reading the error queue, the instrument responds with 0, No error.

Parameter(s): none

:SYSTem:FIRMware:VERSion?

Title: Firmware Version

Description: This command queries the device firmware version.

Parameter(s): none

`:SYSTem:OPTions?`

Title: Query Options

Description: This command retrieves the options that are currently set. The response is returned in "/" delimited form. An empty string is returned if there are no options installed.

Parameter(s): none

`:SYSTem:PRESet`

Title: Preset

Description: This command presets parameters in the current application to their factory default values.

Parameter(s): none

Chapter 8 — SCPI SPA Commands

8-1 Mode Commands

SCPI SPA commands control all instrument spectrum analyzer functions and some general purpose functions. The commands are grouped into the following functional subsystems:

- Section 8-2 "ABORt Subsystem"
- Section 8-3 "CALCulate Subsystem"
- Section 8-4 "CONFigure Subsystem"
- Section 8-5 "DIAGnostic Subsystem"
- Section 8-6 "DISPlay Subsystem"
- Section 8-7 "FETCh Subsystem"
- Section 8-8 "INITiate Subsystem"
- Section 8-9 "MEASure Subsystem"
- Section 8-10 "MMEMory Subsystem"
- Section 8-11 "READ Subsystem"
- Section 8-12 "SENSe Subsystem"
- Section 8-13 "STATus Subsystem"
- Section 8-14 "TRACe Subsystem"
- Section 8-15 "TRIGger Subsystem"
- Section 8-16 "UNIT Subsystem"

8-2 ABORt Subsystem

The abort subsystem includes commands that allow the user to stop current measurement activities on the instrument.

:ABORt

Title: Abort

Description: Resets the trigger system. This has the effect of aborting the sweep or any measurement that is currently in progress. Additionally, any pending operation flags that were set by initiation of the trigger system will be set to false. If `:INITiate:CONTinuous` is OFF (i.e. the instrument is in single sweep mode), send the command :INITiate[:IMMediate] to trigger the next sweep. If `:INITiate:CONTinuous` is ON (i.e. the instrument is in continuous sweep mode) a new sweep will start immediately.

Parameter(s): None

8-3   CALCulate Subsystem

The commands in this subsystem process data that has been collected.

:CALCulate:ACPower:LIMit:ADJacent:ABSolute <numeric_value> {DBM}
:CALCulate:ACPower:LIMit:ADJacent:ABSolute?

Title:	Adjacent Channel Power Adjacent Absolute Limit
Description:	Sets and queries the amplitude of absolute limit for ACPR adjacent power.
Parameter(s):	<numeric_value> {DBM}
Query Return :	Numeric (dBm)
Default Value :	10 dBm
Default Unit :	dBm
Range :	-200 dBm to 200 dBm

:CALCulate:ACPower:LIMit:ADJacent:LOWer:FAIL?

Title:	ACPR Limit Adjacent Lower Fail
Description:	This command queries the result of a limit check on lower adjacent channel power.
Parameter(s):	none

:CALCulate:ACPower:LIMit:ADJacent:RELative <numeric_value> {DBM}
:CALCulate:ACPower:LIMit:ADJacent:RELative?

Title:	Adjacent Channel Power Adjacent Relative Limit
Description:	Sets and queries the amplitude of relative limit for ACPR adjacent power.
Parameter(s):	<numeric_value> {DBM}
Query Return :	Numeric (dBm)
Default Value :	10 dBm
Default Unit :	dBm
Range :	-200 dBm to 200 dBm

:CALCulate:ACPower:LIMit:ADJacent:UPPer:FAIL?

Title:	ACPR Limit Adjacent Upper Fail
Description:	This command queries the result of a limit check on upper adjacent channel power.
Parameter(s):	none

:CALCulate:ACPower:LIMit:ALTernate:ABSolute <numeric_value> {DBM}
:CALCulate:ACPower:LIMit:ALTernate:ABSolute?

Title:	Adjacent Channel Power Alternate Absolute Limit
Description:	Sets and queries the amplitude of absolute limit for ACPR alternate power.
Parameter(s):	<numeric_value> {DBM}
Query Return :	Numeric (dBm)
Default Value :	10 dBm
Default Unit :	dBm
Range :	-200 dBm to 200 dBm

:CALCulate:ACPower:LIMit:ALTernate:LOWer:FAIL?

           Title: ACPR Limit Alternate Lower Fail

   Description: This command queries the result of a limit check on lower alternate channel power.

   Parameter(s): none

:CALCulate:ACPower:LIMit:ALTernate:RELative <numeric_value> {DBM}
:CALCulate:ACPower:LIMit:ALTernate:RELative?

           Title: Adjacent Channel Power Alternate Relative Limit

   Description: Sets and queries the amplitude of relative limit for ACPR alternate power.

   Parameter(s): <numeric_value> {DBM}

   Query Return : Numeric (dBm)

   Default Value : 10 dBm

   Default Unit : dBm

         Range : -200 dBm to 200 dBm

:CALCulate:ACPower:LIMit:ALTernate:UPPer:FAIL?

           Title: ACPR Limit Alternate Upper Fail

   Description: This command queries the result of a limit check on upper alternate channel power.

   Parameter(s): none

:CALCulate:ACPower:LIMit:FAIL?

           Title: ACPR Limit Fail

   Description: This command queries the result of a limit check on adjacent channel power ratio.

   Parameter(s): none

:CALCulate:ACPower:LIMit:MAIN <numeric_value> {DBM}
:CALCulate:ACPower:LIMit:MAIN?

           Title: Adjacent Channel Power Main Limit

   Description: Sets and queries the amplitude of limit for main power.

   Parameter(s): <numeric_value> {DBM}

   Query Return : Numeric (dBm)

   Default Value : 10 dBm

   Default Unit : dBm

         Range : -200 dBm to 200 dBm

:CALCulate:ACPower:LIMit:MODE <ABSolute|RELative>
:CALCulate:ACPower:LIMit:MODE?

           Title: Adjacent Channel Power Limit Mode

   Description: Sets the ACPR limit mode to be absolute or relative.

   Parameter(s): <ABSolute|RELative>

   Default Value : ABSolute

         Range : ABSolute|RELative

`:CALCulate:ACPower:LIMit:STATe <0│1│ON│OFF>`
`:CALCulate:ACPower:LIMit:STATe?`

Title: Adjacent Channel Power Limit State

Description: Sets the ACPR limit state to be ON or OFF

Parameter(s): <0|1|ON|OFF>

Query Return : 0 | 1

Default Value : OFF

`:CALCulate:CHPower:LIMit <numeric_value> {DBM}`
`:CALCulate:CHPower:LIMit?`

Title: Channel Power Limit

Description: Sets and queries the amplitude of limit on channel power.

Parameter(s): <numeric_value> {DBM}

Query Return : Numeric (dBm)

Default Value : 10 dBm

Default Unit : dBm

Range : -200 dBm to 200 dBm

`:CALCulate:CHPower:LIMit:FAIL?`

Title: Channel Power Limit Fail

Description: This command queries the result of a limit check on channel power.

Parameter(s): none

`:CALCulate:CHPower:LIMit:PSDensity <numeric_value> {DBM}`
`:CALCulate:CHPower:LIMit:PSDensity?`

Title: Channel Power Spectral Density Limit

Description: Sets and queries the amplitude of limit on channel power spectral density.

Parameter(s): <numeric_value> {DBM}

Query Return : Numeric (dBm)

Default Value : 10 dBm

Default Unit : dBm

Range : -200 dBm to 200 dBm

`:CALCulate:CHPower:LIMit:PSDensity:STATe <0│1│ON│OFF>`
`:CALCulate:CHPower:LIMit:PSDensity:STATe?`

Title: Channel Power Spectral Density Limit State

Description: Sets and queries the state of limit on channel power spectral density. The set form of this command sets the limit state to be ON or OFF.

Parameter(s): <0|1|ON|OFF>

Query Return : 0 | 1

Default Value : OFF

:CALCulate:CHPower:LIMit:PSD:FAIL?

Title: Power Spectral Density Limit Fail

Description: This command queries the result of a limit check on channel power spectral density

Parameter(s): none

:CALCulate:CHPower:LIMit:STATe <0│1│ON│OFF>
:CALCulate:CHPower:LIMit:STATe?

Title: Channel Power Limit State

Description: Sets and queries the state of limit on channel power. The set form of this command sets the limit state to be ON or OFF.

Parameter(s): <0│1│ON│OFF>

Query Return : 0 | 1

Default Value : OFF

:CALCulate{[1]}:LIMit:ACTive?

Title: Limit Active

Description: Queries the numbers of all active limit lines in ascending order. This command returns a empty string if no limits are active.

Parameter(s): none

:CALCulate:LIMit:ALARm <0│1│ON│OFF>
:CALCulate:LIMit:ALARm?

Title: Limit Alarm

Description: This command enables/disables the AAE notification for limit failures.

Parameter(s): <0│1│ON│OFF>

Query Return : 0 | 1

Default Value : OFF

:CALCulate{[1]}:LIMit{[1]│2│3│4│5│6│7│8│9│10}:COMMent <string>
:CALCulate{[1]}:LIMit{[1]│2│3│4│5│6│7│8│9│10}:COMMent?

Title: Limit Comment

Description: Associates a user-defined comment with each limit. The set version of this command takes a single parameter that is a string containing the desired comment. The query version returns the comment that is set.

If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

Parameter(s): <string>

`:CALCulate:LIMit{[1]|2|3|4|5|6|7|8|9|10}:CONTrol[:DATA] <numeric_value> {HZ|KHZ|MHZ|GHZ}, {<numeric_value> {HZ|KHZ|MHZ|GHZ}},...`

`:CALCulate:LIMit{[1]|2|3|4|5|6|7|8|9|10}:CONTrol[:DATA]?`

Title: Limit Control Data

Description: This command sets or queries the control data (X-axis values) for the specified limit.

The numeric suffix on LIMit specifies which limit number to query or set data. If the suffix is omitted, the command will refer to limit 1.

If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

This command takes a list of one or more frequency values as parameters. For example, `CALC:LIM1:CONT:DATA 1MHz, 2MHz, 3MHz`

Note that it is permitted to set one or more invalid 'placeholder' values of Not-A-Number (NAN). The placeholder value for NAN is 9.91e37. If a control data point contains a value of 9.91e37, limit line interpolation from the previous data point, and to the next data point, will not occur. This is useful for defining discontiguous (or segmented) limit lines within a single limit.

For example, to define a limit line of two discontiguous segments, one from 1 MHz to 10 MHz, and another from 20 MHz to 30 MHz, send the following control data:

`CALC:LIM1:CONT:DATA 1MHz, 10MHz, 9.91e37, 20MHz, 30MHz`

Note that the upper (or lower) data, if used, should contain the same amount of points as the control data (see `CALC:LIM:FAIL?` for details on what happens when this is not true). Thus, when using placeholders in control data, it is recommended that placeholders are also used in the upper (or lower) data. For example,

`CALC:LIM1:CONT:UPP 0dBm, 10dBm, 9.91e37, 10dBm, 0dBm`

The exact value for the middle point does not matter, as interpolation will always be skipped due to the control data containing NAN, but using NAN for the corresponding upper (or lower) data value will make it easier to remember that the point is a placeholder.

Parameter(s): <numeric_value> {HZ|KHZ|MHZ|GHZ}, {<numeric_value> {HZ|KHZ|MHZ|GHZ}}, ...

`:CALCulate{[1]}:LIMit{[1]|2|3|4|5|6|7|8|9|10}:CONTrol:MODE <ABSolute|RELative>`
`:CALCulate{[1]}:LIMit{[1]|2|3|4|5|6|7|8|9|10}:CONTrol:MODE?`

Title: Limit Control Mode

Description: Choose either ABSolute or RELative limit.

In ABSolute mode, the control value of the limit line is defined by absolute physical values (Hz).

In RELative mode, the control value of the limit line is relative to the center frequency (Hz).

If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

Parameter(s): <ABSolute|RELative>

:CALCulate{[1]}:LIMit{[1]|2|3|4|5|6|7|8|9|10}:CONTrol:SHIFt <numeric_value> {HZ|KHZ|MHZ|GHZ}

Title: Limit Control Shift

Description: Move a limit line along the control axis. This command changes the value of `:CALCulate<n>:LIMit<k>:CONTrol[:DATA]`.

Issuing this command multiple times will change the limits each time. For example, sending

```
CALC:LIM1:CONT:SHIFT 1 Hz CALC:LIM1:CONT:SHIFT 1 Hz
CALC:LIM1:CONT:SHIFT 1 Hz CALC:LIM1:CONT:SHIFT 1 Hz
CALC:LIM1:CONT:SHIFT 1 Hz
```

will shift the control axis by 5 Hz

If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

Parameter(s): <numeric_value> {HZ|KHZ|MHZ|GHZ}

:CALCulate{[1]}:LIMit{[1]|2|3|4|5|6|7|8|9|10}:COPY <numeric_value>

Title: Limit Copy

Description: Copies a limit line eg: `CALC:LIM1:COPY 2` Copies limit 1 to line 2.

If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

Parameter(s): <numeric_value>

Range : 1 to 10

:CALCulate{[1]}:LIMit{[1]|2|3|4|5|6|7|8|9|10}:DELete

Title: Limit Delete

Description: Deletes a limit line

If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

Parameter(s): none

:CALCulate:LIMit:ENVelope:OFFSet <numeric_value> {DBM}
:CALCulate:LIMit:ENVelope:OFFSet?

Title: Limit Envelope Offset

Description: This command sets/gets the limit envelope offset. This defines how far away from the measured signal indicated the limit envelope is placed. Use `:CALCulate:LIMit:TYPe` to set the currently active limit line.

Parameter(s): <numeric_value> {DBM}

Query Return : Numeric (dBm)

Default Value : 3 dBm

Default Unit : dBm

Range : -100 dBm to 100 dBm

`:CALCulate:LIMit:ENVelope:POINt <numeric_value>`
`:CALCulate:LIMit:ENVelope:POINt?`

Title:	Number of Limit Envelope Points
Description:	This command sets the number of inflection points for the limit envelope.
Parameter(s):	<numeric_value>
Query Return :	Numeric
Default Value :	21
Range :	2 to 41

`:CALCulate:LIMit:ENVelope:SHAPe <SQUare|SLOPe>`
`:CALCulate:LIMit:ENVelope:SHAPe?`

Title:	Limit Envelope Shape
Description:	This command sets/gets the currently active limit envelope shape.
Parameter(s):	<SQUare|SLOPe>
Default Value :	SQUare
Range :	SQUare|SLOPe

`:CALCulate:LIMit{[1]|2|3|4|5|6|7|8|9|10}:ENVelope:UPDate:Y`

Title:	Update Limit Envelope Amplitude
Description:	This command updates the amplitude of the upper and lower limits without changing the frequencies of the inflection points.
Parameter(s):	none

`:CALCulate{[1]}:LIMit{[1]|2|3|4|5|6|7|8|9|10}:FAIL?`

Title:	Limit Fail
Description:	This command queries the result of a limit check. All traces that have had checking enabled (via `CALC:TRAC:CHEC`) will be evaluated against the upper and lower data of the specified limit, unless the limit STATe is OFF (in which case this command will always return 0), or the upper or lower STATe is OFF (in which case only the data with STATe ON will be checked).
	If the sweep has not completed yet, the partial trace will be evaluated. If `INITiate:CONTinuous` is ON, a snapshot of the trace at the time this command was received will be evaluated against the limit. This command returns 1 if any of the checked traces violate the limit, otherwise it returns 0.
	When a limit is evaluated, there are some rules that are followed if the cardinality of the limits control, upper, and lower data are not equal. If there are fewer control data points than upper or lower data points, then only the first n upper or lower points will be evaluated, where n is the number of control points. If there are fewer upper or lower points than control points, then the effective number of upper or lower points will be increased to the number of control points, with the 'extrapolated' points having a value equal to the last upper or lower point.
	If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).
Parameter(s):	none

`:CALCulate:LIMit{[1]|2|3|4|5|6|7|8|9|10}:LOWer[:DATA] <numeric_value>`
`{DBM}, {<numeric_value> {DBM}}, ...`

`:CALCulate:LIMit{[1]|2|3|4|5|6|7|8|9|10}:LOWer[:DATA]?`

Title:	Lower Limit Data
Description:	This command sets or queries the lower limit data (Y-axis values) for the specified limit.
	The numeric suffix on `LIMit` specifies which limit number to query or set data. If the suffix is omitted, the command will refer to limit 1.
	If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).
	This command takes a list of one or more amplitude values as parameters. For example,
	`CALC:LIM1:LOW:DATA 1 dBm, 2dBm, 3 dBm`
	Note that it is permitted to set one or more data values of +/- infinity. The placeholder value for +/- infinity is +/-9.9e37. If a lower data point contains a value of +/-9.9e37, the amplitude at that point will be treated as if it were +/-infinity (i.e. the lower limit will either always fail or always pass at that point).
	It is also permitted to set one or more invalid 'placeholder' values of Not-A-Number (NAN). This is useful for defining discontiguous (or segmented) limit lines within a single limit. For details, and an example, of using placeholder values, see `CALC:LIM:CONT:DATA`.
Parameter(s):	<numeric_value> {DBM}, {<numeric_value> {DBM}}, ...

`:CALCulate:LIMit{[1]|2|3|4|5|6|7|8|9|10}:LOWer:ENVelope:CREate`

Title:	Create Lower Limit Envelope
Description:	This command is used to create an Lower limit envelope on the selected trace.
Parameter(s):	none

`:CALCulate{[1]}:LIMit{[1]|2|3|4|5|6|7|8|9|10}:LOWer:MODE`
`<ABSolute|RELative>`
`:CALCulate{[1]}:LIMit{[1]|2|3|4|5|6|7|8|9|10}:LOWer:MODE?`

Title:	Limit Lower Mode
Description:	Choose either `ABSolute` or `RELative` limit.
	In ABSolute mode, the control value of the limit line is defined by absolute physical values (dBm).
	In RELative mode, the control value of the limit line is relative to the reference level (dB).
	If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).
Parameter(s):	<ABSolute|RELative>

:CALCulate{[1]}:LIMit{[1]|2|3|4|5|6|7|8|9|10}:LOWer:SHIFt <numeric_value> {DB}

Title: Lower Limit Shift

Description: Move the lower limit up or down by a relative amplitude. This command changes the value of :CALCulate<n>:LIMit<k>:LOWer[:DATA].

Issuing this command multiple times will change the limits each time. For example, sending

CALC:LIM1:LOW:SHIFT 1 dB CALC:LIM1:LOW:SHIFT 1 dB CALC:LIM1:LOW:SHIFT 1 dB CALC:LIM1:LOW:SHIFT 1 dB CALC:LIM1:LOW:SHIFT 1 dB

will shift the lower limit by 5 dB.

If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

Parameter(s): <numeric_value> {DB}

:CALCulate{[1]}:LIMit{[1]|2|3|4|5|6|7|8|9|10}:LOWer:STATe <0|1|ON|OFF>
:CALCulate{[1]}:LIMit{[1]|2|3|4|5|6|7|8|9|10}:LOWer:STATe?

Title: Lower Limit State

Description: Turns ON or OFF the lower limit.

If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

Parameter(s): <0|1|ON|OFF>

:CALCulate:LIMit{[1]|2|3|4|5|6|7|8|9|10}:LOWer[:TRACe]:POINts?

Title: Lower Limit Points

Description: This command queries the upper limit trace points (Y-axis values) for the specified limit. This differs from the limit data in that a value is returned for each point in the trace to indicate the values that are being used to evaluate limit pass/fail status. The numeric suffix on LIMit specifies which limit number to query or set data. If the suffix is omitted, the command will refer to limit 1.If a limit of the specified number does not exist, an empty list will be returned.

Parameter(s): none

:CALCulate{[1]}:LIMit{[1]|2|3|4|5|6|7|8|9|10}:NAME <string>
:CALCulate{[1]}:LIMit{[1]|2|3|4|5|6|7|8|9|10}:NAME?

Title: Limit Name

Description: Associates a user-defined name with each limit. The set version of this command takes a single parameter that is a string containing the desired limit name. The query version returns the name that is set.

If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

Parameter(s): <string>

:CALCulate{[1]}:LIMit{[1]|2|3|4|5|6|7|8|9|10}:STATe <0|1|ON|OFF>
:CALCulate{[1]}:LIMit{[1]|2|3|4|5|6|7|8|9|10}:STATe?

Title: Limit State

Description: Turns the limit check for a specific limit ON or OFF.

> If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

Parameter(s): <0|1|ON|OFF>

:CALCulate{[1]}:LIMit{[1]|2|3|4|5|6|7|8|9|10}:TRACe{[1]|2|3|4|5|6}:CHE Ck <0|1|ON|OFF>
:CALCulate{[1]}:LIMit{[1]|2|3|4|5|6|7|8|9|10}:TRACe{[1]|2|3|4|5|6}:CHE Ck?

Title: Limit Trace Check

Description: This command turns the limit check for a specific trace on and off.

> If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

Parameter(s): <0|1|ON|OFF>

:CALCulate:LIMit{[1]|2|3|4|5|6|7|8|9|10}:UPPer[:DATA] <numeric_value> {DBM}, {<numeric_value> {DBM}}, ...
:CALCulate:LIMit{[1]|2|3|4|5|6|7|8|9|10}:UPPer[:DATA]?

Title: Upper Limit Data

Description: This command sets or queries the upper limit data (Y-axis values) for the specified limit.

> The numeric suffix on LIMit specifies which limit number to query or set data. If the suffix is omitted, the command will refer to limit 1.

> If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

> This command takes a list of one or more amplitude values as parameters. For example,

> `CALC:LIM1:UPP:DATA 1 dBm, 2dBm, 3 dBm`

> Note that it is permitted to set one or more data values of +/- infinity. The placeholder value for +/- infinity is +/-9.9e37. If an upper data point contains a value of +/-9.9e37, the amplitude at that point will be treated as if it were +/-infinity (i.e. the upper limit will either always pass or always fail at that point).

> It is also permitted to set one or more invalid 'placeholder' values of Not-A-Number (NAN). This is useful for defining discontiguous (or segmented) limit lines within a single limit. For details, and an example, of using placeholder values, see CALC:LIM:CONT:DATA.

Parameter(s): <numeric_value> {DBM}, {<numeric_value> {DBM}}, ...

:CALCulate:LIMit{[1]|2|3|4|5|6|7|8|9|10}:UPPer:ENVelope:CREate

Title: Create Upper Limit Envelope

Description: This command is used to create an Upper limit envelope on the selected trace.

Parameter(s): none

:CALCulate{[1]}:LIMit{[1]|2|3|4|5|6|7|8|9|10}:UPPer:MODE <ABSolute|RELative>
:CALCulate{[1]}:LIMit{[1]|2|3|4|5|6|7|8|9|10}:UPPer:MODE?

Title: Upper Limit Mode

Description: Choose either ABSolute or RELative limit.

In ABSolute mode, the control value of the limit line is defined by absolute physical values (dBm).

In RELative mode, the control value of the limit line is relative to the reference level (dB).

If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

Parameter(s): <ABSolute|RELative>

:CALCulate{[1]}:LIMit{[1]|2|3|4|5|6|7|8|9|10}:UPPer:SHIFt <numeric_value> {DB}

Title: Upper Limit Shift

Description: Move the upper limit up or down by a relative amplitude. This command changes the value of :CALCulate<n>:LIMit<k>:UPPer[:DATA].

Issuing this command multiple times will change the limits each time. For example, sending

CALC:LIM1:UPP:SHIFT 1 dB CALC:LIM1:UPP:SHIFT 1 dB CALC:LIM1:UPP:SHIFT 1 dB CALC:LIM1:UPP:SHIFT 1 dB CALC:LIM1:UPP:SHIFT 1 dB

will shift the upper limit by 5 dB.

If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

Parameter(s): <numeric_value> {DB}

:CALCulate{[1]}:LIMit{[1]|2|3|4|5|6|7|8|9|10}:UPPer:STATe <0|1|ON|OFF>
:CALCulate{[1]}:LIMit{[1]|2|3|4|5|6|7|8|9|10}:UPPer:STATe?

Title: Upper Limit State

Description: Turns ON or OFF the upper limit.

If a limit of the specified number does not already exist, a default limit will be created first (having empty data, with state set to ON).

Parameter(s): <0|1|ON|OFF>

:CALCulate:LIMit{[1]|2|3|4|5|6|7|8|9|10}:UPPer[:TRACe]:POINts?

Title: Upper Limit Points

Description: This command queries the upper limit trace points (Y-axis values) for the specified limit. This differs from the limit data in that a value is returned for each point in the trace to indicate the values that are being used to evaluate limit pass/fail status. The numeric suffix on LIMit specifies which limit number to query or set data. If the suffix is omitted, the command will refer to limit 1. If a limit of the specified number does not exist, an empty list will be returned.

Parameter(s): none

:CALCulate:MARKer:AOFF

Title: Marker All Off

Description: Turns all markers off.

Parameter(s): none

`:CALCulate:MARKer{[1]|2|3|4|5|6|7|8|9|10|11|12}:FUNCtion <OFF|NOISe>`
`:CALCulate:MARKer{[1]|2|3|4|5|6|7|8|9|10|11|12}:FUNCtion?`

Title: Marker Function

Description: Select the marker function to perform post-processing operation. The default/OFF function performs pass through operation.

Parameter(s): <OFF|NOISe>

Default Value: OFF

Range: OFF|NOISe

`:CALCulate:MARKer{[1]|2|3|4|5|6|7|8|9|10|11|12}:MAXimum`

Title: Marker Move To Highest Peak

Description: Moves the marker X value to the point in the marker's assigned trace that has the highest peak.

Parameter(s): none

`:CALCulate:MARKer{[1]|2|3|4|5|6|7|8|9|10|11|12}:MAXimum:LEFT`

Title: Marker Move To Left Peak

Description: Moves the marker X value to the point in the marker's assigned trace that is the next highest peak to the LEFT of the current X position of the marker.

Parameter(s): none

`:CALCulate:MARKer{[1]|2|3|4|5|6|7|8|9|10|11|12}:MAXimum:NEXT`

Title: Marker Move To Next Peak

Description: Moves the marker X value to the point in the marker's assigned trace that is the next highest peak.

Parameter(s): none

`:CALCulate:MARKer{[1]|2|3|4|5|6|7|8|9|10|11|12}:MAXimum:RIGHt`

Title: Marker Move To Right Peak

Description: Moves the marker X value to the point in the marker's assigned trace that is the next highest peak to the RIGHT of the current X position of the marker.

Parameter(s): none

`:CALCulate:MARKer{[1]|2|3|4|5|6|7|8|9|10|11|12}:MODE`
`<POSition|DELTa|FIXed|OFF>`
`:CALCulate:MARKer{[1]|2|3|4|5|6|7|8|9|10|11|12}:MODE?`

Title: Marker Mode

Description: Selects the marker mode. POSition mode is a normal marker mode. DELTa mode is marker report difference relative to another marker. FIXed mode is a marker who's Y value is fixed at the last measured value before it is set to FIXed. OFF mode is disable the marker. Delta markers and their associated reference marker must use the same marker function (:CALCulate:MARKer:FUNCtion).

Parameter(s): <POSition|DELTa|FIXed|OFF>

Default Value : OFF

Range : POSition|DELTa|FIXed|OFF

:CALCulate:MARKer{[1]|2|3|4|5|6|7|8|9|10|11|12}:MOVE:LEFT

Title: Marker Move To Left

Description: Moves the marker X value to the next display point to the LEFT.

Parameter(s): none

:CALCulate:MARKer{[1]|2|3|4|5|6|7|8|9|10|11|12}:MOVE:RIGHt

Title: Marker Move To Right

Description: Moves the marker X value to the next display point to the RIGHT.

Parameter(s): none

:CALCulate:MARKer:PEAK:EXCursion <numeric_value>
:CALCulate:MARKer:PEAK:EXCursion?

Title: Marker Excursion

Description: Sets the excursion for a marker. The excursion is the vertical distance from the peak to the next highest valley which must be exceeded for a peak to be considered a peak in marker max commands.

Parameter(s): <numeric_value>

Query Return : Numeric

Default Value : 0

Range : 0 to 200

:CALCulate:MARKer:PEAK:EXCursion:STATe <0|1|ON|OFF>
:CALCulate:MARKer:PEAK:EXCursion:STATe?

Title: Marker Excursion State

Description: Turn on/off excursion checking for marker max commands.

Parameter(s): <0|1|ON|OFF>

Query Return : 0 | 1

Default Value : OFF

:CALCulate:MARKer:PEAK:THReshold <numeric_value> {DBM}
:CALCulate:MARKer:PEAK:THReshold?

Title: Marker Threshold

Description: Sets the threshold level for a marker. The threshold is the level that a peak must exceed to be considered a peak in marker max commands.

Parameter(s): <numeric_value> {DBM}

Query Return : Numeric (dBm)

Default Value : 0 dBm

Default Unit : dBm

Range : -200 dBm to 100 dBm

:CALCulate:MARKer:PEAK:THReshold:STATe <0|1|ON|OFF>
:CALCulate:MARKer:PEAK:THReshold:STATe?

Title: Marker Threshold State

Description: Turn on/off threshold checking for marker max commands.

Parameter(s): <0|1|ON|OFF>

Query Return : 0 | 1

Default Value : OFF

**:CALCulate:MARKer{[1]|2|3|4|5|6|7|8|9|10|11|12}:REFerence
<numeric_value>**
:CALCulate:MARKer{[1]|2|3|4|5|6|7|8|9|10|11|12}:REFerence?

Title: Marker Reference

Description: Sets the reference marker for the specified delta marker. This setting will be applied only if the marker mode set to DELTa.

Parameter(s): <numeric_value>

Query Return : Numeric

Default Value : 0

Range : 0 to 12

:CALCulate:MARKer{[1]|2|3|4|5|6|7|8|9|10|11|12}[:SET]:CENTer

Title: Marker Set Center

Description: Sets the center frequency of the instrument to the current X value of the marker.

Parameter(s): none

:CALCulate:MARKer{[1]|2|3|4|5|6|7|8|9|10|11|12}[:SET]:RLEVel

Title: Marker Set Reference Level

Description: Sets the reference level of the instrument to the current Y value of the marker.

Parameter(s): none

:CALCulate:MARKer{[1]|2|3|4|5|6|7|8|9|10|11|12}:TRACe <numeric_value>
:CALCulate:MARKer{[1]|2|3|4|5|6|7|8|9|10|11|12}:TRACe?

Title: Marker Trace

Description: Changes the trace to which the marker is currently attached.

Parameter(s): <numeric_value>

Query Return : Numeric

Default Value : 1

Range : 1 to 6

:CALCulate:MARKer{[1]|2|3|4|5|6|7|8|9|10|11|12}:X <numeric_value> {HZ|KHZ|MHZ|GHZ}
:CALCulate:MARKer{[1]|2|3|4|5|6|7|8|9|10|11|12}:X?

Title:	Marker Position
Description:	Sets the marker frequency. Only values between the Start and Stop Frequency settings are valid. Setting markers outside the current Span is not allowed.
Parameter(s):	<numeric_value> {HZ|KHZ|MHZ|GHZ}
Query Return :	Numeric (Hz)
Default Value :	100000000000 Hz
Default Unit :	Hz
Range :	-100000000000 Hz to 100000000000 Hz

:CALCulate:MARKer{[1]|2|3|4|5|6|7|8|9|10|11|12}:Y <numeric_value> {DBM}
:CALCulate:MARKer{[1]|2|3|4|5|6|7|8|9|10|11|12}:Y?

Title:	Marker Value
Description:	Set/Get the marker Y value. The user defined Y marker value will be applied only if the marker is in Fixed mode.
Parameter(s):	<numeric_value> {DBM}
Query Return :	Numeric (dBm)
Default Value :	10 dBm
Default Unit :	dBm
Range :	-150 dBm to 30 dBm

:CALCulate:OBW:LIMit <numeric_value> {HZ|KHZ|MHZ|GHZ}
:CALCulate:OBW:LIMit?

Title:	OBW Limit
Description:	Sets and queries the frequency limit on occupied bandwidth power.
Parameter(s):	<numeric_value> {HZ|KHZ|MHZ|GHZ}
Query Return :	Numeric (Hz)
Default Value :	10000 Hz
Default Unit :	Hz
Range :	1000 Hz to 100000000000 Hz

:CALCulate:OBW:LIMit:FAIL?

Title:	OBW Limit Fail
Description:	This command queries the result of a limit check on occupied bandwidth power
Parameter(s):	none

:CALCulate:OBW:LIMit:STATe <0│1│ON│OFF>
:CALCulate:OBW:LIMit:STATe?

Title: OBW Power Limit State

Description: Sets and queries the state of limit on occupied bandwidth power. The set form of this command sets the limit state to be ON or OFF

Parameter(s): <0|1|ON|OFF>

Query Return : 0 | 1

Default Value : OFF

8-4   CONFigure Subsystem

This set of commands prepares the instrument for the selected measurement. It disables any currently-enabled measurements and activates the specified measurement. It sets the instrument to single sweep mode, waiting for an `:INITiate` command. It will not initiate the taking of a measurement. Current instrument settings may be changed to default values. These changes are identified with their respective measurement commands.

`:CONFigure:ACPower`

Title:	Configure Adjacent Channel Power Ratio
Description:	Configures the default adjacent channel power ratio measurement. Disables any other active one-button measurements, including channel power and occupied bandwidth, Sets the main channel bandwidth equal to the span. Sets the adjacent channel bandwidth and channel spacing equal to the main channel bandwidth. Sets the detection method to RMS. Sets the instrument to single sweep mode (`:INITiate:CONTinuous OFF`). Measurement settings can be modified by using the `[:SENSe]:ACPower` commands before initiating a sweep.
Parameter(s):	none

`:CONFigure:CHPower`

Title:	Configure Channel Power
Description:	Configures the default channel power measurement. Disables any other active one-button measurements, including ACPR and occupied bandwidth. Sets the integration bandwidth equal to the span. Sets the detection method to RMS. Sets the instrument to single sweep mode (`:INITiate:CONTinuous OFF`). Measurement settings can be modified by using the `[:SENSe]:CHPower` commands before initiating a sweep. Note that this measurement is not valid in zero span.
Parameter(s):	none

`:CONFigure:OBWidth`

Title:	Configure Occupied Bandwidth
Description:	Configures the default occupied bandwidth measurement. Disables any other active one-button measurements, including channel power and ACPR. Sets the method to %. Sets the % of power to 99%. Sets the instrument to single sweep mode (`:INITiate:CONTinuous: OFF`). Measurement settings can be modified by using the `[:SENSe]:OBWidth` commands before initiating a sweep. Note that this measurement is not valid in zero span.
Parameter(s):	none

8-5 DIAGnostic Subsystem

:DIAGnostic:SWEep:TIME?

Title: Measured Sweep Time

Description: This command queries the measured sweep time, in number of milliseconds. This command will return "nan" if no measured sweep time is available, which happens if the sweep was reset and the instrument has not yet swept enough to measure a full sweep.

Parameter(s): none

8-6 DISPlay Subsystem

This subsystem provides commands that modify the display of data for the user. They do not modify the way in which data are returned to the controller.

:DISPlay:POINtcount <numeric_value>
:DISPlay:POINtcount?

Title: Display Point Count

Description: Changes the number of display points the instrument currently measures. Increasing the number of display points can improve the resolution of measurements but will also increase sweep time. This command is not valid in zero span mode.

Parameter(s): <numeric_value>

Query Return : Numeric

Default Value : 501

Range : 10 to 10001

:DISPlay:VIEW <NORMal|SPECtrogram>
:DISPlay:VIEW?

Title: Display View

Description: The display view command can be used to enable/disable spectrogram features.

Parameter(s): <NORMal|SPECtrogram>

Default Value: NORMal

Range: NORMal|SPECtrogram

:DISPlay:VIEW:SPECtrogram:AADJust

Title: Spectrogram Scale Auto Adjust

Description: Automatically adjusts the spectrogram scale reference and bottom amplitude to the max and min amplitudes, respectively, of the most recent trace data collected.

Parameter(s): none

`:DISPlay:VIEW:SPECtrogram:BOTTom <numeric_value> {DBM}`
`:DISPlay:VIEW:SPECtrogram:BOTTom?`

Title: Spectrogram Scale Bottom

Description: The spectrogram scale bottom indicates the amplitude that corresponds to the least intense color in the spectrogram waterfall display. This is used in conjunction with the spectrogram scale reference command to establish the color gradient scale.

Parameter(s): <numeric_value> {DBM}

Query Return: Numeric (dBm)

Default Value: -150 dBm

Default Unit: dBm

Range: -150 dBm to 30 dBm

`:DISPlay:VIEW:SPECtrogram:HISTory[:DATA]? <numeric_value>`

Title: Spectrogram History Data

Description: This command transfers the spectrogram history from the instrument to the client. This command takes an integer parameter specifying the last trace ID received by client and returns all trace data after the received trace ID in a binary block response. The binary block response is formated as below:

Spectrogram Information	Description
History Header	20 Bytes
Number Of Traces	4 bytes, unsigned integer
Number Of Trace Points Per Trace	4 bytes, unsigned integer
Last trace ID in the block	4 bytes, unsigned integer
Reserved	8 bytes
History Body	Block of trace points formated as a 4 byte, single-precision floating point value for each point. The history body size (in bytes) can be calculated as: `<Number Of Traces> * (<Number Of Trace Points Per Trace> * 4).` If no new trace data was found in history, this command will return header only binary block with all zeros except <last trace ID in the block> is set to the last trace ID received by client.

Parameter(s): <numeric_value>

:DISPlay:VIEW:SPECtrogram:HUE <numeric_value>
:DISPlay:VIEW:SPECtrogram:HUE?

Title: Spectrogram Hue

Description: The spectrogram hue command indicates the color that represents the highest amplitude in the spectrogram waterfall display. All of the other amplitudes are represented by colors starting at this hue setting and following a color wheel.

Parameter(s): <numeric_value>

Query Return: Numeric

Default Value: 0

Range: 0 to 359

:DISPlay:VIEW:SPECtrogram:LAYout <BOTTom│TOP│FULLscreen>
:DISPlay:VIEW:SPECtrogram:LAYout?

Title: Spectrogram Layout

Description: The spectrogram layout command describes where the spectrogram should be drawn on the front end. This command doesn't change any behavior in the backend but will be included in save/recall operations.

Parameter(s): <BOTTom│TOP│FULLscreen>

Default Value: BOTTom

Range: BOTTom│TOP│FULLscreen

:DISPlay:VIEW:SPECtrogram:REFerence <numeric_value> {DBM}
:DISPlay:VIEW:SPECtrogram:REFerence?

Title: Spectrogram Scale Reference

Description: The spectrogram scale reference indicates the amplitude that corresponds to the most intense color in the spectrogram waterfall display. This is used in conjunction with the spectrogram scale bottom command to establish the color gradient scale.

Parameter(s): <numeric_value> {DBM}

Query Return: Numeric (dBm)

Default Value: 10 dBm

Default Unit: dBm

Range: -150 dBm to 30 dBm

:DISPlay:VIEW:SPECtrogram:TRACe:SELection <POSition│TIME>
:DISPlay:VIEW:SPECtrogram:TRACe:SELection?

Title: Cursor Selection

Description: Selects which time cursor setting to use, position or time. For position, the DISP:VIEW:SPEC:POS setting will be used to determine which trace from the spectrogram history to show. For time, the DISP:VIEW:SPEC:TIME setting will be used instead.

Parameter(s): <POSition│TIME>

Default Value: POSition

Range: POSition│TIME

`:DISPlay[:WINDow]:TRACe:Y:SCALe:RLEVel <numeric_value> {DBM}`
`:DISPlay[:WINDow]:TRACe:Y:SCALe:RLEVel?`

Title: Reference Level

Description: Sets the reference level amplitude value for the y-axis. This value is the display reference level, which means it has the reference level offset applied. It also means that a change to the reference level offset will change this setting (though the actual, unadjusted reference level will stay the same).

To obtain the actual reference level, either add in the reference level offset, or temporarily set the offset to 0 (in which case the display reference level will reflect the actual one).

Parameter(s): <numeric_value> {DBM}

Query Return : Numeric (dBm)

Default Value : 0 dBm

Default Unit : dBm

Range : -150 dBm to 30 dBm

`:DISPlay[:WINDow]:TRACe:Y[:SCALe]:RLEVel:AUTO[:IMMediate]`
`<numeric_value> {DB}`

Title: Automatic Reference Level

Description: This command causes the reference level to immediately be set to an automatically computed value that best displays the particular data. The reference level is set to a specified dB above the selected trace max value. This command is semantically equivalent to `:DISPlay[:WINDow]:TRACe[:SCALe]:RLEVel <amplitude>` with the computed value for amplitude.

Parameter(s): <numeric_value> {DB}

`:DISPlay[:WINDow]:TRACe:Y[:SCALe]:RLEVel:OFFSet <numeric_value> {DB}`
`:DISPlay[:WINDow]:TRACe:Y[:SCALe]:RLEVel:OFFSet?`

Title: Reference Level Offset

Description: Sets the reference level offset value for the y-axis. This offset is used for display purposes only, and does not affect any other settings that depend on reference level.

See `DISP:WIND:TRAC:Y:SCAL:RLEV` for details on the interaction between reference level offset and display reference level.

Parameter(s): <numeric_value> {DB}

Query Return : Numeric (dB)

Default Value : 0 dB

Default Unit : dB

Range : -99.9 dB to 99.9 dB

8-7   FETCh Subsystem

This set of commands returns the most recent measurement data of the active measurement. They will not switch to another measurement. To make a new measurement, use the INITiate command. To get new measurement data, use the READ or MEASure query commands

:FETCh:ACPower?

Title: Fetch Adjacent Channel Power Ratio

Description: Returns the most recent adjacent channel power ratio measurement results. If the instrument is sweeping, it will not return until the sweep is complete. If the instrument is not sweeping and the current data is not valid it will return error -230. This could occur if there was a *RST immediately before the :FETCh? or if a measurement parameter was changed without an :INITiate.

Data is returned as 9 comma-separated values: main channel power, absolute lower adjacent channel power, absolute upper adjacent channel power, absolute lower alternate channel power, absolute upper alternate channel power, relative lower adjacent channel power, relative upper adjacent channel power, relative lower alternate channel power, relative upper alternate channel power.

If the measurement is not enabled with [:SENSe]:ACPower:STATe then, the instrument will indicate error -400 and return the string "nan,nan,nan,nan,nan,nan,nan,nan,nan".

Parameter(s): none

:FETCh:AMPLitude? <numeric_value> {HZ|KHZ|MHZ|GHZ}

Title: Fetch Amplitude

Description: Returns the amplitude at the given frequency. The command does not wait for the sweep to complete. If the trace data at the requested frequency is invalid (or out of span) then NAN is returned and error code -230 is indicated.

Parameter(s): <numeric_value> {HZ|KHZ|MHZ|GHZ}

:FETCh:CHPower?

Title: Fetch Channel Power and Density

Description: This command returns the most recent channel power measurement results: channel power and channel power density. If the instrument is sweeping, it will not return until the sweep is complete. If the instrument is not sweeping and the current data is not valid it will return error -230. This could occur if there was a *RST immediately before the :FETCh? or if a measurement parameter was changed without an :INITiate. Data is returned as 2 comma-separated values: channel power, channel power density. If the measurement is not enabled with [:SENSe]:CHPower:STATe then, the instrument will indicate error -400 and return the string "nan,nan".

Parameter(s): none

`:FETCh:CHPower:CHPower?`

Title: Fetch Channel Power and Density

Description: Returns the most recent channel power measurement result. It returns only the channel power, not the channel power density. Use `:FETCh:CHPower?` to get both channel power and channel power density. If the instrument is sweeping, it will not return until the sweep is complete. If the instrument is not sweeping and the current data is not valid it will return error -230. This could occur if there was a *RST immediately before the `:FETCh?` or if a measurement parameter was changed without an :INITiate. If the measurement is not enabled with `[:SENSe]:CHPower:STATe` then, the instrument will indicate error -400 and return the string "nan,nan".

Parameter(s): none

`:FETCh:CHPower:DENSity?`

Title: Fetch Channel Power Density

Description: Returns the most recent channel power density measurement result. It returns only the channel power density, not the channel power. Use `:FETCh:CHPower?` to get both channel power and channel power density. If the instrument is sweeping, it will not return until the sweep is complete. If the instrument is not sweeping and the current data is not valid it will return error -230. This could occur if there was a *RST immediately before the `:FETCh?` or if a measurement parameter was changed without an :INITiate. If the measurement is not enabled with `[:SENSe]:CHPower:STATe` then, the instrument will indicate error -400 and return the string "nan,nan".

Parameter(s): none

`:FETCh:OBWidth{[1]|2}?`

Title: Fetch Occupied Bandwidth

Description: Returns a different set of measurement information depending on the suffix. The default suffix of 1 will return the most recent occupied bandwidth measurement results: occupied bandwidth, percent of power and dB down. One of either percent of power or dB down is measured and the other is set. That is determined by the value set using `[:SENSe]:OBWidth:METHod`. If the measurement is not enabled with `:SENSe:OBWidth:STATe` then, the instrument will indicate error -400 and return the string "nan,nan,nan".

Using suffix 2 will return the most recent channel power, x dB bandwidth, percent bandwidth, and transmit frequency error in Hz. The channel power and occupied bandwidth measurements will be calculated regardless of `CHP:STAT` and `OBW:STAT` settings.

For either suffixes, if the instrument is sweeping, it will not return until the sweep is complete. If the instrument is not sweeping and the current data is not valid it will return error -230. This could occur if there was a `*RST` immediately before the :FETCh? or if a measurement parameter was changed without an `:INITiate`.

Parameter(s): none

`:FETCh:PEAK?`

Title: Fetch Peak

Description: Returns a pair (amplitude, frequency in Hz) of the peak amplitude in the current sweep. The command does not wait for the sweep to complete. If the trace data is invalid then both numbers in the pair will be NAN and error code -230 will be indicated.

Parameter(s): none

8-8   INITiate Subsystem

This subsystem controls the triggering of measurements.

:INITiate:CONTinuous <0|1|ON|OFF>
:INITiate:CONTinuous?

Title: Sweep Type

Description: Specifies whether the sweep/measurement is triggered continuously. If the value is set to ON or 1, another sweep/measurement is triggered as soon as the current one completes. If continuous is set to OFF or 0, the instrument remains initiated until the current sweep/measurement completes, then enters the idle state and waits for the :INITiate[:IMMediate] command or for :INITiate:CONTinuous ON.

If :INITiate:CONTinuous is changed to ON before the current sweep/measurement completes, a new sweep/measurement will be continuously triggered as soon as the current sweep/measurement completes. If :INITiate[:IMMediate] is received before the current sweep/measurement completes, it will be ignored. Clients must either wait for the current sweep/measurement to complete before triggering a 'single sweep', or :ABORt the sweep/measurement after setting :INITiate:CONTinuous to OFF (which will cause the instrument to immediately enter the idle state where it can accept new triggers).

The default value is ON. That is, sending :INIT:CONT is equivalent to sending :INIT:CONT ON. The query version of the command returns a 1 if the instrument is continuously sweeping/measuring and returns a 0 if the instrument is in single sweep/measurement mode.

Parameter(s): <0|1|ON|OFF>

Query Return : 0 | 1

Default Value : ON

:INITiate[:IMMediate]

Title: Initiate Single Sweep

Description: Initiates a sweep/measurement. If :INITiate:CONTinuous is set to ON, or if :INITiate:CONTinuous is set to OFF but the current sweep has not completed yet, this command is ignored. Use this command in combination with :STATus:OPERation? or *OPC? to synchronize the capture of one complete set of data. When this command is sent, the "sweep complete" bit of :STATus:OPERation? is set to 0, indicating that the measurement has not completed. The data collection is then triggered. The controlling program can poll :STATus:OPERation? to determine the status. When the "sweep complete" bit is set to 1, data is ready to be retrieved.

This command is also overlapped, so alternatively, *OPC? can be used to wait for completion of the measurement without polling. When this command is received, the pending operation bit is set. The pending operation will finish once the sweep/measurement is done. Clients can use *OPC? to "block" until the sweep/measurement is completed.

Parameter(s): none

:INITiate[:IMMediate]:ALL

Title: Initiate Average Count Sweep

Description: Initiates sweep until all active traces reach its average count

Parameter(s): none

8-9   MEASure Subsystem

These commands take the instrument from its current state, enable the specified measurement and put the instrument into single sweep mode. They correct any parameters that are invalid given the new measurement state such that a valid measurement can take place. Other settings may be changed; see the documentation of CONFigure for each measurement. They then initiate the measurement. When the measurement is complete, they return the result.

To make a measurement with settings other than the "default" measurement settings applied by CONFigure, do the following:

- Send the appropriate CONFigure command to set the desired measurement.
- Modify the settings as required.
- Send the appropriate READ command to measure and return the result.

To get the current measurement data, use the appropriate FETCh command.

:MEASure:ACPower?

Title: Measure Adjacent Channel Power Ratio

Description: Sets the active measurement to adjacent channel power ratio, sets the default measurement parameters, triggers a new measurement and returns the main channel power, lower adjacent, upper adjacent, lower alternate and upper alternate channel power results. It is a combination of the commands :CONFigure:ACPower; :READ:ACPower? For a description of the default adjacent channel power ratio measurement parameters see :CONFigure:ACPower. To make an adjacent channel power ratio measurement with settings other than the default values send: :CONFigure:ACPower Commands to set desired settings :READ:ACPower?

Data is returned as 9 comma-separated values: main channel power, absolute lower adjacent channel power, absolute upper adjacent channel power, absolute lower alternate channel power, absolute upper alternate channel power, relative lower adjacent channel power, relative upper adjacent channel power, relative lower alternate channel power, relative upper alternate channel power.

Parameter(s): none

:MEASure:CHPower?

Title: Measure Channel Power And Density

Description: Sets the active measurement to channel power, sets the default measurement parameters, triggers a new measurement and returns the channel power and channel power density results. It is a combination of the commands :CONFigure:CHPower; :READ:CHPower? For a description of the default channel power measurement parameters see :CONFigure:CHPower. To make a channel power measurement with settings other than the default values send: :CONFigure:CHPower Commands to set desired settings :READ:CHPower? Data is returned as 2 comma-separated values: channel power, channel power density.

Parameter(s): none

`:MEASure:CHPower:CHPower?`

Title: Measure Channel Power

Description: Sets the active measurement to channel power, sets the default measurement parameters, triggers a new measurement and returns channel power as the result. To measure both channel power and channel power density use `MEASure:CHPower?` It is a combination of the commands `:CONFigure:CHPower; :READ:CHPower?` For a description of the default channel power measurement parameters see `:CONFigure:CHPower`. To make a channel power measurement with settings other than the default values send: `:CONFigure:CHPower` Commands to set desired settings `:READ:CHPower?`

Parameter(s): none

`:MEASure:CHPower:DENSity?`

Title: Measure Channel Power Density

Description: Sets the active measurement to channel power, sets the default measurement parameters, triggers a new measurement and returns channel power density as the result. To measure both channel power and channel power density use `MEASure:CHPower?` It is a combination of the commands `:CONFigure:CHPower; :READ:CHPower?` For a description of the default channel power measurement parameters see `:CONFigure:CHPower`. To make a channel power measurement with settings other than the default values send: `:CONFigure:CHPower` Commands to set desired settings `:READ:CHPower?`

Parameter(s): none

8-10 MMEMory Subsystem

The commands in the Mass MEMory subsystem contain functions that provide access to the instrument setup and data storage. The commands in the Mass MEMory subsystem contain functions that provide access to the instrument setup and data storage.

`:MMEMory:LOAD:LIMit <string>,<string>,<string>`

Title: Load Limit From File

Description: This command loads limit data from the specified limit file. The file location is resolved using the MSUS and file path parameters. Parameters: 1. Label: Used to specify which limit to load. Currently, the label only supports loading all limits. Send an empty string or "ALL" to load all limits. 2. File path: The file path (including file name) relative to the MSUS root directory. File path is case sensitive. File extension is optional. 3. MSUS: Device to load the file from. See `MMEMory:MSUSs?` for information on obtaining the list of available devices. MSUS parameter is case sensitive. The model of the device that the limit was saved in must match the model of the device to load in; otherwise, the load will be rejected.

Parameter(s): <string>,<string>,<string>

`:MMEMory:STOEvent:CLEarall`

Title: Clear All Save On Event

Description: Turns off all save on event types that are active.

Parameter(s): none

`:MMEMory:STOEvent:EOSWeep:MODE <CONTinuous│SINGle>`
`:MMEMory:STOEvent:EOSWeep:MODE?`

Title:	End of Sweep Save On Event Mode
Description:	Specifies the stop mode of the end of sweep save on event system. Setting the value to `CONTinuous` will cause the instrument to keep saving traces at the completion of every valid sweep. Setting the value to `SINGle` will trigger a save trace on the next complete valid sweep and then automatically turn the end of sweep save on event feature OFF.
Parameter(s):	<CONTinuous|SINGle>
Default Value :	CONTinuous
Range :	CONTinuous|SINGle

`:MMEMory:STOEvent:EOSWeep[:STATe] <0│1│ON│OFF>`
`:MMEMory:STOEvent:EOSWeep[:STATe]?`

Title:	End of Sweep Save on Event State
Description:	Turn the end of sweep save on event ON or OFF. Turning the feature on will cause the instrument to automatically save a trace whenever a sweep completes.
	A common cause of the command failure is not having enough space available on the storage location. Use `:MMEMory:CATalog:DIRectory` query command to retrieve the total space available on the storage location.
Parameter(s):	<0|1|ON|OFF>
Query Return :	0 | 1
Default Value :	OFF

`:MMEMory:STOEvent:LIMit:INTerval <numeric_value> {US│MS│S│MIN│HR}`
`:MMEMory:STOEvent:LIMit:INTerval?`

Title:	Limit Save On Event Interval
Description:	Sets the time interval to keep saving after a limit line failure has occurred when :MMEMory:STOEvent:LIMit:MODE is set to INTerval.
Parameter(s):	<numeric_value> {US|MS|S|MIN|HR}
Query Return :	Numeric (ms)
Default Value :	60000 ms
Default Unit :	ms
Range :	0 ms to 216000000 ms

:MMEMory:STOEvent:LIMit:MODE <CONTinuous│SINGle│INTerval>
:MMEMory:STOEvent:LIMit:MODE?

Title: End of Sweep Save On Event Mode

Description: Specifies the stop mode of the limit save on event system. Setting the value to CONTinuous will cause the instrument to keep saving traces at every limit line failure. Setting the value to SINGle will trigger a save trace on the next limit line failure and then automatically turn the end of sweep save on event feature OFF automatically. Setting the value to INTerval will trigger a save on the next limit line failure and continue to save at every end of sweep until the set time interval has expired.

Parameter(s): <CONTinuous│SINGle│INTerval>

Default Value : CONTinuous

Range : CONTinuous│SINGle│INTerval

:MMEMory:STOEvent:LIMit:PTRigger[:STATe] <0│1│ON│OFF>
:MMEMory:STOEvent:LIMit:PTRigger[:STATe]?

Title: Limit Pretrigger Save on Event State

Description: Turn the limit pre-trigger save on event ON or OFF. Turning the feature ON will cause the instrument to automatically save a trace captured prior to the limit line failure trace. The :MMEMory:STOEvent:LIMit[:STATe] and :INITiate:CONTinuous needs to be turned ON for the pre-trigger feature to apply.

A common cause of the command failure is not having enough space available on the storage location. Use :MMEMory:CATalog:DIRectory query command to retrieve the total space available on the storage location.

Parameter(s): <0│1│ON│OFF>

Query Return : 0 │ 1

Default Value : OFF

:MMEMory:STOEvent:LIMit[:STATe] <0│1│ON│OFF>
:MMEMory:STOEvent:LIMit[:STATe]?

Title: Limit Save on Event State

Description: Turn the limit save on event ON or OFF. Turning the feature on will cause the instrument to automatically save a trace whenever a limit line failure occurs.

A common cause of the command failure is not having enough space available on the storage location. Use :MMEMory:CATalog:DIRectory query command to retrieve the total space available on the storage location.

Parameter(s): <0│1│ON│OFF>

Query Return : 0 │ 1

Default Value : OFF

:MMEMory:STOEvent:TIMer:INTerval <numeric_value> {US|MS|S|MIN|HR}
:MMEMory:STOEvent:TIMer:INTerval?

Title: Timer Save On Event Interval

Description: Sets the time interval to save when `:MMEMory:STOEvent:TIMer[:STATe]` is enabled. The queried value is always in milliseconds.

Parameter(s): <numeric_value> {US|MS|S|MIN|HR}

Query Return : Numeric (ms)

Default Value : 240000 ms

Default Unit : ms

Range : 0 ms to 3600000 ms

:MMEMory:STOEvent:TIMer:SIZe <numeric_value>
:MMEMory:STOEvent:TIMer:SIZe?

Title: Limit Save on Event Size

Description: Specify the total size, in bytes, the timer save on event will utilize. This feature prevents the save-on-event timer from filling the memory of the specified mass storage device. If the size specified is exceeded, subsequent timer expirations will cause the oldest save-on-event timer file to be deleted and replaced with the new measurement file.

The total size only applies to the current directory (as specified by `:MMEMory:MSIS` and `:MMEMory:CDIRectory`).

Parameter(s): <numeric_value>

Query Return : Numeric

Default Value : 1000000

Range : 1000 to 1000000000000

:MMEMory:STOEvent:TIMer[:STATe] <0|1|ON|OFF>
:MMEMory:STOEvent:TIMer[:STATe]?

Title: Limit Save on Event State

Description: Turn the timer save on event ON or OFF. Turning the feature on will cause the instrument to automatically save a trace at the interval specified by `:MMEMory:STOEvent:LIMit:INTerval`, if space is available. Available memory may be checked using `:MMEMory:CATalog:DIRectory` query command.

Parameter(s): <0|1|ON|OFF>

Query Return : 0 | 1

Default Value : OFF

`:MMEMory:STORe:LIMit <string>,<string>,<string>`

Title: Store Limit To File

Description: This command stores the limit data into the specified file location. The file location is resolved using the MSUS and file path parameters. Intermediate folders specified by the file path parameter are automatically created. The output file extension is **.lim**. The command automatically overwrites the specified file if present. Parameters: 1. Label: Used to specify which limit to store. Currently, the label only supports storing all limits. Send an empty string or "ALL" to store all limits. 2. File path: The file path (including file name) relative to the MSUS root directory. File path is case sensitive. File extension is optional. 3. MSUS: Device to store the file to. See `MMEMory:MSUSs?` for information on obtaining the list of available devices. MSUS parameter is case sensitive.

A common cause of the command failure is not having enough space available on the storage location. Use `:MMEMory:CATalog:DIRectory` query command to retrieve the total space available on the storage location.

Parameter(s): <string>,<string>,<string>

8-11   READ Subsystem

This set of commands returns the most recent measurement data of the active measurement. They will not switch to another measurement. To make a new measurement, use the `INITiate` command. To get new measurement data, use the `READ` or `MEASure` query commands This set of commands combines the `ABORt`, `INITiate` and `FETCh` commands. It aborts any current triggering sequence and sets the trigger state to idle. It then initiates a new active measurement (i.e. begins the collection of new data). When the measurement is complete, it returns the result. These commands will not switch to another measurement.

To get the current measurement data, use the `FETCh` command.

`:READ:ACPower?`

Title: Read Adjacent Channel Power Ratio

Description: Triggers a new adjacent channel power ratio measurement and returns the results: main channel power, lower adjacent and upper adjacent channel power. It is a combination of the commands `:ABORT; :INITiate; :FETCh:ACPower?` The channel power measurement must be the active measurement (specified by the command `:CONFigure:ACPower`). The current measurement can be queried using the command `:CONFigure?`

Data is returned as 9 comma-separated values: main channel power, absolute lower adjacent channel power, absolute upper adjacent channel power, absolute lower alternate channel power, absolute upper alternate channel power, relative lower adjacent channel power, relative upper adjacent channel power, relative lower alternate channel power, relative upper alternate channel power.

If the measurement is not active, the instrument will indicate error -400 and return the string "nan,nan,nan,nan,nan". If :INITiate command fails it returns a string "nan,nan,nan,nan,nan,nan,nan,nan,nan".

Parameter(s): none

`:READ:CHPower?`

Title: Read Channel Power And Density

Description: Triggers a new channel power measurement and returns the results: channel power and channel power density. It is a combination of the commands `:ABORT;` `:INITiate;` `:FETCh:CHPower?` The channel power measurement must be the active measurement (specified by the command `:CONFigure:CHPower`). Data is returned as 2 comma-separated values: channel power, channel power density. If the measurement is not active, the instrument will indicate error -400 and return the string "nan,nan". If `:INITiate` command fails it returns a string "nan,nan".

Parameter(s): none

`:READ:CHPower:CHPower?`

Title: Read Channel Power And Density

Description: Triggers a new channel power measurement and returns the channel power result: channel power and channel power density. It is a combination of the commands `:ABORT;` `:INITiate;` `:FETCh:CHPower?` The channel power measurement must be the active measurement (specified by the command `:CONFigure:CHPower`). Data returned is : channel power. If the measurement is not active, the instrument will indicate error -400 and return the string "nan" If `:INITiate` command fails it returns a string "nan".

Parameter(s): none

`:READ:CHPower:DENSity?`

Title: Read Channel Power And Density

Description: Triggers a new channel power measurement and returns the results: channel power and channel power density. It is a combination of the commands `:ABORT;` `:INITiate;` `:FETCh:CHPower?` The channel power measurement must be the active measurement (specified by the command `:CONFigure:CHPower`). Data returned is : channel power density. If the measurement is not active, the instrument will indicate error -400 and return the string "nan". If `:INITiate` command fails it returns a string "nan".

Parameter(s): none

8-12   SENSe Subsystem

The commands in this subsystem relate to device-specific parameters, not signal-oriented parameters.

[:SENSe]:ACPower:BANDwidth|BWIDth:ADJacent <numeric_value>
{HZ|KHZ|MHZ|GHZ}
[:SENSe]:ACPower:BANDwidth|BWIDth:ADJacent?

Title:	Adjacent Channel Power Adjacent Integration Bandwidth
Description:	Sets the adjacent channel bandwidth for adjacent channel power measurement. Integration bandwidth must be less than or equal to span
Parameter(s):	<numeric_value> {HZ|KHZ|MHZ|GHZ}
Query Return:	Numeric (Hz)
Default Value:	10350000 Hz
Default Unit:	Hz
Range:	10 Hz to 200000000000 Hz

[:SENSe]:ACPower:BANDwidth|BWIDth:ALTernate <numeric_value>
{HZ|KHZ|MHZ|GHZ}
[:SENSe]:ACPower:BANDwidth|BWIDth:ALTernate?

Title:	Adjacent Channel Power Alternate Integration Bandwidth
Description:	Sets the alternate channel bandwidth for adjacent channel power measurement. Integration bandwidth must be less than or equal to span
Parameter(s):	<numeric_value> {HZ|KHZ|MHZ|GHZ}
Query Return:	Numeric (Hz)
Default Value:	10350000 Hz
Default Unit:	Hz
Range:	10 Hz to 200000000000 Hz

[:SENSe]:ACPower:BANDwidth|BWIDth:MAIN <numeric_value> {HZ|KHZ|MHZ|GHZ}
[:SENSe]:ACPower:BANDwidth|BWIDth:MAIN?

Title:	Adjacent Channel Power Main Integration Bandwidth
Description:	Sets the main channel bandwidth for adjacent channel power measurement. Integration bandwidth must be less than or equal to span
Parameter(s):	<numeric_value> {HZ|KHZ|MHZ|GHZ}
Query Return:	Numeric (Hz)
Default Value:	10350000 Hz
Default Unit:	Hz
Range:	10 Hz to 200000000000 Hz

`[:SENSe]:ACPower:BANDwidth│BWIDth:SPACing <numeric_value>`
`{HZ│KHZ│MHZ│GHZ}`
`[:SENSe]:ACPower:BANDwidth│BWIDth:SPACing?`

Title:	Adjacent Channel Power Spacing
Description:	Controls the channel spacing which is the distance from the modulated carrier signal to the upper or lower Adjacent Channel.
Parameter(s):	<numeric_value> {HZ│KHZ│MHZ│GHZ}
Query Return:	Numeric (Hz)
Default Value:	10350000 Hz
Default Unit:	Hz
Range:	10 Hz to 200000000000 Hz

`[:SENSe]:ACPower:STATe <0│1│ON│OFF>`
`[:SENSE]:STATe?`

Title:	Adjacent Channel Power State
Description:	Sets the state of the adjacent channel power ratio measurement, ON or OFF. When using `:CONFigure:ACPower`, the state is automatically set to ON.
Parameter(s):	<0│1│ON│OFF>
Query Return :	0 │ 1
Default Value :	OFF

`[:SENSe]:AVERage:COUNt <numeric_value>`
`[:SENSe]:AVERage:COUNt?`

Title:	Sense Average Count
Description:	Sets the effective number of averages and the length of the rolling min and max hold. Due to memory limitations the actual length of buffers for rolling min and max hold are limited to 2,000,000 / number of trace points.
Parameter(s):	<numeric_value>
Query Return :	Numeric
Default Value :	10
Range :	2 to 1000

[:SENSe]:AVERage:TYPE
<NORMal│MINimum│MAXimum│AVERage│RMAXimum│RMINimum>

[:SENSe]:AVERage:TYPE?

Title: Sense Average Type

Description: Specifies how successive traces are combined to produce the resulting display value. Only applies to trace 1. Setting the TYPE to NORMal will cause the displayed value for a point to be the current measured value for that point. Setting the TYPE to AVERage will cause the displayed value for a point to be the average of the last <integer> measured values where <integer> is set by [:SENSe]:AVERage:COUNt. Setting the TYPE to MAXimum will cause the displayed value for a point is the maximum measured value for that point over sweeps. Setting the TYPE to MINimum will cause the displayed value for a point is the minimum measured value for that point over sweeps. Setting the TYPE to RMAXimum will cause the displayed value for a point to be the maximum of the last <integer> measured values where <integer> is set by [:SENSe]:AVERage:COUNt. Setting the TYPE to RMINimum will cause the displayed value for a point to be the minimum of the last <integer> measured values where <integer> is set by [:SENSe]:AVERage:COUNt.

Parameter(s): <NORMal│MINimum│MAXimum│AVERage│RMAXimum│RMINimum>

Default Value : NORMal

Range : NORMal│MINimum│MAXimum│AVERage│RMAXimum│RMINimum

[:SENSe]:BANDwidth│BWIDth[:RESolution] <numeric_value> {HZ│KHZ│MHZ│GHZ}
[:SENSe]:BANDwidth│BWIDth[:RESolution]?

Title: RBW

Description: Sets the resolution bandwidth. Note that using this command turns the automatic resolution bandwidth setting OFF.

Parameter(s): <numeric_value> {HZ│KHZ│MHZ│GHZ}

Query Return : Numeric (Hz)

Default Value : 3000000 Hz

Default Unit : Hz

Range : 1 Hz to 3000000 Hz

[:SENSe]:BANDwidth│BWIDth[:RESolution]:RATio <numeric_value>
[:SENSe]:BANDwidth│BWIDth[:RESolution]:RATio?

Title: RBW Span Ratio

Description: Sets the ratio of the resolution bandwidth to the span for use when the resolution bandwidth to span coupling is enabled. Note that the front panel interface sets the inverse ratio: the span to the resolution bandwidth.

Parameter(s): <numeric_value>

Query Return : Numeric

Default Value : 0.01

Range : 1e-04 to 1

`[:SENSe]:BANDwidth|BWIDth:SHAPe <FLATtop|NUTall>`
`[:SENSe]:BANDwidth|BWIDth:SHAPe?`

Title: Resolution Bandwidth Filter Type

Description: This command sets the RBW filter type, Flat Top window or Nutall.

Parameter(s): <FLATtop|NUTall>

Default Value : FLATtop

Range : FLATtop|NUTall

`[:SENSe]:BANDwidth|BWIDth:VIDeo <numeric_value> {HZ|KHZ|MHZ|GHZ}`
`[:SENSe]:BANDwidth|BWIDth:VIDeo?`

Title: VBW

Description: Sets the video bandwidth. Note that using this command turns the automatic video bandwidth setting OFF.

Parameter(s): <numeric_value> {HZ|KHZ|MHZ|GHZ}

Query Return : Numeric (Hz)

Default Value : 3000000 Hz

Default Unit : Hz

Range : 1 Hz to 3000000 Hz

`[:SENSe]:BANDwidth|BWIDth:VIDeo:RATio <numeric_value>`
`[:SENSe]:BANDwidth|BWIDth:VIDeo:RATio?`

Title: VBW RBW Ratio

Description: Sets the ratio of the video bandwidth to the resolution bandwidth for use when the video to resolution bandwidth coupling is enabled. Note that the front panel interface sets the inverse ratio: the resolution bandwidth to the video bandwidth which is an integer, in other words, if you send 0.35, the display will show 2 not 2.857.

Parameter(s): <numeric_value>

Query Return : Numeric

Default Value : 1

Range : 1e-04 to 1

`[:SENSe]:BANDwidth|BWIDth:VIDeo:TYPE <LINear|LOGarithmic>`
`[:SENSe]:BANDwidth|BWIDth:VIDeo:TYPE?`

Title: VBW Averaging

Description: Changes the VBW/Average type.

Parameter(s): <LINear|LOGarithmic>

Default Value : LINear

Range : LINear|LOGarithmic

[:SENSe]:BANDwidth[:RESolution]:AUTO <0│1│ON│OFF>
[:SENSe]:BANDwidth[:RESolution]:AUTO?

Title:	RBW Auto
Description:	Sets the state of the coupling of the resolution bandwidth to the frequency span. Setting the value to ON or 1 will result in the resolution bandwidth being coupled to the span. That is, when the span changes, the resolution bandwidth changes. Setting the value to OFF or 0 will result in the resolution bandwidth being uncoupled from the span. That is, changing the span will not change the resolution bandwidth. When this command is issued, the resolution bandwidth setting itself will not change
Parameter(s):	<0│1│ON│OFF>
Query Return :	0 │ 1
Default Value :	ON

[:SENSe]:BANDwidth:VIDeo:AUTO <0│1│ON│OFF>
[:SENSe]:BANDwidth:VIDeo:AUTO?

Title:	VBW Auto
Description:	Sets the state of the coupling of the video bandwidth to the resolution bandwidth. Setting the value to ON or 1 will result in the video bandwidth being coupled to the resolution bandwidth. That is, when the resolution bandwidth changes, the video bandwidth changes. Setting the value to OFF or 0 will result in the video bandwidth being uncoupled from the resolution bandwidth. That is, changing the resolution bandwidth will not change the video bandwidth
Parameter(s):	<0│1│ON│OFF>
Query Return :	0 │ 1
Default Value :	ON

[:SENSe]:CAPTure:TIMe <numeric_value> {US│MS│S│MIN│HR}
[:SENSe]:CAPTure:TIMe?

Title:	Capture Time
Description:	Determines how much time to spend taking samples for each portion of the spectrum. Increasing the capture time is useful for detecting modulated signals (frequency or amplitude modulation). The query version of this command reports the setting value in milliseconds.
Parameter(s):	<numeric_value> {US│MS│S│MIN│HR}
Query Return:	Numeric (ms)
Default Value:	0 ms
Default Unit:	ms
Range:	0 ms to 10000 ms

`[:SENSe]:CHPower:BANDwidth|BWIDth:INTegration <numeric_value>`
`{HZ|KHZ|MHZ|GHZ}`
`[:SENSe]:CHPower:BANDwidth|BWIDth:INTegration?`

Title:	Channel Power Integration Bandwidth
Description:	Sets the integration bandwidth for channel power measurement. Integration bandwidth must be less than or equal to span
Parameter(s):	<numeric_value> {HZ|KHZ|MHZ|GHZ}
Query Return :	Numeric (Hz)
Default Value :	10350000 Hz
Default Unit :	Hz
Range :	10 Hz to 200000000000 Hz

`[:SENSe]:CHPower:STATe <0|1|ON|OFF>`
`[:SENSe]:CHPower:STATe?`

Title:	Channel Power State
Description:	Sets the state of the channel power measurement, ON or OFF. When using `:CONFigure:CHPower` the state is automatically set to ON
Parameter(s):	<0|1|ON|OFF>
Query Return :	0 | 1
Default Value :	OFF

`[:SENSe]:DETector[:FUNCtion] <POSitive|NEGative>`
`[:SENSe]:DETector[:FUNCtion]?`

Title:	Detection Mode
Description:	Sets the detection method for calculating each display point. Each display point represents several measurements. The detection type determines how the display point is derived from its associated measurements. POSitive Peak detection displays the maximum value of the associated measurements. RMS detection displays the average power of the associated measurements. NEGative Peak detection displays the minimum value of the associated measurements.
Parameter(s):	<POSitive|NEGative>

`[:SENSe]:FREQuency:CENTer <numeric_value> {HZ|KHZ|MHZ|GHZ}`
`[:SENSe]:FREQuency:CENTer?`

Title:	Center Frequency
Description:	Sets the center frequency. Note that changing the value of the center frequency will change the value of the coupled parameters Start Frequency and Stop Frequency. It may also change the value of the span.
Parameter(s):	<numeric_value> {HZ|KHZ|MHZ|GHZ}
Query Return :	Numeric (Hz)
Default Value :	35000000000 Hz
Default Unit :	Hz
Range :	5 Hz to 69999999995 Hz

[:SENSe]:FREQuency:OFFSet <numeric_value> {HZ|KHZ|MHZ|GHZ}
[:SENSe]:FREQuency:OFFSet?

Title: Frequency Offset

Description: Set a frequency offset, which will be added to the start, stop, and center frequencies. This offset is for display purposes only and does not affect the frequency range being measured.

This command is only applicable when making CPRI measurements.

Parameter(s): <numeric_value> {HZ|KHZ|MHZ|GHZ}

Query Return : Numeric (Hz)

Default Value : 0 Hz

Default Unit : Hz

Range : -500000000000 Hz to 500000000000 Hz

[:SENSe]:FREQuency:SPAN <numeric_value> {HZ|KHZ|MHZ|GHZ}
[:SENSe]:FREQuency:SPAN?

Title: Span

Description: Sets the frequency span. Setting the value of <freq> to 0 Hz is the equivalent of setting the span mode to zero span. Note that changing the value of the frequency span will change the value of the coupled parameters Start Frequency and Stop Frequency, and may change the Center Frequency. Additionally, the RBW and VBW limits for zero span are from 5 kHz to 20 MHz and zero span is limited to Spectrum view only.

Parameter(s): <numeric_value> {HZ|KHZ|MHZ|GHZ}

Query Return : Numeric (Hz)

Default Value : (Maximum range of the instrument) Hz

Default Unit : Hz

Range : 10 Hz to (Maximum range of the instrument) Hz

[:SENSe]:FREQuency:SPAN:FULL

Title: Set to Full Span

Description: Sets the frequency span to full span. Note that changing the value of the frequency span will change the value of the coupled parameters, Start Frequency and Stop Frequency and may change the Center Frequency.

Parameter(s): none

[:SENSe]:FREQuency:SPAN:LAST

Title: Set to Last Span

Description: Sets the frequency span to the previous span value. Note that changing the value of the frequency span will change the value of the coupled parameters, Start Frequency and Stop Frequency and may change the Center Frequency.

Parameter(s): none

[:SENSe]:FREQuency:STARt <numeric_value> {HZ|KHZ|MHZ|GHZ}
[:SENSe]:FREQuency:STARt?

Title: Start Frequency

Description: Sets the start frequency. Note that in the spectrum analyzer, changing the value of the start frequency will change the value of the coupled parameters, Center Frequency and Span.

Parameter(s): <numeric_value> {HZ|KHZ|MHZ|GHZ}

Query Return : Numeric (Hz)

Default Value : 0 Hz

Default Unit : Hz

Range : 0 Hz to 69999999990 Hz

[:SENSe]:FREQuency:STOP <numeric_value> {HZ|KHZ|MHZ|GHZ}
[:SENSe]:FREQuency:STOP?

Title: Stop Frequency

Description: Sets the stop frequency. Note that in the spectrum analyzer, changing the value of the stop frequency will change the value of the coupled parameters, Center Frequency and Span.

Parameter(s): <numeric_value> {HZ|KHZ|MHZ|GHZ}

Query Return : Numeric (Hz)

Default Value : (Maximum range of the instrument) Hz

Default Unit : Hz

Range : 10 Hz to (Maximum range of the instrument) Hz

[:SENSe]:IMAGe[:REJection] <NLOW|NHIGh|NORMal>
[:SENSe]:IMAGe[:REJection]?

Title: Image Rejection

Description: This command sets/queries image rejection mode. NLOW sets local oscillator (LO) to lowside only. NHIGh sets LO to highside only. Default is NORMal, which engages both high and low and applies the image rejection algorithm.

Parameter(s): <NLOW|NHIGh|NORMal>

Default Value: NORMal

Range: NLOW|NHIGh|NORMal

[:SENSe]:OBWidth:METHod <XDB|PERCent>
[:SENSe]:OBWidth:METHod?

Title: Occupied Bandwidth Method

Description: Sets the method for calculating occupied bandwidth. XDB calculates the occupied bandwidth based on points a specified number of dB below the carrier. Issue command [:SENSe]:OBWidth:XDB to set the number of dB to be used. PERCent calculates the occupied bandwidth based on points a specified percentage of the carrier power below the carrier. Issue command [:SENSe]:OBWidth:PERCent to set the percentage to be used.

             The measurement always gives a result, even if there is no signal. For example, the 100 dBc Occupied Bandwidth is the current full span.

Parameter(s): `<XDB|PERCent>`

Default Value : PERCent

Range : XDB|PERCent

`[:SENSe]:OBWidth:PERCent <numeric_value>`
`[:SENSe]:OBWidth:PERCent?`

Title: Occupied Bandwidth Percent

Description: This command sets the percentage of carrier power used to measure the occupied bandwidth. This value is used in the measurement if `:SENSe:OBWidth:METHod` is set to `PERCent`.

Parameter(s): `<numeric_value>`

Query Return : Numeric

Default Value : 99

Range : 1e-06 to 99.999999

`[:SENSe]:OBWidth:STATe <0|1|ON|OFF>`
`[:SENSe]:OBWidth:STATe?`

Title: Occupied Bandwidth State

Description: Sets the state of the occupied bandwidth measurement, ON or OFF. When using `:CONFigure:OBWidth`, the state is automaticaly set to ON

Parameter(s): `<0|1|ON|OFF>`

Query Return : 0 | 1

Default Value : OFF

`[:SENSe]:OBWidth:XDB <numeric_value> {DB}`
`[:SENSe]:OBWidth:XDB?`

Title: Occupied Bandwidth XDB

Description: This command sets the number of dB below the carrier used to measure the occupied bandwidth. This value is used in the measurement if `:SENSe:OBWidth:METHod` is set to XDB.

Parameter(s): `<numeric_value> {DB}`

Query Return : Numeric (dB)

Default Value : 3 dB

Default Unit : dB

Range : 0.001 dB to 100 dB

`[:SENSe]:POWer:RF:GAIN:STATe <0|1|ON|OFF>`
`[:SENSe]:POWer:RF:GAIN:STATe?`

Title: IF Gain

Description: Sets the state of the IF Gain. Note that the reference level must be set less than or equal to –10 dBm in order to turn on the IF gain.

Parameter(s): <0|1|ON|OFF>

Query Return : 0 | 1

Default Value : OFF

`[:SENSe]:REFerence:EXTernal <0|1|ON|OFF>`
`[:SENSe]:REFerence:EXTernal?`

Title: External Reference State

Description: Enable or disable the use of an external 10 MHz reference as a reference source.

Parameter(s): <0|1|ON|OFF>

Query Return : 0 | 1

Default Value : OFF

`[:SENSe]:SWEep:TIMe <numeric_value> {PS | NS | US | MS | S | MIN | HR}`
`[:SENSe]:SWEep:TIMe?`

Title: Zero Span Sweep Time

Description: Sets the value of the zero span sweep time parameter.

Parameter(s): <numeric_value> {PS | NS | US | MS | S | MIN | HR}

Query Return: Numeric (ms)

Default Value: 1000 ms

Default Unit: ms

Range: 0.02 ms to 60000 ms

8-13   STATus Subsystem

The commands in this subsystem relate to the current operating state of the instrument.

:STATus:OPERation[:EVENt]?

Title: Get Operation Status

Description: This command requests information about the current status of the instrument. Each bit of the return value represents some operation. Only a subset of the bits are implemented for each application. The number returned is the decimal representation of the bit-wise OR of the enabled bits:

Bit	Decimal	Value Description
0	1	Not implemented
1	2	Not implemented
2	4	Not implemented
3	8	Not implemented
4	16	Not implemented
5	32	Not implemented
6	64	Not implemented
7	128	Not implemented
8	256	Sweep Complete

This bit is set to 0 when the command :INITiate[:IMMediate] is sent to trigger a sweep. It will have a value of 1 when the sweep has completed.

9	512	I/Q Capture

This bit indicates whether the instrument is currently capturing I/Q data. It is set to 1 when the MEAS:IQ:CAPT command is issued. This bit will be set to 0 when the capture is completed normally (in block mode), or is aborted, either due to the ABORt command or some other command which invalidates the capture.

10	1024	Not implemented
11	2048	Not implemented
12	4096	Not implemented
13	8192	Not implemented
14	16384	Not implemented
15	0	Will always be 0

Parameter(s): none

8-14   TRACe Subsystem

This subsystem contains commands related to the transfer of trace data to and from the instrument.

:TRACe:CLEar <numeric_value>

Title: Trace Clear

Description: This command clears the trace's history and trace data for the trace number entered.

Parameter(s): <numeric_value>

Range : 1 to 6

:TRACe:CLEar:ALL

Title: All Traces Clear

Description: This command clears all traces' history and trace data.

Parameter(s): none

:TRACe[:DATA]? <numeric_value>

Title: Trace Data

Description: This command transfers trace data from the instrument to the controller. Data is transferred from the instrument as an IEEE definite length arbitrary block response, which has the form <header><block>.

This command takes a single integer parameter specifying the trace number to transfer. If the parameter value is out of the range of valid trace numbers, the first trace (1) will be transferred. (Currently only one trace is supported, so this parameter has no effect.)

The ASCII header specifies the number of data bytes. It looks like #AX, where A is the number of digits in X and X is the number of bytes in the <block>.

The first character is the literal ascii hash '#' 043. The second character (A) is a single ascii digit '1' to '9' describing the number of bytes in the length section (X). This number is called nlength. The next nlength bytes make up an ascii string of digits '1' to '9' describing the length of the <block> data.

For example, if the first 6 bytes are #49999, then the nlength is 4. The 4 bytes of length are 9999. After that follows the <block>, which would be 9999 bytes in size.

The format of the block data is a comma-delimited list of 32-bit real amplitudes in dBm. The number of amplitudes returned is equal to the current number of display points (DISPlay:POINtcount).

The query command will return a #0 if data is invalid for the active trace.

Parameter(s): <numeric_value>

:TRACe{[1]|2|3|4|5|6}:DETector[:FUNCtion] <POSitive|RMS|NEGative>
:TRACe{[1]|2|3|4|5|6}:DETector[:FUNCtion]?

Title: Trace Detector Type

Description: Sets the detection method for the specific trace. The detection type determines how the display point is derived from its associated measurements. POSitive Peak detection displays the maximum value of the associated measurements. RMS detection displays the average power of the associated measurements. NEGative Peak detection displays the minimum value of the associated measurements.

Parameter(s): <POSitive|RMS|NEGative>

Default Value : POSitive

Range : POSitive|RMS|NEGative

:TRACe{[1]|2|3|4|5|6}:DISPlay[:STATe] <0|1|ON|OFF>
:TRACe{[1]|2|3|4|5|6}:DISPlay[:STATe]?

Title: Trace Display State

Description: The trace visibility state. If it is OFF, the :TRAC:DATA? command will return "nan".

Parameter(s): <0|1|ON|OFF>

:TRACe{[1]|2|3|4|5|6}:DISPlay:VIEW:SPECtrogram:ELAPsed?

Title: Spectrogram Elapsed

Description: Provides the index and time values for the specified trace based on which trace from the spectrogram history it represents.

Parameter(s): <integer>,<numeric_value> Two comma-separated values are returned. The first one is the index and the second is the elapsed time in milliseconds. Negative values indicate that the result is invalid.

:TRACe{[1]|2|3|4|5|6}:DISPlay:VIEW:SPECtrogram:POSition <numeric_value>
:TRACe{[1]|2|3|4|5|6}:DISPlay:VIEW:SPECtrogram:POSition?

Title: Spectrogram Trace Position

Description: The command sets the spectrogram history index that specific trace referencing to.

Parameter(s): <numeric_value>

Range: 0 to 599

:TRACe{[1]|2|3|4|5|6}:DISPlay:VIEW:SPECtrogram:TIME <numeric_value>
:TRACe{[1]|2|3|4|5|6}:DISPlay:VIEW:SPECtrogram:TIME?

Title: Spectrogram Trace Time

Description: The command selects the spectrogram history trace based on elapsed time from the newest trace.

Parameter(s): <numeric_value> ms

Range: 0 ms to 10000 ms

:TRACe:PRESet:ALL

Title: Preset All Trace

Description: This command preset all traces which turn Traces 2-6 off and set Trace 1 to Clear/Write, Active, Peak Detector.

Parameter(s): none

:TRACe:SELect <numeric_value>
:TRACe:SELect?

Title: Select Trace

Description: The selected trace is used for making certain measurements, like Channel Power and Occupied Bandwidth. Channel Power example:

TRAC:SEL4
FETCh:CHP?

Parameter(s): <numeric_value>

Query Return : Numeric

Default Value : 1

Range : 1 to 6

:TRACe:STATus? <numeric_value>

Title: Trace Status

Description: This command returns a response of the same format as a valid TRACe[:DATA] response, except that instead of amplitude, each comma-delimited value is a decimal integer representing the bitwise-OR of one or more status bits. Each bit of the integer is set according to the table below to indicate that the corresponding trace point has the indicated status:

Bit	Decimal Value	Description
0	1	ADC Overrange
1	Not Implemented	Not Implemented
2	Not Implemented	Not Implemented
3	8	LO1 Lock Failure
4	16	LO2 Lock Failure
5	32	TG LO Lock Failure
6	64	Limit Failure
7-31	Not Implemented	Not Implemented

Parameter(s): <numeric_value>

:TRACe{[1]|2|3|4|5|6}:SWEep:COUNt[:CURRent]?

Title: Trace Sweep Count

Description: The trace sweep count return current sweep count which can be useful for multiple-sweep measurements like average and min/max hold. When in normal mode, the trace sweep count will always be 1.

Parameter(s): none

`:TRACe{[1]|2|3|4|5|6}:TYPE`
`<NORMal|MINimum|MAXimum|AVERage|RMAXimum|RMINimum|RAVerage>`

`:TRACe{[1]|2|3|4|5|6}:TYPE?`

Title:	Trace Type
Description:	Specifies how successive sweeps are combined to produce the resulting display value. Setting the TYPE to NORMal will cause the displayed value for a point to be the current measured value for that point. Setting the TYPE to AVERage will cause the displayed value for a point to be the average of the last <integer> measured values where <integer> is set by `[:SENSe]:AVERage:COUNt`. Setting the TYPE to MAXimum will cause the displayed value for a point is the maximum measured value for that point over sweeps. Setting the TYPE to MINimum will cause the displayed value for a point is the minimum measured value for that point over sweeps. Setting the TYPE to RMAXimum will cause the displayed value for a point to be the maximum of the last <integer> measured values where <integer> is set by `[:SENSe]:AVERage:COUNt`. Setting the TYPE to RMINimum will cause the displayed value for a point to be the minimum of the last <integer> measured values where <integer> is set by `[:SENSe]:AVERage:COUNt`.
Parameter(s):	<NORMal|MINimum|MAXimum|AVERage|RMAXimum|RMINimum|RAVerage>
Default Value :	NORMal
Range :	NORMal|MINimum|MAXimum|AVERage|RMAXimum|RMINimum|RAVerage

`:TRACe{[1]|2|3|4|5|6}:UPDate[:STATe] <0|1|ON|OFF>`
`:TRACe{[1]|2|3|4|5|6}:UPDate[:STATe]?`

Title:	Trace Update State
Description:	The trace update state determine whether the trace is update in every sweep.
Parameter(s):	<0|1|ON|OFF>

8-15   TRIGger Subsystem

`:TRIGger[:SEQuence]:ATRigger <numeric_value> {US|MS|S|MIN|HR}`
`:TRIGger[:SEQuence]:ATRigger?`

Title:	Trigger Auto Period
Description:	The trigger auto period is the amount of time that must pass without an trigger event before a measurement is triggered automatically.
Parameter(s):	<numeric_value> {US|MS|S|MIN|HR}
Query Return:	Numeric (ms)
Default Value:	1000 ms
Default Unit:	ms
Range:	0.001 ms to 5000 ms

`:TRIGger[:SEQuence]:ATRigger:STATe <0|1|ON|OFF>`
`:TRIGger[:SEQuence]:ATRigger:STATe?`

Title: Trigger Auto State

Description: The trigger auto state indicates whether or not a measurement should be triggered automatically after the Trigger Auto Period elapses.

Parameter(s): <0|1|ON|OFF>

Query Return: 0 | 1

Default Value: OFF

`:TRIGger[:SEQuence]:DELay <numeric_value> {US|MS|S|MIN|HR}`
`:TRIGger[:SEQuence]:DELay?`

Title: Trigger Delay

Description: The trigger delay is the amount of time between when an external trigger event happens and when the measurement starts.

Parameter(s): <numeric_value> {US|MS|S|MIN|HR}

Query Return: Numeric (ms)

Default Value: 0 ms

Default Unit: ms

Range: 0 to 1670 ms for non-zero span. –(sweep time) to 1670 ms for zero span.

`:TRIGger[:SEQuence]:DELay:STATe <0|1|ON|OFF>`
`:TRIGger[:SEQuence]:DELay:STATe?`

Title: Trigger Delay State

Description: The trigger delay state turns trigger delay on/off.

Parameter(s): <0|1|ON|OFF>

Query Return: 0 | 1

Default Value: OFF

`:TRIGger[:SEQuence]:HOLDoff <numeric_value> {US|MS|S|MIN|HR}`
`:TRIGger[:SEQuence]:HOLDoff?`

Title: Trigger Holdoff

Description: The trigger hold off is the amount of time between when a measurement ends and when to start looking for the next external trigger event.

Parameter(s): <numeric_value> {US|MS|S|MIN|HR}

Query Return: Numeric (ms)

Default Value: 0 ms

Default Unit: ms

Range: 0 ms to 5000 ms

`:TRIGger[:SEQuence]:HOLDoff:STATe <0|1|ON|OFF>`
`:TRIGger[:SEQuence]:HOLDoff:STATe?`

Title: Trigger Holdoff State

Description: The trigger holdoff state turns trigger holdoff on/off.

Parameter(s): <0|1|ON|OFF>

Query Return: 0 | 1

Default Value: OFF

`:TRIGger[:SEQuence]:SLOPe <POSitive|NEGative|ANY>`
`:TRIGger[:SEQuence]:SLOPe?`

Title: Trigger Slope

Description: The trigger slope indicates whether the trigger point is on the rising or the falling edge of the trigger signal.

Parameter(s): <POSitive|NEGative|ANY>

Default Value: POSitive

Range: POSitive|NEGative|ANY

`:TRIGger[:SEQuence]:SOURce <EXTernal|IMMediate|VIDeo>`
`:TRIGger[:SEQuence]:SOURce?`

Title: Trigger Source

Description: The trigger source indicates whether or not to look for a trigger condition before making measurements. VIDeo trigger is only valid for zero span operation.

Parameter(s): <EXTernal|IMMediate|VIDeo>

Default Value: IMMediate

Range: EXTernal|IMMediate|VIDeo

`:TRIGger[:SEQuence]:VIDeo:HYSTeresis <numeric_value> {DB}`
`:TRIGger[:SEQuence]:VIDeo:HYSTeresis?`

Title: Trigger Video Hysteresis

Description: A relative amplitude value in dBm centered around the video trigger level which the input signal must cross for a trigger event to occur when trigger source is set to video (TRIG:SOUR VID).

Parameter(s): <numeric_value> {DB}

Query Return: Numeric (dB)

Default Value: 0 dB

Default Unit: dB

Range: 0 dB to 200 dB

```
:TRIGger[:SEQuence]:VIDeo:LEVel <numeric_value> {DBM}
:TRIGger[:SEQuence]:VIDeo:LEVel?
```

Title:	Trigger Video Level
Description:	The amplitude value in dBm which the input signal must cross for a trigger event to occur when trigger source is video (TRIG:SOUR VID).
Parameter(s):	<numeric_value> {DBM}
Query Return:	Numeric (dBm)
Default Value:	0 dBm
Default Unit:	dBm
Range:	−150 dBm to 30 dBm

8-16 UNIT Subsystem

This subsystem sets the default measurement units.

```
:UNIT:CHPower:PSDensity <DBMHz│DBMMhz>
:UNIT:CHPower:PSDensity?
```

Title:	Power Spectral Density Units
Description:	Sets the power spectral density units to be either dbm/Hz or dbm/MHz.
Parameter(s):	<DBMHz│DBMMhz>
Default Value :	DBMHz
Range :	DBMHz│DBMMhz

```
:UNIT:POWer <DBM│DBUV>
:UNIT:POWer?
```

Title:	Measurement Units
Description:	Sets the default amplitude units for input, output and display. Available units: dBm, dBuV.
Parameter(s):	<DBM│DBUV>
Default Value :	DBM
Range :	DBM│DBUV

Appendix A — SCPI Error Table

This section lists the error code/messages returned from the device when an error occurs during the execution of the SCPI command.

Error messages are classified by error number as listed in table below.

Error Number	Error String	Description
11	EEPROM read/write error	EEPROM read and/or write failed
10	Hardware communication error	Failed to communicate with device hardware.
2	Option mismatch	Operation failed due to option mismatch.
1	Model mismatch	Operation failed due to option mismatch.
0	No error	The queue is completely empty. Every error/event in the queue has been read or the queue was purposely cleared by power-on, `*CLS,` etc.
-100	Command error	Command error
-101	Invalid character	A syntactic element contains a character which is invalid for that type.
-102	Syntax error	An unrecognized command or data type was encountered.
-103	Invalid separator	The parser was expecting a separator and encountered an illegal character.
-104	Data type error	The parser recognized a data element different than one allowed.
-108	Parameter not allowed	More parameters were received than expected for the header.
-109	Missing parameter	Fewer parameters were received than required for the header.
-110	Command header error	An error was detected in the header.
-120	Numeric data error	Error is generated when parsing a data element which appears to be numeric, including the non-decimal numeric types.
-121	Invalid character in number	An invalid character for the data type being parsed was encountered.
-123	Exponent too large	The magnitude of the exponent was larger than 32000.
-124	Too many digits	The mantissa of a decimal numeric data element contained more than 255 digits excluding leading zeros.
-131	Invalid suffix	The suffix does not follow the syntax or suffix is inappropriate for this device.
-141	Invalid character data	Either the character data element contains an invalid character or the particular element received is not valid for the header.
-160	Block data error	Error is generated when parsing a block data element.
-171	Invalid Expression	The expression data element was invalid; for example, unmatched parentheses or an illegal character.
-200	Execution error	Execution error
-213	Init ignored	Indicates that a request for a measurement initiation was ignored as another measurement was already in progress.
-222	Data Out of Range	The processed parameter is outside of the instrument's defined range.

Error Number	Error String	Description
-224	Illegal parameter value	Indicates that an exact value, from a list of possibles, was expected.
-230	Invalid trace data	Data corrupt or stale
-233	Invalid version	Indicates that the version does not match the version expected by the device.
-251	Missing mass storage	Indicates that a legal program command or query could not be executed because of missing mass storage.
-256	File name not found	Indicates that a legal program command or query could not be executed because the file name on the device was not found.
-300	Device-specific error	Device-specific error
-340	Calibration Failed	Calibration Failed
-350	Queue overflow	A specific code entered into the queue in lieu of the code that caused the error. This code indicates that there is no room in the queue and an error occurred but was not recorded.
-363	Input buffer overrun	Software or hardware input buffer on incoming port overflows with data caused by improper or nonexistent pacing.
-400	Query error	Query error

Appendix B — Alphabetical SCPI Command List

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